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GENDER GAP IN PENSION SAVINGS: EVIDENCE FROM PERU'S INDIVIDUAL CAPITALIZATION SYSTEM

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Gender gap in pension savings: Evidence from Peru's individual capitalization system*

Javier Olivera† Yadiraah Iparraguirre‡

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Abstract

We study the gender gap in pension funds in Peru, a country where the main pension system is based on individual retirement accounts. We exploit randomly selected samples of administrative pension fund individual registers collected between 2005 and 2019 and find a gender gap in favour of men at each percentile of the distribution of pension funds. The unconditional gender gap decreases along the percentiles until it reaches a sort of "glass ceiling" around the 85th percentile, and then it increases substantially. We also detect heterogeneity by birth cohorts, indicating that older cohorts show higher gender gaps in pension saving because of the capitalization process. Moreover, we find that awareness about pension fund risk management –a proxy for financial literacy– increases the dispersion of pension savings over the distribution and, therefore, increases inequality and the gender gap. This situation is aggravated by the fact that Peru has very low levels of financial literacy.

Key words: Gender gap, Pension savings, Financial literacy, Unconditional quantile, Peru

JEL-classification: D31, G23, J16, J32.

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Brecha de género en el ahorro pensionario: Evidencia del sistema de capitalización individual de Perú*

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29 de junio de 2022

Resumen

Estudiamos la brecha de género en los fondos de pensiones en Perú, país donde el principal sistema de pensiones se basa en cuentas individuales de retiro. Analizamos muestras seleccionadas aleatoriamente de registros administrativos individuales de fondos de pensiones recopilados entre 2005 y 2019. Encontramos una brecha de género a favor de los hombres en cada percentil de la distribución de los fondos de pensiones. La brecha de género, no condicionada, disminuye a lo largo de los percentiles hasta alcanzar una especie de "techo de cristal" alrededor del percentil 85, y luego aumenta sustancialmente. También detectamos heterogeneidad por cohortes de nacimiento, indicando que las cohortes de mayor edad muestran mayores brechas de género en el ahorro pensionario debido al proceso de capitalización. Además, encontramos que el conocimiento sobre la gestión del riesgo de los fondos de pensiones –una variable que captura alfabetización financiera– aumenta la dispersión de los ahorros pensionarios en la distribución y, por lo tanto, aumenta la desigualdad y la brecha de genero en los fondos de pensiones. Esta situación se ve agravada por el hecho de que Perú tiene niveles muy bajos de alfabetización financiera.

Palabras claves: Brecha de género, Fondos de pensión, Alfabetización financiera, Regresiones por cuantiles, Perú

Códigos JEL: D31, G23, J16, J32.

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1 Introduction

Various Latin American countries reformed their pension systems by implementing schemes based on individual retirement accounts (IRA) during the wave of structural reforms of the 1990's. The previous public pension schemes – mostly based on Pay-as-you-go (PAYG) financing – were fully or partially replaced with the new IRA systems. Among the frequently mentioned goals of these reforms were solving public financial imbalances and facilitating individuals to access to better pensions by means of individual capitalization. There are studies assessing the benefits and problems created by these reforms in different dimensions such as pension adequacy, saving behaviour and capital market development (e.g. Bosch et al. (2013); Arenas de Mesa (2019); Altamirano-Montoya et al. (2018)), but less on gender gaps in pension savings accumulation.

It has been found that the key factors to understand the gender gap and its trends in pensions are the effects of the life course of women, including their participation in the labour market, differential mortality, and the institutional characteristics of the pension system (Bando, 2019; Madero-Cabib et al., 2019). Despite advances in educational attainment of women, the family roles and the labour market characteristics are still strong determinants of gender gaps. Women often participate less in the labour market, spend disproportionately more time in household tasks and have lower wages (Cordova et al., 2021; Arza, 2015; Madero-Cabib et al., 2019). It has been illustrated that these conditions may hamper the ability of women in the long-term to accumulate pension savings and generate adequate levels of pensions (Altamirano-Montoya et al., 2018).

The design of the pension system and its rules have an important role on determining pension outcomes by gender. For example, minimum contributions spells, minimum pensions, retirement age, mortality tables used to compute pension benefits and the link between benefits and earnings have a key role on the gender differences observed in pensions (Arza, 2015; Bertranou, 2001). This means that IRA systems, which strengthen the link between lifetime wages and pensions, prompt a new set of gender equality issues. The gender gap could further expand if we consider that financial knowledge or the ability to make better investment choices or annuity management is more prevalent among men than among women (Lusardi and Mitchell, 2010; Hastings et al., 2010; Fonseca et al., 2012).

We seek to contribute to the literature on gender pension gap by studying the case of Peru, a country where the main compulsory pension system is based on IRA. This is the Private Pension System (known as SPP, due to its Spanish name). Although there is an alternative public pension system (known as SNP, due to its Spanish name), most of the new workers enrol into the SPP (in 2019, the ratio between new affiliates of the SPP to the SNP was about 5 to 1). We use representative samples of the non-retired population affiliated to the SPP, randomly selected from administrative registers in 2005, 2006, 2013, 2015, 2016, and 2019. Our data allows us to analyse gender gaps in pension balances along birth cohorts and across the years of our period of analysis.

There are not many empirical studies assessing gender gaps in pension wealth generated in IRA systems. Note, however, that a recent study by Cordova et al. (2021) finds in Germany that the low participation and capitalization of women in private pension plans may explain their lower pensions. Thus, low pensions are mainly explained by the type of occupation, income level, hours of work and the presence of children at home. Also in Germany, Flory (2012) finds that the pension wealth gap is heterogeneous by birth cohort groups. The gender gap tends to be lower among younger cohorts than among older cohorts. In the United Kingdom, Foster and Smetherham (2013) find that the factors strongly associated to individual contribution rates are the type of occupation, income, economic position and having young children, with these predictors being more salient for women than for men.

Studies on net worth show a gender gap favouring men over women. Schneebaum et al. (2018) exploit the Household, Finance and Consumption Survey (HFCS) to study the gender gap throughout the distribution of net wealth across single-person households in eight European countries. They find that the gap increases with the percentiles of the distribution of net wealth, showing evidence of a "glass ceiling" problem. When looking at the gap by type of wealth, this gap does not come from asset wealth in the household, but from the disparity in occupational pensions. Furthermore, they find that the gender gap increases when both the cohort is older and the percentile is higher, with the exception of Germany and Spain. Likewise, the study by Meriküll et al. (2021) on Estonia finds an increasing gender gap in favour of men across the quantiles of household net wealth. The factors explaining this result are labour market status (self-employment, retirement) education, occupation type, and marital status. Moreover, studies like the ones by Frémeaux and Leturcq (2020) and Sierminska et al. (2019) exploit individualized wealth portfolios to understand several drivers of gender wealth gaps.

Like some of the previous studies mentioned, we also use unconditional quantile regressions to estimate gender gaps along the distribution of pension wealth. We find a gender gap in favour of men at each percentile of the distribution pension funds, yet this decreases constantly along the percentiles until reaching a sort of "glass ceiling" around the percentile 85. From that point, the gender gap rapidly increases in the top section of the distribution of pension wealth. Overall, our results point out that on the one hand, we observe a reduction of the gender gap in pension wealth across birth cohorts, which is line with other findings about the increase of female labour participation and wage improvements. However, on the other hand, we observe that this not enough to reduce consistently the pension wealth gap when we observe longer spells in the capitalization system. The capitalization of individual pension contributions –operating via the capital market returns of pension funds– amplifies any early and small gender gap observed at the beginning of the working life.

Moreover, in a country where only 28% of adult population scores correctly in financial literacy questions about interest rate, inflation and risk diversification (see Klapper et al. (2015)) is important to know whether this could have a role on the gender pension wealth gap. We are able to capture financial literacy by observing how individuals move from default options in the risk composition of their portfolio investments, which we call *Awareness of portfolio management*. As has been found in other studies (e.g. Lusardi et al. (2017) find an effect of financial literacy on household wealth inequality), we document that financial literacy may increase inequality in pension savings. Furthermore, the importance of *Awareness of portfolio management* in explaining pension savings gap increases along the distribution of pension wealth, meaning that differences in financial literacy may exacerbate gender gaps as well as pension savings inequality.

The remainder of the document is organized as follows. Section 2 describes the institutional framework of the pension system in Peru. Section 3 describes the data and empirical strategy. Section 4 reports and discusses the main results, and Section 5 exploits available information on portfolio risk choices to study the role of financial literacy on the distribution of pension savings and gender gaps. Section 6 presents additional results regarding a measure of extended pension wealth and the distribution of income. Finally, Section 7 presents the conclusions.

2 Institutional background

The Peruvian pension system is composed of two schemes which represent two mutually exclusive options to the individuals. First, the SPP is a defined contribution (DC) system, which is based on individual retirement accounts (IRA) and started in June 1993. The introduction of this type of system was part of a wave of pension reforms, inspired in the Chilean case, well-spread across Latin America during the 1990's. The pension fund managers (the so-called AFP) are firms receiving the pension contributions and investing the individualized savings on investments tightly regulated by the *Superintendent of Banking, Insurance and Pension Funds* (known as SBS due to its Spanish name). Second, the National Pension System (SNP) is a defined benefit (DB) system operating as a PAYG system. The individuals must choose one of these pension systems at the beginning of their working lives. If the SPP is chosen, the individual must remain there, but a shift from SNP to SPP is possible at any time. In order to recognize part of the contributions made to the SNP, the government has issued "Recognition Bonds" which values are monthly updated by the official prices index. So far, there are three types of bonds, issued as of 1992, 1996 and 2001. There are currently four AFP in Peru: Prima, Integra, Profuturo and Habitat. There were other AFP in the past, but they gradually left the market or merged with other firms over time. After several changes in the regulation, currently the worker contributes 10% (plus administrative fees and insurance premium) of the gross salary to the AFP, or 13% to the SNP.[1].

IRA systems have been strongly criticized for their distributive impacts. These systems tend to favour people with higher incomes and do not guarantee minimum pensions, leaving many people with small pensions during old age and limiting their eligibility for social assistance

[1]The contribution rate was 11% in 1993-1995, 8% in 1996-2005 and 10% since 2005

programs. At least in Peru, an individual is eligible to social pensions only if she is older than 65, extreme poor and has no private or public pensions. The dis-equalizing effects of IRA systems are aggravated in contexts with high levels of informality and high turnover between formal and informal employment, which reduces the frequency of contributions. Likewise, these systems are criticized for their high fees and administrative costs. Yet, these systems have also attracted support when the assessment of the IRA system is focused on the positive contributions made on national savings, economic growth and the development of new annuity markets.

