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Choice of pension management fees and effects on pension wealth

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Abstract

We study a policy change to the management fees of pension funds that the Government of Peru implemented in 2013 to shed light on the effects of individual choices on pension wealth. The reform established a new balance fee (default option) that is a percentage of the pension balance unless the individual opts to remain with the current load factor fee that is a percentage of salary. We use administrative data to simulate pension balances that account for the individual's choice of fee and the corresponding counterfactual. Our results indicate that the reform has been potentially adverse to 63.8 percent of individuals. This figure is composed of 40.4 percent of individuals that were assigned to the default option and 23.4 percent who voluntary chose the load fee. These results reflect that the policy is badly designed and that individuals have an alarming lack of soundness in their financial decisions. We also detect heterogeneity in the intensity of the losses and gains due to the reform, where the losses are larger than the gains. In particular, younger and poorer individuals and those who were assigned to the balance fee show higher losses. Moreover, the change in the fee is also associated with increasing inequality in pension wealth and a reduction in the people's well-being.

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

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

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1 Introduction

Over time, the reasons for transforming old public pension systems into Individual Retirement Accounts (IRA) has fueled much debate among both policymakers and academics. Latin America is an interesting case because an important wave of pension reforms started in 1981 with Chile and then moved to other countries (e.g., Peru 1992, Colombia 1993, Mexico 1997). Studies have reached some agreement on the positive spillovers of these reforms such as enhancing a country's savings and growth rates as well as its financial and annuity markets (Kritzer et al. (2011), Aguila et al. (2014)). But, this stream of research provides little knowledge of how management fees affect people's pension wealth. Indeed, the level of these fees and the way funds charge them can differ considerably across countries, and therefore they may have different effects on the final value of pensions and people's well-being. Further, the high level of fees are a constant source of criticism in countries where IRA systems are mandatory. Hence, gaining a better understanding of their effects on the value of pensions is important.[1]

We use a policy change to the fee scheme of Peruvian IRAs in 2013 to shed light on its potential long-term effects on people's well-being. Before the reform, individuals paid a load factor fee, which was based on a percentage of the individual's monthly salary. The new reform establishes a balance fee that is based on a percentage of the pension balance. When the fee was established, individuals had about five months to choose between the two fees. After this window, if individuals did nothing, they were assigned to the balance fee (default option).[2] Importantly, this fee is not applicable to the pension balance accrued before the reform; it applies only to the balances after the reform and to the balances of new individuals.

Our analysis uses a sample of administrative registers of 64,588 individuals enrolled at the Peruvian IRA system as of December 2016. This data comes from the Superintendencia de Banca, Seguros y Administradoras Privadas de Fondos de Pensiones (known as SBS) that is a public institution that monitors and regulates the private pension system. We simulate the final value of the pension balance for each individual in our sample under certain assumptions and apply a series of sensitivity checks for key parameters. We use this sample to capture the heterogeneity of the population in the IRA system that is exposed to the policy change to management fees along with those individuals who actively opt out of the new balance fee. Importantly, we simulate savings by accounting the individual's choice of fee and the corresponding counterfactual. Therefore, we are able to assess the losses and gains in savings due to the choice of fee.

Other studies analyze the effects of fees in compulsory IRA systems on pension wealth such as Whitehouse (2001), Alonso et al. (2014), Aguila et al. (2014) and Chávez-Bedoya (2017). In particular, Alonso et al. (2014) analyses some features of the Peruvian policy reform that

[1] See Table A.1 in the appendix for a description on fees in IRAs for selected countries and Table A.2 for details on the fee levels of Peruvian IRAs.

[2] We refer to the balance fee as the default option because if an individual did nothing at the time the reform was implemented, she was automatically assigned to the balance fee, and this assignment is irreversible.

included various regulatory changes and not only the change in management fees. They use a representative agent model. However, they only compute the mechanical effect of the change in fees on the specific example of a 40-year-old worker. Chávez-Bedoya (2017) discusses the theoretical implications of the density of pension contributions and risk aversion on the final level of individual pensions for different schemes of management fees. He illustrates his predictions with parameters of the Peruvian IRA system. Our work is different because we use observed and representative data of the individuals that the reform affects and exploit the heterogeneity in that population to draw results for different groups of individuals.[3] Indeed, accounting for individual heterogeneity is important when one studies pension choices due to a reform as the gaps between winners and lossers can be considerable (see for example Gallo et al. (2018)). 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 the potential gains and losses from the change in fees. Aguila et al. (2014) study the Mexican IRA system that in 2008, had three types of fees (load fee, balance fee and return rate fee), but then went to only a load fee. 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) reduce the returns on an IRA by around 1 percent per year.

The balance fee of the Peruvian reform 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 poorly designed default options –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)).

Our results indicate that the policy reform is beneficial only for 36.2 percent of the people but adversely affects the other 63.8 percent. This last figure is composed of 40.4 percent of individuals who were assigned to the balance fee (i.e. for whom this option was wrong) and the 23.4 percent who voluntary made a bad choice by staying in the load factor fee. This result has therefore elements of a poorly designed policy and an alarming lack of soundness in the financial decisions of individuals.

We also detect large heterogeneity in the intensity of the 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 pension balance for those who lose is -5.0 percent and it is 3.1 percent for those who gained from the reform. Furthermore, the balance fee means higher losses among those who opted for it than the choice of load fees. Among the individuals assigned to the balance fee, the average size of the change in the final pension balance for those who lose is -7.0 percent; and for those

[3]Our analysis focuses on the individuals for whom the reform is salient defined as those enrolled before 2013 and showing an active contributory behaviour.

who gain, it is 0.9 percent. Among the individuals who opt for the load fee, the average size of the change in the final pension balance for those who lose is -1.3 percent; and for those who gain, it is 3.6 percent. We also find important differences in losses and gains across age groups and income and retirement wealth distribution. The younger and poorer individuals show higher losses.

We also conduct some robustness checks to see whether our results change when we vary the level of fees, move to a welfare analysis (using indirect utility functions) or when we explore the inequality of pension wealth. We find that our main result remains: the overall number of people are worse off due to the reform.

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

Participation in the SPP or SNP is mandatory only for individuals who are formally registered on a payroll, that is 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 do not contribute at all because a high transition exists between the formal and informal sectors. The share of individuals in the labour force who contributed regularly to the SPP and SNP was about 17 and 10 percent, respectively, in 2015.

The AFP (Administradora Privada de Fondos de Pensiones in Spanish) manages the individual accounts of the SPP. There are currently four AFPs in the system: Prima, Integra, Profuturo and Habitat.[4] Workers are the sole contributors to the AFP and do so at a rate of 10 percent of the their monthly gross wage.[5] Two additional charges are also paid by the worker. The first one is a premium paid to insurance firms to cover disability and mortality risks, and the second one is a management fee paid to the AFP. The employer deducts both the insurance and the

[4]Other AFPs existed (Unión Vida, Horizonte) but opted out the market over time.

