

Gender Policy, the Minimum Pension Age and Non-contributory Rights for Women – the Case of Chile¹

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A common observation in most countries, developed or under developed, is that women are often at a disadvantage with respect to men in terms of their financial protection in old age. This is a result of multiple factors related to child caring, labor market participation and pension design. Pension systems are almost everywhere based on acquiring rights through employment related contributions. Women tend to contribute for shorter periods while taking care of children (or other dependent relatives); they often have a lower attachment to the formal labor markets than men; they usually retire earlier and they live longer. Pension systems in developed countries often include some elements that tend to compensate for these differences, through the form of minimum pensions or other non-contributory rights, different eligibility criteria (like years of contribution or minimum retirement age), unisex mortality tables (or defined benefits that are independent of gender, as in most DB schemes), etc. In this article, we analyze the different ways through which pension design in DC systems can affect pension entitlements of women, with a focus on the reality of a middle income developing country. To do so, we use labor and contribution histories of Chilean women to simulate the effect of alternative arrangements on women's pensions and the pension gender gap. The use of Chilean data is interesting in at least three dimensions: it is the country with the longest history of a pension system mostly based on a financial DC scheme; it is a middle income developing country with a medium-sized informal sector, a factor that is often overlooked in developed countries analysis; the country implemented in 2008 the largest pension reform since the original DC reform in 1980, which included a number of initiatives specifically aimed at reducing the gender gap in the pension system. Among the simulations performed, we include these recent improvements, together with a minimum pension program and a raise in legal retirement age for women from 60 to 65 years old. Our results suggest that the introduction of a bonus per child can significantly raise pensions of women in the lower part of the pension distribution. The new Solidarity Pillar introduced in 2008 will have a tremendous impact on all individuals with small pensions but especially among women, as they are more likely to be eligible for these benefits. Finally, raising women's legal retirement age to 65 would have an important effect (9% on average), but especially among women who are not eligible for the New Solidarity Pillar. The minimum pension program, due to its restrictive eligibility criterion, has a limited scope for raising women's pensions or lowering the pension gender gap.

¹ Forthcoming in Holzmann, Robert and Edward Palmer (eds.), *Non-Financial Defined Contribution (NDC) Systems: Progress and New Frontiers in a Changing Pension World*, The World Bank, 2011

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1.- Introduction

A common observation in most countries, developed or developing, is that women are often at a disadvantage with respect to men in terms of their financial protection in old age. This is a result of multiple factors related to child caring, labor market participation and pension design. Pension systems are almost everywhere based on acquiring rights through employment related contributions. Women tend to contribute for shorter periods while taking care of children (or other dependent relatives); they have a lower attachment to the formal labor markets than men, and they usually retire earlier and live longer.

In this article we analyze the different factors that affect pension differences by gender in the context of a pension system mostly based on a Defined Contribution contributory scheme. Based on the experience learned in almost 30 years under such an environment, we present aggregate statistics and simulation results that shed light on the relative importance of the different factors. Some of this experience may be directly applied to countries with other retirement structures, including NDC schemes.

In a DC World, pensions are directly related to four main factors: accumulation of pension rights, retirement age, type of pension and longevity. This can directly be seen in a general formula for pension determination:

$$\text{Contributory Pension} = \frac{\text{Balance(frequency, intensity and timing of contributions, returns)}}{\text{factor(age and longevity at retirement, gender, pension type, interest rates, covered beneficiaries)}}$$

$$\text{Total pension income} = \text{Contributory pension} + \text{non-contributory rights} + \text{survivorship pensions}$$

Actuarial calculations imply that pensions are in direct relationship with the frequency and intensity of lifetime contributions, particularly those performed when young. The importance of returns cannot be underestimated, as it can account for a large share of the balance at the moment of retirement.

On the part of the denominator, the most critical factor is retirement age; earlier retirement implies interrupting accumulation, interrupting compound interest on part of the balance but specially that the accumulated balance has to finance pensions for a longer period. In some cases, as in Chile, different mortality tables are used for men and women, therefore translate the higher female longevity into lower pensions (for the same balance). The use of gender-differentiated tables is directly related to the existence of different pension products: annuities and programmed withdrawal. In the latter case, under which individuals slowly withdraw their balance, it would be impractical to use unisex tables. Expected interest rates at the moment of retirement directly affects pensions, but should not have any effect on gender differences. Finally, actuarial calculations imply that pensions are reduced in order to finance survivorship pensions to legal beneficiaries.

In addition to the analysis of contributory pensions, we take into considerations two further topics: the role played by the poverty prevention pillar (first pillar) as a gender equalizer and the importance of survivorship pensions.

It is worth mentioning that this is not the first article to analyze the gender gap in the Chilean context. Most notably, Berstein & Tokman (2005), using the same source of data, analyze how the pension system increased the labor market gender gap in the pre-reform context. The main contribution of the current article is the analysis of the gender elements included in the 2008 pension reform, with particular emphasis on the New Solidarity Pillar.

The structure of the article is the following: in the following section, we briefly describe the main aspect of the Chilean pension system, including the main changes introduced by the 2008 reform, that affect pension differences by gender. In section 3, we show how the different elements of DC pension calculations presented earlier affect the gender gap in the Chilean context. In section 4, we present results from a simple pension simulation using Chilean micro-data to put in perspective the relative importance of the different components and the potential impacts of the changes introduced by the 2008 reform. In section 5, we conclude.

2.- The Chilean pension system and gender elements of the 2008 reform

2.1.- The Chilean pension system

The current Chilean pension system can be decomposed into three main pillars: a poverty prevention pillar, a contributory pillar and a voluntary pillar.³

The poverty prevention pillar, before the 2008 reform, was based on two components: a means-tested assistance pension (the PASIS) and the Minimum Pension Guarantee (MPG) for individuals who contributed for at least 20 years to the individual capitalization scheme, but that were not able to finance a minimum amount for their retirement. Together, these two programs corresponded to the main government programs aimed at avoiding old age poverty, and were financed by general revenue.

The contributory pillar was drastically reformed in 1980. The previous system was based on a number of PAYG schemes, that provided defined benefits calculated as a proportion of the wages received during the last period of working life. These schemes were running increasing deficits, caused by large imbalances between the benefits that were promised and the contributions that were made into the system. In 1980, the military government created a unique national scheme that was based on individual accounts where each worker's savings are deposited and invested in financial instruments by professional firms, the Pension Fund Administrators (the AFP system). These firms can freely set an administrative fee in exchange for the different services they provide

³ Part of the material in this section was extracted from Rofman, Fajnzylber and Herrera (2009).

(collection, record-keeping, investment, benefit calculation and payment, and customer service) and individuals can switch at any time between AFPs.

Individuals are not allowed to withdraw funds from their individual accounts until they retire, which can happen at any point after the legal retirement age (65 years for men and 60 for women) or before that (early retirement) if they have accumulated enough funds in their account and they receive a minimum replacement rate. When the individual retires, he or she can choose between buying an annuity from an insurance company or receiving a programmed withdrawal stream from the AFP. In both cases, benefits are actuarially calculated as a function of the individuals savings accumulated over the lifetime, the potential beneficiaries and (age and gender-specific) life expectancy.

To complement the compulsory savings made into the contributory scheme, tax incentives are provided for individuals who make additional voluntary savings in a special set of financial products: voluntary savings accounts managed by the AFPs, mutual funds offered by banks, insurance-plus-savings products provided by insurance companies, etc. The scheme is set so that the part of the individual's income that is allocated into these special products is exempt from income taxes during the years the deposits were made. Interest income from these savings is also tax-exempt, but pensions financed by these savings pay regular income taxes when they are received by the worker. Individuals are allowed to withdraw funds before retirement, but with a penalty, and in addition to the income taxes that ought to be paid at the time of this withdrawal.

2.2.- Gender elements of the 2008 reform

Special attention was given in the reform to introduce measures that could increase gender equality between men and women. In general, women tend to i) have long periods without contributions, usually associated with caring duties over children or other dependent relatives, ii) be hired in low remunerated occupations (relative to men with similar educational background), iii) retire earlier and iv) live longer. All these elements, combined in a pension system that provides no gender redistribution during the retirement phase, create significant differences in the benefit distributions of men and women.

On the other hand, retirement and disability benefits under the AFP scheme inherited many of the asymmetric design elements of previous regimes: women cannot provide survivorship benefits to their husbands (or the fathers of their children), unless they are disabled. This means that they are entitled to lower benefits from the workers' disability and survivorship insurance program while paying the same premium. At the same time, pension formulas do not have to reserve funds for husbands in case they outlive their wives, a regulation that increases women's benefits. In addition, mortality tables used to calculate benefits under a programmed withdrawal schedule are gender specific (which is consistent with this self-insured option) and insurance companies are allowed to make differentiated offers to men and women.