The SPP could also exacerbate the inequalities observed in labor income through the capitalization process and the disparity in the frequency of contributions among individuals. This means that the process of capitalization and the fact that richer individuals contribute more frequently could generate larger differences in pension savings than in incomes. In addition, these inequalities may further increase once we take into account the absence of minimum guaranteed benefits in the SPP and the fact that the computation of pensions use gender-differentiated mortality tables, which favour men over women.[2] This differs from DB systems, which tend to reduce inequality through minimum guaranteed pensions and the use of unisex mortality tables to determine the amount of pensions. Consequently, gender inequality in pension savings could be significant in IRA type systems. We can see some of the main factors driving gender gaps in pension savings with the following stylized equations:

$$B_i = a \sum_{j=25}^{65-j} (w_{ij} d_{ij})(1+r)^{(65-j)} \qquad i = m, f \tag{1}$$

$$Gender\ Gap = B_m - B_f = a \sum_{j=25}^{65-j} (w_{mj} d_{mj} - w_{fj} d_{fj})(1+r)^{(65-j)} \tag{2}$$

The equation 1 indicates the level of pension balance (B_i) accumulated at retirement age by men (m) or women (f). The value depends on income (w), frequency of contributions ($d \in [0,1]$), contribution rate (a), return rate (r), and the period of capitalization ($65 - j$) (assumed between age 25 and 65). The gender gap is reported in equation 2, showing the difference of pension balances accrued by men and women at retirement. We observe that two main components affect the level of the gender gap, which are the wages and the capitalization process. On the one hand, we have the differences in labor income (weighted by frequency of contributions, which may reflect occupation status and degree of formality), and on the other hand we have the capitalization process driven by the return rate and the length of the capitalization period. A gender gap could potentially be observed at any period of the labour span of the

[2]Women have larger life expectancy than men, which must be reflected in the annuity price formula used to compute pensions in the SPP. For example, the difference in pensions attributed to differential sex mortality would be about 10% (in favour men over women) when we compute an annuity at age 65 using the SPP's official life tables for a single a man and a single woman with the same level of pension balance, and a discount interest rate of 3%.

individual, but it is key to recognize that only at retirement age we could fully account for all the capitalization process affecting the full value of pension savings.

3 Data and empirical strategy

3.1 The data

We use cross-sectional samples of the total non-retired population from the SPP administrative registers as of 2005, 2006, 2013, 2015, 2016, and 2019. The samples are random, stratified and representative of the following strata for each sampling year: 5-year age group, sex and year of enrolment in the SPP. These are the only available data sets including information about each individual's pension balance, management fees, income and some demographic variables. For each year, the sample is equivalent to 2% of the total non-retired population in the SPP[3].

The initial sample size is composed of 600,360 observations, which corresponds to individuals aged between 21 and 64 in each sample year. We do not consider individuals older than 65 as this is the legal retirement age. After dropping individuals with no information on pension balance (165), affiliated for less than one month (1,307), being in pension fund type 0 (1,536), and with zero pension balance (64,152), we obtain our final sample of 533,200 observations. The balances of value zero may reveal that the individual is not able or does not want to accumulate pension funds. Given that our interest rests on assessing pension fund gender gaps of people who do save for pensions, we removed the individuals who have not pension savings.[4] Thus, our analysis is representative of the non-retired population who have at least contributed once to their retirement savings in the SPP.

The micro-data include information on age, gender, employment condition and income at the individual level. The data also include information on the pension account, such as the enrollment date, AFP, last contribution date, pension balance, type of fee (load factor or balance fee), type of pension fund, information about recognition bonds, and contribution density. This last variable indicates the share of contributions made by the individual with respect to the theoretical total number of contributions that the individual should made, so that the values ranges between 0 and 1. However, as this variable is only available for the samples extracted in 2015, 2016, and 2019, we are still able to use the date of the last registered contribution, available for all the sample years, to compute a proxy variable. The variable *regular contributor* takes value one if the last contribution registered for the individual was made in the sampling year, and zero otherwise.

[3]The sample size is 1.8% of the SPP non-retired population for 2005 and 2006, and is 2% for each of the other years.

[4]Among the individuals with zero pension balance, 28% have been enrolled in the SPP for 15 years or more, 45% between 5 and 14 years, and 23% between 1 and 4 years. Possible explanations for this behaviour are that the individual was enrolled while she was working in an activity with no obligation to contribute (informal sector or as self-employed) or was inactive (e.g. students). There are also the so-called "ghost affiliates", who are individuals who never realized they were enrolled at some point by an AFP salesman.

There are four main types of pension funds. Fund type 0 is designed to maintain capital, offers both very low return and volatility and is intended for individuals who are in the process of acquiring a pension. Fund type 1 includes investments with relatively low returns and volatility and is mandatory for individuals aged 60-65, unless the individual has expressly chosen to be assigned to fund type 0 or 2. Fund type 2 includes investments with moderate growth and volatility and combines both fixed-income instruments and equities. Fund type 3 is generally composed of investments with higher returns and volatility such as equities. [5] When an individual enrolls for the first time into an AFP, the default pension fund is type 2. Choosing another type of pension fund requires a special administrative procedure. Following Bernal and Olivera (2020) we use these pension fund risk defaults to compute a measure about how active individuals are regarding their portfolio management. The variable *Active portfolio management* takes the value of one if an individual under 60 has a pension fund type 1 or 3 or whether an individual older than 60 has a pension fund other than type 1; and takes value zero otherwise. This variable indicates that the individual has taken action to move away from the default pension fund risk portfolio. We argue that this variable captures awareness about risk diversification and may therefore be a proxy for financial literacy. We expect that more sophisticated individual investors will be more likely to deviate from the defaults.

3.2 Empirical strategy

First, we use OLS regressions to explore and estimate the gender gap in pension balance according to the following equation:

$$B_i = \alpha + \beta_1 male_i + \beta_j C_{ji} + \pi year_i + \gamma_j C_{ji} \times male_i + X_i^{'} \theta + \varepsilon_i \tag{3}$$

Where B_i is the pension balance of individual i, C_{ji} is an indicator variable for the birth year cohort j of the individual, $year_i$ is the year of the sample draw, $male_i$ is an indicator variable for men, $X_i^{'}$ is a vector of covariates, and ε_i is the error term. As we are interested in estimating the gender gap magnitudes along the distribution of pension wealth, we will perform unconditional quantile regressions (UQR). These regressions are based on an extension of the Recentered Influence Function (RIF), which provides a linear approximation of the unconditional quantiles of the dependent variable of analysis (Firpo et al., 2009). This function is defined as the following:

$$RIF(B;Q_\tau,F) = Q_\tau + IF(B;Q_\tau,F) \tag{4}$$

Where Q_τ is the value of pension balance B at quantile τ in the unconditional distribution F of pension balances, and $IF(B;Q_\tau,F)$ is the quantile influence function. The influence function

[5] Fund type 0 invest 100% on fixed-income instruments. Fund type 1 invests up to 90% in short-term fixed-income instruments and up to 10% in equities; fund type 2 invests up to 55% in short-term fixed-income instruments and up to 45% in equities; and fund type 3 is composed of investments up to 80% in equities and up to 20% in short-term fixed-income instruments.

of a statistic (in our case, the quantile) indicates how sensible is this statistic to different areas of the distribution (Choe and Van Kerm, 2018). This function is represented as follows:

$$IF(B;Q_\tau,F) = \frac{(\tau - I[B \leq Q_\tau])}{f_B(Q_\tau)} \tag{5}$$

Where $f_B(Q_\tau)$ is the density function up to the percentile τ and $I[B \leq Q_\tau]$ is a binary variable that takes the value of one when the value of B is lower than the corresponding percentile, and zero otherwise. Replacing equation 5 in 4 we obtain equation 6 that represents the RIF. Using the RIF assures that the change in its average value over time is equal to the change in the statistic of interest (Davies et al., 2017).

$$RIF(B,Q_\tau) = Q_\tau + \frac{(\tau - I[B \leq Q_\tau])}{f_B(Q_\tau)} \tag{6}$$

Once the RIF estimators of B are computed, the following equation can be estimated by OLS:

$$RIF(B,Q_\tau) = \alpha + \beta_1 male_i + \beta_j C_{ji} + X_i^{'}\theta + \varepsilon_i \tag{7}$$

The RIF regression allows us to evaluate the impact of any covariate on the statistic of interest and determine which variable is associated with the greatest influence on the distribution. The coefficients obtained from the regression can be interpreted as how much an infinitesimal change in the distribution of the covariate influences a given quantile, maintaining everything else constant, which is known as the unconditional quantile partial effect (UQPE). This method allows us to focus on a certain point of the distribution of the pension balance (high or low percentile), regardless of whether the values of the covariates are the same (Firpo et al., 2009; Choe and Van Kerm, 2018). This represents an advantage for studying gender gaps compared to the conditional quantile regression (CQR) method. The reason is that the CQR estimates can only be interpreted on a set of individuals sharing covariates with the same values and cannot be used to estimate the impact of a variable of interest on the corresponding unconditional percentile (Firpo et al., 2009). Thus, we could evaluate the effect of increasing the participation of men or increasing a year of affiliation in a certain upper percentile of the distribution, in which there are probably more men than women.

In addition, we use the Oaxaca-Blinder decomposition based on the RIF regressions for men and women at given percentiles. Following the standard decomposition equation, we have the following:

$$\bar{B}_{m,\tau} - \bar{B}_{f,\tau} = \left(\overline{X}_m - \overline{X}_f\right)\beta_{m,\tau} + \overline{X}_f\left(\beta_{m,\tau} - \beta_{f,\tau}\right) \tag{8}$$

Where $\bar{B}_{m,\tau} - \bar{B}_{f,\tau}$ represents the gender gap in pension wealth at percentile τ, $\overline{X}_m$ and $\overline{X}_f$ represent the average values of the explanatory variables, and $\beta_{m,\tau}$ and $\beta_{f,\tau}$ are the coefficients that come from running RIF regressions for men and women. The decomposition allows the gender gap to be separated into two components: a component explained by differences in the characteristics between men and women, and an unexplained component that has its origin in the differences in the returns of the variables that are typically linked to gender discrimination in the labor market.

4 Results

4.1 Descriptive analysis

Table 1 reports the percentiles of the distribution of pension savings for men an women and the raw gender gap observed at each of these percentiles. In average, men owns 37% more pension funds than women do, but this gap is different across the distribution of pension funds.[6] The gender gaps show a sort of U shape, being about 60% higher for men in the three first deciles, and then reducing until the 89th percentile. From that point, the gap increases quickly towards the top section of the distribution of pension savings. For example, the gender gap grows from 22% at the 90th percentile to 43% at the 99.5th percentile. The findings are similar to other studies assessing gender wealth gaps. For instance, Anglade et al. (2017) also find a U-shaped distribution of gender gaps in the distribution of wealth of single individuals in Ecuador. Given that pension fund accumulation in IRA systems can mimic savings from earnings – which is an important component of financial wealth – it is not surprising that our distribution of gender gaps follow established patterns in gender wealth gaps. The results of Table 1 also confirm the high levels of inequality in the distribution of pension wealth. For example, women (men) in the 99th percentile owns 41 (49) times more savings than women (men) in the 50th percentile. Overall, the Gini index of pension savings is 0.75, while the Gini index of income in 2019 is 0.42 (according to World Bank Open Data). These differences in the distribution of pension savings and income are well aligned with general patterns showing that wealth tend to be more unequally distributed than income. When we replicate the results of Table 1 for each sampling year (see Figure A.1 in the Appendix), we observe that the raw gender gaps (measure in men-to-women ratios of pension savings) have been increasing in the lower percentiles of the distribution of pension funds between 2005 and 2019, while the gaps observed in the top percentiles have shown a rather stable pattern for the same period.[7]

[6] The raw gender gap is 7,942 Soles, which represents about 8 minimum wages in Peru.

[7] We only plot the percentile 50th for the bottom group, but other percentiles in the bottom section of the distribution also show an increase in the raw gender gaps. We also notice that in 2005 and 2006, women had larger levels of pension wealth than men until about the percentile 80th. The percentile 99th shows a decrease in gender gaps (47% in 2005 and 35% in 2019), but the other top shares show do not change much in the period.