[5]The contribution rate has been different than 10 percent. In 1993-1995, it was 11 percent, which included a solidarity charge and, during 1995-2005, the Government reduced the rate to 8 percent. Since 2005, the Government has maintained the contribution rate at 10 percent.

management fee from the monthly gross wage, but in the case of the first one there is a 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, the Government passed an important reform for the SPP in July 2012 (Law N° 29903) that 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 coverage and contributions. One important aspect of the reform was the change in the way the administrative fees were charged. It was established that the new fee would be based on the individual's pension balance. After a transition period of 10 years, this fee would be the only option from 2023 onward.

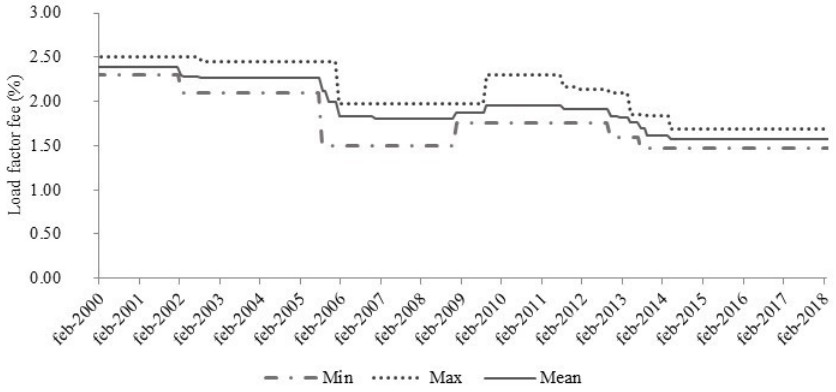
The 2012 reform also introduced two auction schemes with the primary objective of reducing administrative fees. One concerns the choice of the AFP that will enroll all the new workers for two years, and the other one concerns the choice of the insurance firm that will provide the coverage for the disability 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. Because firms with the lowest prices would win the bid in this type of auction, the Government expected a reduction in the fees paid by the individuals. Other changes included in this reform aimed at enhancing efficiency by allowing the 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 fee reform

Figure 1 illustrates the evolution of the load factor fee over the period 2000 to 2018. The figure shows a reduction over the period from 2.39 percent in 2000 to 1.58 percent in 2017, although most of this variation took place between 2005 and 2013. This reduction seems to be 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) that in turn triggered price reductions in January 2006 by AFP Profuturo and AFP Unión Vida. However, these reductions did not last long because in December 2008, AFP Prima increased its 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, that was the lowest in the system. These fees have not varied since then. [6]

[6]Regarding the insurance premium, the value increased from 1.23 percent in December 2013 to 1.36 percent in December 2017.

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.

The Government passed a broader reform in July 19th 2012, but the details for changing management fees were published in November 8th 2012. Individuals could choose their preferred fee between January 2, 2013 and May 31, 2013, before the new scheme became effective on June 1, 2013. More precisely, the default option was the balance fee, so that the individuals preferring to remain in the previous load factor fee had to follow certain procedures in a window of five months. The only option for new individuals enrolling in an AFP after February 1, 2013 was the balance fee.

To remain in the load factor fee, individuals had to communicate their decision to the 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, the reform established a cooling-off period of six months after June 1, 2013 to allow individuals to reverse their decision of staying with the load factor fee. By December 2013, 35 percent (1.92 million) of individuals stayed with the previous load factor fee, while 65 percent joined the new balance fee.

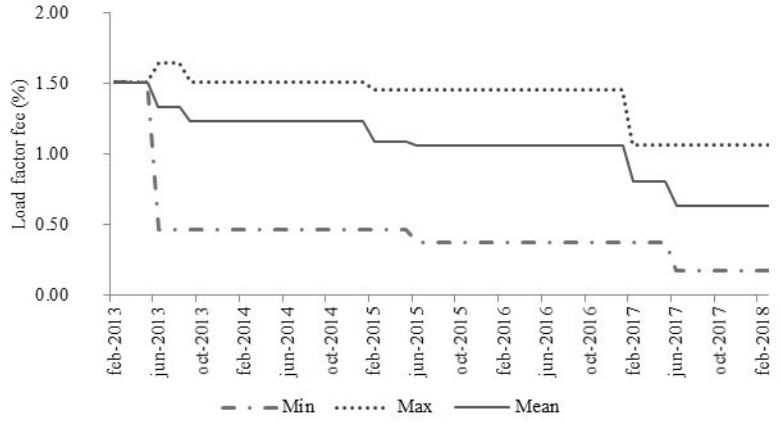
The balance fee is embedded in the so called mixed fee scheme, which by regulation is a transitory scheme valid until 2023. The first component of this scheme is a load factor fee that will gradually decrease to zero by that year, and the second component is a balance fee that will be the only type of fee after 2023.[7]

Figure 2 shows the evolution of the two components of the mixed fee scheme. As of February 2013, the average load factor fee was 1.51 percent, whereas in February 2018 it was 0.63 percent, which is a significant reduction in a five-year period. There is some variance among

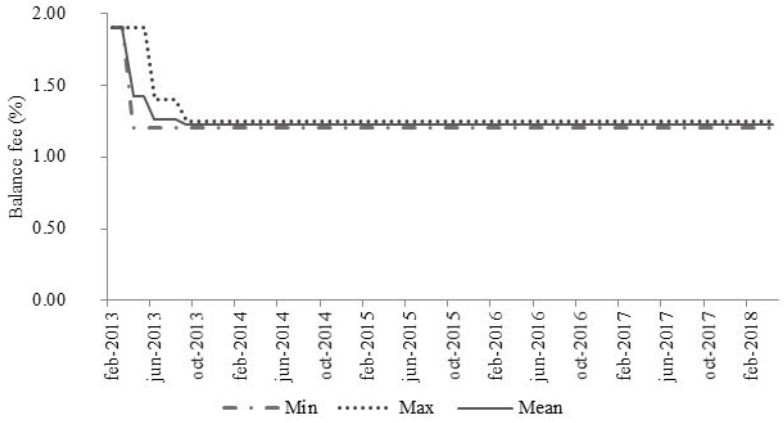
[7] According to specific rules generated by the reform, the load factor fee of the mixed fee scheme must be reduced by 86.5 percent for the period from February 2013 to January 2015, 65.8 percent from February 2015 to January 2017, 50.0 percent from February 2017 to January 2019, 31.5 percent from February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

Figure 2: Mixed Fees

(a) Load Factor Component



(b) Balance Component



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

AFPs. For example, Prima AFP and Habitat AFP offer the lowest prices, 0.18 and 0.38 percent, respectively, whereas Profuturo AFP is the most expensive at 1.07 percent. While the reform seems to have reduced the load factor component over the last five years, not much has changed for the balance fee. This fee has not changed since June 2013 when its average value was 1.23 percent. It is worth mentioning that the reverse auction does not mandate any type of reduction on the value of this fee when choosing the winner of the bid. This is perhaps the reason for the lack of variation in this component.

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

that includes 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 year-old individuals who enrolled in the SPP before 2013. Individuals enrolled in 2013 or later have not 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 have enrolled in the SPP a long time ago.[8] An individual who became affiliated to the SPP along time ago and, simultaneously, have an empty balance might indicate that she is an infrequent contributor or no contributor at all. Given our interest in 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. We define these individuals as those whose last registered contribution occurred at least in 2013 (14,546 individuals are dropped). This is a somewhat flexible criterion because in practice, the individual made at least one contribution between 2013 and 2016.[9] Further, we drop 11,656 individuals who do not register incomes or who have no information on their last year with a contribution. 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, that is, those showing a more active contributory behaviour, but it is not of the total population of the SPP.