Introduction of the New Solidarity Pillar

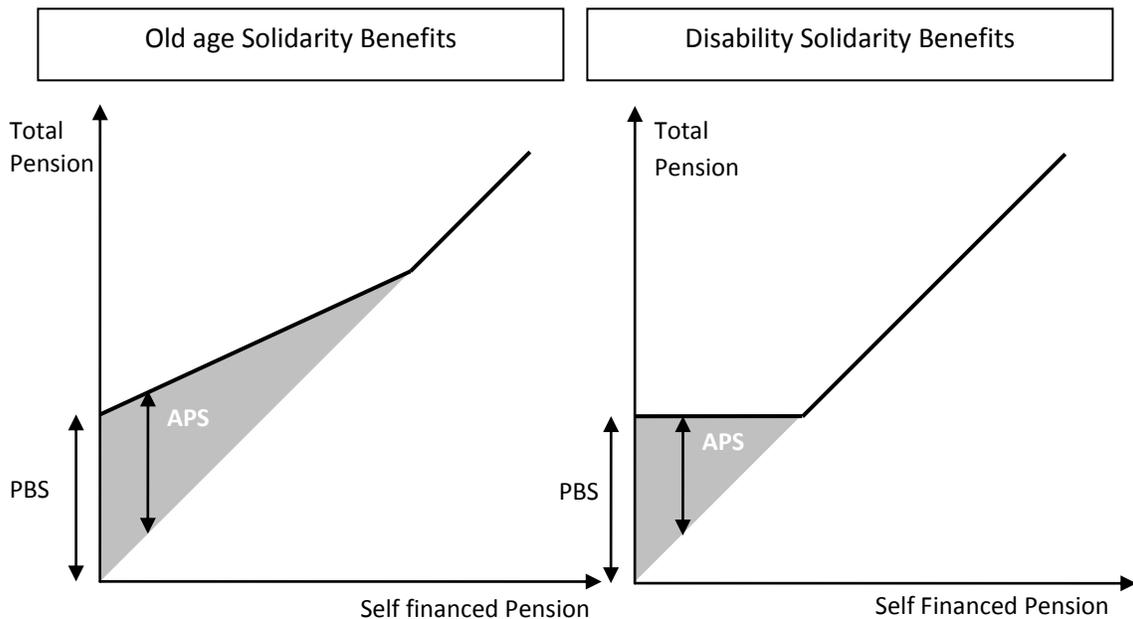
To address these differences, the reform considers a number of measures. The main one is certainly the introduction of the New Solidarity Pillar. Previous to the reform, poverty in old age was partially addressed by two main programs: the minimum pension guarantee, that provided a floor for pensions for individuals who contributed for at least 20 years, and the Assistance Pensions program (PASIS) for poor individuals with no pension entitlements.

The 2008 reform replaces these programs with a unique scheme that guarantees that all individuals in the 60% less affluent fraction of the population will have a guaranteed basic pension, regardless of their contribution history. This new program provides old age and disability subsidies, financed by general revenues of the State.

Individuals with no contributions are entitled to an old-age Basic Solidarity Pension (PBS), once they reach 65 years of age, and fulfill the affluence and residence requirements. Individuals who made contributions but will receive a pension below a certain threshold are entitled to a Pension Solidarity Complement (APS), with the same affluence and residence requirements. The disability program provides benefits under similar conditions, but for individuals between the ages of 18 and 64. Once disabled individuals reach the age of 65, they are eligible for old-age solidarity benefits.

The schedule of subsidies is best described in the following figure, which presents solidarity subsidies and total pensions, as a function of self-financed entitlements.

Figure 2.1 – Subsidies and final pensions under the New Solidarity Pillar



Source: Figure III-6 in Rofman, Fajnzylber and Herrera (2009).

It is worth noticing two particular elements of this design: the strong integration between the contributory system and the solidarity pillar and the concern for contributory incentives that this integration raises. Integration allows guaranteeing that everybody in the first three quintiles will receive a pension equivalent to, at least, the PBS. If the benefit had been established with a cap (as in the disability case), there would be strong disincentives to contribute for low income individuals, as their retirement income would not increase with the number or amount of contributions. With the chosen design, old-age total pensions are monotonically increasing with self financed savings, i.e. every dollar saved always increases retirement income, but not by a full dollar.

By design, the New Solidarity Pillar will be more beneficial for women, as they are more likely to never have contributed or done so with less frequency than men. In addition, benefits are gender neutral, therefore benefiting women because of their higher longevity.

State financed Bonus to mothers for every child born or adopted

The reform introduces a subsidized bonus to mothers, for every child born or adopted. The subsidy is equivalent to the contribution of a full time minimum wage worker for 18 months, and receives an annual rate of return (equivalent to the net average return of AFP's Fund C) from the day of birth until the mother reaches the age of 65. This benefit is subject to the residency requirement but is not means tested.

Since Chile is among the countries with the longest maternity leave regulations in the region (18 weeks) and at the same time with one of the lowest female labor force participation rates, the introduction of this bonus is extremely important to achieve decent retirement income, particularly among low income workers. But beyond the financial benefit, the measure is extremely valued by the population, as a form of social recognition to the (non-remunerated) activity of giving birth and taking care of children during their first months of life.

Economic compensation in case of divorce or annulment

In addition, the reform introduces the legal concept of pension related economic compensation in case of divorce or annulment. Under this figure, a judge can instruct, if required, the transference of retirement funds between individual accounts, as a form of economic compensation to the part that presents a loss during the period they were married. This transference cannot exceed 50% of the resources accumulated in the account of the contributing part, during the period the two persons were married.

Separation of disability and survivorship insurance contracts between men and women and transference of the difference in premia to the low-cost group individual accounts

The premium that is charged to participants in the AFP system for the disability and survivorship insurance (SIS) was, before the reform, the same for men and women, despite the fact that these are less likely to become disabled and do not generate survivorship benefits to their spouses, unless they are disabled. To avoid this cross-subsidy, the reform requires AFPs to obtain separate

insurance contracts for men and women, to charge affiliates for the higher of the new premia (most likely the men's contract) and deposit the difference for the other group in the savings account of the less risky group (most likely, women). As a result, women's final contribution to their pension funds will be slightly higher than the 10 percent prescribed in the law. This can be seen as a way to maintain a unique insurance cost for all participants, while increasing the amount of savings available to women at the time of retirement.

In May 2009, the AFP contracted the new insurance contracts, resulting in a premium for men of 1.87% of covered wage and a premium for women of 1.67%. The difference (0.2%) will increase the contribution of women in the system (from 10% to 10.2%).

Widower pensions

One of the main gender asymmetries prevailing in the pension system is the impossibility of generating survivorship pensions to widowers, unless they are disabled. As part of the reform, the requirement of reserving part of the accumulated funds at retirement for paying survivorship pensions and the coverage under the survivorship insurance are now applicable to both men and women. In the first case - retirement calculation - the inclusion of widowers will actuarially decrease the pension of the retiring woman in exchange for the additional benefit. In the second case, the additional coverage will be financed by a unique insurance premium corresponding to all women in the system, therefore eliminating the current cross-subsidies from insured women to insured men.

The measures described in this subsection account for most of what can be done to improve pension equality between men and women through pension system design. Clearly, however, most of the pension inequality is associated with cultural factors governing the distribution of labor at the household level and the labor market distortions that occur through occupation or wage discrimination. These factors cannot be appropriately addressed through pension reforms.

3.- DC pensions and the gender gap

Contributory pensions under a DC scheme (financial or notional) are affected by a number of factors, related to the personal contribution history, retirement decisions, financial returns and other design elements. One way to picture this is using a general pension calculation formula:

$$\text{Contributory Pension} = \frac{\text{Balance}(\text{complete contribution history, returns})}{\text{factor}(\text{Age, mort. tables, pension type, interest, beneficiaries})}$$

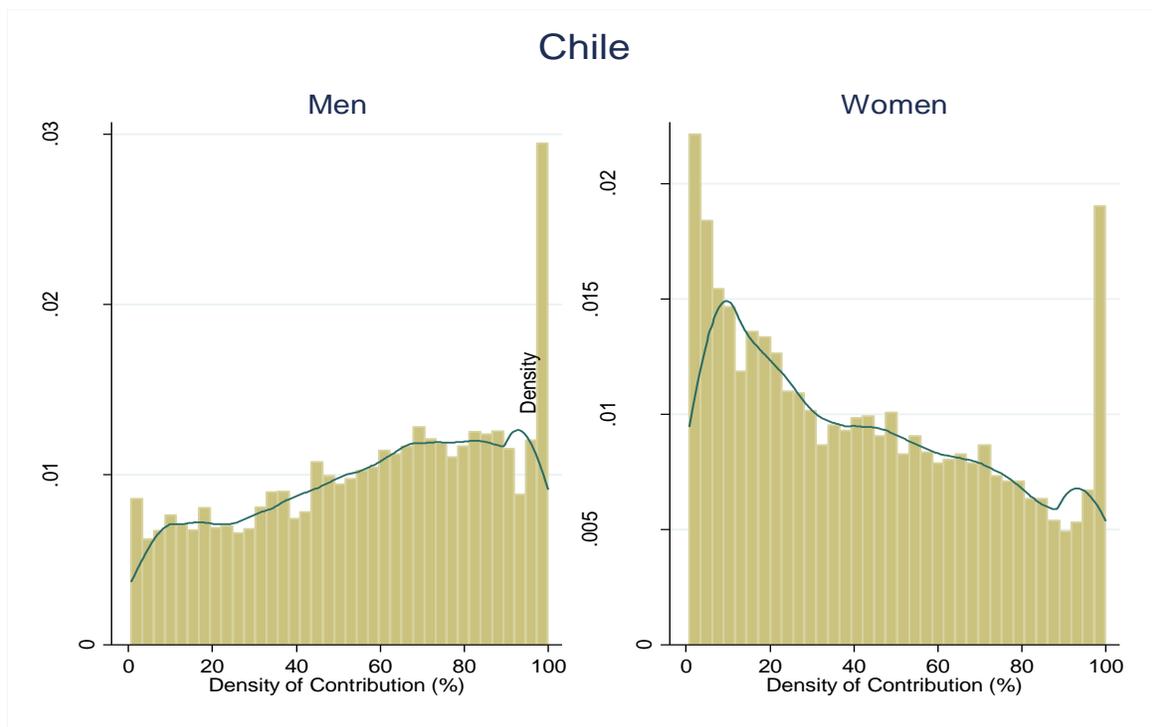
In addition to the pension rights acquired through social security contributions, individuals may be entitled to non contributory rights (for example, the New Solidarity Pillar under the reformed system in Chile, minimum pension entitlements, assistance pensions, etc.) and in some cases, to receive survivorship pensions.