Table 1: Raw gender gaps in pension savings in 2019 (Soles)

Variables	Mean	Percentile											
		10	20	30	40	50	60	70	80	90	95	99	99.5
Male	29,332	439	1,204	2,469	4,579	7,875	13,117	21,430	36,224	67,340	114,827	323,676	477,979
Female	21,390	274	750	1,534	2,803	4,943	8,383	14,505	27,016	55,359	87,017	239,763	335,168
Gap (M-F)	7,942	164	454	934	1,776	2,932	4,734	6,925	9,207	11,982	27,810	83,913	142,811
P-value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Men-to-women ratio	1.37	1.60	1.61	1.61	1.63	1.59	1.56	1.48	1.34	1.22	1.32	1.35	1.43

Note: The table uses the sample of registers drawn in December 2019 (N=124,942, N male=76,029, N female=48,913).

Table 2 reports the means of pension balances by gender and various characteristics of the individuals for the sampling year 2019. As expected, older cohorts accumulate more pension savings than younger cohorts; and we also observe a reduction in the absolute amounts of gender gaps among younger cohorts. Yet, the gender gaps in percentage terms do not show a clear decreasing pattern along birth cohorts as with the case of the absolute values, but at least we see that the percentage gender gap is higher in the the oldest cohorts than in the youngest cohorts.

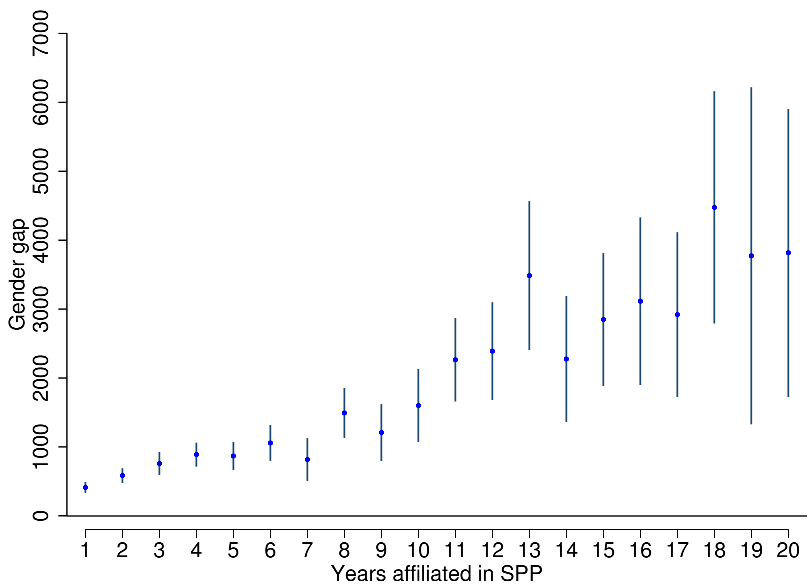
Table 2: Unconditional means by gender in pension savings in 2019 (Soles)

Variables	Total		Male		Female		Diff (M-F)		Gap in %
	Mean	S. D.	Mean	S. D.	Mean	S. D.	Difference	S. E.	
All	26,223	(71,536)	29,332	(80,145)	21,390	(55,222)	7,942***	(414)	37.1
Birth cohorts									
1996-1998	1,441	(1,698)	1,549	(1,810)	1,302	(1,533)	247***	(38)	19.0
1989-1991	7,488	(10,216)	7,857	(10,529)	7,002	(9,768)	855***	(191)	12.2
1979-1981	23,471	(37,944)	25,427	(38,005)	20,399	(37,647)	5,029***	(731)	24.6
1969-1971	48,808	(98,800)	51,970	(108,708)	43,178	(77,806)	8,792***	(2,258)	20.4
1959-1961	69,919	(166,585)	74,857	(178,212)	59,501	(138,400)	15,356**	(6,334)	25.9
Years enrolled in SPP									
1-3	2,142	(5,958)	2,450	(7,656)	1,784	(2,906)	666***	(86)	37.3
9-11	14,155	(24,872)	14,912	(27,581)	12,957	(19,790)	1,956***	(453)	15.1
19-21	40,335	(65,332)	42,263	(70,628)	36,810	(54,159)	5,453***	(1,213)	14.8
25-27	89,839	(168,542)	93,014	(180,244)	82,536	(137,661)	10,478***	(3,835)	12.7
Regular contributor									
No	10,828	(31,089)	12,103	(34,833)	8,863	(24,076)	3,240***	(278)	36.6
Yes	37,319	(88,397)	41,683	(98,950)	30,495	(68,164)	11,188***	(671)	36.7
AFP									
Habitat	12,305	(70,062)	15,374	(87,196)	8,569	(40,035)	6,805***	(1,025)	79.4
Integra	32,697	(73,963)	35,632	(81,267)	28,064	(60,380)	7,568***	(783)	27.0
Prima	25,513	(77,090)	29,615	(87,993)	19,686	(57,698)	9,929***	(783)	50.4
Profuturo	27,945	(59,036)	29,051	(62,107)	25,674	(52,096)	3,377***	(741)	13.2
Recognition Bond									
No	23,766	(61,627)	26,516	(68,949)	19,498	(47,788)	7,018***	(359)	36.0
Yes	186,133	(254,390)	206,694	(281,452)	151,320	(195,731)	55,374***	(12,003)	36.6

Note: The table uses the sample of registers drawn in December 2019 (N=124,942, N male=76,029, N female=48,913). The mean differences are computed using two-sample equal variance t-tests by gender. *p<0.10, **p<0.05, ***p<0.01.

The years of affiliation play an important role in the accumulation of savings, particularly if the contributions are more frequent. The descriptive statistics show that the gender gap amounts can increase substantially with the number of years affiliated in the SPP. Figure 1 exploits the entire pooled sample of 2005-2019 and shows the gender gap for each period of affiliation, regardless the calendar year. This also shows a substantial increase in the gender gap value for each year of affiliation. The relatively large intervals of confidence reveal that there is still substantial heterogeneity within each period of savings accumulation. Note, however, that the gender gaps in percentage terms tend to decrease with the number of years of affiliation, which could indicate that for each period of accumulation there are women who are not completely "left behind" in terms of pension balance accumulation. This is somewhat supported by the fact that the percentage gender gap is similar for those individuals with a regular contribution behaviour as for those showing an irregular contribution pattern, meaning that men and women are similarly distributed in terms of contribution frequency. This last point is confirmed by the results shown in Figure A.2 in the Appendix, which reports a similar distribution of pension contributions between men and women.

Figure 1: Unconditional gender gaps by number of years enrolled in SPP (pooled sample)



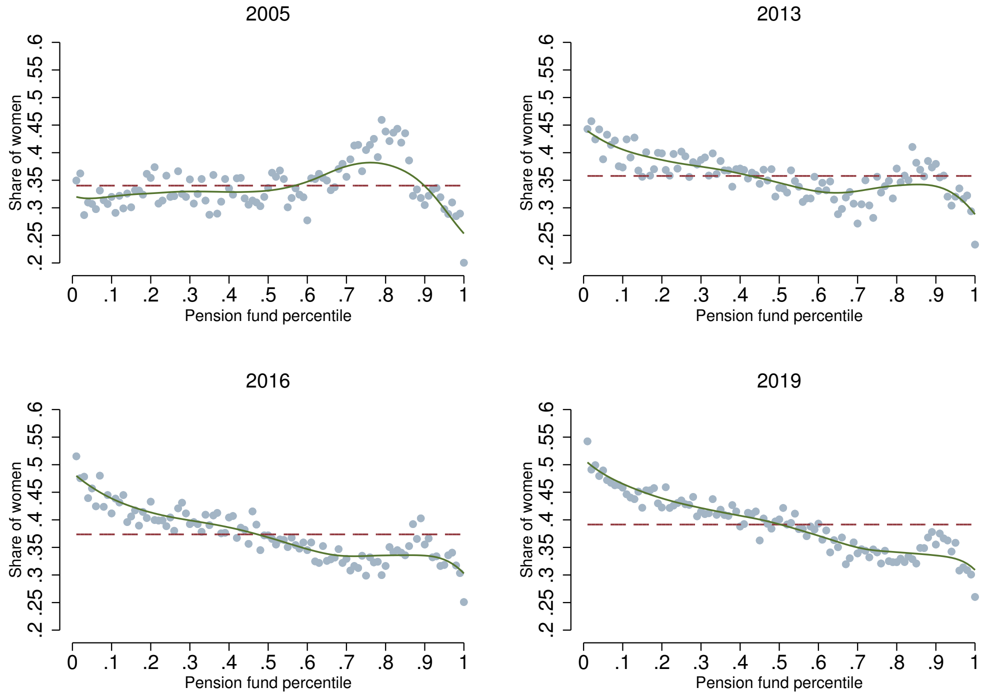
Note: The figure uses the pooled sample of 2005-2019. The vertical lines indicate confidence intervals at 95%.

The mean is one of the moments of the whole distribution and it could mask different values of the gender gaps along the distribution of pension funds. In Table 1, we have already observed that the gender gap is very high at the 99th percentile of the pension fund distribution, reaching 83,913 Soles, while this is 2,932 Soles at the median of the distribution. Figures A.3. and A.4 in the Appendix report the gender gaps at different percentiles of the distribution of pension funds across cohorts and selected sampling years. In all cases, the gender gap increases substantially since around the 90th percentile.

Regarding the gender gap by AFP, there are some notable differences steaming from the composition of affiliates in each firm. AFP Habitat reports the largest percentage gender gap of all AFP, that is men owns in average 79% more pension savings than women do. Yet, this gap is only 13% in AFP Profuturo. One of the reasons behind this difference is that Habitat is the youngest firm in the market and hence their affiliates have been participating fewer years in the SPP (people have contributed in average 59 months in Habitat, and 198 months in Profuturo). We noticed before that the percentage gender gap falls with the years of enrolment in the SPP. Lastly, the gender gap by Recognition Bond (RB) status shows a much larger gap for those affiliates who have this bond than for those who have not the bond. The reason is that the individuals with RB are mostly older individuals who have already capitalized sizable savings. Nevertheless, there are practically no differences in the percentage gender gap by RB.

Figure 2 shows an additional way of exploring gender differences in pension savings. This figure plots the share of women within the percentiles of the distribution of pension funds observed in four different years, and also reports the average share of women in the SPP (in dotted lines). First, we observe that the average participation of women in the SPP masks important differences across the distribution of pension funds. Second, we observe how the plots moves towards a more clear negative-slope curve from 2005 to 2019, meaning that the participation of women decreases within the richest percentiles and increases within the poorest percentiles. While in 2005, the share of women in the percentiles (mostly under the 70th percentile) was similar and around the average share, in 2019 we observe a strong negative relation between women participation and the percentiles of pension funds. These results could point to a deteriorating position of women in the distribution of pension savings.

Figure 2: Share of women across the unconditional distribution of pension savings



Note: The figures show the share of women across the unconditional distribution of pension balance for each year. The adjusted curves show the lowess-smoothed shares of women, and the dotted lines indicate the average share of women in the SPP.