The data contains demographic information on age, gender, employment condition and income, of individuals. The data also have information on the pension account, as the enrollment date, AFP, last contribution date, pension balance, balance affected and unaffected by the reform, type of chosen or allocated fee, type of pension fund, contribution density, 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. Fund type 1 includes investments with relatively low returns and volatilities and it is mandatory to individuals aged 60-65 unless the individual chooses fund type 0 or 2. Fund type 2 includes investments with moderate growth and volatility that combines both fixed-income instruments and equities and fund type 3 is generally composed of investments with higher returns and volatilities such as equities. Ideally, this last type of fund is chosen by younger and/or more sophisticated individual investors. Fund type 0 is designed to maintain the capital, offer a low return and volatility and is intended for individuals in the process of retirement after age 65.[10]

[8] Of these cases, 81 percent have enrolled in 2006 or earlier.

[9] 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.

[10] 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

We also use two additional and similar samples of SBS's data from years 2006 and 2013 to compute the growth rates of labour income based on 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. We construct quintiles of income, pension balance, and contribution density. The quintiles are specific by birth cohorts as of 2016 for the following age groups, 21-25, 26-30, ..., 61-64, in order to reduce life-cycle effects. The type of occupation, employee or self-employed, corresponds to that recorded in the last contribution. The date of the last contribution indicates the last time the individual was registered in an occupation where she contributed to a pension. As a 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, while 47 percent (30,351) were assigned to the default balance (mixed) fee. This is interesting for our analysis because choosing the load factor fee is an active decision, where individuals had to inform the AFP and follow a specific procedure. Despite this transaction cost, a significant portion of the population seems to have opted for it.

On average, individuals who choose the balance (mixed) fee are younger than those in the load factor fee (38 versus 41 years-old), are predominantly male than female (69 versus 61 percent), have less time in the SPP (8.2 versus 10.4 years), and have lower 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 with the balance fee contribute on average 47 percent of the time they are enrolled, while individuals 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 of the fee scheme, invest their funds in the fund type 2, which is a portfolio with moderate risk. However, the proportion of individuals who choose a riskier portfolio (composed of up to 80 percent in equities) and the load factor fee doubles the proportion in the balance fee (9.4 versus 4.7 percent), which might mean that they are a more financially sophisticated group.

In summary, the individuals who decide to stay with the load factor fee are slightly older, have more time in the SPP, are more likely to be women, earn higher incomes, have more pension savings, contribute more often, and have slightly higher preferences for risk than the group of individuals who choose the balance fee. Differences by gender are reported in Table A.4 in the appendix.

is composed of investments up to 80 percent in equities and 70 percent in short-term fixed-income instruments.

Table 1: Mean Differences among Individuals by Actual Fee

Variable	Overall	Balance (Mixed) Fee	Load Factor Fee	Mean diff.
	N=64,588	N=30,351	N=34,237	
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

4.1 Charge ratios

We seek to evaluate the potential effect of the choice of fee scheme on the level of pension wealth, that is 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 the proportion of the accumulated fund that fees represent:

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

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

λ^l and λ^m are the charge ratios for the load and balance fees computed at 65, the age of retirement. 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 contribution and fee were accumulated in a savings account. Similar definitions apply for the balance fee. The most convenient fee scheme for the individual is that one with the lower charge ratio. Thus, 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 balance fee is 80 ($S^{m,fee}$) and that this balance would be 100 if the fees were capitalized in the balance ($S^{m,nofee}$). On the other hand, under the load fee scheme, the final balance is 100 ($S^{l,fee}$) and the balance with the capitalization of fees would be 120 ($S^{l,nofee}$). So, the load factor fee has a lower charge ratio, $\lambda = 1 - \frac{100}{120} \cong 1 - \frac{83}{100} < 1 - \frac{80}{100} = \lambda^m$ than the balance fee. In the case of the last one, for each 100 units invested the individual could obtain 80 units, while in the case of the load factor fee, 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 savings balance- due to the choice of a 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 an individual choosing the balance fee, 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 savings account (S_t)

and any management fee a_{jt}, if that is the case. Under the load factor fee 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 down to zero in 2023, and a balance fee a_{2t}, that is levied as a proportion of the balance, that will remain beyond that year. Thus, under the mixed fee scheme, the income deduction is $d_{3t} = c_t + a_{3t}$ up to 2023 and $d_{3t} = c_t$ after that year. Individuals make pension contributions with probability p_t, and the savings balances earn returns r_t. The individuals also pay an insurance premium to private firms, but we do not include it in the simulation. The accumulation of the savings balance follows a monthly (t) discrete process as follows:

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

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

Equations 3 and 4 describe the accumulation processes for individuals who choose the load factor fee and those who choose the balance fee, respectively. But, 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).

To compute the charge ratios for each fee scheme, we also use the counterfactual pension balance that comes from both pension contributions and fees being invested in the individual balance. 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 balance fees, respectively. Note that all payroll deductions feed the retirement account. By definition, $S_{t+1}^{l,fee}$ and $S_{t+1}^{m,fee}$ indicate 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 age 65. In this exercise we cannot use the fees already paid between the dates of policy implementation (June 2013) and our sample (December 2016). To do so could 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) for the simulation period, except for the mixed scheme's load fee, which is decreasing.[11] Labour income evolves

[11]The assumed values are 1.58 percent for the load factor fee, on average, 0.63 percent for the load factor component: and 1.23 percent for the balance component, on average, for the mixed fee. See Table A.2 in the appendix for more details.

at growth rates -specific by gender, income quintile and birth cohort- that are estimated using SPP's individual 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 densities of individual's contributions 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 shares in the pension fund that the individual holds at t multiplied by the share value of period t. Similar to Chávez-Bedoya (2017), we assume that the share values follow the stochastic process in a Geometric Brownian Motion (GBM), that 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; and 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, we assume an average real annual rate of return of 5 percent. This assumption follows SBS (2013) and is based on the fact that as an economy registers sustainable growth and its stock market develops, the country's risk and pension fund's returns should reduce. The evidence from OECD countries shows that real annualized rates of pension funds were lower than 5 percent during the period from 2002 to 2011. Furthermore, the annualized rate of returns of the Chilean private pension system (which has been in place for more than 35 years) decreased from 14 percent in 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 the returns except for the period from 2005 to 2011 due to abnormal returns. We conduct 1,000 GBM simulations in order to obtain different paths for the share values and, therefore, different phats for the rates of returns. We take the average of all the simulations for the share values.

5 Results

5.1 Who gains and who loses with the policy?

Table 2 summarizes our main results. The columns indicate whether the individual falls into the balance fee (default) or she deliberately chooses 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.