In this section, we analyze each of these factors and their relative importance in the Chilean context.

3.1.- Contribution histories (frequency, intensity and timing)

Probably the most important determinant of pensions in a DC context is how often individuals contribute to the system, a concept usually referred to as density of contributions. The following figure presents the distribution of this density for men and women in Chile, estimated by Forteza et al (2009), using individual administrative data between 1981 and 2004, for a representative sample of 24 thousand participants in the AFP system.⁴

Figure 3.1.- Distribution of the Density of Contributions



Source: Figure 4, Forteza et al (2009)

Clearly, the distribution shows important differences between the contributory behavior of men and women. Men's distribution is skewed to the right, with a large mode in 100% contribution density. In contrast, the female distribution is bimodal with modes at the two extremes (0 and 100%). As the following table shows, men contribute on average 15 percentage points more frequently than women. The fraction of women who contribute less than 25% of their working life more than doubles that of men (36% against 17.4%).

⁴ An individual with 100 percent density contributed his entire working life, whereas workers with 50% density contributed half of the months between the age of 20 and the last moment they were observed in the data.

Table 3.1 – Statistics of the contribution densities for men and women

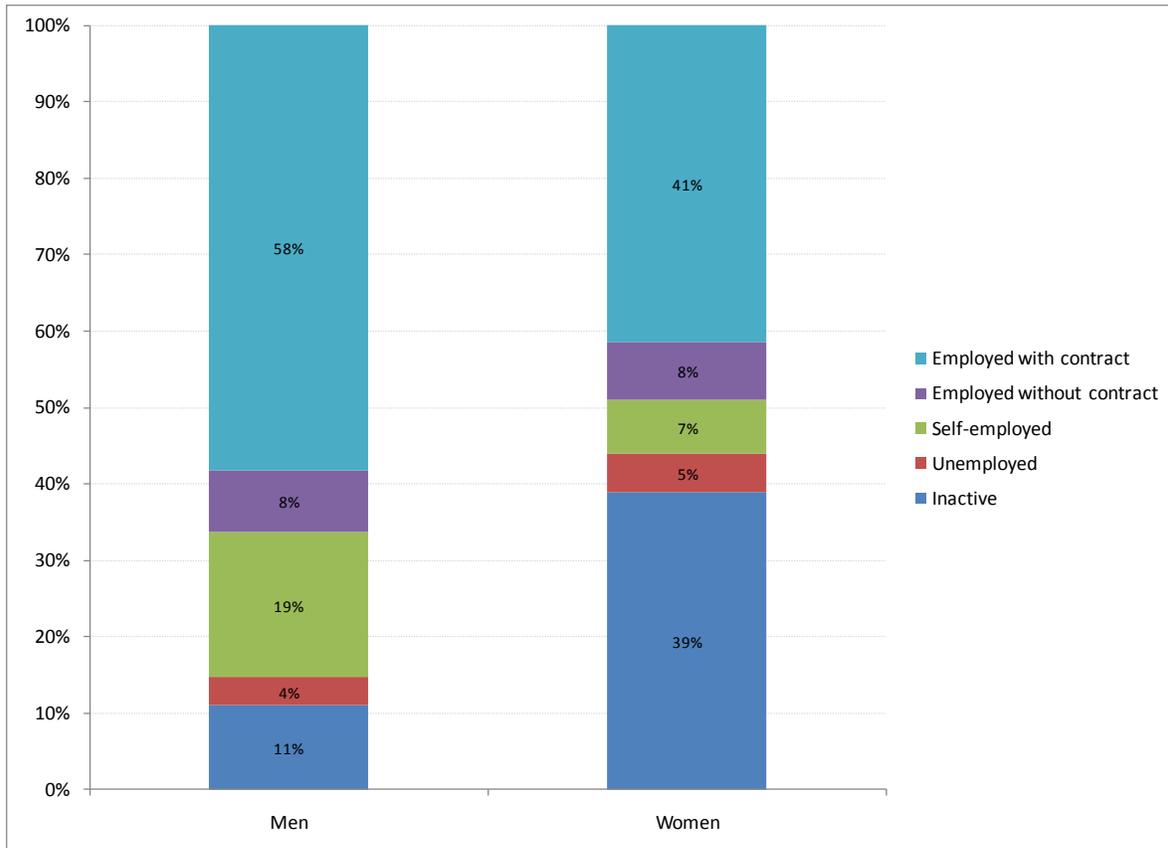
Characteristics	Mean	Median	Percentage of Contributors with Densities (d) ...				
			$d < 25\%$	$25\% \leq d < 50\%$	$50\% \leq d < 75\%$	$75\% \leq d < 100\%$	$d = 100\%$
Total	51.4	52.2	25.5	22.4	24.9	26.0	1.3
Men	57.9	61.3	17.4	21.0	27.9	32.1	1.6
Women	43.0	39.2	36.0	24.2	20.9	18.0	0.9

Source: Extracted from table 5, Forteza et al (2009)

To understand the source of these differences, it is possible to show the activity that men and women were doing, when they were not contributing. The following figure shows the average fraction of the working life that men and women spent in different occupational categories.⁵ Men spend most of their working life in formal occupations (58% as employed with contracts), an additional 27% as informal or self-employed workers and only 11% being inactive. In contrast, women spend 39% of their working life as inactive, 41% as formal workers and 15% as self-employed or informal workers. If informality is the main challenge for pension participation for men, inactivity represents the bulk of the coverage problem for women.

⁵ The graph was constructed using self-reported histories between 1980 and 2002 for approximately 15,000 individuals included in the Encuesta de Protección Social (EPS). Only the reported histories between the ages of 18 and 65 were included in the analysis. More detail on the EPS is provided in section 4.1.

Figure 3.2 – Fraction of time spent in different occupational categories

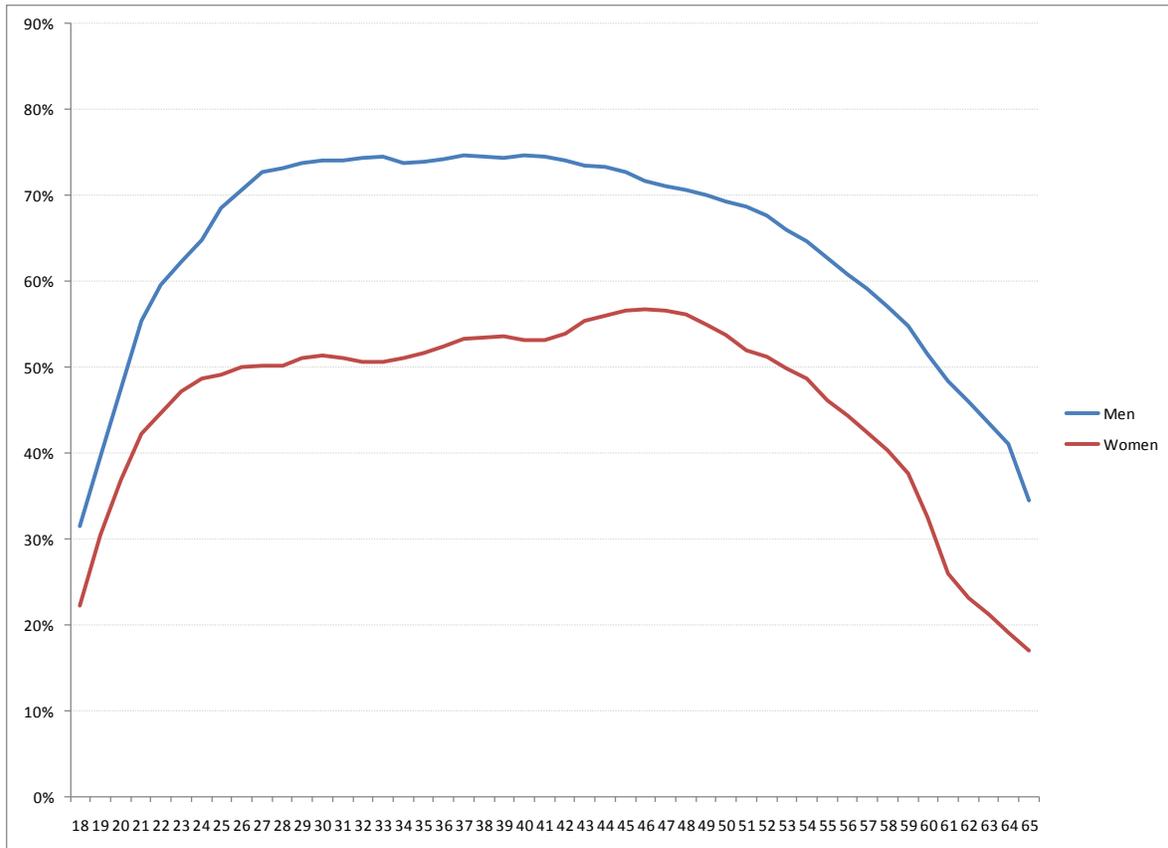


Source: Author's calculations, based on self reported histories from the EPS Survey.

As mentioned earlier, the timing of contributions plays a significant role in DC systems, as early contributions accumulate interest over a longer period. The following figure shows the average density of men and women over their lifetime, based on data from the EPS.⁶ Not only do men contribute with a higher frequency than women but their highest densities (around 74%) occur between the ages of 27 and 46, whereas women's periods with the highest densities (around 55%) occur between the ages of 39 and 50.

⁶ It is important to mention that average densities by age are calculated with data from different cohorts (densities at older ages come from earlier cohorts, intermediate ages from the whole sample and young ages from the latest cohorts). Contreras et al (2005) show that cohort effects are important, as younger cohorts present much higher labor force participation rates than do older ones.

Figure 3.3 – Average densities of contribution by age and gender



Source: Author's calculations, based on self reported histories from the EPS Survey.