4.2 Pooled OLS

Table 3 shows the estimates of pension balance on a pooled sample including all the year data sets. With no covariates, apart from year fixed effect, the gender gap in pension savings is on average 5,513 Soles in favour of men. Once we control for AFP and birth cohort, the gap is 3,405 Soles (Model 3), which represents about about 16% and 63% of the mean and median pension balances in the sample, respectively. Model 4 shows the results from the estimation of equation 3, which includes interactions between cohorts and gender. These estimates are useful to retrieve the expected gender gap by cohort $(\beta_1 + \gamma_j C_{ji})$ plotted in Figure 3. Model 5 adds interactions between sample year and gender, and between sample year and cohorts. This allows us to retrieve the gap by cohort for each year showed in Figure 4.

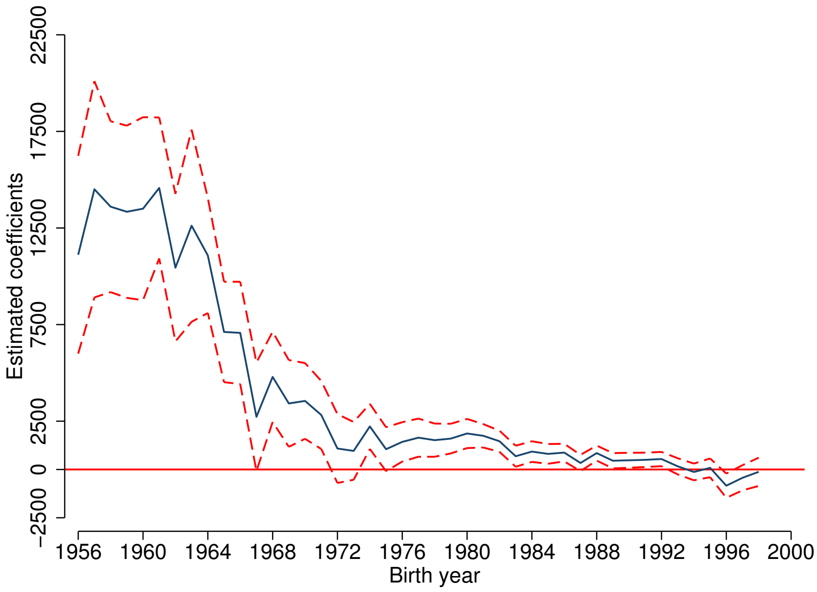
Table 3: OLS estimates of pension savings (2005-2019)

Variables	(1)	(2)	(3)	(4)	(5)
Male	5,513.0***	3,461.8***	3,405.2***	18,342.5**	18,582.2**
	(160.7)	(142.7)	(143.2)	(7,980.9)	(8,092.6)
Regular contributor		20,144.5***	20,249.8***	20,370.5***	20,616.2***
		(128.3)	(128.9)	(130.3)	(132.3)
Recognition Bond		59,334.1***	59,022.7***	59,640.7***	60,591.9***
		(1,172.9)	(1,202.6)	(1,214.5)	(1,227.8)
Years enrolled in SPP		-123.8**	-347.1***	-331.1***	124.1**
		(56.3)	(56.3)	(56.1)	(53.3)
Years enrolled in SPP^2 /100		12,364.0***	12,213.5***	12,144.2***	10,186.8***
		(275.5)	(280.5)	(279.5)	(267.7)
Constant	5,624***	-12,821.5***	-22,487.6***	-35,817.2***	-38,167.1***
	(146.4)	(346.9)	(4,421.0)	(6,268.6)	(6,389.1)
Year	Yes	Yes	Yes	Yes	Yes
AFP		Yes	Yes	Yes	Yes
Cohort			Yes	Yes	Yes
Cohort*Male				Yes	Yes
Year*Male					Yes
Cohort*Year					Yes
Observations	533,200	533,200	533,200	533,200	533,200
R-squared	0.008	0.155	0.161	0.162	0.162

Notes: The sample corresponds to the pooled samples drawn in 2005, 2006, 2013, 2015, 2016 and 2019. The dependent variable for all regressions is the pension balance. Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Figure 3 reveals that the gender gap reduces among younger cohorts. Approximately, up to the cohort 1983, there is a statistically significant positive gender gap, but younger cohorts tend to exhibit a gender gap that is not statistically different from zero. It is interesting to observe a decline in the gender gap among younger cohorts, but Figure 3 could be masking some important heterogeneity across sample years. The capitalization of pension balances could potentially hinder individuals who do not contribute frequently and/or have lower incomes. Thus, if women were more likely to have lower incomes, then a longer period enrolled in the pension system could exacerbate the differences in the pension pots between women and men. Figure 4 could help to observe this.

Figure 3: Conditional gender gaps by cohorts (pooled sample)

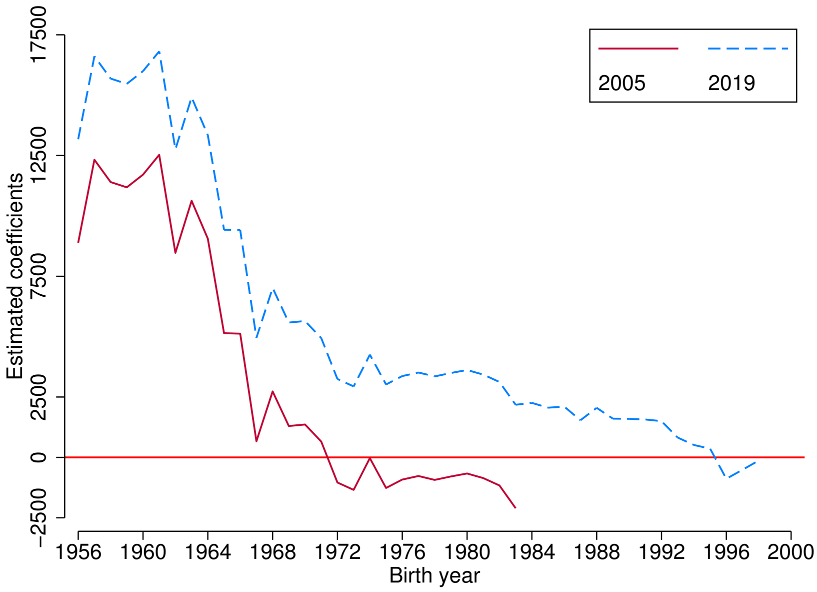


Notes: The figure plots the sum of estimated coefficients from Model 4 of Table 3, which represent the expected gender gap by birth-year cohort. The dotted lines indicate 95% confidence intervals.

Figure 4 shows the expected gender gap by cohorts observed in 2005 and 2019, the two most distanced sample years of our data. It is clear from the figure that for a given cohort, the pension gap increases with the length of the period affiliated in the SPP.[8] On the one hand, we observe a decreasing gender gap among younger cohorts, which is in line with other findings in the labour market, but on the other hand, the length of time participating in the pension system increases the gap by means of the capitalization process.

[8]Starting in 2005, the gender gap increases on average by S/. 1,550, S/. 2,356, S/. 3,409 and S/.4,285 in 2013, 2015, 2016 and 2019, respectively.

Figure 4: Conditional gender gap by cohorts in 2005 and 2019



Notes: The figure plots the sum of estimated coefficients from Model 5 of Table 3, which represent the expected gender gap by birth year cohort and sample year.

4.3 Unconditional quantile regression analysis

We obtain two important findings in the OLS regressions: (1) there is a positive gender gap in pension balances favouring men over women; (2) the gap is heterogeneous at the cohort level, being higher for older cohorts and lower for younger groups. Given that we are interested in studying the gender gap along the distribution of pension savings, we estimate unconditional quantile regressions using RIF regressions. As explained before, the RIF regressions allow us to measure how a marginal increase in the participation of men affects the dispersion of pension savings, which could indicate an increase in the gender pension savings gap. We exploit the sample of year 2019 to avoid contaminating our results with different distributions of previous years. Unlike the pooled sample, we introduce some additional variables that are available in that year and are interesting to explore. These covariates are the contribution density (a continuous variable between 0 and 1), type of pension fund risk and region of residence. Table 4 reports the RIF regression coefficients for the 25th, 50th, 75th, 90th, 95th and 99th quantiles, along with bootstrapped (1,000 iterations) standard errors.

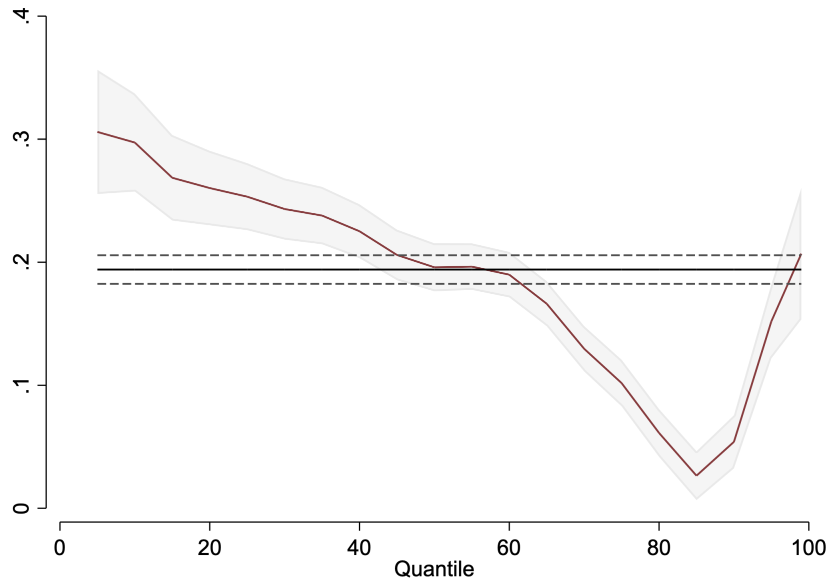
Table 4: Unconditional quantile regression coefficients on logs of pension savings (2019)

Variables	OLS	Q25	Q50	Q75	Q90	Q95	Q99
Male	0.194***	0.253***	0.196***	0.102***	0.0540***	0.152***	0.207***
	(0.00589)	(0.0139)	(0.00996)	(0.00966)	(0.0110)	(0.0154)	(0.0273)
Contribution density	3.537***	4.158***	4.082***	3.337***	2.027***	1.816***	1.309***
	(0.00923)	(0.0196)	(0.0137)	(0.0146)	(0.0188)	(0.0266)	(0.0455)
Years enrolled in SPP	0.375***	0.598***	0.472***	0.202***	0.0409***	0.0296***	-0.0142*
	(0.00203)	(0.00460)	(0.00297)	(0.00290)	(0.00319)	(0.00444)	(0.00729)
Years enrolled in SPP^2/100	-0.823***	-1.572***	-1.100***	-0.175***	0.245***	0.249***	0.355***
	(0.00733)	(0.0159)	(0.0110)	(0.0111)	(0.0132)	(0.0188)	(0.0324)
Recognition Bond	0.716***	-0.110***	0.219***	0.946***	2.276***	3.753***	6.893***
	(0.0293)	(0.0417)	(0.0366)	(0.0382)	(0.0820)	(0.161)	(0.457)
Fund type 2	-0.271***	0.298***	-0.0773	-0.890***	-1.255***	-1.471***	-2.013***
	(0.0477)	(0.0607)	(0.0552)	(0.0718)	(0.130)	(0.233)	(0.709)
Fund type 3	0.0981**	0.0839	0.192***	0.104	-0.0149	0.257	-0.749
	(0.0491)	(0.0636)	(0.0584)	(0.0766)	(0.138)	(0.245)	(0.724)
Constant	4.558***	1.078***	3.254***	7.443***	10.63***	11.58***	14.25***
	(0.0769)	(0.164)	(0.118)	(0.121)	(0.172)	(0.283)	(0.805)
Observations	124,829	124,829	124,829	124,829	124,829	124,829	124,829
R-squared	0.751	0.425	0.591	0.532	0.320	0.203	0.081

Notes: The regressions use the sample drawn on December 2019. The dependent variable for all regressions is the pension balance in logarithm. All regressions control for birth cohort, AFP, and region. Bootstrapped standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

The regression results show that a marginal increase in the proportion of men will pull the overall pension balance distribution upwards. In other words, the replacement of women by more men leads to a more unequal distribution, which could imply a growing gender gap in detriment of women. Figure 5 illustrates the non-monotonic effects of gender across the different quantiles since the effect of gender is different at each point of the distribution.

