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**BETTER-INFORMED WORKERS AND RETIREMENT  
SAVINGS DECISIONS: IMPACT EVALUATION OF A  
PERSONALIZED PENSION PROJECTION IN CHILE**

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# Better-informed Workers and Retirement Savings Decisions: Impact Evaluation of a Personalized Pension Projection in Chile

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## Abstract

In a defined contribution pension system based on individual accounts information is essential, as plan members are responsible for taking actions in order to avoid undesirable low levels of pension income during retirement. In this paper we use a unique natural experiment to analyze the impact of information on savings decisions. In 2005, Pension Fund Administrators started sending out a Personalized Pension Projection (PPP). The first sending included only individuals who contributed in a particular quarter of the year and some of them did not receive the statements due to problems with the accuracy of their current address. We use matching estimation techniques exploiting these sources of variation during the first year to identify the impact of information on savings decisions. Our results show that the new information provided caused an increase in the probability of making voluntary contributions for old age, of approximately 1.4 percentage points, for individuals in the 40-50 age group. The effect on a younger group was smaller, consistent with myopia or liquidity constraints explanations for the commonly observed fact that pension concerns only arise once individuals approach retirement age. The impact on women is significantly larger than that on men, potentially reflecting a higher sense of urgency. As expected, individuals exposed to a positive tax benefit when making voluntary contributions exhibit a significantly larger impact than tax exempt individuals. Contrary to what we expected, however, individuals with high projected replacement rate present a slightly higher impact than those with lower replacement rate. Overall, these results suggest that a simple improvement in the information provided in the pension system may have important effects on retirement decisions made by individuals.

*JEL Classification Number:* J26, G14, G23

*Keywords:* Social security statements, saving decisions, information disclosure, natural experiments.

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## 1. - Introduction

Several pension systems in the world have recently moved from Defined Benefits (DB) to Defined Contributions (DC) schemes. One of the main concerns of DC pensions systems is that they transfer several of the risks involved in the financing of pensions to plan members.<sup>2</sup> In contrast with traditional defined benefits systems, the pension to be received by an individual in a DC system is not only a function of the history of contributions made during their lifetime, but depends also on financial returns and age and gender due to specific mortality factors at retirement. Participants can partly mitigate these risks by keeping close track of their balances and taking decisions accordingly; either by increasing their savings, moving their funds to more conservative or aggressive alternatives, or postponing retirement. To take these decisions, it is essential for individuals to have good information on their current state and the alternatives they have to improve their situation. In this paper we analyze the impact of improving information on retirement savings decisions.

An early experience with a national mandatory DC pension system based on individual accounts is the case of Chile<sup>3</sup>, where all dependent workers must contribute 10% (plus administration fees) of their covered income to the corresponding Pension Fund Administrator (AFP) of their choice, and after reaching the legal retirement age, they can either buy an annuity or withdraw their savings through a monthly programmed withdrawal schedule.

Due to the key role of information in the system, since 2005 the Supervisory authority required that AFPs must start sending out a Personalized Pension Projection (PPP) to their members, which is an estimation of the expected pension that a plan member will receive, given their current balance and some conservative assumptions about future returns. The PPP considers two extreme scenarios depending on the age of the plan member: to stop saving versus to continue saving until retirement for younger members, or to retire at the legal retirement age versus to postpone retirement in 3 years for members close to the legal retirement age.

To facilitate its distribution, the PPP is included once a year as an annex of the regular balance statement that AFPs send out every quarter. Due to problems with the information on the current address of a group of plan members, however, only some of the plan members actually received the statement during 2005. Moreover, statements were not sent to individuals who hadn't made compulsory contributions during the last quarter of 2004. We use these two sources of identification to analyze the impact of information on savings decisions. The basic idea is that individuals that did not receive the statement provide a control group for the individuals who did receive it. Since these sources of identification may not be random, we control for potential selection bias between individuals who received the PPP and those who did not using standard regression analysis and matching estimators. We first estimate the propensity score of receiving the statement, eliminating observations that do not satisfy minimal overlap conditions (Rosenbaum and Rubin, 1983). Then, we estimate average

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<sup>2</sup> At the same time DC plans don't have vesting period or political risks that DB schemes usually have

<sup>3</sup> Chile enacted a law (D.L. N° 3,500) that replaced the prevailing PAYG system, based on a number of defined benefit PAYG schemes similar to other countries, with a unique national system based on individual savings accounts which are invested in financial instruments and managed by private fund managers known as Pension Fund Administrators (AFPs).

treatment effects on the treated (those who received the statement) using regressions, propensity score matching and matching on covariates.

As the statement was sent once very year starting in 2005, we concentrate on potential behavioral changes during the first twelve months after the first statement was sent. This way, we have a well defined treatment (receipt of the statement).<sup>4</sup>

Our results suggest that the new information provided to plan members —the level of pension that they would be able to finance— did change their behavior: individuals who received the statement increased the probability of making voluntary contributions, particularly in the older group (40 to 50 years of age), by more than 1.3 percentage points. The effect on younger cohorts was smaller, consistent with some form of myopia or liquidity constraints. The impact on women is significantly larger than that on men, potentially reflecting a higher sense of urgency. As expected, individuals exposed to a positive tax benefit when making voluntary contributions exhibit a significantly larger impact than tax exempt individuals. Contrary to what we expected, however, individuals with high projected replacement rate present a slightly higher impact than those with lower replacement rate.

The next section will provide more detail on the context in which the PPP was created, including a discussion of the importance of information on retirement decisions and the relevant literature on financial education to which this paper is related. Section 3 will present the impact evaluation exercise, its methodology and results and in section 4, we conclude.

## **2. - Context**

### ***2.1 The Importance of Information on Pension Savings Decisions.***

In the Defined Contributions pensions system of individual capitalization existing in Chile, individuals are responsible for making decisions that will ultimately affect the amount of pension that they will receive. In the accumulation stage, individuals participating in the system must decide the administrator in which they will delegate the management of their retirement funds and in which type (s) of fund (s), among the five offered by each AFP, will their resources be invested. These decisions can be carried out at any point in time.

Near the end of the working life these individuals must decide in which moment they will retire, whether earlier than the legal retirement age if they fulfill the requisites or later if they prefer to delay the decision beyond the legal age of pension. This decision is completely independent from the decision to retire from the labor market.

In order to make these decisions, members need to be informed and to adequately understand the consequences of their decisions. The latter point tackles the issue of financial literacy. There is abundant evidence that financial literacy is scarce, even in developed countries that present higher levels of participation in financial markets, such as shown in Lusardi and Mitchell (2006). In fact, the important impact of default options on savings decisions found in

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<sup>4</sup> Future versions of the article could incorporate the statements sent in following years. This would mean dealing with multiple treatments: receipt of the 2005 statement only, receipt of 2005 and 2006 statement, etc.

the literature can be attributed in part to the effect of individuals regarding those options as information offered by their pension providers. In this interpretation, default options are viewed as information about the adequate level of savings in order to obtain a desired level of income in retirement (see Madrian and Shea (2001)).

Although financial literacy is scarce, there is also evidence that information has important effects on retirement decisions and that people respond to incentives. Dufflo and Saez (2002) find that attendance to information seminars boost participation in retirement plans, even among coworkers of the individuals who belonged to the treatment group. This result suggests that information provided through certain channels may have spillover effects that make them more effective. Chan and Stevens (2003) find that well-informed individuals are five times more responsive to incentives than the average individual. They also find that behavior of ill-informed individuals is consistent with their own misperception of pension incentives rather than being unresponsive to any incentives. This suggests an important role of providing better information in order to make better decisions.