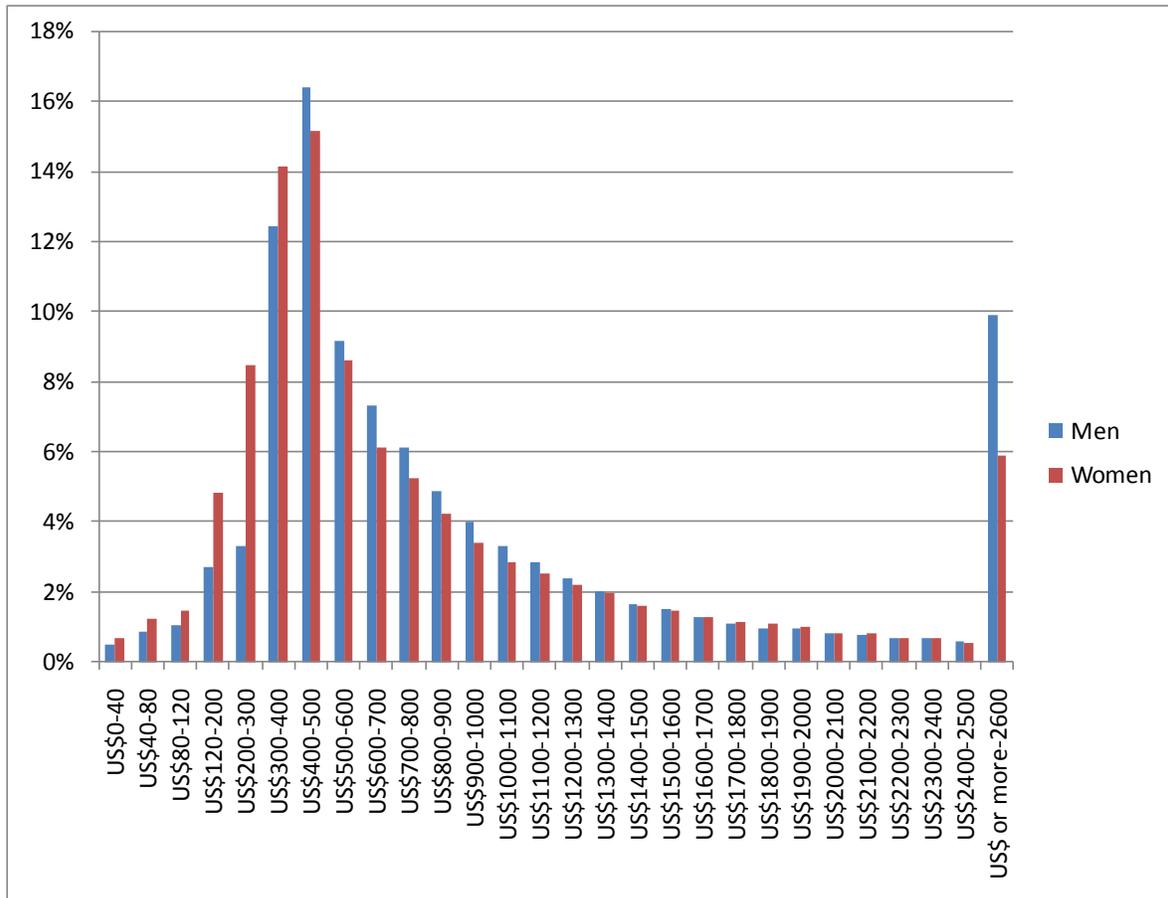
Finally, the following figure shows the earnings distributions of male and female contributors to the pension system, as of September 2009 (2.4 million men and 1.6 million women). These unconditional distributions are quite similar except for certain regions: there is a higher proportion of women earning below the official minimum wage (currently close to US\$320) and a larger proportion of men receive earnings at or above the maximum covered wage (approximately US\$2500). Overall, the median covered wage of men is between US\$600 and US\$700 for men and between US\$500 and US\$600 for women.⁷

The larger fraction of women receiving less than the minimum wage could be explained by part time jobs and domestic workers (for whom there is a lower minimum wage).

Clearly, these unconditional distributions do not capture the potential differences in wages at similar levels of education or experience.

⁷ Average earnings are greatly affected by the large fraction of individuals at the top covered income bracket; US\$938 for men and US\$825 for women.

Figure 3.4 – Income distribution of contributors by gender, September 2009



Source: Author’s calculations, based on official data available at www.spensiones.cl.

Summarizing, Chilean women tend to present substantially lower and later contribution densities than Chilean men, essentially explained by the fact that women spend a large fraction of their working life as inactive. Moreover, women tend to receive slightly lower earnings than men and a much lower fraction of women receive wages above the earnings ceiling for contributions. All these labor market factors directly translate into lower pensions in a DC system.

3.2.- Retirement age

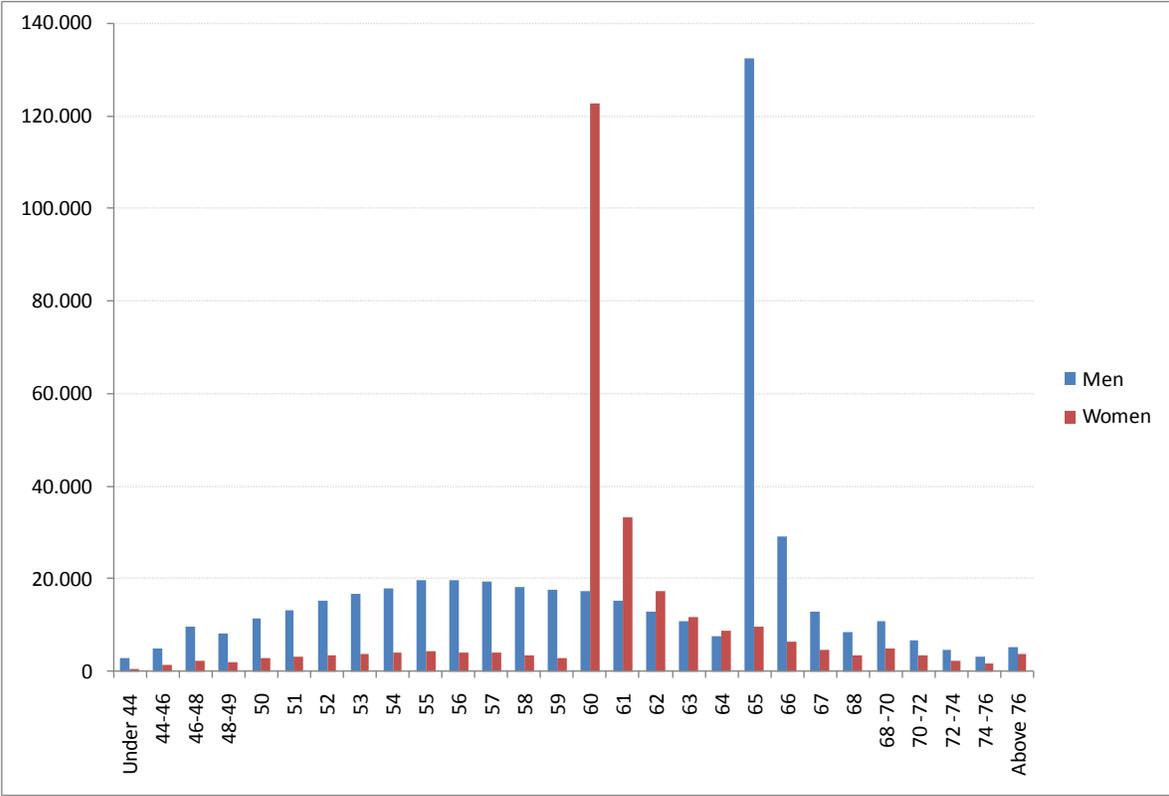
Actuarial calculations of pensions in DC systems imply that retirement age has a strong and direct effect on the pension levels; earlier retirement implies that individuals’ savings must cover a longer payment period, therefore reducing the initial pension.

The following figure shows the age at retirement (including early retirement) for both men and women, as of September 2009.⁸ The most prominent aspect is the great importance of the

⁸ The figure corresponds to the 746,325 individuals that have taken old-age retirement in the system, including 37,135 individuals who were deceased by September 2009.

minimum retirement age defined by law: 28% of men retired at age 65 and 45% of women retired at age 60. A large fraction of men (55%), however, qualify and apply for early retirement, including 45% of male retirees by age 60. In contrast, only 15% of female retirees acquired this status before the legal retirement age, probably reflecting the fact that they often do not qualify for this possibility, due to their lower balances.⁹

Figure 3.5 – Distribution of old-age retirement age by gender, September 2009



Source: Author’s calculations, based on official data available at www.spensiones.cl

Another reading of the previous figure is that, even if there are no actuarial advantages (as is often the case in DB systems) individuals tend to retire as early as they are allowed to. This could partly be associated with the lack of familiarity with the way pensions are calculated in a DC scheme; individuals face the illusion of having the possibility of receiving two wages, without anticipating the effect that this decision has on earnings once they actually retire from the labor market.¹⁰

In comparison with the labor market factors described in the previous section, the previous figure shows that pension design plays a significant role in the decision of when to retire. Raising the

⁹ Early retirement requires that individuals be able to finance a pension at least equal 150% of the minimum pension and with a replacement rate of at least 70%.

¹⁰ In the Chilean system, there is no incompatibility or penalty for working while retired. Start receiving a pension and retiring from the labor market do not often occur simultaneously.

minimum retirement age (for instance to equalize it with that of men) would automatically increase female pensions at retirement, at the expense of forcing them to wait until that age.¹¹ At the same time, it would be interesting to reinforce the information provided to individuals looking for early retirement to make sure they understand the consequences of their decisions in their future earnings profile.