We find that the policy is beneficial to only 36.2 percent of the individuals, while it is unbeneficial to 63.8 percent. On the one hand, 4,252 individuals benefit from the balance fee and 19,155 benefit from the load factor fee. So, only a total of 23,407 out of 64,588 individuals (36.2 percent) made the right choice and chose the fee with the lower charge ratio at the time the policy gave them the chance to do so. On the other hand, the allocation of the balance fee for the majority of individuals appears to be a bad decision. For these individuals, 86 percent (=26,099/30,351) are currently losing money in comparison to the balance they would have had under the load factor fee. Similarly, among the individuals who actively decided to remain in the load factor fee, 44 percent (=15,082/34,237) made the wrong decision. 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's financial decisions.[12]

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

	Individuals' actual fee		
	Balance (mixed) fee (default option)	Load factor fee (active choice)	Total
Balance (mixed) fee is better 1/.	4,252	15,082	19,334
Load factor fee 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 it has a lower charge ratio. The baseline simulation assumes a simple (not weighted) average balance fee of 1.23 percent.

Because the reform is potentially adverse for around two-thirds of the individuals, it is important to explore with more detail who are the individuals losing or gaining more and how much are these gains and losses. For this end, we run probit models to determine the likelihood of choosing the load fee and the likelihood that this scheme will be a better option than the balance fee for the individual. Table 3 displays the 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

[12]It must be mentioned that the original policy reform promoted by the Government was severely amended by the Parliament, which resulted in some loss of consistency. The original idea of the Government was to change from the load factor fee to a balance fee for allindividuals. Therefore, it expected that competition would cause reductions in the fees, but the Parliament allowed individuals to remain in the load fee scheme.

that the individual will choose the load factor fee. In this case, the dependent variable equals one if the individual chooses the load factor fee and zero otherwise, and the equation uses the full sample for the analysis.

Column 1 of Table 3 shows that females, older and self-employed individuals are more prone to choose the load factor fee. The contribution density is a very important determinant of choosing this type of fee. For example, an increase of 10 percent in the contribution density is associated with an increase of 6.2 percentage points in the probability of choosing the load factor fee. This choice is positively associated with the position of the individual in the distributions of income and savings balance in 2016. So, income-rich or pension balance-rich individuals are more likely to choose the load factor 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 the load factor fee by 6.0 percentage points, while this effect is 24.3 percentage points for the same quintiles of the pension balance distribution.

However, some differences exist in the likelihood of choosing the load factor 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 factor fee. So, the individuals that are more willing to take risk are more prone to choose the load factor fee. Indeed, it seems that individuals who voluntary opted for risky funds[13] (7.2 percent of the sample) are more knowledgeable and sophisticated investors who exerted the option of keeping the load factor fee if this was the best option for them.[14]

[13]This requires a special administrative procedure.

[14]This conjecture seems to be the case. Among the individualswith risky funds, 42.4 percent chose the best possible fee scheme (the one producing the lower charge ratio). For the individuals 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: This table contains theprobit marginal effects for distinctive samples. All regressions include regional fixed effects. The reference category for the balance and income quintiles is the first quintile, for the self-employed individuals is employee, for the fund administrators is AFP Integra, and for the fund type is the fund type 2 (moderate). Robust standard errors are 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 feefor the individual. For this model, the dependent variable equals one if the charge ratio of the load factor fee is lower than that of the balance fee and zero otherwise. The sample consists of individuals who decided to stay with the load factor fee. Within this group, being male, young, and a frequent contributor increases 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 decreases the probability that the load factor fee is a good option. In the case of the income distribution, the relation 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 quintiles 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 factor fee is indeed a better scheme by age, income and savings ventiles. We plot

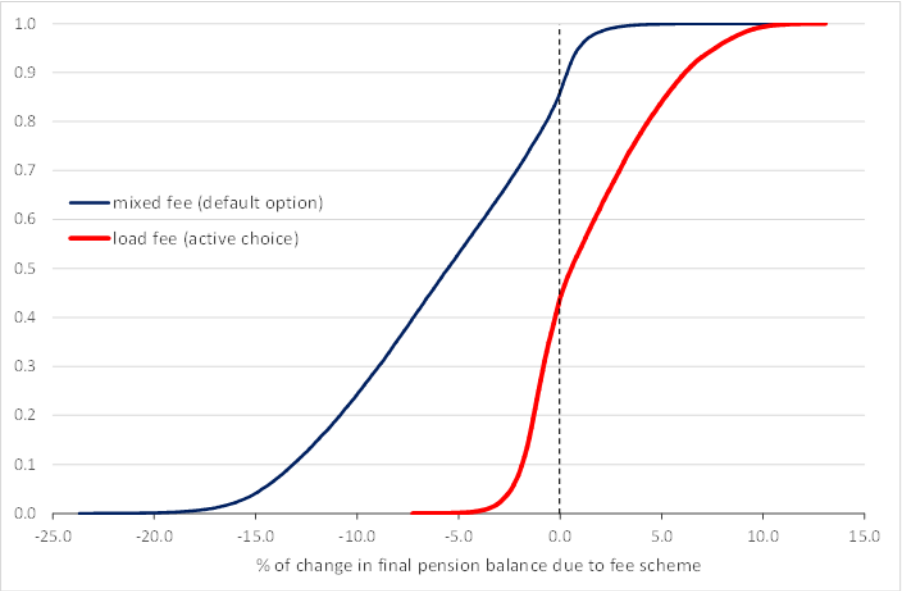
this probability by the actual fee chosen by the individuals. The figure shows that independent of the ventile of income or savings, individuals assigned to the balance fee have a very high probability that the load factor fee would have been a better option (above 80 percent). This finding means that they would pay less (as a percentage of their lifetime pension balances) if they had remained with the previous fee. This is especially true for individuals at the top part of the distributions. For individuals who staywith the load factor fee, 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 balance fee, the load factor fee would have been a better option until age 51 with a probability above 50 percent. Above that age, this likelihood significantly decreases. For individuals who stay with the load factor fee, the probability also decreases and reaches zero at the age of 44.

5.2 The extent of gains and losses

Although we find that a large share of individuals lose money in the fee scheme where they are, we also assess the intensity of these losses and whether some gains exist. As explained in Section 4.1, the difference in 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 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 balance fee, and the thick red line represents the cumulative distribution for the individuals who chose the load factor fee.

The figure shows that the intensity of the loss is very high for the persons who chose the balance fee. On the contrary, the size of the gains is considerably lower. For example, 20.2 percent of these individuals will lose between 10 and 15 percent of the value of their final pension balance, and about 4.1 percent will lose more than 15 percent. Among the individuals assigned to the balance fee, 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 gain, and is -5.9 percent for all the individuals. In contrast, as shown in Figure 3, the losses among the individuals who opted for the load factor fee are less severe. 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 gain, and is 1.4 percent for all the individuals in this scheme.

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



Losses and gains due to the reform vary largely over age. As Table 4 shows, young individuals (those below 40 years-old) with the default balance feeare the main losers of the reform. Choosing this scheme means that these individuals pay more resources to the AFP and therefore their pension balances are lower. For example, all individuals in the 21-25 age group lose money, and their pension balance is lower by 13.6 percent, while the 51-55 age group is less affected because only 34 percent lose money and their balances are lower 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, cohorts above 45 years-old are those who lose more but the reduction 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 independent of the quintile, a significant proportion (around 86 percent) of individuals who chose the balance fee are the main losers of the reform. Their retirement savings are lower by around 7.0 percent.