The paper most closely related to our study is Mastrobuoni (2006), which assesses the impact of a new Social Security statement on information and retirement decisions in the United States. It finds that the introduction of the statement significantly improved information but did not imply an overall improvement in workers retirement behavior. However, it does find a significant impact in important groups. In particular people aged 62 and 65, which are the ages used in the Social Security statement for benefit projections, become less sensitive to Social Security incentives, suggesting a use of these ages as focal points. This finding should warn policymakers that the subset of information to be presented to individuals should be picked very carefully to avoid potential confusion or misinformation effects. On the other hand, uninformed workers appear to make better retirement decisions after the statement was introduced, with the important exception of black workers. This result suggests an important role for the provision of this kind of information for relevant target groups of members of the pension system. This role could be even more important in the case of Chile, where the pension obtained from the system is an important source of income during retirement for a vast majority of participants.

## ***2.2 Motivations for Developing a Personalized Pension Projection Statement***

The pension system in Chile has changed significantly throughout its history. In 1980, it was decided to reform the pension system, changing the pay as you go system by an individual capitalization, with defined contributions, private management of the funds, free choice of Pension Fund Administrators by affiliates and state supervision. In addition, the system was defined as mandatory for dependent workers entering for the first time in the labor force, and voluntary for those who were affiliated with the old system, as well as for the self-employed.

Despite its prolonged existence; there is a strong lack of information about the pension system by users. The tables below summarizes results from a Social Protection Survey conducted in 2004 that asked a representative sample of members about knowledge and participation in the system. This analysis is separated by gender and age group, in order to replicate the same groups that define the different designs for the PPP (see section 3).

**Table 2.1 – Information about the pension system, by age and gender**

Age		Do you have Voluntary Savings?		Have you ever received any statement of your AFP?		Do you know how much money you have in your individual account?		Do you know in which type of funds are your savings?	
		Men	Women	Men	Women	Men	Women	Men	Women
<u>Group 1:</u> individuals aged 20-30	yes	2%	1%	72%	66%	46%	42%	35%	31%
	no	98%	99%	28%	34%	54%	58%	64%	68%
<u>Group 2:</u> men aged 30–55 and women aged 30–50	yes	3%	3%	73%	66%	60%	50%	36%	31%
	no	97%	97%	26%	34%	40%	50%	63%	69%
<u>Group 3:</u> men aged 56–63 and women aged 51–58	yes	2%	2%	66%	66%	62%	51%	27%	29%
	no	98%	98%	33%	34%	38%	49%	70%	69%

Source: Own calculations based on data from *Encuesta de Protección Social* (EPS 2004).

**Table 2.2 – Information about retirement options, by age and gender**

Age		Do you know that you can retire early?		Would you retire later, if you would receive a better pension?		Do you know about pensions options?	
		Men	Women	Men	Women	Men	Women
<u>Group 1:</u> individuals aged 20-30	yes	53%	55%	0%	0%	5%	5%
	no	47%	45%	65%	100%	94%	94%
<u>Group 2:</u> men aged 30–55 and women aged 30–50	yes	63%	60%	13%	31%	10%	9%
	no	37%	40%	72%	45%	89%	91%
<u>Group 3:</u> men aged 56–63 and women aged 51–58	yes	72%	67%	45%	28%	22%	17%
	no	28%	33%	54%	67%	78%	83%

Source: Own calculations based on data from *Encuesta de Protección Social* (EPS 2004).

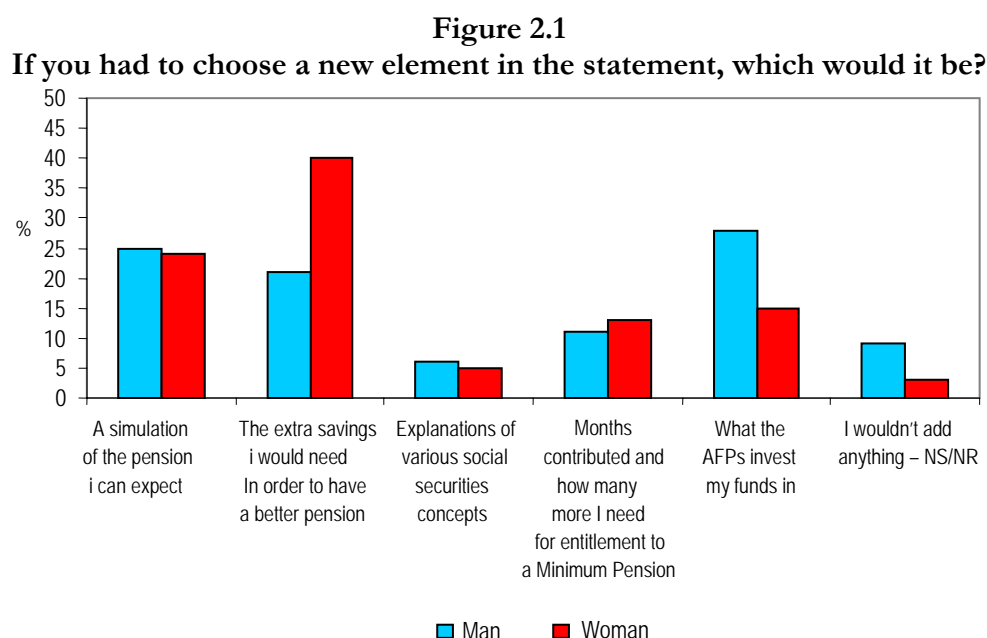
Note: In some cases, individuals did not answer or answered that they did not know the answer. This explains why some of the totals do not add up to 100%.

The results show that nearly 100% of people have no voluntary savings plan, regardless of age and gender<sup>5</sup>. In addition, about 30% of them said they have not received information from their AFP regarding their accounts. Faced with the question of whether they know how much money they have in their individual accounts, young people say not knowing in a greater rate than older people. With respect to whether they know where their savings are invested, only 30% said they know the type of fund where they are. Almost 40% of the people do not know that they can retire early. In addition, younger people declare they would not be willing to retire later, even if this involves a better pension. However, older individuals are more likely be

<sup>5</sup> As of December 2004 a total of 285,727 voluntary savings accounts existed in the AFP system, representing 3.8% of total members at that date.

willing to retire later in order to increase their pension. Finally, there is a strong ignorance of the options of pension that could be chosen at the time of retirement.

In addition, the CERC<sup>6</sup> survey in April 2005 showed that one of the important elements to be included in the statement was the simulation of the expected pension, as shown in Figure 2.1.



Source: CERC Barometer, April 2005.

The typical statement basically included the updated account balance plus the contributions made in the last 4 month period. In order to transform this information into an estimation of the pension to be received, the typical member would need to make important assumptions and relatively complex calculations, which in practice impede the individual to have an idea of her expected income adequacy during retirement and act accordingly. Notice that both the request for a provision of a pension simulation and of the extra savings needed to obtain a better pension are a sign of the participants' need for being provided a clearer estimate of the expected pension they could obtain given their current savings level.