3.3.- Mortality tables and pension types

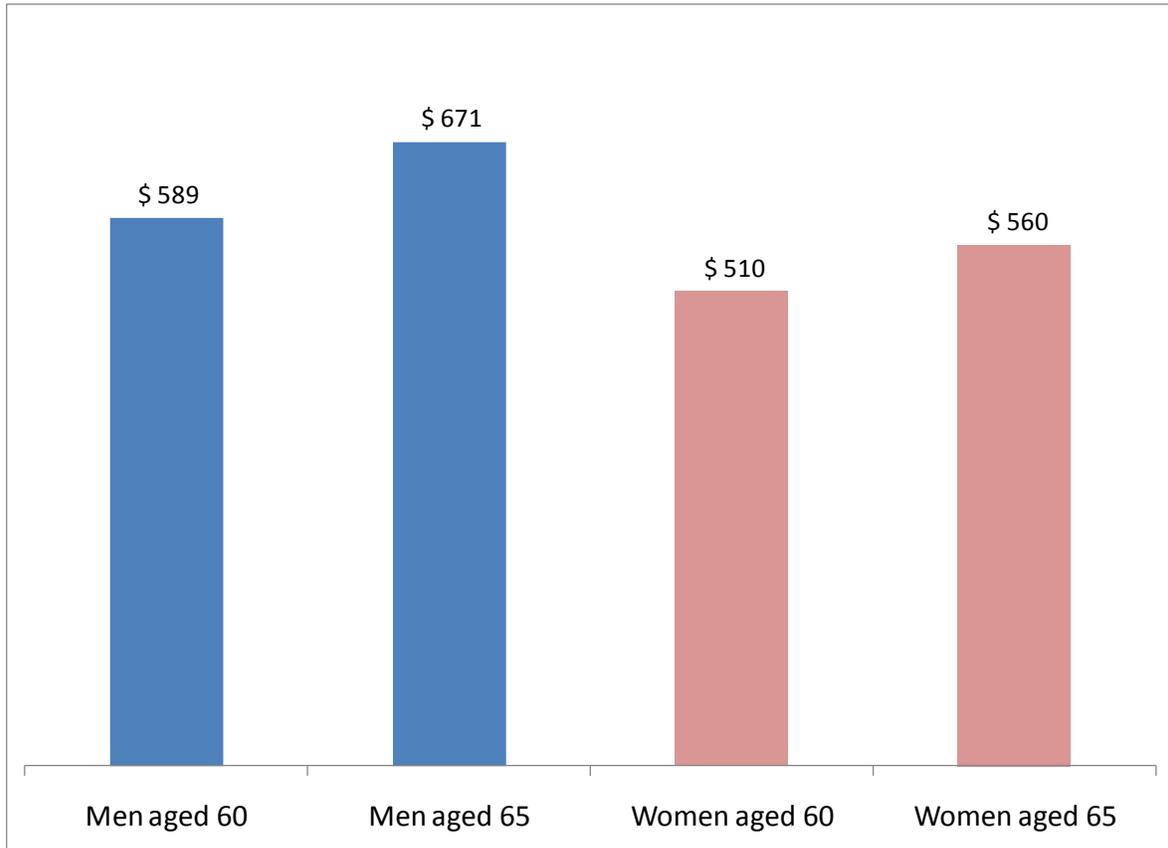
In Chile, retirees can opt for two main alternative retirement instruments: they can keep their funds in the same AFP and start receiving payments from it under a programmed withdrawal schedule (also called phased withdrawal) or to use their funds to buy an annuity from an insurance company. In the first case, pensions are calculated using official formulas, interest rates and mortality tables. In the second case, insurance companies compete and offer their annuities based on their own calculations. In all cases, gender differentiated mortality tables are used in all the calculations, translating the higher longevity of women into lower pensions (keeping all other factors constant).¹²

To see the importance of this issue, the following figure shows the pension level that would be financed for single men and women aged 60 and 65, with US\$100,000 in their account (using the official mortality tables for pensioners). Women's pensions, for the same age and balance, are 13% lower at age 60 and 17% lower at age 65. In addition, the figure shows the effect of postponing retirement age in 5 years, as discussed in the previous section. This postponement alone (without including the additional contributions or interest income that might increase the balance) would increase women's pensions in 10%.

¹¹ This measure (raising legal retirement age for women until age 65) was proposed by the Pension Reform committee but not included in the reform bill sent to congress. To show its importance, we will include this measure in the simulation exercise of section 4.

¹² According to the official mortality tables for 2009 old-age pensioners, life expectancy at age 60 is equal to 82 years old for men and 88 for women.

**Figure 3.6 – Simulated pensions for single men and women, aged 60 and 65
(Balance=US\$100,000)**



Source: Author's calculations, based on programmed withdrawal formula, and official interest rates and mortality tables for old-age pensioners.

During the reform process, the issue of using gender-differentiated mortality tables was discussed in the context of the Pension Reform committee. The reasons for not including a recommendation to use unisex tables were the following (Consejo Asesor Presidencial para la Reforma Previsional, 2006):

- In contrast with other countries, in Chile there is a possibility to retire under a programmed withdrawal schedule. Under unisex tables, men would be more attracted to this option, leaving the annuities market only for women, therefore defeating the purpose of the measure.
- There is no practical experience in using these tables in countries with individuals capitalization schemes.
- As pensions are calculated taking into considerations the group of potential beneficiaries, the impact of unisex tables would be of second order.

- The use of unisex tables would imply a cross-subsidy from retired men to retired women, without a clear understanding of whether this subsidies would fall on men of higher or lower income.
- The use of gender-differentiated tables implicitly incorporates the effect of other variables that affect longevity, like socioeconomic status.
- Official mortality tables are used to calculate the reserve requirements of annuity providers. Using unisex tables might cause them to under or over reserve depending on the gender structure of the company.
- Annuities are freely fixed by insurance companies, which have the incentive to use the mortality tables that most closely approach their pool of insured individuals.

3.4.- Poverty prevention pillar

In addition to the importance of self-financed pensions, individuals have access, under certain conditions, to non-contributory benefits financed by general revenues. The benefits are generally gender-neutral in terms of their eligibility requirements and provide benefits until death, therefore mitigating the longevity difference between and women.

Before the 2008 reform, there were mainly two programs to cover individuals with low pension entitlements: the minimum pension guarantee (MPG) for individuals who contributed for at least 20 years but were not able to finance a pension above a certain threshold (the minimum pension) and the *Pension Asistencial* (PASIS, Assistance Pension) for poor elderly without other source of pension income.

Using data from the 1960-65 cohort of the Social Protection Survey, Berstein and Tokman (2005) analyze the effect of different components of the (pre-reform) pension system on the pension gap, including the MPG component. They conclude that, even if the MPG program tends to favor more women than men, it is not enough to compensate for the differences in retirement age and gender-differentiated mortality tables. The effect is that gender differences that occur during the active life are exacerbated during retirement, especially for high education individuals. The following table summarizes these results.

Table 3.2 – Pensions, wages and gender gaps by education level (1960-65 Cohort)

	Average Wages(Ch\$)			Average annuities (Ch\$)			Change in gap
	Men	Women	Wage gap	Men	Women	Annuity gap	
Primary education	81.842	34.833	135%	104.274	43.335	141%	-4%
Secondary education	129.413	62.107	108%	176.671	76.028	132%	-18%
College educated	272.898	157.949	73%	380.955	150.815	153%	-52%

Source: Translated from Table 3, Berstein and Tokman (2005).

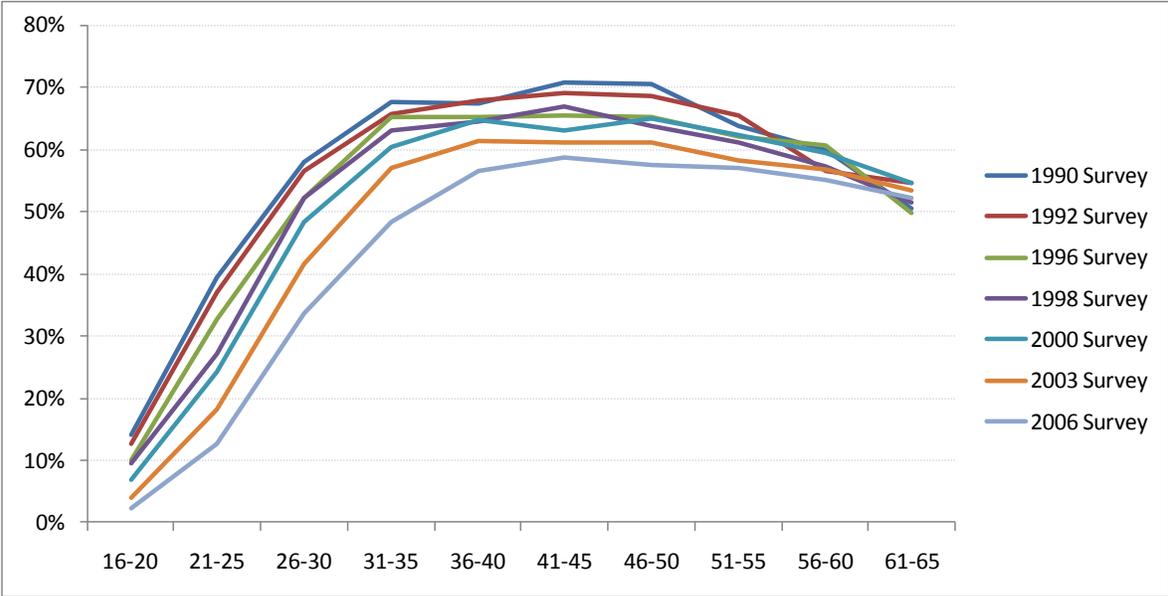
As described earlier, the 2008 reform brought about a number of measures directed at reducing the pension gap, including the replacement of the MPG and the PASIS programs by the New

Solidarity Pillar and the introduction of the bonus per each live birth. In the following section, we will simulate to what extent these new measures are able to compensate for the pension gap.