Table 4: Losses and Gains by Actual Fee 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 factor 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 displays the results. The first column shows the marginal effects of a probit model where the dependent variable equals one if the individual has the fee scheme with the lower change ratio, and zero otherwise. Males are slightly less prone to making a good choice. Being a male reduces the likelihood of making a good call by 2.8 percentage points. Being one year older reduces the likelihood by 0.4 percentage points. 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 individual than for a 55-year-old one. The contribution density and self-employment along with the position in the pension balance distribution are positively associated with the likelihood of making a good choice, but the effect of the 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 percentage points. Furthermore, having a secure or risky pension fund instead of a moderately risky pension fund increases this probability by 18.5 and 3.2 percentage points, respectively.

The second set of results of Table 5 shows the OLS estimates of the percentage change in the pension balance (Δ_{ml}). Age and contribution density are two of the most important variables that determine the sizes of the gains and losses. For example, moving from the second to the third quintile of the age distribution (from age 39 to 47) is associated 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. Further, a higher position in the pension balance distribution and being self-employed are also associated with larger gains. But, 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, maleand are employees, and who have low pension balances, a low contribution density, more years in the SPP and have less risky pension funds.

Table 5: Determinants of Making a Good Choice of Fee 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 regressions include regional fixed effects. The reference category for the balance and income quintiles is the first quintile, for the self-employed is employee, for the fund administrators is AFP Integra, for the fund type is the fund type 2 (moderate). Robust standard errors are in parentheses. *p<0.10, **p<0.05, ***p<0.01.

6 Sensitivity checks

6.1 Impact on welfare

In the previous section we compared the charge ratios to see whether individuals benefited from the policy reform in terms of the pension balance. However, assessing the effects of the reform on a measure of welfare including risk preferences, time discounting and consumption could be 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, e.g., in Kotlikoff and Spivak (1981)) is to compute the indirect utilities for each individual for both types of fees and assess how much the individual should be compensated to be indifferent in 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 $x+t$, and $R = (1+r_t)$ is one plus the interest rate, that for simplicity, is similar to the return rate for the pension funds.

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 of the individual, 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 fees, 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 chooses the load factor fee or the balance (mixed) fee, 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 with the resources from pensions obtained in old-age until death. We assume that the individual receives a life annuity pension that 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. Similarly, by using different values of γ we analyze how the gains or looses depend on the degree of risk aversion.

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

$$C_t^* = \frac{W_0^{l,fee}(S_0)}{\sum_{t=0}^{D-65} p_{x_t}\beta^{\frac{t}{\gamma}}R^{\frac{t}{\gamma}-t}} \quad (13)$$

where $W_0^{l,fee}(S_0)$ is a function of the initial balance, S_0, and it summarizes all resources from labor and pension savings described in the right-hand side of the budget constraint.

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

$$C_t^* = \frac{W_0^{m,fee}(S_0)}{\sum_{t=0}^{D-65} p_{x_t}\beta^{\frac{t}{\gamma}}R^{\frac{t}{\gamma}-t}} \quad (14)$$

where $W_0^{m,fee}(S_0)$ equals the right-hand side of the corresponding budget constraint.

Once the optimal consumption plans are found for each fee, we obtain the indirect utilities as functions of the initial balance as follows:

$$V_t(S_0) = \sum_{t=0}^{D-65} p_{x_t} \beta^t \left[\frac{W_0^{l,fee}(S_0)}{\frac{p_{x_t} \beta^{\frac{t}{\gamma}} R^{\frac{t}{\gamma}-t}}{1-\gamma}} \right]^{(1-\gamma)} \tag{15}$$

$$H_t(S_0) = \sum_{t=0}^{D-65} p_{x_t} \beta^t \left[\frac{W_0^{m,fee}(S_0)}{\frac{p_{x_t} \beta^{\frac{t}{\gamma}} R^{\frac{t}{\gamma}-t}}{1-\gamma}} \right]^{(1-\gamma)} \tag{16}$$

where $V_t(S_0)$ and $H_t(S_0)$ are the indirect utilities for the load factor and balance fees, respectively.

An increase or decrease in utility from the change to a balance fee can be measured in Soles or number of times the initial pension balance, S_0. By solving for M in equation 17, we can obtain the number of times we need to increase or decrease the initial wealth to leave an individual assigned to the balance fee as well off she would be with the load fee, but without this additional wealth. This measure resembles the concept of compensating variation, that 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.[15]

$$V_t(S_0) = H_t(MS_0) \tag{17}$$

We compute the total resources, consumption plans, and indirect utilities for all individuals in our sample. The simulations of resource streams from labor and pension balances were explained in Section 4.2. To calculate consumption plans and indirect utilities, we assume values of $R = 1.05$ and $\beta = 0.95$ and use the Mortality Tables SPP-S-2017 to determine survival probabilities for singles.[16] 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 fee. The mean differences are significant for all cohorts, independent 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, the mean differences are not significant; therefore, which type of fee brings the highest utility is difficult to distinguish.

[15] Note that for the iso-elastic utility function, the calculation is independent of the initial level of balance.

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

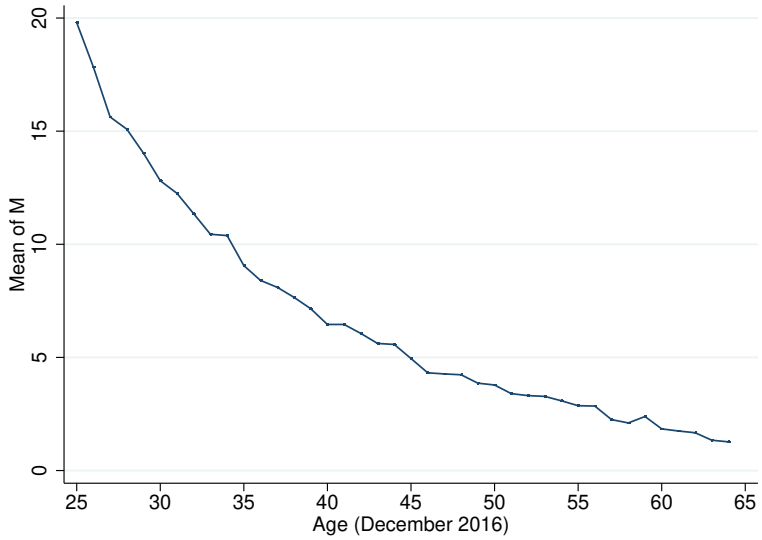
Table 6: Mean Difference of Indirect Utility Functions (IUF) by Level of Risk Aversion