In view of this, it was decided to define a calculation methodology and prepare a design to provide members with a personalized pension forecast, based on the total balance of accumulated funds and the number of years remaining before the member reaches legal retirement age, plus a series of assumptions on the yield of the funds, the amount of future contributions and the contribution density.

Some of the basic criteria used in this forecast were:

<sup>6</sup> The Superintendence of AFPs hires special questions to the “Centro de Estudios de la Realidad Contemporánea” (CERC) on the AFP system that are inserted in a broad questionnaire on current affairs related with political and social issues, known as the CERC Barometer.



- To include more than one scenario, so that members would not perceive this information as a promise of a given pension amount.
- Not to provide a pension forecast for members who are too young, because, since the balance in their individual capitalization account is very low, the pension scenarios would depend entirely on their income level and, to a very limited extent, on the accumulated balance. So a non-personalised appendix has been included for members under 30 years of age, encouraging them to contribute early in life.
- To provide suggestions to improve the pension, thereby inviting members to take action if they obtain a pension that they consider to be too low.
- To use simple language so that all members can understand the information being provided. For this reason, most technical terms such as percentages and figures in UF (an inflation-indexed monetary unit) were avoided.

In order to test the level of understanding and the effectiveness of the material, a focus group was performed, which provided the guidelines for the design of the definitive version.

As a result, the following pension forecast scenarios were defined for members over thirty years of age:

- 1) Members who are more than 10 years away from reaching legal retirement age, i.e. women between 30 and 50 years of age and men between 30 and 55 years, receive a personalised appendix which forecasts their pension in two extreme scenarios: in the first, the person contributes every month up to legal retirement age, using for this purpose the average earnings of the last six contributions; in the second, the person stops contributing and retires at the legal age with the funds accumulated up to that moment. For both scenarios, the Pension Fund is assumed to have had a real annual rate of return of 5%. The member is then presented with a series of recommendations to increase the value of his/her pension, such as voluntary savings, contributing as a self-employed worker or contributing on the complete wage.
- 2) Members who will reach legal retirement age in 2 to 10 years time, i.e. women between 51 and 58 years of age and men between 56 and 63 years, are presented with an appendix explaining the advantages of postponing the pension decision. A forecast is made for each person in which the member contributes for half the months up to legal retirement age and retires at that age; and a second forecast in which he/she contributes for half the months until 3 years after reaching legal retiring age (63 years for women and 68 years for men) and retires at that age. In both cases, the Pension Fund's real annual rate of return is assumed to be 5%.

Younger members (below age 30) receive an information flyer whose purpose is to educate them of the advantages of starting to contribute early, frequently and for the full salary and the impact of early contributions on future pensions.<sup>7</sup>

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<sup>7</sup> A detailed description of the different statements can be found in Appendix 1.

As table 3.1 shows, the PPP has already been included in three consecutive years. In 2007, the projection was sent to all affiliates, regardless of their recent activity (close to 8 million individuals). Our analysis focuses in the first year of the program (2005).

**Table 2.3 – History of statements sent including the PPP annex**

Date	Activity
July 2005	First time the PPP was included in the statements sent to all members who had made contributions during the January-April 2005 quarter.
July 2006	Second time the PPP was included in the statements sent to all members who had made contributions during the January-April 2006 quarter.
March 2007	First time the PPP was included in the statements sent to all members (regardless of recent activity).

### **2.3. - Descriptive statistics from the July 2005 statements**

In this section, we present descriptive statistics based on the data contained in the PPP annex included in the July 2005 statements, the first time this information was sent out. According to the regulation, more than 3.3 million individuals were sent a personalized pension projection (PPP) annex, of which close to 3 million were 10 years away or more from legal retirement age.

**Table 2.4– Universe of members who were sent a Personalized Pension Projection**

Sex	More than 10 years away from legal retirement age	Less than 10 years away from legal retirement age
Male	1,843,297	160,039
Female	1,113,627	185,229
Total	2,956,924	345,268

When we analyze the information provided in the statements, such as Taxable Earnings (TE), number of months with contributions in the previous year, estimated pensions in each scenario and the corresponding replacement rates, the evidence shows that there are strong differences by gender. Women have Taxable Earnings equivalent to 80% of men's TE. They are also less likely to contribute in the previous year and on average have estimated pensions that are less than half than those of men in each projection scenario.

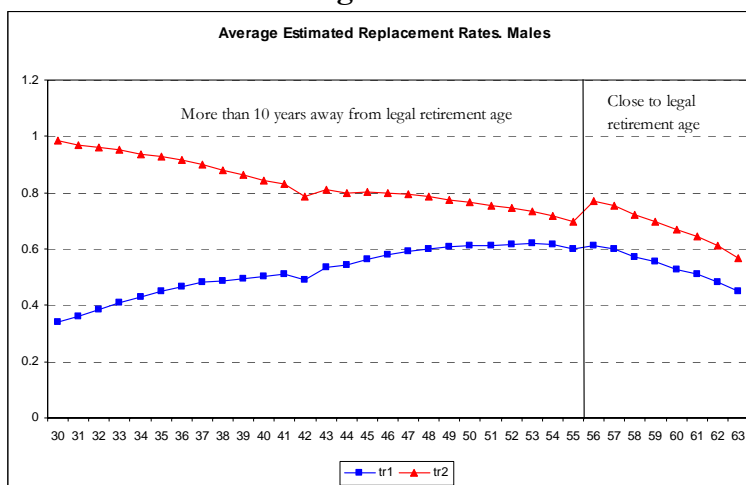
**Table 2.5 – Average characteristics of men and women who were sent a PPP annex**

Variable	Female	Male	All	Female/Male ratio
Average Taxable Earnings	\$ 273,399	\$ 341,369	\$ 314,635	80%
Months	7.72	8.88	8.43	87%
PPP1	\$ 68,065	\$ 162,355	\$ 125,268	42%
PPP2	\$ 126,096	\$ 276,616	\$ 217,412	46%
Replacement Rate 1	0.35	0.50	0.44	70%
Replacement Rate 2	0.57	0.84	0.73	68%

This feature of the Chilean pension system has been previously documented<sup>8</sup> and is largely affected by low (formal) labor market participation rates among women and interrupted work careers associated with taking care of children and relatives.

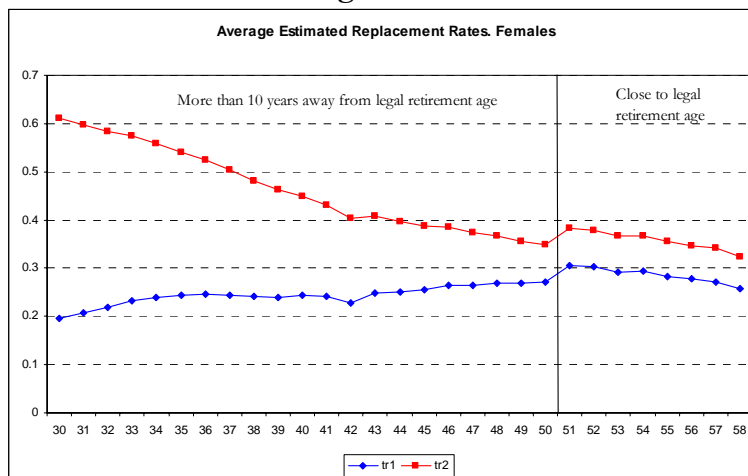
The average replacement rates by age implicit in the information sent in this statement are shown in the following graphs for each gender. In both graphs the vertical line divides the age-groups to which different statements are sent. Men below 55 years of age and women younger than 50 are sent a statement such as the one shown in Appendix 3.2, where the estimated pension is provided under the alternative scenarios: not to contribute until legal retirement age (tr1) and contributing for all the periods (tr2). Older workers are sent a PPP such as the one shown in appendix 3.3, where the extreme scenarios are to retire at the legal retirement age or three years later. The small spike in the replacement rate at the base scenario when moving from one age group to the next corresponds to the effect of assuming a 50% contribution density until legal retirement age rather than no contributions. The spike in the alternative scenario shows the effect of postponing retirement in 3 years (assuming a 50% density) rather than having a 100% contribution density until legal retirement age. It is clear from these results that postponing retirement has a stronger effect on the estimated pension than the density of contributions at advanced ages.