Figure 5: Male coefficients of unconditional quantile regressions, 2019



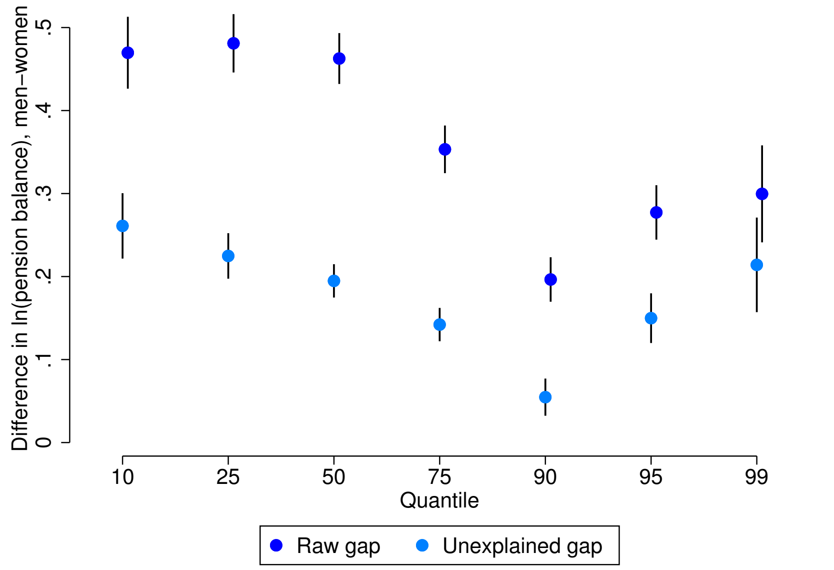
Notes: The graph plots the coefficients for male of unconditional quantile regressions whose specification is the same as in Table 4. The shadowed area indicates 95% confidence intervals.

The first result observed in Figure 5 is that a larger share of men generates a positive gender gap and increases the dispersion of pension savings for all the percentiles. A second result is that the gender gap decreases consistently along the quantiles until approximately the 85th quantile, from where the gap starts to grow rapidly towards the top quantiles. Thus, greater participation of men in the top quantiles accelerates the grow of the gender pension savings gap, and generates more inequality. This result may reflect a sort of "glass ceiling effect". Explanations for this effect are related to the fact that women are more likely to be in jobs with lower salaries and in lower ranked positions in the firm than men do. Thus, women have fewer opportunities and less resources to capitalize in the pension system. Given the direct link between pension savings, labour income and occupation status in an IRA system, it is not surprising finding a gendered ceiling in pension savings.

4.4 Oaxaca–Blinder decomposition of gender differentials in pension funds

Our full regression results of the Oaxaca-Blinder decomposition can be consulted in Table A.3 in the Appendix, while Figure 6 below plots the estimated raw gender gap and the unexplained component of such gap along distinctive quantiles of the pension fund distribution. The gender gap is positive for any quantile and follows the previous reported negative trend until about the 90th quantile from where it increases towards the upper end of the distribution. The unexplained share of the gap decreases consistently along the quantiles until about the 90th quantile (56%, 47%, 42%, 40%, and 28% for the 10th, 25th, 50th, q75th, and 90th quantiles, respectively), and then it increases to 54% at the 95th quantile and 72% at the 99th quantile. This behaviour is consistent with the previously described "glass ceiling effect". The most important variables increasing the unexplained gender gap in pension savings in the top quantiles (95th and 99th) of the pension funds distribution are density of contributions and years of affiliation. These variables substantially determine the pension balance accrued across years and are directly linked to labour market outcomes (incomes, occupation, skills, etc.) in an IRA system. Thus, the factors behind the unexplained or "discriminated" part of gender income gaps in the labour market will not only be translated to the gender pension savings gap, but will also be exacerbated because of the capitalization process over time embedded in the IRA system.

Figure 6: The gender gap in quantiles of pension savings



Notes: The graph plots the raw and unexplained gender gaps in pension balance across quantiles of the distribution of pension funds. The estimates are based on Oaxaca-Blinder RIF decomposition, which are reported in Table A.3 in the Appendix. The vertical axis shows the estimated values of the raw gap and the unexplained gap (men minus women). The bars indicate 95% confidence intervals.

5 The role of financial literacy

We explore the role of financial literacy on gender gaps in pension savings and on the distribution of pension savings. We capture financial literacy by exploiting the individual choices (or not) of pension fund portfolios with different risk attributes. As the individual has always the option of opting out of the *default* pension fund risk allocation, we consider that this action implies awareness with portfolio management and therefore may involve better levels of financial literacy. This strategy has also been employed by Bernal and Olivera (2020) when they analyse a reform of pension fund management fees in Peru in which the affiliates could opted out of the *default* set by the pension policy. It has been noted that knowledge or awareness of risk diversification enable individuals to make better choices of annuities (Lusardi and Mitchell, 2010; Hastings et al., 2010; Banks et al., 2015) and correct decisions in retirement (Clark et al., 2011; Agnew and Szykman, 2011).

As defined before in section 3, we use the variable *Active portfolio management* to capture the role of financial literacy on gender gaps. Table 5 exploits the samples obtained between 2013 and 2019 and provides a first insight about how financial literacy, gender, and pension wealth distribution could be linked.[9] Overall, we observe that only 6.2% and 4.8% of men and women, respectively, could be considered as financially savvy, which implies that a large majority of people are not opting out from the default pension fund risk choices set up by the regulation. In the bottom half of the distribution of pension funds, only 0.9% and 1.3% of women and men are actively managing their portfolios, yet these shares increase along richer groups in the distribution of pension savings. Thus, the richer the individual, the higher the likelihood to be financially savvy. For example, 28.2% and 34.7% of women and men belonging to the top 1% share are actively managing their portfolios; these figures are 20.3% and 44.7% for women and men belonging to the top 0.1% share. Furthermore, we observe an increasing difference between the percentage of women and men with financial literacy along the distribution of pension funds. This difference is 1.4 percentage points across all affiliates, but it is 24.3 percentage points for the affiliates located in the top 0.1% of the distribution of pension funds. All in all, women tend to be less financially savvy than men, even among the richer group of affiliates, which could contribute to expand the gender gap in pension wealth.

Table 5: Percentage of people with *Active portfolio management* by pension savings shares (2013-2019)

Pension savings share	Female	Male	Diff (M-F)	P-value	N
Overall	4.8	6.2	1.4	0.00	430,698
Bottom 50%	0.9	1.3	0.3	0.00	215,368
P50-90th	7.0	7.4	0.4	0.00	172,280
Top 10%	20.1	22.8	2.7	0.00	43,050
Top 5%	24.7	28.0	3.2	0.00	21,516
Top 1%	28.2	34.7	6.5	0.00	4,299
Top 0.5%	27.4	37.2	9.8	0.00	2,148
Top 0.1%	20.3	44.7	24.3	0.00	429

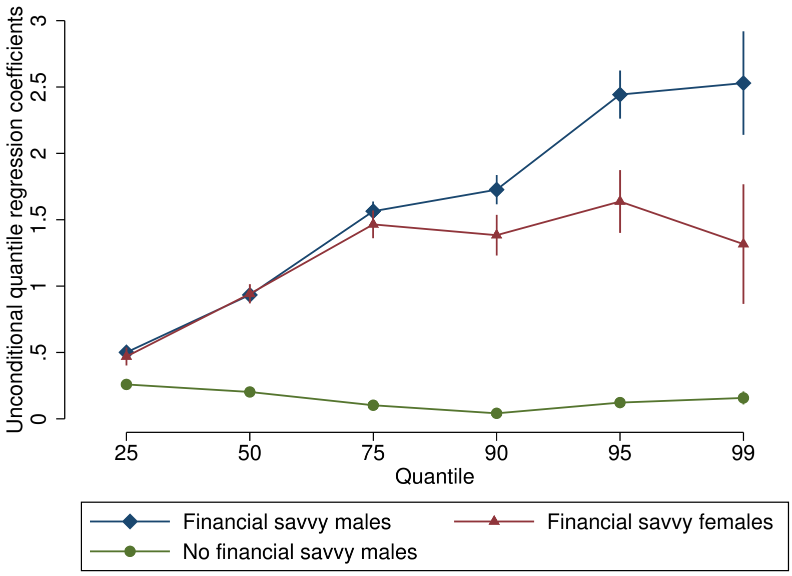
Notes: The sample is composed of individuals from sampling years 2013, 2015, 2016, and 2019. For each sample year, we compute 1,000 quantiles for the distribution of pension savings, and then we pool all the samples. We use the pooled sample to compute the percentage of people with *Active portfolio management* within distinctive groups of quantiles, irrespective of the sample year. The pooled sample size is 430,698 observations: N=94,315 in 2013, N=103,399 in 2015, N=108,091 in 2016, and N=124,942 in 2019.

Following on our previous models of unconditional quantile regressions, we assess the role of financial literacy on the distribution of wealth and gender gaps. The only difference with

[9]The pension funds with different risk compositions were implemented in 2006. However, our sample of December 2006 has not available information about the pension fund type chosen by the individual. This is why we use the other available samples drawn between 2013 and 2019.

respect to the models of Table 4 is that this time we include two additional covariates in the regressions: the dummy variable *Active portfolio management* and its interaction with *Male*. The full results of these regressions are reported in Table A.4 in the Appendix, but we plot our coefficients of interest in Figure 7. We plot the combined coefficients, and their 95% confidence intervals, indicating three distinctive groups: savvy financial males (i.e. males who actively manage their portfolios), savvy financial females, and no savvy financial males. We observe that, in general, financial literacy has stronger effects at higher quantiles, pulling the distribution of pension wealth upwards. In other words, a greater participation of individuals (regardless of gender) with financial knowledge contributes to a greater dispersion of pension wealth, i.e. more inequality. A second observation is that financial savvy males can contribute more than financial savvy females to the dispersion of pension savings (the coefficients curve of financial savvy males is always above the coefficients curve of females in Figure 7). Therefore, the gender gaps in pension savings could expand along the distribution of pension funds.

Figure 7: Unconditional quantile coefficients of *Active portfolio management*



Notes: The graph plots the UQR coefficients for financial savvy males, financial savvy females and no financial savvy males retrieved from Table A.4 in the Appendix. The vertical bars indicate 95% confidence intervals.

6 Additional results

6.1 Extended pension wealth

Some SPP affiliates who were before in the public pension system have Recognition Bonds (RB), which represent past pension contributions made to the public system. These bonds are paid at retirement and introduced into the pension balance of the affiliates in order to compute pension amounts. The total pension wealth of these affiliates should include the BR value. Thus, we use a concept of "extended pension wealth" by adding the updated RB value to the pension balance. We run the same quantile regressions we used before on this new outcome and report the results in Table A.5 in the Appendix. The results are practically the same we obtained in Table 4.