Age group	Relative risk aversion	IUF load factor fee	IUF balance (mixed) fee	Mean difference
21-25	0.10	82.89	76.23	6.66***
26-30	0.10	165.97	155.76	10.21***
31-35	0.10	264.14	252.51	11.64***
36-40	0.10	387.29	375.98	11.31
41-45	0.10	530.39	521.58	8.81
46-50	0.10	630.83	626.35	4.47
51-55	0.10	705.15	704.53	0.62
56-60	0.10	752.70	754.41	-1.71
61-64	0.10	589.61	591.19	-1.58
21-25	0.50	186.16	177.59	8.56***
26-30	0.50	207.76	200.59	7.17***
31-35	0.50	201.12	196.30	4.82***
36-40	0.50	183.38	180.52	2.87**
41-45	0.50	161.62	160.19	1.43
46-50	0.50	133.65	133.13	0.51
51-55	0.50	106.86	106.82	0.04
56-60	0.50	84.74	84.86	-0.11
61-64	0.50	57.91	58.01	-0.09
21-25	0.90	18.84	18.65	0.18***
26-30	0.90	17.99	17.86	0.13***
31-35	0.90	16.42	16.34	0.08***
36-40	0.90	14.63	14.58	0.04*
41-45	0.90	12.84	12.82	0.02
46-50	0.90	10.94	10.93	0.01
51-55	0.90	9.16	9.16	0.00
56-60	0.90	7.49	7.49	-0.00
61-64	0.90	5.95	5.95	-0.00

Notes: The table gives the means of the indirect utility functions and are expressed in thousands of utils. For this table we dropped 2.9 percent of the sample because they presented values of S_0 near to zero. *p<0.10, **p<0.05, ***p<0.01.

Figure 4 shows the average additional wealth (M), by age, we would need to give individuals in the balance fee to make them as well off as they would be with the load factor fee. We find that $M \geq 1$ for all individuals, which indicates that they need additional resources to reach their initial utility levels, and therefore, they are worse-off due to the reform. Note that M is very large for young individuals (for example cohort 21-55-years-old), which shows that they would need to be compensated around 20 times their initial wealth to make them indifferent between the choice of the two fees. They are the most affected by the reform in terms of welfare. Importantly, results are independent of the value of risk aversion.

Figure 4: Mean of Additional Wealth Needed to Compensate Individuals



Notes: For this figure we restrict the sample to individuals older than 25 years. We dropped 2.9 percent of the sample because they presented values of S_0 near to zero.

Figure A.2 and Table A.8 in the appendix provides additional results by actual fee choice and quintiles of income, density of contribution and pension balance. Figure A.2 shows that individuals assigned to the balance fee (in all cohorts) would need to be compensated significantly more than those who chose the load factor fee. If we analyze the distributions of the pension balance and contributions, Table A.8 shows that individuals in the first quintiles would need relatively more additional resources to reach their initial utility levels before the reform. In contrast, in terms of income, individuals in the upper quintiles would need very large compensations.

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

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 balance fee of 1.23 percent). We highlight this change by using two different values for the balance 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 a 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 intensities of the

losses and gainsvary. [17]

Table 7 summarizes our results. As expected, the percentage of individuals that are better off (winners) with the balance fee increases. In the baseline scenario shown in Table 2, this 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 with the balance fee 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 balance fee, and this percentage is higher than the percentage of winners (19.6). For those who opted for the load factor fee, the scenarios of decreasing balance fees naturally implies that they 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 when decreasing balance fees are always good news for the individuals, 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 is that more individuals in the load factor fee become losers because they do not switch to the balance 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. Balance (mixed) fee is better & balance fee is chosen	6.6	10.5	19.6
b. Load factor fee 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 factor fee is better & balance fee is chosen	40.4	36.5	27.4
d. Balance fee 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 it has a lower charge ratio. 2/. Balance fees correspond to simple average of fees.

Figures A.3 and A.4 in the appendix show the cumulative distribution of gains and 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 who chose the balance fee in comparison to the distribution shown in Figure 3, specially in the scenario of a balance fee of 0.75 percent. The

[17] 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 that reaches 0.60 percent around the year 2024. The assumption is based on the evolution of the ratio of the revenues from the Pension Funds fee and the total pension balance over time for the Chilean pension system after 30 years of functioning.

size of the gains also changes positively in this scenario, as expected. Consequently, the losses among the individuals who opted for the load factor fee increase, which indicates they will have relatively lower pension balances.

In sum, the analysis presented in this section suggests that first, the relative proportions of losers and winners change with the levels of the balance fees. The fraction of winners (losers) with the balance fee increases with a lower (higher) fee. Second, the intensities of the losses and gains for individuals assigned to the balance fee varies when the fee is lower. The intensity of the loss reduces and the intensity of the gains increases. However, an open question is 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)). Because the pension balance is part of household wealth portfolios, we could assess whether the 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 the inequality in pension balances (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 has 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 the RIF regressions. First, the influence function (IF) (Hampel et al. (1986)) of each individual on the pension balance distribution is computed. This computation means that we can 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 IF is linearly regressed against some covariates of interest. For example, a positive coefficient for the mixed fee (a dummy variable) may mean 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 chose the balance fee. [18]

The IF and Gini index are computed with the pension balance simulated for each individual by accounting for her actual fee scheme, i.e. that is the pension balance projected until the individual is 65. In order to reduce the role of life-cycle effects due to the paths of accumulation for pension balances, 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

[18] 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)).

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 regional fixed effects; $balancefee$ equals one if the individual chose the balance fee and zero otherwise.

$$IF_i = \alpha + \beta_1 X_i + \beta_2 balancefee_i + \varepsilon_i \tag{18}$$

Table 8 presents only the coefficients estimated for $balancefee$ for each cohort group (the estimates of all covariates are in the appendix). The coefficients represent 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 balance fee is associated with an increase of 0.12 percent in the Gini index of pension wealth. When statistically significant, the effect on the inequality of the balance 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 have both a low income and a low contribution density, that then enlarges 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 for an 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 Governments should carefully design pension policies, and take into consideration market limitations and the lack of adequate financial liter-

acy, particularly when using an irreversible default option. In pension systems, mistakes made by individuals have irreversible and long-term consequences. We show that a reform of the fees in pension funds that was implemented in Peru in 2013 has adverse effects on pension wealth. The reform established a new balance fee that is a percentage of the pension balance unless the individual has opted to stay with the previous fee: the load factor fee that is a percentage of salary. Our results indicate that the reform adversely affects the pension wealth of 63.8 percent of individuals. This percentage is composed by 40.4 percent of individuals who were assigned or chose the balance fee and 23.4 percent who freely chose the load factor fee.

Our analytical data set composed of individual administrative records does not allow us to establish whether the individuals with the balance fee were simply inactive regarding the choice of a fee scheme or believed that the balance fee was the best scheme for their interests. But it is worrying that the majority of them is worse off due to the reform. For those who opted for the load factor fee, is also worrying that almost one quarter of the individuals were "wrong" about staying with this scheme.

We also perform some robustness checks and find that the individuals who chose the balance fee are better off as the fee decreases. But, even when decreasing the balance fees is good news, we observe that this fee may also increase the overall number of people losing due to the reform. This is because less individuals benefit from the load factor fee because they do not switch to the balance fee. Therefore, if a hypothetical reduction in balance fees occurs, the Government may consider encouraging a shift from the load factor to the balance fee for certain individuals.