**Figure 2.2a**



<sup>8</sup> See for example Berstein and Tokman (2005)

**Figure 2.2b**



### 3. – Impact evaluation of the introduction of the PPP

The main goal of this section is to evaluate whether the additional (and individually tailored) information had an effect on the savings behavior of individuals who received the statement. We will concentrate on middle-aged individuals (between 30 and 50 years old), who received two different projections: one under the assumption that they make no additional contribution until retirement and one assuming that they contribute every month until retirement. The adequacy of expected retirement income can be weighted in these two scenarios and if deemed insufficient the individual can take remedial actions, such as starting or increasing voluntary contributions, which is mentioned as a way of improving future pensions in the same PPP statement. We will analyze the probability of making voluntary contributions after receiving the PPP as our outcome variable of interest.

#### 3.1. – Identification strategy

Given the design of the PPP, a number of identification strategies are available to estimate the impact of the different options:

- Middle aged individuals received a projection, whereas young workers (below 30) received only an informational leaflet (see Appendix 1). One could use regression discontinuity techniques to compare outcomes of individuals with ages just above and below the 30 years threshold.
- On the other extreme, individuals who were close to retirement (up to two years away from the minimum retirement age) received projections showing the effect of delayed retirement, whereas individuals too close (under two years away from minimum retirement age) to retirement did not receive anything. Similarly, regression discontinuity techniques could be used to compare decisions on the timing of retirement of individuals with ages just above and below the threshold

- In the middle, some individuals received projections based on two extreme future contributive scenarios (0% density and 100% density) whereas others received projections with average density but with two alternative retirement ages.
- Some individuals received the statement and some individuals did not receive it, due to problems with their addresses or because the statement was not sent to them because they hadn't contributed during the corresponding quarter.<sup>9</sup> Controlling for differences in the characteristics of the members of each group, we could compare the outcomes of interest between members who received the statement and members who did not.

In this version of the article, we concentrate on the last strategy, given that it provides us with the possibility of evaluating the impact over a broader age spectrum and without depending on regression discontinuity assumptions. In addition, not enough time has passed since the introduction of the PPP to evaluate the impact on retirement decisions.

The basic idea behind this strategy is that individuals who did not receive a statement provide a control group for the individuals that did receive it. As this source of identification is not necessarily exogenous to the outcomes of interest (old age savings decisions), we use non experimental techniques to address potential endogeneity biases. This will be explained in more detail in the following sections.

### 3.2. – Data

To implement this strategy, a database was compiled that included information about the individuals and their projections, but also regarding the submission and delivery status of the statement that was sent and, if applicable, the causes why it was returned to the AFP. During the July 2005 wave, close to 3.3 million statements were sent to active members, of which 273,014 were returned to the AFP. The causes why the statements were returned are presented in the following table.

**Table 3.1 – Causes why the statements were returned to the AFPs**

Cause	Number of statements returned in July 2005	Percentage
Change of address	120,694	44.21%
Wrong address	52,010	19.05%
Unknown in address	5,192	1.90%
Rejected	6,036	2.21%
Dead	580	0.21%
There is nobody to receive	1,020	0.37%
Expired deadline	75,894	27.8%
Others	11,588	4.24%
Total	273,014	100%

As we can see, the main reasons for not receiving the statement (among those who were sent one) were related to a change in the address of the person or wrong address.

The main concern with using returned statements as a source of identification is the possibility that individuals with address problems are systematically different from individuals who did

<sup>9</sup> For instance, only individuals who had made contributions during the January-April 2005 period were sent the July 2005 statement containing the first PPP.

receive their statements. Similarly, when using the submission status as source of identification (i.e. when using as control group individuals who were not sent a statement), concerns might arise because individuals who did not contribute in a particular quarter might be different in other dimensions related to savings behavior (for example, more stable jobs). The following table shows some of the characteristics of both the individuals who received the statements and those who did not (table 3.2a presents differences among individuals who were sent a statement and 3.2b among individuals who received it and those who did not because the statement was not sent). This table was constructed using a sample of individuals for which it was possible to observe the contribution and savings both before and after the introduction of the PPP and that presented at least one compulsory contribution after 2003.<sup>10</sup> A number of measures were constructed to capture potential pre-treatment differences in observable characteristics between the two groups.

The results suggest that in practically all dimensions the two groups are statistically different, calling the need for quasi-experimental techniques to be used to account for potential unobservable differences between the two groups. In particular people who did receive the PPP tend to be older, have higher density of contributions and salaries, and are in general more likely to make voluntary contributions, which is our outcome of interest. All these results are expected, since having an updated address at the AFP (the main reason for receiving the statement) or making regular compulsory contributions (the main reason for being sent a statement) are likely correlated with being more attached to pension savings in general.

**Table 3.2a –Characteristics of individuals who received statements and those who were sent one but did not receive it.**

Characteristic	Average among individuals who received the statement	Average among individuals who did not receive the statement	T-test for the difference in means
Voluntary savings during previous year	0.021	0.003	(5.41)**
Age as of June 2005	39.773	39.455	(1.05)
Male	0.631	0.642	(-0.4)
Average covered wage during 2005 (ch\$ million)	0.312	0.223	(8.16)**
Density of contributions between age 20 and June 2005	0.572	0.493	(5.28)**
At least one compulsory contribution between July 2005-June 2005	0.977	0.953	(2.05)*
Average Balance in Compulsory savings account (in UF)	23259.900	14103.166	(8.55)**
Average Balance in Voluntary savings account (in UF)	109.991	17.064	(4.06)**
Positive balance in voluntary savings	0.052	0.038	(-1.28)

Robust t statistics in parentheses

\* significant at 5%; \*\* significant at 1%

<sup>10</sup> Pretreatment variables were constructed using the Affiliates Pension Histories (HPA), a longitudinal administrative database based that was collected on a representative sample of 24 thousand members of the AFP system. More detailed on this database can be found in Bernstein et al (2006).