3.5.- Survivorship pensions and divorce

To this point, we have focused on self-financed pensions earned by men and women or non-contributory entitlements. An important third alternative for protection in old age is to be indirectly covered by survivorship pensions. This traditional concept of social security systems depends, however, on individuals being married and maintaining their family ties until retirement. As the following figure shows, in the last two decades in Chile, there has been a tendency among women to postpone marriage and a lower fraction of women are married during the period before legal retirement age (from 60% in 1990, to 55% in 2006).

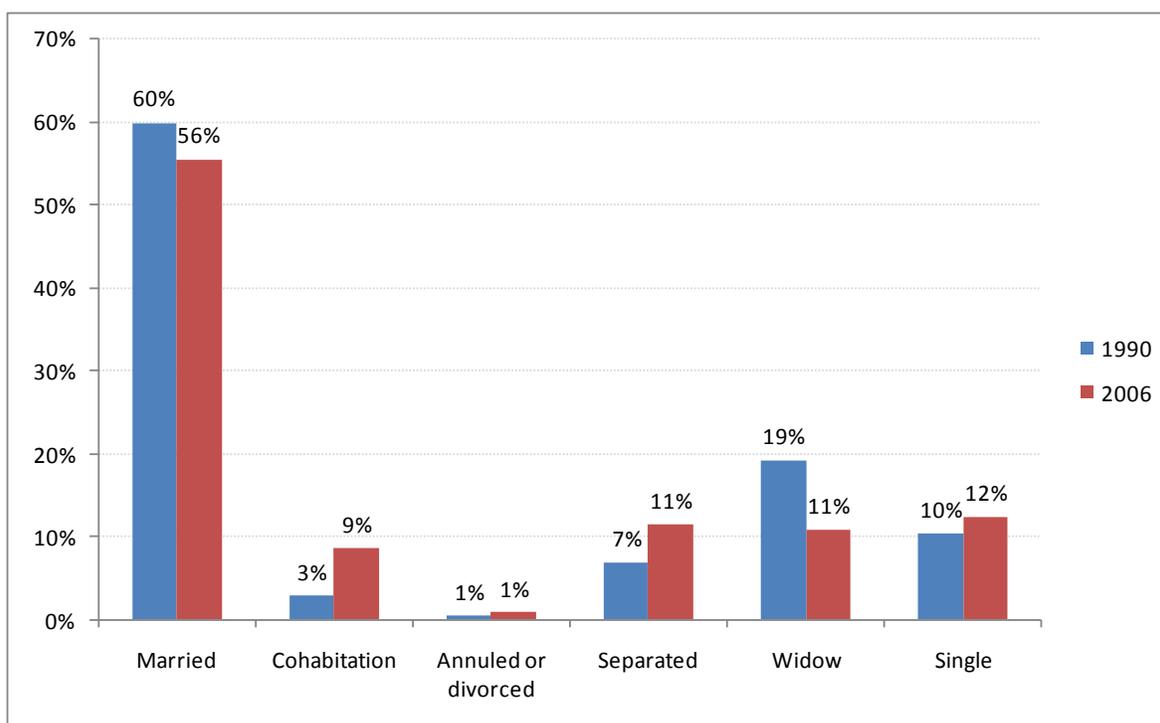
Figure 3.7 – Fraction of women who are married by age and cohort



Source: Author’s calculations, based on CASEN household survey, multiple years.

The following figure shows the evolution between 1990 and 2006 of the civil status of women in the 55-60 age range. The 5 percentage points reduction in married women has been accompanied by increases in cohabitations (6 percentage points), separations (4 percentage points) and singlehood (2 percentage points).

Figure 3.8 – Civil status of women aged 55-60, in 1990 and 2006



Source: Author's calculations, based on CASEN household survey, 1990 AND 2006.

Overall, we can expect that indirect coverage provided by husbands will tend to decrease over time, as women postpone or avoid marriage and separations, annulment or divorces increase over time.

4.- Results from a micro-simulation

To compare how the different measures taken in the 2008 reform will affect female pensions in Chile, we construct a simulation model based on individual level histories taken from the 2002 *Encuesta de Protección Social* (EPS, Social Protection Survey).¹³ Self-reported labor histories are

¹³ An alternative source of micro-level data would have been the Affiliates Pension Histories (HPA), a data base including the administrative contribution histories of a sample of 24 thousand individuals, a subsample of which were interview for the EPS survey. For more details on this dataset, see for example Fajnzylber & Robalino (2009). Unfortunately, this database is not yet publicly available. The main difference is that there is no recollection error, as could be the case with the EPS. Berstein & Tokman (2005) present some comparative statistics of the distribution of densities from the EPS and the HPA. Average densities are quite similar (55% for men in the HPA compared to 59% in the EPS, and 48% and 46% for women in the HPA and EPS, respectively) but median density for men is higher in the EPS than in the HPA (64% against 48%). This difference is a lower source of concern in this article, given that we are primarily interested in comparing pension distributions across different scenarios, rather than precisely estimating the pension distribution.

completed using econometric projection models and pension entitlements calculated under different scenarios. This section describes the data, methodology and simulation results.

4.1.- Data and methodology

The EPS follows a sample of approximately 17 thousand individuals who were interviewed in 2002, 2004, 2006 and 2008. In this article, we use data from the first survey (2002), where individuals are asked to self-report their labor history for the period 1980-2002.¹⁴ We focus on individuals born between 1962 and 1967, who most likely entered the labor market after the 1980 reform. As we are interested in estimating their pension entitlements, we must predict the contribution status and earnings from 2002 until the moment they retire (60 or 65 years old).

To complete the history of contributions we first estimate a linear probability model for a variable that is equal to one if the person worked and made social security contributions in a given month. As we have longitudinal data for a relatively large sample, we estimate a fixed effect model and we use it to predict the probability of making contributions in a given month for the period that is not observed in the data. The estimated model has the following form:

$$\text{Contributed}_{it} = \alpha + \beta'X_{it} + \varphi_i + \varepsilon_{it}$$

where X_{it} includes the variables Age and Age squared and their interaction with a female dummy variable and schooling. The set of parameters φ_i represent the individual level fixed effects, which are also included in the prediction model. The results from this model are included in Appendix. The fitted values from the previous equation (censored to 0 if the prediction is negative and 1 if the prediction is greater than one) are used as an estimate of the probability of making contributions in a particular month.

To complete the projection, we also need an estimate of the earned income for contributors. As the EPS self-reported histories do not include earnings, we use a different approach. Using cross-section data from another set of household surveys, the CASENs, we estimate a linear model for labor income and then we use the coefficients to impute earnings in the EPS labor histories.¹⁵ In this case the model has labor income as dependent variable, the same X_{it} used in the contribution equation plus a female dummy variable, schooling, squared schooling and a cohort variable defined by the year of birth (divided by 1000). The results from this model are included in Appendix.

$$\text{Earnings}_{it} = \alpha + \beta'Z_{it} + \delta * \text{cohort}_i + v_{it}$$

¹⁴For more information on this survey, see www.proteccionsocial.cl. The information includes the labor status, region, occupation, existence and type of contract, labor relationship, and contribution status.

¹⁵ We use the 1990, 1992, 1994, 1996, 1998, 2000, 2003 and 2006 versions of CASEN. For more information on this survey, see www.mideplan.cl/casen.

With the results from these two models, together with returns data, we are able to construct projected pensions for each individual in the sample: we estimate the real balance in the account at retirement (which can occur at age 60 or 65, depending on the scenario) and then we calculate the corresponding annuity given official mortality tables and annuity interest rates.¹⁶

4.2.- Simulated scenarios

To observe how the 2008 reform affects female pensions, we constructed 5 incremental scenarios, depending on the different measures that were included. In addition, we include two scenarios (called scenario 4-MP and 5-MP) in which we include a Minimum Pension guarantee instead of the New Solidarity Pillar. These scenarios are summarized in the following table.

Table 4.1 – Simulation scenarios

Scenario	Description
1	Base scenario: women retire at age 60, men at age 65
2	Scenario 1 + bonus per child
3	Scenario 2 + 0.2% additional contribution rate
4	Scenario 3 plus Solidarity Pillar
5	Scenario 4 + women retiring at age 65
4 – MP	Scenario 3 plus Minimum Pension
5 – MP	Scenario 4-MP + women retiring at age 65

As described in section 2.2, current legal retirement age is 60 for women and 65 for men (scenario 1). In scenario 2, we include the State financed Bonus to mothers for every child born. This corresponds to the equivalent of 18 monthly contributions for a minimum wage worker that earns the rate of return of the pension from the month of birth until the moment the mother reaches the age of 65. The history of births is included in the EPS.¹⁷ In addition to the bonus, scenario 3 also includes the additional 0.2% of earnings that women started to over-contribute since July 2009, as a result of the separation of male and female contracts for the Disability and Survivorship Insurance. Scenario 4 includes benefits from the New Solidarity Pillar for individuals with estimated pensions (calculated in scenario 3) below US\$510.¹⁸ Let us notice that, under scenario 4, both men and women are benefited, even if it is expected that the effect will be greater among

¹⁶ We use historic returns for the period 1981-2006 and 4% real interest rate for the missing period. We use a 3.5% interest rate for annuity calculations. We calculated pensions assuming that everybody in the sample was single at the moment of retirement.

¹⁷ The exact month of birth is not included in the EPS. We assume all children were born in the month of June.