We also observe large heterogeneity in the intensities of losses and gains due to the reform, where the losses are larger than the gains. In particular, the younger and poorer individuals and those with the balance fee show higher losses. Moreover, we use Gini-Recentered Influence Function regressions to uncover the predictors of the inequality in pension balances and detect that the change in the fee scheme is associated with increasing inequality in 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 to the pension balance instead of to salaries, which would lead to higher rates of returns for both individuals and providers. However, this assumption seems to be strong in a market with just four providers and very low dynamic in prices over time. 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 the Mandatory Provident Fund (MPF) as of December 2013. 2/. There is an average administrative fee of 0.028% on the account value (2015) of the Notional Defined Contribution . 3/. This represents a statutory cap on annual management charges for the stakeholder's pension plan. Other than these 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) savings plans was 0.78%. The fees varied from a minimum of 0.28% up to a maximum of 1.38% of assets. This fee included record-keeping, and 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 the funds. There is no legal maximum fee. 10/. Charge for disability and survivor insurance and administrative fees.

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

Pension Fund (AFP)	Load factor fee or fee on salary (%)	Mixed fee 1/.		Percentage of individuals 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 1, 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 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.

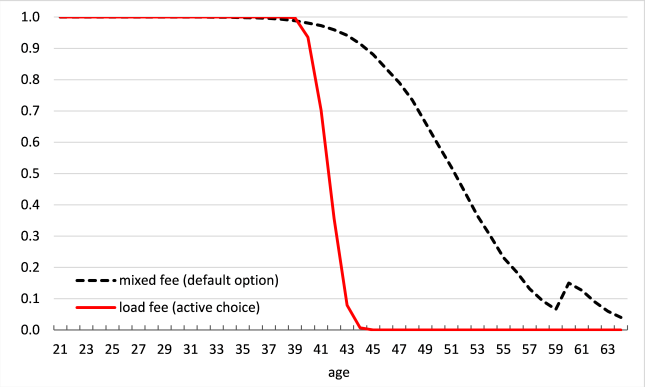
Table A.4: Mean Differences Among Individuals by Gender and Actual Fee Scheme

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***

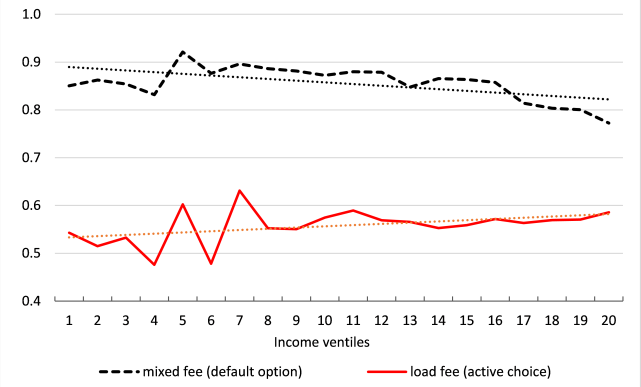
Notes: Based on data provided by the Superintendency of Banking, Insurance and Pension Funds (SBS).

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

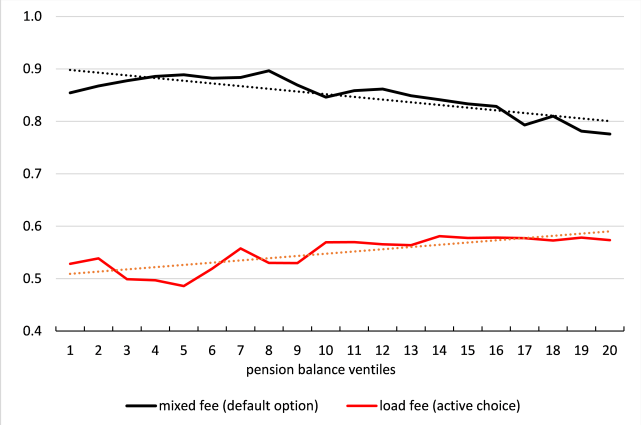
(a) Predicted Probability by Age and Actual Fee Scheme



(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

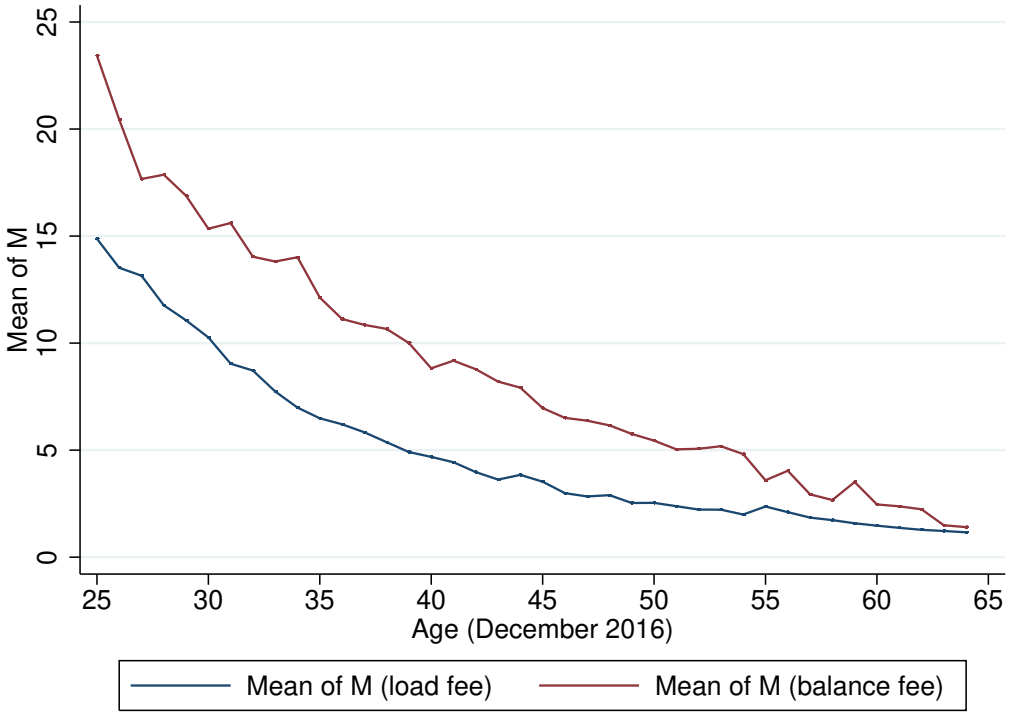
Table A.6: Losses and Gains by Actual Fee Scheme and Contribution Density Quintiles

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

Figure A.2: Mean of Additional Wealth Needed (M) by choice of Fee



Notes: For this Figure we restrict the sample to individuals older than 25 years. We dropped 2.9 percent of the sample because they presented values of S_0 near to zero.