6.2 Imputed income

One of the limitations of the registers data is the limited availability of updated wages. For the 2019 sample, about 58% of the individuals have contributed in the year of the sampling draw and therefore they have updated information for their wages, 35% have outdated wage information but have the date of last contribution, and 7% have no wage information nor the date of last contribution. We do not use wage information in our main analysis due to its limited availability, but at least we could attempt to impute and update them to explore the relationship between our results on gender pension wealth gaps and gender income gaps.

The procedure to impute monthly earnings for the 2019 sample is as follows: the initial value of the wage is the last value recorded in the sample. In case the value corresponds to any year before 2019, we update the recorded value by inflation and wage premiums per cohort (5-year groups), sex, and contribution behavior.[10] The imputation of incomes for the affiliates who have not this information uses the predicted values from a regression of wage (in logs) against sex, recognition bond, decile of contribution density, type of administrative fee, AFP, type of pension risk fund, affiliation duration in the SPP, percentile of pension balance, age, age squared, and region. In the SPP, the contributions are calculated over wages which value must be at least equal to the minimum wage (equal to 930 Soles). Thus, we set up that earnings cannot be lower than the official minimum wage.

Table 6 reports the means and percentiles of the distribution of monthly earnings in our 2019 sample. The raw gender gap in earnings is 19%, which is about half the gender gap in pension savings (37%). We do not observe gaps along the first three deciles because of our assumption that affiliates must earn at least the minimum wage. The gender income gap is about 11% at the 40th percentile and increases smoothly until 18% at the 95th percentile. Then, the income gap grows quickly to 31% and 40% at the 99th and 99.5th percentiles, respectively. The values of the gaps in income and pension wealth can greatly differ along the first percentiles and even beyond the media of both distributions, but their values tend to converge towards the top 1% and beyond (see Table 1). At the median of each distribution, the pension wealth gap is 59%, but this is only 15% in incomes; while that at the 90th percentile, the pension wealth gap is 22% and the income gap is 16%. As reported in other studies assessing gender wealth gaps, we also observe a larger gender gap along the distribution of pension wealth than along the distribution of incomes.

[10]The wage premiums are estimated using the 2015, 2016 and 2019 samples. We estimate the variations in the median wages by sex, birth cohorts, and whether the individual contributed in the sampling year or not.

Table 6: Raw gender gaps in earnings and pension savings-to-earnings ratio in 2019 (Soles)

Variables	Mean	Percentile											
		10	20	30	40	50	60	70	80	90	95	99	99.5
Distribution of earnings:													
Male	2,445	930	930	930	1,119	1,378	1,649	2,034	2,724	4,421	7,000	17,141	24,643
Female	2,053	930	930	930	1,009	1,200	1,430	1,760	2,335	3,800	5,945	13,106	17,574
Gap (M-F)	393	0	0	0	110	178	219	274	389	621	1,055	4,035	7,069
P-value	0.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Men-to-women ratio	1.19	1.00	1.00	1.00	1.11	1.15	1.15	1.16	1.17	1.16	1.18	1.31	1.40

Note: The table uses the sample of registers drawn in December 2019. The table shows the means and percentiles of the distribution of monthly earnings, which include updated and imputed salaries for individuals who did not contribute in 2019 or had missing income information.

We also compute the ratio between pension savings and monthly earnings for each individual, which indicates the number of income months accumulated in the retirement account. Some studies on income and wealth inequality (e.g. Piketty and Zucman (2014) and Cowell et al. (2017)) use the wealth to income ratio to explore the evolution and country differences of wealth inequality due to changes in asset prices and income returns. The left-hand side panel of Table 7 reports the average of individual pension savings-to-earning ratios by distinctive income groups of the distribution of earnings. Overall, men have 2.2 more months of incomes in their pension accounts, yet this gap is 3 months for the individuals who belong to the bottom 50% of the earnings distribution. For the individuals belonging to the top 10%, top 5% and top 1% of the earnings distribution, the gaps are equal to 1.2, 1.8, and 2.2. Note however that these values use the earnings of the corresponding income group, which are higher in the top groups, and hence the level of pension wealth is larger in the top income groups. For example, Table 6 shows that a woman and man in the 99th income percentile earn about 11 and 12 times more than a woman and man in the 50th percentile. In order to capture these differences in income, the right-hand side panel of Table 7 shows the pension savings-to-earning ratios expressed as the mean pension saving of a particular income group over the mean income across all affiliates rather than the mean income for that group. Overall, the gender gap is 3.5 months of average income, but the gap is larger in the top income groups: 10.9, 17,5 and 36.5 months for top 10%, top 5%, and top 1% income shares, respectively.

Table 7: Raw gender gaps in pension savings-to-earnings ratio in 2019 (Soles)

	Using mean earnings of each income group						Using overall mean earnings					
	Mean	Bottom 50%	P50-90th	Top 10%	Top 5%	Top 1%	Mean	Bottom 50%	P50-90th	Top 10%	Top 5%	Top 1%
Male	10.9	9.6	11.5	14.3	14.6	12.7	12.8	4.2	11.0	57.3	81.4	150.1
Female	8.8	6.6	10.9	13.1	12.8	10.5	9.3	2.9	10.1	46.4	63.9	113.6
Gap (M-F)	2.2	3.0	0.6	1.2	1.8	2.2	3.5	1.3	1.0	10.9	17.5	36.5
P-value	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00

Note: The table uses the sample of registers drawn in December 2019. The left-hand side panel shows the average of individual pension savings-to-earning ratios by distinctive income groups of the distribution of earnings. The right-hand side panel is similar to the other panel, but the pension savings-to-earning ratios is computed as the mean pension saving of a particular income group over the mean income across all affiliates rather than the mean income for that group.

7 Conclusions

Our study uncovers a large gender gap in favour of men in pension savings. Although this gap falls for younger cohorts (because the salary gap is also lower in these groups), the IRA system's capitalization process may be reversing this improvement, expanding therefore the gap in pension savings across the ilfe-cycle. We also explore gender gaps along the distribution of pension savings and find that the gap favouring men is always positive at each percentile, but it decreases until it reaches a kind of "glass ceiling" around the 85th percentile, where the gap increases substantially. The low levels of financial education captured by the individual's risk management of pension fund portfolios (i.e. the ability to opt out from default choices of risk-specific pension funds) contribute to the increase of inequality in the distribution of pension funds and on widening the gender pension savings gap. Indeed, pension-savings-rich individuals have higher levels of awareness with risk portfolio management, and among them, financial savvy males contribute more than financially savvy females to increasing inequality in pension savings.

Thus, we observe that on one hand, financial literacy is an important determinant of overall pension wealth inequality, and on the other hand, it is also key to explain increasing gender gaps in pension savings. This situation is not helped by the fact that Peru has very low levels of financial literacy, and therefore, policy-makers should rethink about the design of existing default choices in the risk composition of pension fund portfolios. Requiring greater financial knowledge about the returns and risks of pension funds may mostly affect groups with low financial literacy such as individuals employed in low-skilled occupations and women.

We also notice that some instruments that can attenuate gender pension savings inequality, such as minimum pension guarantees and unisex life tabes, are absent in Peru's IRA system. Thus, extending social assistance pension programs and/or setting pension guarantees could help in the short run. Nevertheless, in the long-run there are pending problems for the gender gap in pension wealth and pensions. For example, there is still room to improve the adequacy of benefits, the distribution of household chores between men and women, and the social protection culture, in particular among people who do not work in the formal labour market.

Overall, our results could be useful to other countries with IRA systems or countries that are considering increasing the relative importance of these systems in their pension models. These systems can improve the incentive alignment between individual contributions and retirement savings, but one danger is exacerbating gender pension gaps. Furthermore, more need to be done regarding the periods when women are less able to contribute (e.g. due to child birth and childbearing) or in the events of divorce as the IRA are fully individualized and are not part of the shared household wealth. We also consider our paper is useful to investigate a component of wealth distribution (pension savings) that is closely related to earnings savings. Very few developing countries have wealth surveys and are not able to study wealth distribution patterns, but some of them have IRA systems. Thus, a way forward to study wealth distributions with more detail is exploiting data of individual pension accounts as we have done in our paper. We wish our study opens new avenues for future research on gender gaps in wealth and pensions, in particular in developing countries, which still show low levels and high dispersion on financial literacy.

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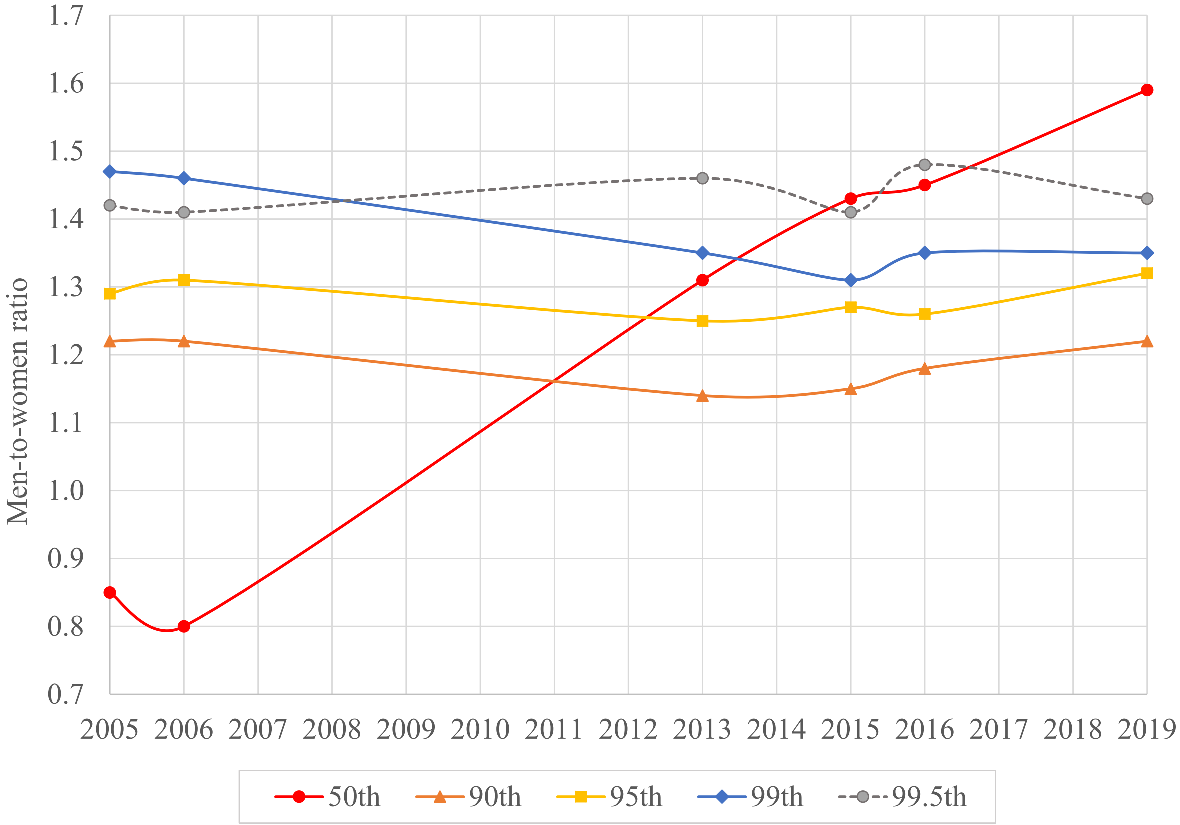
Appendix

Figure A.1: Raw gender gaps in pension savings at specific percentiles of the pension savings distribution (2005-2019)



Note: The figure plots the raw ratio of men's pension savings to women's pension savings at distinctive percentiles of the distribution of pension funds of each available sample year.