¹⁸ The exact formula used (in Ch\$) was $\text{Subsidy} = 75000 - \text{pension} * 75000 / 255000$. The result was then converted using an exchange rate of Ch\$500 per US\$. We assumed that all individuals with pensions below US\$510 were eligible for the subsidy. As described in section 2, residency and means-testing requirements must also be met. In practice, it is expected that most individuals with small pensions will meet the means-testing requirement (being part of a household belonging to the 60% poorest segment of the population).

women, as they have lower pensions and are thus entitled to higher subsidies from the New Solidarity Pillar. Scenario 5 also includes a measure that was not included in the 2008 reform, i.e. raising the minimum retirement age for women to 65.¹⁹

Scenarios 4-MP and 5-MP are analogous to 4 and 5, except that instead of the New Solidarity Pillar, we set a floor of approximately US\$200 for all individuals with least 20 years of contributions. This is equivalent to the Minimum Pension Guarantee that was in place before the 2008 reform.²⁰ We allow for a 2% increase in real terms in the value of the minimum pension, from the year 2009 onwards.

4.3.- Results

The following table shows the mean and median of the pension distribution for men and women, under the 7 scenarios, together with women to men pension ratios. Under the base scenario, women would earn an average US\$265.2, equivalent to 46% of the average pension of men (US\$582.4). This ratio increases to 54% with introduction of the bonus per child (a 20% increase in women's average pensions). As expected the additional contribution rate (scenario 3) increases average pensions by 2% with respect to scenario 2. The inclusion of the solidarity pillar increases both men's and women's average pensions in 5% and 20%, respectively, therefore increasing the pension ratio from 55% to 63%. Finally, the additional 5 years of contributions and the lower life expectancy when women retire at age 65 raises women's pension in an additional 9%, leaving the women to men ratio in 68% in average terms.²¹

In contrast with the New Solidarity Pillar, scenario 4-MP shows the almost null impact of the minimum pension program, showing a slight effect on women's average pension (2%) and a larger impact on women's median pension (17%). This is consistent with other studies that found a relatively limited coverage of the minimum pension program.²² The reason for this is that, in the Chilean labor market, individuals who qualify for the minimum pension program (with at least 20 years of contributions) are also those who are able to finance pensions above the guaranteed minimum pension. The intersection between the two restrictions is therefore quite small.

¹⁹ This measure was proposed by the 2006 Pension Reform Committee that wrote the report that was the base for the 2008 reform. It was not included in the reform bill sent to Congress.

²⁰ In fact, individuals who were at least 45 years when the reform was passed are still eligible for the Minimum Pension Guarantee. These individuals can choose between the two systems.

²¹ It is important to mention that the comparisons made here do not necessarily show the marginal contribution of the reform relative to the previous scheme, as before the 2008 reform, two programs were in place to reduce poverty in old age: an assistance pension and a minimum pension program. The marginal increases presented here are calculated relative to a situation without a poverty prevention pillar.

²² See for example Berstein, Larrain & Pino (2005).

Table 4.2 – Simulation results – mean and median

	Average men	Average women	Women/Men ratio (%)	Median men	Median women	Women/Men ratio (%)
Scenario 1	\$ 582.4	\$ 265.2	46%	\$ 557.9	\$ 204.2	37%
Scenario 2	\$ 582.4	\$ 317.2	54%	\$ 557.9	\$ 252.0	45%
Scenario 3	\$ 582.4	\$ 322.5	55%	\$ 557.9	\$ 256.1	46%
Scenario 4	\$ 611.9	\$ 388.5	63%	\$ 557.9	\$ 330.7	59%
Scenario 5	\$ 611.9	\$ 424.8	69%	\$ 557.9	\$ 353.5	63%
Scenario 4 - MP	\$ 583.1	\$ 329.4	56%	\$ 557.9	\$ 299.3	54%
Scenario 5 - MP	\$ 583.1	\$ 369.0	63%	\$ 557.9	\$ 309.2	55%

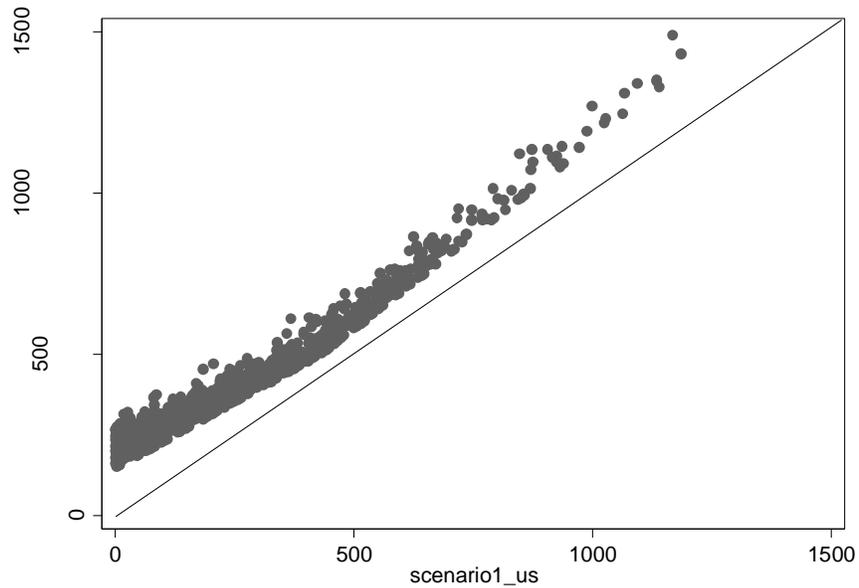
Source: Author's calculations.

The median results show a more negative initial situation: women's median pension in the base scenario represent only 37% of men's median pension. The different measures introduced, particularly the bonus per child and the New Solidarity Pillar, significantly reduce the median pension gap. This reflects the fact that both measures were designed with a progressive goal: the bonus per child was set in absolute terms (with respect to the minimum wage) and therefore represents a higher fraction of total pensions for of low income women. The Solidarity Pillar subsidy decreases with the level of pension, therefore affecting individuals (men and women) in the lower part of the distribution. As the median pension of men is above the threshold for the solidarity pillar, median pensions are kept unchanged for men in all scenarios.

To capture more clearly the distributional effects of the complete package of measures, the following figure shows the joint distribution of female pensions under scenario 1 (x-axis) and 5 (y-axis). As expected, all points are above the 45 degree line, reflecting the fact that all measures are pension improving. In addition, the increase seems to be higher in the lower part of the distribution. To see this more clearly, figure 4.2 shows in the y-axis the percentage increase in individual's pensions when going from scenario 1 to scenario 5.²³ While women with pensions above US\$500 perceive an increase between 25% and 40%, female workers in the lower part of the initial pension distribution see their pensions increased in more than 100%.

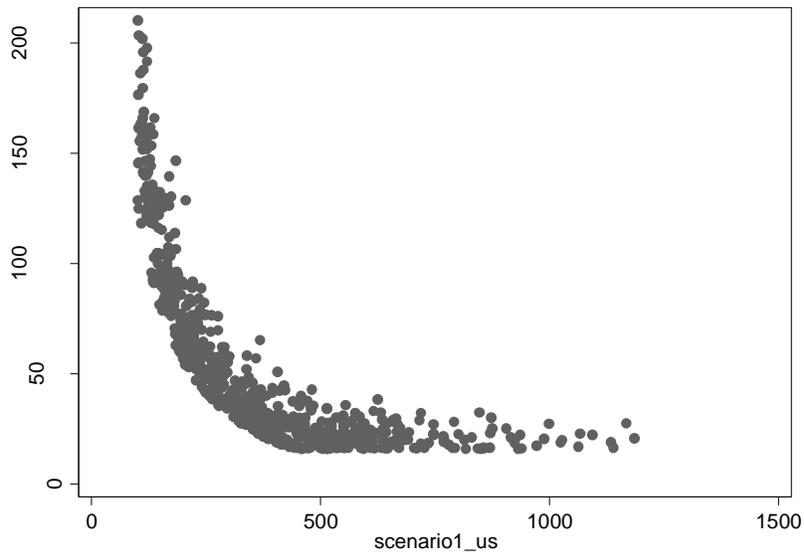
²³ For visual purposes, individuals with pensions below US\$100 were not included in this graph, as their pension5 to pension1 ratio was too high to include in the figure.

Figure 4.1 – Joint distribution of female pensions under scenarios 1 and 5



Source: Author's calculations.