Table A.8: Average M by Age Group and Quintiles of Balance, Contribution and Incomee

Age group	Quintiles of Balance				
	Q1	Q2	Q3	Q4	Q5
21-25	25.02	12.68	12.15	18.71	-
26-30	22.96	10.79	9.63	9.79	10.85
31-35	22.83	8.85	6.55	6.27	6.29
36-40	19.90	7.65	5.24	4.16	4.14
41-45	18.37	6.83	4.15	3.20	2.98
46-50	14.52	5.75	3.44	2.38	2.14
51-55	12.18	4.50	2.87	1.97	1.70
56-60	8.06	3.12	2.06	1.60	1.41
61-64	4.32	1.92	1.46	1.22	1.16

	Quintiles of Contribution				
	Q1	Q2	Q3	Q4	Q5
21-25	34.39	18.34	12.82	11.02	9.89
26-30	27.94	13.34	10.02	8.90	9.94
31-35	22.77	9.32	7.01	6.17	5.07
36-40	16.97	7.05	5.15	4.84	3.59
41-45	13.83	5.69	4.02	4.00	2.66
46-50	10.40	4.26	3.32	2.70	2.00
51-55	8.12	3.65	2.76	2.25	1.64
56-60	5.65	2.55	1.97	1.96	1.38
61-64	3.02	1.70	1.38	1.36	1.14

	Quintiles of Income				
	Q1	Q2	Q3	Q4	Q5
21-25	12.33	21.23	24.08	29.15	40.56
26-30	9.11	14.94	15.58	17.00	21.17
31-35	7.45	10.56	10.96	12.43	11.78
36-40	5.69	7.96	8.02	7.84	8.19
41-45	4.68	5.56	6.25	6.02	6.28
46-50	3.61	4.17	4.60	4.26	3.93
51-55	2.80	3.14	3.62	3.21	3.32
56-60	2.23	2.16	3.03	2.26	2.14
61-64	1.51	1.52	1.74	1.67	1.42

Figure A.3: Cumulative of Gains and Losses with a Balance Fee of 1%

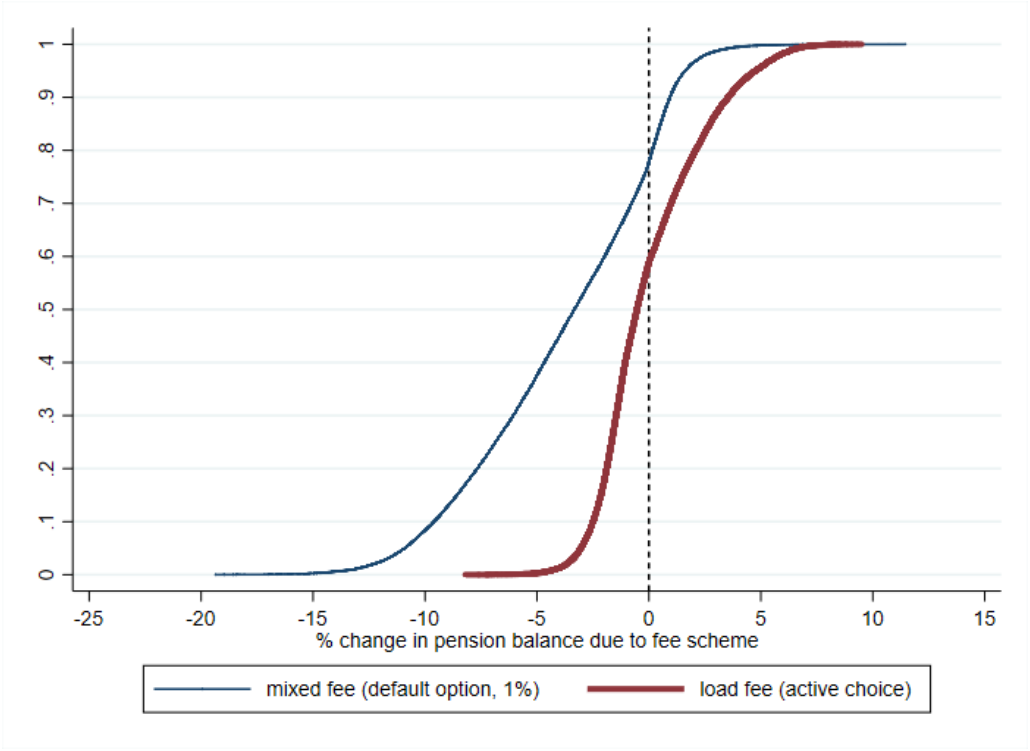


Figure A.4: Cumulative of Gains and Losses a Balance Fee of 0.75%

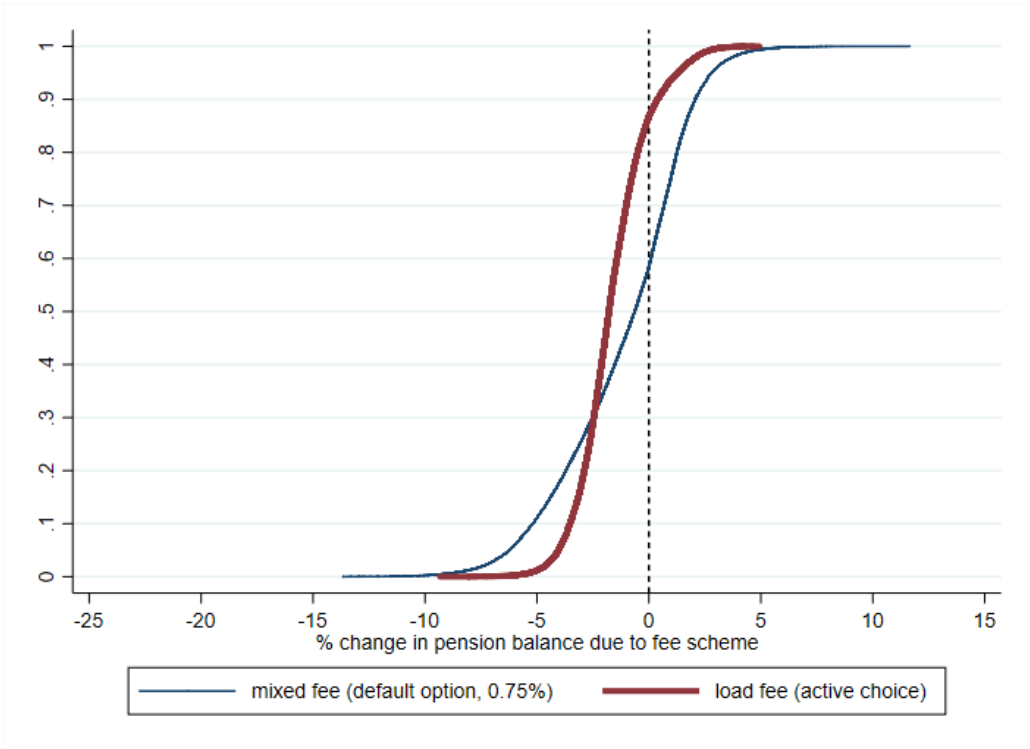


Table A.9: Mean of Additional Wealth Needed (M) by Cohort and Different Levels of the Balance Fee

Cohort	Balance Fee		
	1.23%	1.00%	0.75%
21-25	20.50	20.50	20.47
26-30	14.83	14.83	14.81
31-35	10.65	10.66	10.64
36-40	7.55	7.55	7.55
41-45	5.77	5.78	5.77
46-50	4.11	4.11	4.11
51-55	3.21	3.21	3.21
56-60	2.33	2.33	2.33
61-64	1.54	1.54	1.54

Notes: We dropped 2.9 percent of the sample because they presented values of S_0 near to zero.

Table A.10: 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

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