**Table 3.2b –Characteristics of individuals who received statements and those who were not sent one.**

Characteristic	Average among individuals who received the statement	Average among individuals who did not receive the statement	T-test for the difference in means
Voluntary savings during previous year	0.021	0.005	(6.17)**
Age as of June 2005	39.772	39.661	(0.7)
Male	0.632	0.612	(1.43)
Average covered wage during 2005 (ch\$ million)	0.312	0.183	(21.50)**
Density of contributions between age 20 and June 2005	0.571	0.377	(26.81)**
At least one compulsory contribution between July 2005-June 2005	0.976	0.689	(23.56)**
Average Balance in Compulsory savings account (in UF)	23259.899	12213.425	(13.90)**
Average Balance in Voluntary savings account (in UF)	109.992	3.976	(4.91)**
Positive balance in voluntary savings	0.052	0.010	(11.33)**

Robust t statistics in parentheses

\* significant at 5%; \*\* significant at 1%

### 3.3. – Methodology

The main challenge that occurs when trying to evaluate the impact of an intervention (such as the introduction of the PPP) on potential outcomes of interest (such as the amount of voluntary retirement savings performed by individuals) is to estimate what would have happened with an individual in the counterfactual situation in which she hadn't been exposed to the intervention (if she hadn't receive the statement). This is only possible if we can observe the behavior of an individual both before and after the intervention and/or we can credibly identify individuals who can serve as a control group for the treated individuals. When no random assignment is available (as in the evaluation of experimental drugs), finding a credible control group (one that is very similar to the treated individuals) is a difficult task, as assignment is usually determined by characteristics that we do not observe and that could be related to the outcome of interest.

The field of program evaluation has made significant progress in the last years, borrowing techniques from statistics and applying them to construct quasi-experimental estimators that allow researchers to evaluate the effect of social interventions in settings where no experimental identification is possible. Most of the recent developments are oriented to make use of rich information about pre-treatment observable characteristics to control for unobservable differences that may be correlated with the potential outcomes of interest.<sup>11</sup>

An important literature that assesses the performance of alternative matching estimators based on randomized experiments and Monte Carlo simulations has recently developed. First Dehejia and Wahba (1999) claimed that simple cross-section matching estimators perform well

<sup>11</sup> See for example Rosenbaum and Rubin (1983), Dehejia and Wahba (1999), Heckman, Ichimura and Todd (1998), or Abadie and Imbens (2001).

when trying to replicate treatment effects based on experimental evidence. Later, Smith and Todd (2005) found that their results are very sensitive to the sample used and the variables included to estimate the propensity score. Based on Monte Carlo simulations, Zhao (2004) finds that when the correlations between covariates and the participation indicator are high, propensity-score matching performs relatively well, but when the sample size is too small, propensity score matching does not perform well compared with other matching estimators; He also finds that matching on covariates using the Mahalanobis metric is relatively robust under different settings.

In our case, we will first use the concept of overlap introduced by Rosenbaum and Rubin (1983), i.e. we discard treated individuals that do not have a reasonable counterfactual set to choose from in the control group. To do so, we estimate a parsimonious specification of the propensity score (the probability that a person belongs to the group of treated individuals, conditional on his or her pre-treatment characteristics). This means fitting a logit model using the presence in the treated group (having received a statement) as dependent variable and the pre-treatment variables presented in table 3.2 as covariates. In order for the balancing property to be satisfied, several interactions between these variables were introduced as covariates in the model. The final specification chosen was the most parsimonious one that satisfied the balancing property in each identification strategy and age group. The result of this exercise is presented in the following tables.



**Table 3.3a – Estimation of the propensity score for receiving a statement**  
Control Group = Individuals who were sent a statement but did not receive it

Variables	Dependent Variable = 1 if received a statement, 0 if was sent but not received	
	Age between 30 and 50	Age between 40 and 50
Age as of June 2005	0.015 (1.5)	-0.092 (0.94)
Contributions made 2005	-0.811 (-1.85)*	-5.943 (1.28)
Male * Contributions made 2005	0.509 (2.06)**	
Age as of June 2005 * Contributions made 2005		0.122 (1.21)
Density of contributions between age 20 and June 2005 squared	0.928 (1.2)	
Density of contributions between age 20 and June 2005 * Contributions made 2005	1.286 (1.90)*	1.596 (3.53)***
Voluntary savings during previous year * Age as of June 2005	0.052 (1.94)*	
Voluntary savings during previous year * Male	-5.044 (-4.17)***	-2.345 (-1.70)*
Density of contributions between age 20 and June 2005 * Voluntary savings during previous year	6.825 (5.35)***	5.286 (3.69)***
Density of contributions between age 20 and June 2005 * Male	-1.492 (-3.25)***	-0.657 (-1.84)*
pc_2005 * Average covered wage during 2005 (ch\$ million)	2.698 (3.59)***	
Male * Positive Voluntary Account balance	-0.522 (-1.51)	-0.624 (-1.33)
Density of contributions between age 20 and June 2005 * Average covered wage during 2005 (ch\$ million)	-1.905 (-1.69)*	
Average covered wage during 2005 (ch\$ million) * Contributions made 2005		1.369 (2.67)***
Constant	2.142 (4.27)***	6.807 (1.52)
Observations	7813	3906
Balancing property satisfied	yes	yes

Robust z statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

**Table 3.3b – Estimation of the propensity score for receiving a statement**  
Control Group = Individuals who were not sent a statement

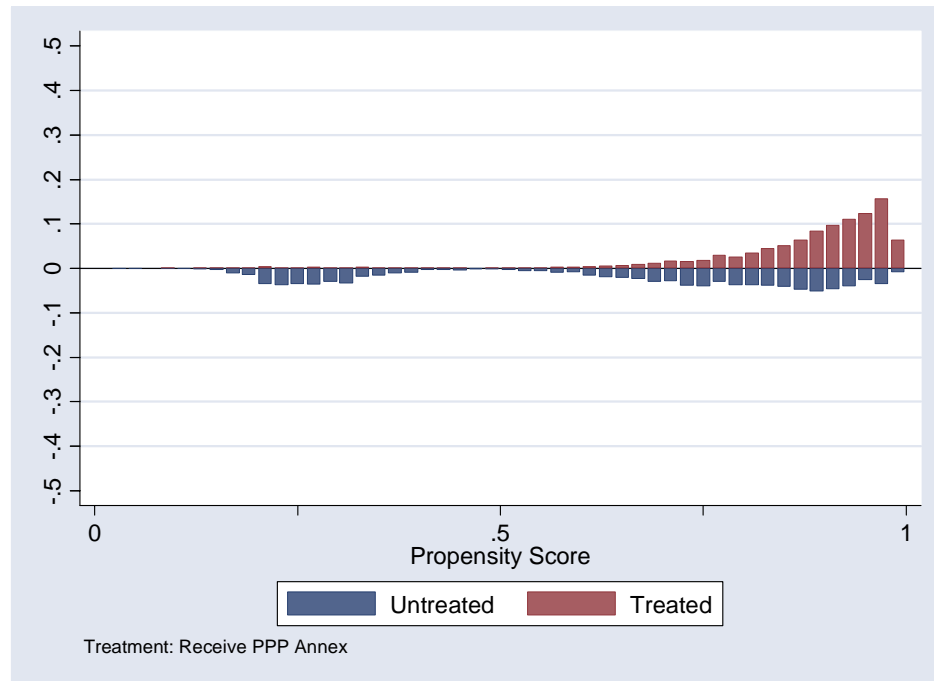
Variables	Dependent Variable = 1 if received a statement, 0 if statement was not sent	
	Age between 30 and 50	Age between 40 and 50
Age as of June 2005	-0.162 (-1.76)*	0.057 (2.00)**
Contributions made 2005		2.182 (7.47)***
Male * Contributions made 2005		-0.42 (3.81)***
Density of contributions between age 20 and June 2005 * Contributions made 2005	2.297 (6.41)***	2.223 (3.19)***
Density of contributions between age 20 and June 2005 * Voluntary savings during previous year		4.128 (1.81)*
Density squared of contributions between age 20 and June 2005	-0.503 (-1.33)	
Male * Positive Voluntary Account balance	-1.003 (-1.42)	
Density of contributions between age 20 and June 2005 * Average covered wage during 2005 (ch\$ million)	0.985 (1.37)	1.521 (1.42)
Average covered wage during 2005 (ch\$ million) *	1.711	
Contributions made 2005	(2.10)**	
Age as of June 2005 * Contributions made 2005	0.034 (7.26)***	
Average covered wage during 2005 (ch\$ million)	5.143 (5.79)***	7.149 (7.19)***
Average squared covered wage during 2005 (ch\$ million)	-6.093 (-9.97)***	-6.352 (-7.01)***
Contributions made 2005 * Positive Voluntary Account balance	0.802 (1.33)	5.071 (1.76)*
Average covered wage during 2005 (ch\$ million) *	1.408	6.743
Positive Voluntary Account balance	(1.53)	(3.58)***
Density of contributions between age 20 and June 2005		3.78 (1.26)
Voluntary savings during previous year * Average covered wage during 2005 (ch\$ million)		-3.843 (-2.49)**
Density of contributions between age 20 and June 2005 * Age as of June 2005		-0.097 (-1.49)
Age as of June 2005 * Positive Voluntary Account balance		-0.127 (-2.08)**
Age squared as of June 2005	0.002 (1.55)	
Age as of June 2005 * Male	-0.01 (-4.10)***	
Average covered wage during 2005 (ch\$ million) *	0.503	
Male	(1.39)	
Cosntant	2.264 (1.24)	-4.506 (-3.44)***
Observations	8940	4469
Balancing property satisfied	yes	yes