Figure 4.2 – Joint distribution of female pension under scenario 1 and relative increase in pensions from scenario 1 to scenario 5 (initial pensions above US\$100 only)

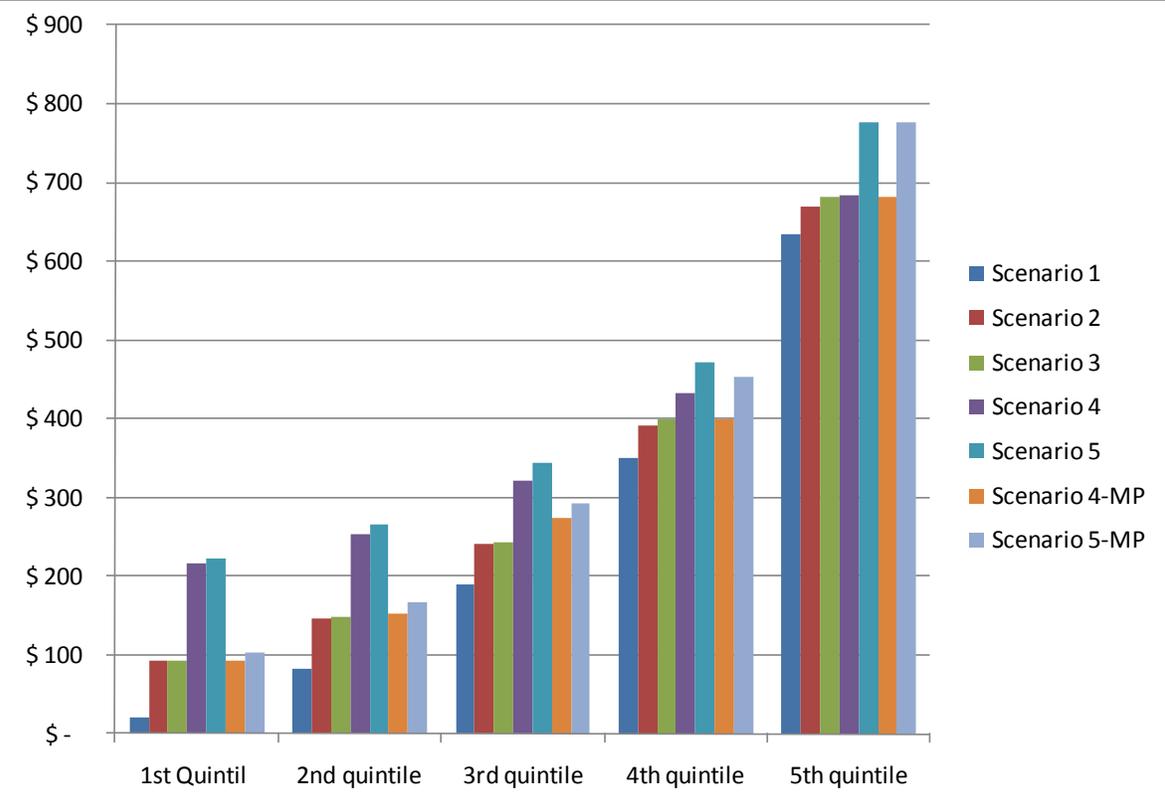


Source: Author's calculations.

Finally, the following figure shows average female pensions for the 7 scenarios, for the 5 quintiles of the initial pension distribution. Once again, in the first three quintiles, both the bonus per child and the Solidarity play a significant role in increasing women's pension. Interestingly, increasing retirement age has a much higher impact (with respect to scenario 4) in the upper quintiles (9% and 14% in the 4th and 5th quintiles, respectively), rather than the lower quintiles (3% and 5% in

the first two quintiles). The reason for this is the implicit tax associated with the reduction in benefits from the Solidarity Pillar; additional savings (including those coming from postponing retirement) done by individuals with pensions below the NSP threshold are “taxed” in a fraction equivalent to 29.4% (75000/255000). The minimum pension has a very limited impact, except for the third quintile, the part of the distribution where are located the few individuals who qualify for this program. In this group, the minimum pension program raises average female pensions by 12.3%.

Figure 4.3 – Average female pensions by scenario and quintile of the initial pension distribution



Source: Author’s calculations.

5.- Concluding remarks

The pension gender gap is the result of both the labor market characteristics of an economy and design elements of the pension system itself. In this article, we empirically analyzed the effect of 5 alternative measures on the pension distribution of men and women.

The results show three main results: i) the introduction of a bonus per child (that is fixed in absolute terms) can significantly raise pensions of women in the lower part of the distribution. Its effect directly translates into a reduction in the gender gap, as it only affects women (at least in the Chilean case). ii) The new Solidarity Pillar introduced in 2008 has a tremendous impact on all individuals with small pensions but especially among women, as they are more likely to be eligible for these benefits. Its effect on reducing the average pension gap is comparable to that of the bonus per child. iii) Raising women's legal retirement age to 65 would have an important effect (9% on average), but especially among women who are not eligible for the New Solidarity Pillar.

In contrast, and coinciding with previous results, the minimum pension's limited scope implies a relatively small role in lowering the pension gender gap.

From these results, a few generalizations could be attempted. Focusing on establishing a strong poverty prevention pillar seems like an attractive instrument to achieve both distributional goals and gender equity considerations. The design of this pillar is not irrelevant, however. On one side, the design of the minimum pension guarantee turned out to be a weak protection device, at least in the context of the Chilean labor market. On the other side, the strong design of the New Solidarity Pillar provides a high level of protection together with an important gender equalizing impact. This comes at the cost of significantly affecting the incentives to increase one's contributory pension, as the savings efforts of individuals with low pension entitlements are implicitly "taxed" at a 30% marginal rate, by the effect of reduced subsidies.²⁴ This can be seen from the reduced effect of postponing retirement age on women who are covered by the New Solidarity Pillar.

The use of a bonus per child (or the equivalent child care credits in many developed countries) has a clear and direct impact on women's pensions. It seems reasonable, however, to appropriately combine it with other forms of assistance for mothers who decide to keep working while taking care of their children. In addition, it is not evident whether the bonus should necessarily be assigned to mothers (as in the Chilean case) or more generally to the individual who is taking care of the child. Assigning it exclusively to mothers, even if it is probably the most prevalent case in developing countries, tends to perpetuate the traditional division of roles in the family.

It is worth mentioning that, for data considerations, we did not include in the simulations the effects of the economic compensation in case of divorce (which would tend to increase women's pensions) or the effect of survivorship pensions for women (which would tend to reduce women's

²⁴ Valdés (2007) discusses the incentive effects of the introduction of the Solidarity Pillar, arguing that future increases in the size of benefits could crowd out participation in the contributory scheme.

pensions).²⁵ From our perspective, the traditional view of one income provider in the family is increasingly disappearing. In this sense, pension calculation should be made more flexible, in order to allow for lower survivorship pensions in cases where the spouse is able to self-finance some reasonable retirement income.

Finally, we mentioned that the average effect on the gender gap of postponing retirement age for women was smaller than the effect of non-contributory benefits. We consider that it should still be taken under careful consideration. Among the amendments introduced by the 2008 pension reform, a significant one was the introduction of the obligation to contribute from the part of formal self-employed workers (which was previously voluntary). The main argument for this measure was that together with the extended rights associated with the New Solidarity Pillar came also an extended obligation to contribute for one's pension. A similar argument could be made with respect to the minimum retirement age and its relation with the New Solidarity Pillar; minimum retirement age could be increased to equate it with that of men or the benefits of the New Solidarity Pillar for women who retired before age 65 should be calculated as if they had retired at this age. That way, there wouldn't be an implicit tax on postponing retirement, a reality that is inevitable given the permanent increases in life expectancy experienced by most countries in the world.

²⁵ It is not easy to identify in the EPS marriage spells that ended in divorce and it is almost impossible to predict in what proportion of cases would the judges in charge of applying economic compensations in case of divorce make use of the transfer between pension accounts. With respect to survivorship pensions, we would require a model to predict the probability of reaching retirement while married.

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Appendix 1 - Estimation results

	Contribution status (Fixed effect)	labor earnings (Ch\$million) (linear regression)
Age (100)	-0.055 (2.15)*	-0.383 (8.16)**
Age²	-1.719 (62.28)**	0.454 (8.32)**
Age * female	-2.015 (106.77)**	-1.324 (38.01)**
Age² * female	2.709 (116.23)**	1.410 (32.50)**
Age * schooling	64.564 (282.79)**	22.329 (51.82)**
Age² * schooling	-66.391 (252.00)**	-20.344 (39.93)**
Female		0.184 (28.04)**
Schooling		-0.078 (86.05)**
Schooling²		28.280 (201.70)**
Cohort (year of birth/1000)		0.152 (2.59)**
Constant	-0.276 (139.38)**	0.011 (0.10)
Observations	3339907	511352
Number of fixed effects	14622	0
R-squared	0.12	0.37
Absolute value of t statistics in parentheses		
* significant at 5%; ** significant at 1%		

Appendix 2 – Fitted values for contribution and earnings models

Figure A2.1 – Observed and predicted probability of contributing by age and gender (EPS 2002)

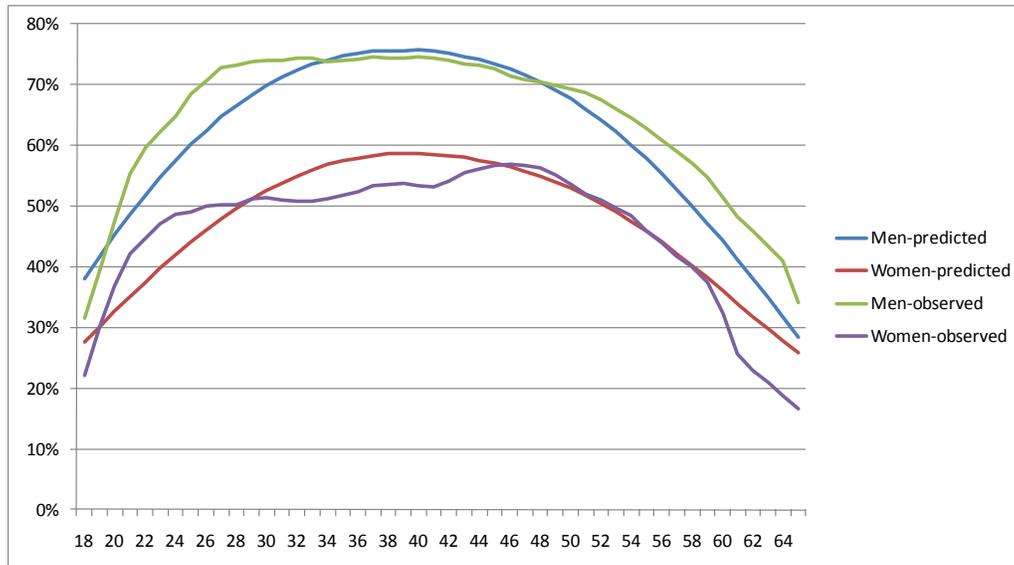


Figure A2.2 – Observed and predicted labor earnings by age and gender (CASEN 1990-2006)