Figure A.2: Histograms of contribution density by gender (2015-2019)

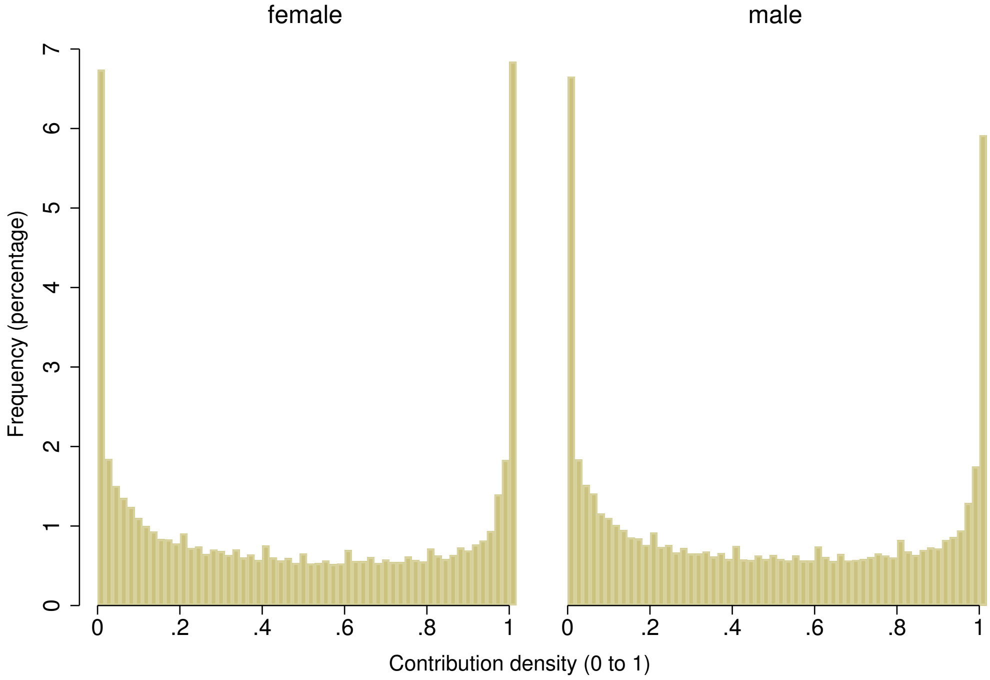
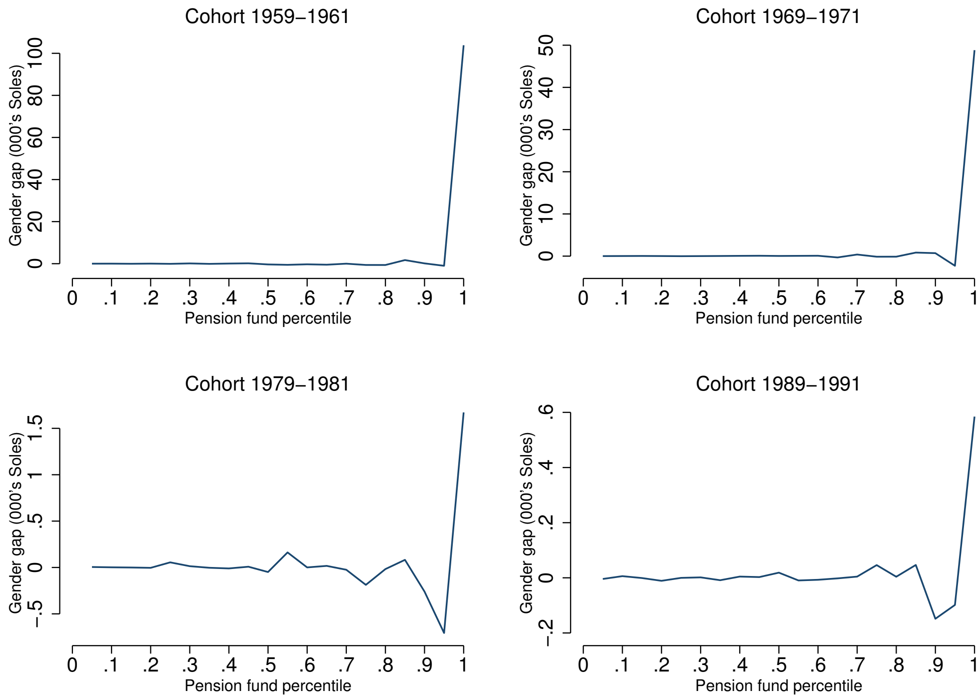
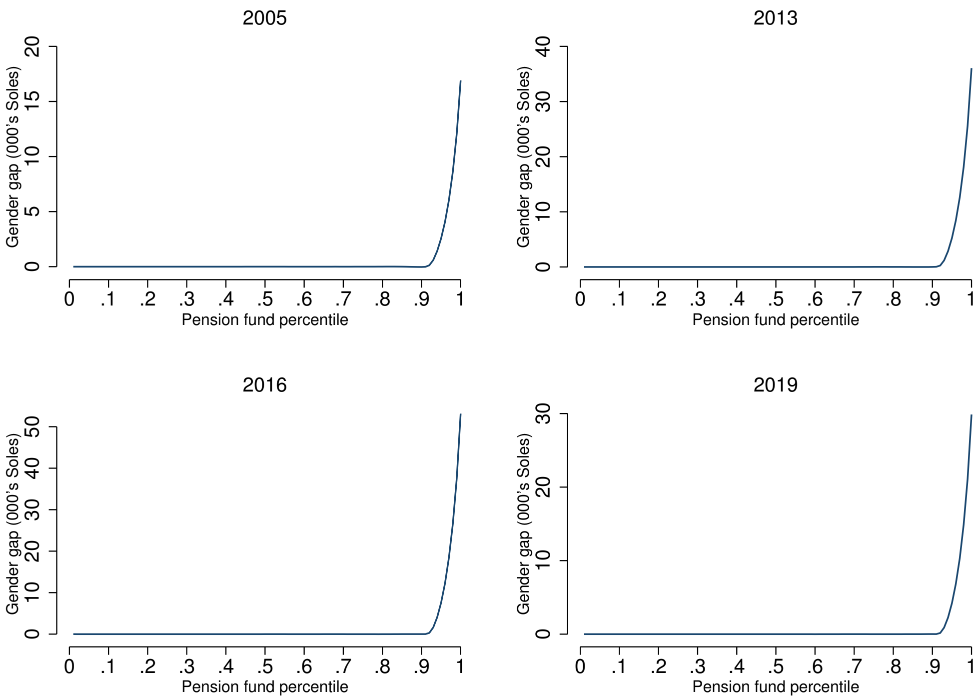


Figure A.3: Cohort-specific gender gap across the unconditional distribution of pension balance (2019)



Note: The figures show the lowess-smoothed gender gaps across the unconditional distribution of pension balance for each cohort in 2019.

Figure A.4: Cohort-specific gender gap across the unconditional pension fund distribution in various years



Note: The figures show the lowess-smoothed gender gaps across the unconditional distribution of pension balance for each year.

Table A.1: Additional descriptives

	(1) 2005	(2) 2006	(3) 2013	(4) 2015	(5) 2016	(6) 2019
Pension balance	9,261.02	14,580.27	20,105.94	22,376.41	24,292.47	26,239.68
	(105.14)	(181.62)	(184.16)	(193.65)	(229.78)	(202.43)
Pension balance + RB	12,560.84	17,689.31	21,497.46	23,488.38	25,262.47	26,676.40
	(153.45)	(222.42)	(202.49)	(208.09)	(242.91)	(208.56)
Age	37.33	37.69	38.07	38.47	38.50	38.33
	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)	(0.03)
Years enrolled in SPP	7.22	8.22	10.83	11.64	11.92	12.30
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Regular contributor	0.57	0.61	0.62	0.59	0.58	0.58
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Contribution density	-	-	-	0.48	0.49	0.48
				(0.00)	(0.00)	(0.00)
Recognition Bond (RB)	0.11	0.10	0.04	0.03	0.03	0.02
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
RB value	3,300	3,109	1,392	1,112	970	437
	(68.09)	(65.84)	(34.24)	(28.79)	(26.83)	(15.69)
Active portfolio management	-	-	0.06	0.06	0.05	0.06
			(0.00)	(0.00)	(0.00)	(0.00)

Notes: The table shows the main descriptive statistics of our sample.

Table A.2: Unconditional quantile regressions of pension balance (2005, 2013 and 2019)

Variables	OLS	Q25	Q50	Q75	Q90	Q95	Q99
2005:							
Male	-0.00079	-0.0278	-0.0984***	-0.0539***	0.204***	0.256***	0.361***
	(0.0129)	(0.0253)	(0.0185)	(0.0139)	(0.0238)	(0.0291)	(0.0445)
Regular contributor	1.391***	2.010***	1.811***	0.792***	0.618***	0.509***	0.281***
	(0.0130)	(0.0255)	(0.0191)	(0.0135)	(0.0219)	(0.0260)	(0.0381)
Years enrolled in SPP	0.640***	1.198***	0.792***	0.0724***	-0.0384***	-0.124***	-0.184***
	(0.00861)	(0.0172)	(0.0104)	(0.00752)	(0.0124)	(0.0149)	(0.0224)
Years enrolled in SPP^2	-3.050***	-6.674***	-3.810***	0.682***	1.298***	1.770***	1.942***
	(0.0621)	(0.117)	(0.0813)	(0.0627)	(0.106)	(0.129)	(0.197)
Recognition Bond	1.158***	0.666***	1.103***	1.388***	2.440***	2.751***	2.687***
	(0.0218)	(0.0290)	(0.0271)	(0.0301)	(0.0703)	(0.0983)	(0.176)
Constant	3.974***	0.690***	3.410***	7.505***	8.310***	9.150***	11.11***
	(0.163)	(0.246)	(0.182)	(0.154)	(0.336)	(0.461)	(0.949)
2013:							
Male	0.0950***	0.133***	0.0944***	-0.0531***	0.0592***	0.119***	0.227***
	(0.00915)	(0.0169)	(0.0129)	(0.0127)	(0.0134)	(0.0216)	(0.0314)
Regular contributor	1.779***	2.321***	1.934***	1.502***	0.836***	0.926***	0.527***
	(0.00984)	(0.0176)	(0.0133)	(0.0131)	(0.0134)	(0.0209)	(0.0294)
Years enrolled in SPP	0.253***	0.418***	0.396***	0.105***	-0.00887**	-0.0398***	-0.0967***
	(0.00355)	(0.00720)	(0.00473)	(0.00438)	(0.00435)	(0.00670)	(0.00965)
Years enrolled in SPP^2	-0.440***	-1.129***	-0.940***	0.299***	0.499***	0.661***	0.746***
	(0.0162)	(0.0302)	(0.0218)	(0.0220)	(0.0235)	(0.0372)	(0.0558)
Recognition Bond	1.222***	0.423***	0.831***	1.633***	2.545***	4.532***	5.013***
	(0.0234)	(0.0278)	(0.0250)	(0.0348)	(0.0646)	(0.135)	(0.275)
Constant	3.617***	-0.156	4.083***	6.863***	9.346***	10.17***	12.80***
	(0.0827)	(0.121)	(0.0920)	(0.104)	(0.138)	(0.279)	(0.633)
2019:							
Male	0.174***	0.225***	0.169***	0.0933***	0.0472***	0.138***	0.187***
	(0.00797)	(0.0152)	(0.0117)	(0.0110)	(0.0115)	(0.0156)	(0.0272)
Regular contributor	1.815***	2.192***	2.101***	1.606***	0.962***	0.884***	0.648***
	(0.00841)	(0.0152)	(0.0122)	(0.0117)	(0.0119)	(0.0160)	(0.0262)
Years enrolled in SPP	0.335***	0.548***	0.425***	0.162***	0.0219***	0.0195***	-0.0180**
	(0.00249)	(0.00489)	(0.00312)	(0.00303)	(0.00324)	(0.00446)	(0.00719)
Years enrolled in SPP^2	-0.663***	-1.386***	-0.918***	-0.0141	0.340***	0.328***	0.408***
	(0.00909)	(0.0168)	(0.0120)	(0.0123)	(0.0139)	(0.0194)	(0.0329)
Recognition Bond	1.250***	0.502***	0.831***	1.466***	2.608***	4.077***	7.155***
	(0.0295)	(0.0334)	(0.0302)	(0.0407)	(0.0852)	(0.164)	(0.460)
Constant	4.199***	1.234***	3.427***	6.598***	9.262***	9.945***	12.72***
	(0.0672)	(0.113)	(0.0833)	(0.0862)	(0.122)	(0.200)	(0.580)