Robust z statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

As Rosenbaum and Rubin (1983) show, the propensity score contains all the relevant information to assess the overlap condition. Figure 3.1 shows the distribution of propensity scores for treated and control units, for the 30-50 age group, for the case in which treatment status is equal to 1 if the individual received a statement and 0 if the statement was not sent. As expected, treated individuals present more mass close to one, whereas the propensity score for untreated individuals is more widely spread in the interval.

**Figure 3.1 – Propensity score distribution among treated and control units**



With the overlap condition in mind, individuals with propensity score below 0.093 or above 0.9978 were dropped from the sample in this age group.

We then turn to the estimation of average treatment effects on the treated. For this step, we used a number of different methods. All estimators can be given a causal interpretation under the assumption that selection is based on the observed characteristics. In other words, conditional on two individuals having the same observables, assignment to treatment is random:

- A simple Ordinary Least Squares (OLS) regression using all the pretreatment variables as covariates. The specification used can have the interpretation of average treatment effect (ATE) or ATE on the treated, under the additional assumptions that The conditionals expectations of the potential outcomes are linear in the observables and treatment effect is constant.<sup>12</sup>

<sup>12</sup> Alternatively, one could allow for treatment to vary with the observables by including an interaction between the treatment variable and all the observed characteristics (expressed in differences with respect to the sample mean among the treated). This will be included in future work.

- Average treatment effect on the treated using a nearest-neighbor propensity score matching (NNPSM) method. Under this method, the propensity score is used to identify, for each treated individual, the control unit with the closest propensity score.<sup>13</sup>
- Average treatment effect on the treated using a propensity score radius matching (PSRM) method. In this case, the search for similar control units is restricted to individuals with a propensity within a certain neighborhood of the treated person.<sup>14</sup>
- Nearest neighbor using matching on covariates (MC). In this method, the entire vector of covariates (instead of the propensity score only) is used to identify the control individual with the closest observable characteristics to the treated unit.<sup>15</sup>

### 3.4. – Results

In this section, we present estimators using the methodologies described earlier, applied to two different age-groups (30-50 and 40-50) and under two alternative identification strategies: control groups defined by individuals who did not receive their statement and a second control group including instead the individuals who were not sent a statement.

Table 3.4 presents the detailed results of the OLS estimator applied to the two age groups and the two identification strategies. We use the same variables included in Table 3.2 presented in the previous section. The outcome of interest (the dependent variable) is a dummy variable equal to 1 if the person made at least one contribution to an AFP individual voluntary savings account in the 12 months that followed reception of the PPP statement (July 2005 – June 2006).

As we can see, in all the specifications the average treatment effect is positive and statistically significant in all cases, except in the 40.50 age group when using individuals who were not sent the statement as a control group. The effect ranges from 0.3% to 0.8%. The interpretation of these results is that an individual who received a statement presents a probability of making voluntary contributions in the first 12 months after receiving it approximately 0.8% higher than individuals who did not receive it. Considering that during the July 2004-June 2005 period, only 1.75% of the individuals aged between 30 and 50 years old made voluntary contributions in an AFP, the estimated marginal effect of receiving a PPP statement is quite significant.

The control variables included in the regression suggest that the probability of making voluntary contributions is strongly serially correlated (having made contributions the previous year is a strong predictor) but also increases with age, taxable earnings and whether they had a positive balance in their voluntary savings account at the beginning of the period. Women are generally more likely to be making voluntary contributions. These results are consistent with the most common way of making voluntary contributions, automatic payroll deductions made

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<sup>13</sup> All the estimations were performed using the statistical package Stata. Propensity score matching estimators were implemented using routines developed by Sascha Becker and Andrea Ichino (2002).

<sup>14</sup> More specifically, we use a 0.05 radius in the implementation of this estimator.

<sup>15</sup> For a discussion on matching estimators using Stata, see Abadie et al (2004). In our estimations, we use 1 nearest neighbor, the Mahalanobis metric for calculating distances between vectors of covariates, the bias-corrected version of the matching estimator and we present heteroskedasticity-consistent standard errors using 4 matches in a second matching stage. We impose exact matching on gender and 5-year age groups.

by employers and with the tax exemption associated to these contributions, which naturally increases with the covered wage.

**Table 3.4 – OLS estimators of the Average Treatment Effect**

Dependent Variable=1 if made voluntary savings during first year after statements were sent

Control group A: Individuals who were sent a statement but this was not received.

Control group B: Individuals who were not sent a statement.

Variables	Control group A		Control group B	
	Age between 30 and 50	Age between 40 and 50	Age between 30 and 50	Age between 40 and 50
Treatment status (1 if received a PPP statement)	0.007 (2.75)***	0.008 (1.79)*	0.003 (1.91)*	0.001 (0.60)
Voluntary savings during previous year	0.708 (19.88)***	0.687 (14.09)***	0.706 (20.21)***	0.686 (14.25)***
Age as of June 2005	0.000 (1.87)*	0.000 (0.13)	0.000 (1.78)*	0.000 (0.18)
Male	-0.004 (-1.74)*	-0.005 (-1.51)	-0.004 (-1.83)*	-0.005 (-1.520)
Average covered wage during 2005 (ch\$ million)	0.047 (5.48)***	0.043 (3.84)***	0.043 (5.35)***	0.041 (3.85)***
Density of contributions between age 20 and June 2005	-0.011 (2.30)**	-0.004 (0.580)	-0.009 (2.06)**	-0.003 (0.590)
Contributions made 2005	0.001 (1.050)	0.000 (0.230)	-0.001 (-0.970)	-0.002 (-1.230)
Positive balance in voluntary savings	0.066 (4.81)***	0.063 (3.67)***	0.068 (4.93)***	0.065 (3.71)***
Constant	0.008 (0.890)	-0.015 (-0.570)	0.011 (1.420)	-0.007 (-0.330)
Observations	7813	3906	8937	4461
R-squared	0.54	0.54	0.55	0.55

Robust t or Z statistics in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

Using the same covariates included in the previous specifications, the following table repeats the OLS results, together with the average treatment on the treated results from the different matching estimators introduced in the previous section. Together with the results for the 30-50 age group, we include results for the older 40-50 cohort.