Notes: Bootstrapped standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. N = 49,448 for 2005, N = 94,315 for 2013, and N = 124,829 for 2019. All regressions control for AFP, and birth cohort.

Table A.3: Results of the detailed decomposition of the gender gap in pension balance over quantiles (2019)

	Q10	Q25	Q50	Q75	Q90	Q95	Q99
Male	6.086***	7.479***	8.973***	10.23***	11.12***	11.65***	12.69***
	(0.0139)	(0.0112)	(0.00956)	(0.00825)	(0.00858)	(0.0115)	(0.0190)
Female	5.616***	6.998***	8.511***	9.881***	10.92***	11.37***	12.39***
	(0.0172)	(0.0140)	(0.0124)	(0.0121)	(0.0106)	(0.0121)	(0.0229)
Gap	0.470***	0.481***	0.463***	0.353***	0.196***	0.277***	0.300***
	(0.0221)	(0.0179)	(0.0156)	(0.0146)	(0.0137)	(0.0167)	(0.0298)
Explained gap							
Total	0.209***	0.256***	0.268***	0.211***	0.141***	0.127***	0.0834***
	(0.0113)	(0.0123)	(0.0121)	(0.00967)	(0.00776)	(0.00866)	(0.0103)
Contribution density	-0.0145*	-0.0159*	-0.0159*	-0.0121*	-0.00804*	-0.00747*	-0.00520*
	(0.00786)	(0.00866)	(0.00862)	(0.00658)	(0.00437)	(0.00406)	(0.00284)
Years enrolled in SPP	0.819***	0.927***	0.683***	0.267***	0.0745***	0.0592***	0.00503
	(0.0271)	(0.0284)	(0.0209)	(0.00978)	(0.00775)	(0.0108)	(0.0189)
Years enrolled in SPP^2/100	-0.534***	-0.592***	-0.382***	-0.0508***	0.0686***	0.0742***	0.102***
	(0.0201)	(0.0203)	(0.0133)	(0.00526)	(0.00665)	(0.00931)	(0.0163)
Recognition Bond	-0.000398	-0.000140	0.000275*	0.00127*	0.00303*	0.00521*	0.00925*
	(0.000257)	(0.000123)	(0.000165)	(0.000695)	(0.00165)	(0.00284)	(0.00504)
Fund type 2	-0.0137***	-0.00782***	0.000430	0.0173***	0.0285***	0.0346***	0.0620***
	(0.00388)	(0.00266)	(0.00188)	(0.00206)	(0.00283)	(0.00383)	(0.00681)
Fund type 3	0.00262	0.00203	0.00292***	0.00200**	0.000789	0.00252	-0.0181***
	(0.00203)	(0.00141)	(0.00104)	(0.000956)	(0.00118)	(0.00170)	(0.00344)
Unexplained gap							
Total	0.261***	0.225***	0.195***	0.142***	0.0552***	0.151***	0.216***
	(0.0201)	(0.0140)	(0.0102)	(0.0102)	(0.0114)	(0.0153)	(0.0291)
Contribution density	-0.0113	-0.0293	-1.35e-05	-0.237***	0.0172	0.194***	0.0636
	(0.0273)	(0.0190)	(0.0139)	(0.0138)	(0.0155)	(0.0208)	(0.0397)
Years enrolled in SPP	0.602***	0.0348	-1.053***	-1.034***	0.199**	0.287***	0.639***
	(0.145)	(0.100)	(0.0735)	(0.0728)	(0.0821)	(0.110)	(0.210)
Years enrolled in SPP^2/100	-0.263***	0.0329	0.545***	0.272***	-0.387***	-0.294***	-0.586***
	(0.0868)	(0.0603)	(0.0442)	(0.0439)	(0.0493)	(0.0657)	(0.126)
Recognition Bond	0.000246	-0.00106	0.000235	0.00131	0.00243*	0.0126***	0.00118
	(0.00258)	(0.00179)	(0.00131)	(0.00131)	(0.00146)	(0.00200)	(0.00374)
Fund type 2	0.214	0.0635	0.199	0.426***	-0.161	0.0855	-2.199***
	(0.261)	(0.181)	(0.133)	(0.132)	(0.148)	(0.196)	(0.378)
Fund type 3	0.0103	0.00707	0.00748	0.00944*	-0.000118	0.0124*	-0.0861***
	(0.00984)	(0.00683)	(0.00501)	(0.00499)	(0.00557)	(0.00740)	(0.0144)
Constant	-2.384*	-2.294**	-0.104	0.240	0.484	-0.703	3.952**
	(1.349)	(0.939)	(0.694)	(0.709)	(0.754)	(0.960)	(1.934)

Notes: The regressions use the Blinder-Oaxaca decomposition method, based on RIF. Bootstrapped standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1. N = 75,961 for group 1 (male), N = 48,868 for group 2 (female). All regressions control for AFP, birth cohort, and region.

Table A.4: Unconditional quantile regression coefficients on logs of pension savings, including financial literacy variables (2019)

Variables	OLS	Q25	Q50	Q75	Q90	Q95	Q99
Male	0.194***	0.259***	0.202***	0.102***	0.0415***	0.122***	0.158***
	(0.00804)	(0.0157)	(0.0119)	(0.0110)	(0.0111)	(0.0147)	(0.0251)
Active portfolio management	0.901***	0.470***	0.942***	1.465***	1.384***	1.637***	1.317***
	(0.0266)	(0.0345)	(0.0369)	(0.0533)	(0.0782)	(0.121)	(0.230)
Male*Active portfolio mana.	-0.0615*	-0.228***	-0.211***	-0.00303	0.302***	0.683***	1.055***
	(0.0324)	(0.0414)	(0.0440)	(0.0636)	(0.0956)	(0.152)	(0.304)
Regular contributor	1.782***	2.178***	2.068***	1.554***	0.906***	0.809***	0.578***
	(0.00824)	(0.0151)	(0.0121)	(0.0116)	(0.0117)	(0.0156)	(0.0252)
Years enrolled exact	0.323***	0.540***	0.412***	0.147***	0.00556*	-0.00236	-0.0400***
	(0.00246)	(0.00491)	(0.00312)	(0.00300)	(0.00319)	(0.00440)	(0.00732)
Years enrolled exact^2/100	-0.656***	-1.389***	-0.909***	0.000870	0.357***	0.350***	0.432***
	(0.00893)	(0.0167)	(0.0119)	(0.0121)	(0.0137)	(0.0191)	(0.0330)
Recognition Bond	1.192***	0.452***	0.773***	1.407***	2.542***	3.974***	7.028***
	(0.0290)	(0.0338)	(0.0307)	(0.0416)	(0.0847)	(0.162)	(0.457)
Constant	4.922***	2.178***	4.083***	6.995***	8.684***	9.592***	14.14***
	(0.496)	(0.455)	(0.639)	(0.637)	(0.836)	(1.267)	(4.283)
Observations	124,829	124,829	124,829	124,829	124,829	124,829	124,829
R-squared	0.566	0.325	0.451	0.403	0.266	0.180	0.079

Notes: The regressions use the sample drawn on December 2019. The dependent variable for all regressions is the pension balance in logarithm. All regressions control for birth cohort, AFP, and region. Bootstrapped standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table A.5: Unconditional quantile regression coefficients on log of extended pension wealth (2019)

Variables	OLS	Q25	Q50	Q75	Q90	Q95	Q99
Male	0.194***	0.253***	0.196***	0.101***	0.0546***	0.152***	0.202***
	(0.00590)	(0.0139)	(0.00997)	(0.00969)	(0.0110)	(0.0153)	(0.0275)
Contribution density	3.529***	4.155***	4.079***	3.329***	2.010***	1.777***	1.294***
	(0.00923)	(0.0196)	(0.0137)	(0.0146)	(0.0189)	(0.0266)	(0.0456)
Years enrolled in SPP	0.375***	0.598***	0.473***	0.202***	0.0411***	0.0265***	-0.0120
	(0.00203)	(0.00460)	(0.00297)	(0.00290)	(0.00321)	(0.00444)	(0.00729)
Years enrolled in SPP^2/100	-0.823***	-1.571***	-1.101***	-0.174***	0.241***	0.257***	0.339***
	(0.00733)	(0.0159)	(0.0110)	(0.0111)	(0.0133)	(0.0188)	(0.0324)
Recognition Bond	0.959***	-0.0511	0.307***	1.197***	3.062***	4.701***	8.415***
	(0.0296)	(0.0417)	(0.0373)	(0.0365)	(0.0762)	(0.163)	(0.487)
Fund type 2	-0.279***	0.293***	-0.0832	-0.917***	-1.285***	-1.601***	-1.859***
	(0.0474)	(0.0608)	(0.0554)	(0.0720)	(0.130)	(0.231)	(0.718)
Fund type 3	0.0930*	0.0817	0.188***	0.0893	-0.0479	0.111	-0.635
	(0.0489)	(0.0637)	(0.0585)	(0.0768)	(0.138)	(0.243)	(0.733)
Constant	4.356***	1.343***	3.180***	6.565***	9.494***	10.57***	13.90***
	(0.0704)	(0.169)	(0.116)	(0.109)	(0.135)	(0.212)	(0.611)
Observations	124,829	124,829	124,829	124,829	124,829	124,829	124,829
R-squared	0.752	0.425	0.590	0.533	0.331	0.216	0.093

Notes: The dependent variable for all regressions is the log of extended pension wealth, that is the sum of the pension balance and the updated Recognition Bond. All regressions control for birth cohort, AFP, and region. Bootstrapped standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

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