**Table 3.5 – Alternative estimators of the Average Treatment on the Treated**  
Dependent Variable=1 if made voluntary savings during first year after statements were sent  
Control group A: Individuals who were sent a statement but this was not received.  
Control group B: Individuals who were not sent a statement.

Method	Control group A		Control group B	
	Age between 30 and 50	Age between 40 and 50	Age between 30 and 50	Age between 40 and 50
Regression (OLS)	0.007 (2.75)***	0.008 (1.79)*	0.003 (1.91)*	0.001 (0.600)
Nearest Neighbor Prop. Score matching	0.024 (13.541)***	0.024 (9.656)***	0.018 (4.211)***	0.022 (3.605)***
Propensity Score radius (0.05) matching	0.024 (13.541)***	0.024 (9.602)***	0.014 (4.965)***	0.020 (5.261)***
Matching in covariates, exact gender and age group	0.0238 (28.33)***	0.0243 (20.53)***	0.009 (5.69)***	0.0137 (11.28)***
Observations	7813	3906	8937	4461

Notes: Robust t or z statistics in parentheses (\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%).

The results suggest, in a highly consistent manner, that reception of the PPP statement had a positive effect on the probability of making voluntary contributions during the 12 months after receiving the statement. The average impact ranges from 0.1 percentage points to 2.4 percentage points, being significantly different from zero (at least at a 10% significance level) in all but one specification in each age group. Estimators based on propensity score matching suggest larger impacts than regression estimators and similar to those based on matching on covariates. The only non-significant result for the latter strategy is found for the broad age group under the second identification strategy. The main difference between the matching results based on propensity score and those based on covariates is the restriction, in the latter case, that matching on gender and age group be exact (i.e. that control individuals are searched only within the same gender\*age cell of the treated members). In fact, covariate-matching specifications not requiring exact matching (not reported here) gave results very similar to the propensity score ones. The observed difference could imply that the true propensity score is not well approximated by the estimated probit model. For this reason, our preferred estimators are those based on matching on covariates with exact gender and age correspondence (the last row). For these estimators, the average impact is equal to 1.37 percentage points in the second specification for the 40-50 age group and insignificant for the 30-50 age group. This larger impact for the older group is consistent with the idea that individuals become increasingly concerned with their pension prospects as they approach retirement age and, when possible, start taking actions to improve it. As mentioned earlier, the results presented here appear to be of significant magnitude, highlighting the importance that information can have on the pension-related decision making process of participants.

Table 3.6 presents the same type of results but for a subsample of individuals who did not made voluntary contributions during the year prior to receiving the statement (July 2004-June 2005). This could be interpreted as a difference-in-difference estimator, conditional on individuals who did not made voluntary savings prior to the intervention. In this case, the

dependent variable is equal to one only when individuals **start** making voluntary contributions the year after the statement was sent. As before, the control group (individuals who did not receive a statement) provides us with an estimate for the change in behavior between the two periods for the treated individuals, had they not received the statement. This allows us to better control for pre-treatment differences in the voluntary savings behavior of treated and controls.

**Table 3.6 –Average Treatment on the Treated – Conditioning on not having made contributions during previous year**

Dependent Variable=1 if made voluntary savings during first year after statements were sent,  
*conditional on not having made contributions during previous year.*

Control group A: Individuals who were sent a statement but this was not received.

Control group B: Individuals who were not sent a statement.

Method	Control group A		Control group B	
	Age between 30 and 50	Age between 40 and 50	Age between 30 and 50	Age between 40 and 50
Regression (OLS)	0.005 (5.13)***	0.005 (3.28)***	0.003 (4.02)***	0.002 (1.74)*
Nearest Neighbor Prop. Score matching	0.008 (7.512)**	0.007 (5.117)***	0.008 (7.512)***	0.007 (5.117)***
Propensity Score radius (0.05) matching	0.008 (7.512)**	0.007 (5.117)***	0.008 (7.512)*	0.007 (5.117)***
Matching in covariates, exact gender and age group	0.0078 (10.68)***	0.0071 (7.14)***	0.0059 (4.55)***	0.0071 (7.01)***
Observations	7654	3819	8771	4374

Notes: Robust t or z statistics in parentheses (\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%).

Results are positive, significant in all specifications, but smaller than in the previous case, with the impact of the PPP ranging from 0.2 percentage points to 0.8 percentage points on the probability of start making voluntary contributions. Our preferred estimator (matching in covariates, with exact coincidence of gender and age group) suggests a medium but strongly significant effect (0.7 percentage points) of receiving the statement on the probability of starting making voluntary contributions. The effect estimated is very similar in both identification strategies because both control groups become very similar when measuring the impact conditioning on not having made voluntary contributions prior to receiving the statement.

### 3.5. – Robustness Check

All the results presented in the previous section rely on the main identifying assumption that controlling for similar observed characteristics, treatment is ignorable, i.e. it can be considered as independent of outcomes of interest. This assumption cannot be directly tested, as it is a statement about the distribution of unobserved characteristics of the individuals and its relationship with the outcome of interest. However, it is possible to test whether the same methodology applied to a context in which one should not expect to find an effect of

belonging to the treatment group provides estimators not economically or statistically different from zero.

Along these lines, we apply the same methodology of the previous section to a counterfactual situation in which all the relevant measurements are done one year prior to the actual implementation of the PPP, but keeping the same treatment status as in the original specification. If the estimated effects of the previous section are due to selection bias (i.e., if conditional on observed controls, individuals who did not receive the PPP are systematically different to treated individuals in dimensions that are correlated with the outcome of interest) they should persist once we move all the measurements forward. If, on the contrary, the estimates cannot be associated with endogenous selection, we shouldn't be able to reject the hypothesis that they are equal to zero.

Table 3.7 presents the equivalent estimators to table 3.5, but applied to the data one year prior to the actual implementation (pretreatment variables measured for the July 2003-June 2004 and the outcome variable measured for the period July 2005-June 2005).

We can see that in most specifications for the second identification strategy, we cannot reject the null hypothesis that the effects were equal to zero, whereas we find significant effects under some matching estimators for the first identification strategy, particularly under our preferred estimator using matching on covariates. In our view, this provides a strong test that our results based on the second control group (particularly the ones based on matching on covariates) reflect the causal impact of receiving a PPP statement on the voluntary savings decision of AFP affiliates. The results based on the first control group are put under doubt by these results, implying that our methods are not able to adequate control for unobserved differences between individuals who received the PPP and those who did not receive it because their address in the AFP systems were not correct. These individuals probably have a lower attachment to the pension system and less interest in getting informed or start making voluntary savings.



**Table 3.7 – Counterfactual estimators of the Average Treatment on the Treated  
(all variables measured one year earlier)**

Dependent Variable=1 if made voluntary savings during first year after statements were sent

Control group A: Individuals who were sent a statement but this was not received.

Control group B: Individuals who were not sent a statement.

Method	Control group A		Control group B	
	Age between 30 and 50	Age between 40 and 50	Age between 30 and 50	Age between 40 and 50
Regression (OLS)	0.001 (0.36)	-0.001 (0.19)	-0.004 (1.31)	-0.004 (1.00)
Nearest Neighbor Prop. Score matching	0.017 (3.559)***	0.019 (1.862)*	0.008 (1.426)	0.008 (0.886)
Propensity Score radius (0.05) matching	0.019 (5.373)***	0.018 (2.601)**	0.009 (2.595)**	0.015 (2.910)**
Matching in covariates, exact gender and age group	0.0219 (23.09)***	0.006 (4.35)***	-0.009 (1.57)	-0.011 (1.37)
Observations	6951	3374	7793	3776

Notes: Robust t or z statistics in parentheses (\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%).

### 3.6. – *Alternative outcomes*

In all specifications presented, the outcome of interest has been whether the individual made at least one voluntary contribution (in one AFP Pension Voluntary Savings Account, known in spanish as APV account) during the 12 months following receipt of the PPP. In this section, we present three alternative outcomes related to voluntary savings behavior during the same period: the number of months in which the person made a contribution to an APV account (Y2), the number of months in which the person made voluntary savings contributions to a non-pension voluntary saving account<sup>16</sup> in an AFP (Y3) and whether the person made voluntary savings contributions to a pension or non-pension voluntary saving account in an AFP (Y4).

Table 3.8 presents the average impact on these outcomes under the different estimators and identification strategies, for the 30-50 age group. Under our preferred estimator (matching on covariates for control group B), receiving the PPP would increase the number of months with positive APV in 0.043, the number of months with positive contributions to a pension or non pension voluntary savings account in 0.288 and the probability of making at least one contribution to any voluntary savings account (pension or non pension) in 3.8 percentage points.

<sup>16</sup> These accounts are similar to the APV accounts but without tax exemption or withdrawal penalties. They are also known as second accounts (*Cuenta 2*).

**Table 3.8 –Average Treatment on the Treated for alternative outcomes of interest**

Control group A: Individuals who were sent a statement but this was not received

Control group B: Individuals who were not sent

Method	Dependent Variable: Number of months with voluntary retirement contributions		Dependent Variable: Number of months with voluntary contributions to savings account		Dependent Variable: Number of months with any voluntary contributions	
	Control group A	Control group B	Control group A	Control group B	Control group A	Control group B
Nearest Neighbor Prop. Score matching	0.207 (12.185)***	0.045 (0.613)	0.292 (1.893)*	0.081 (0.917)	0.051 (3.307)***	0.022 (1.94)*
Propensity Score radius (0.05) matching	0.207 (12.185)***	0.039 (0.930)	0.359 (3.348)***	0.408 (6.87)***	0.056 (5.156)***	0.045 (6.251)***
Matching in covariates, exact gender and age group	0.208 (28.77)***	0.043 (3.1)***	0.181 (2.25)**	0.288 (3.52)***	0.043 (5.76)***	0.038 (4.85)***
Observations	7399	8456	7399	8456	7399	8456

Notes: Robust t or z statistics in parentheses (\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%).

### 3.7. – Results for subgroups of the population

So far, estimates were presented for all the treated in the relevant age groups. We would expect, however, that the impact of additional information should be different for certain subgroups among the treated. In particular, we expect to find higher impacts among women, among individuals who are on the positive tax brackets (not tax exempt) and individuals with low projected replacement rates.

Legal retirement age for women and men are different in Chile: 65 for men and 60 for women. As projections are based on these ages, the higher life expectancy at retirement contributes to the general trend that women tend to have lower pensions than men. At the same time, the generally shorter time to retirement might also increase the sense of urgency of women who receive the projection. We then expect to see a greater effect among women than men.

As voluntary contributions receive a tax benefit only if the individual is in an income bracket where he or she has to pay taxes, we expect the impact to be at least partially affected by the tax range of the individual. Finally, we expect the impact to be smaller for individuals with relatively high projected replacement rates, as these individuals should be closer to their desired benefit.

Table 3.9 presents the results of the average treatment effect on the treated for the three subgroups mentioned above. Individuals were divided by gender, by whether they were exempt from taxes (with taxable income above Ch\$409,158 in 2005), and by the projected replacement (above or below the median replacement rate among the treated). Estimation was

restricted to individuals in the 40-50 age range and conditional not having made voluntary contributions during the previous year.

**Table 3.9 –Average Treatment on the Treated for alternative subgroups – Conditioning on not having made contributions during previous year**

Age between 40 and 50, Control group= Individuals who were not sent a statement

	Men	Women	Tax exempt	Not tax exempt	High replacement rate	Low replacement rate
Regression (OLS)	0.000 (0.07)	0.004 (1.92)*	0.002 (2.14)**	0.010 (1.99)**	0.000 (0.05)	0.003 (2.10)**
Nearest Neighbor Prop. Score matching	0.006 (3.615)***	0.010 (3.622)***	0.003 (2.832)***	0.021 (4.286)***	0.008 (3.328)***	0.007 (3.885)***
Propensity Score radius (0.05) matching	0.006 (3.615)***	0.010 (3.622)***	0.003 (2.832)***	0.022 (4.287)***	0.008 (3.328)***	0.007 (3.885)***
Matching in covariates, exact gender and age group	0.006 (5.30)***	0.010 (4.74)***	0.003 (3.68)***	0.021 (5.84)***	0.008 (4.80)***	0.007 (5.88)***
Observations	2767	1599	3481	887	1687	2692

Notes: Robust t or z statistics in parentheses (\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%).

As expected, the impact on women is significantly larger than that on men, potentially reflecting their higher sense of urgency caused by the reception of the projection. Also consistent with our prior beliefs, individuals exposed to a positive tax benefit when making voluntary contributions exhibit a significantly larger impact than tax exempt individuals. This could also reflect the generally lower liquidity constraints of higher income individuals. Contrary to what we expected, however, individuals with high replacement rate present a slightly higher impact than those with lower replacement rate.<sup>17</sup>

<sup>17</sup> This result could partly be explained by potential measurement error in the projected replacement rate, which was specially constructed for all individuals but without all the relevant information. In particular, recognition bond information was not available to construct an appropriate estimate of pension wealth when the projection was made. If recognition bond amounts are negatively correlated with balances in the individual accounts, the relationship in replacement rates could be reversed, particularly for individuals in this age group, who are likely to have a significant share of their pension wealth as recognition bonds.

## 4. - Final Remarks

The PPP represents a substantial improvement in the quality of information provided to participants in the Chilean pension system. For the first time in its 25 years of existence, members were exposed to official information about the expected level of pensions they would receive. Although these projections are based on a number of assumptions, they allow members to make informed decisions that could improve their pension prospects, by making or increasing the amount of voluntary savings (for those who can), ensuring that their contributions are correctly paid, contributing as self-employed workers or delaying the retirement decision.

It is not often, however, that changes of this magnitude are subject to rigorous statistical evaluations to determine their impact on individual behavior or to improve on its design. To the best of our knowledge, this is the first time that this type of evaluation has been implemented on the effect of improved information provision on individual decision of participants in defined contribution pension systems<sup>18</sup>.

Our results suggest that the new information provided to participants in the system, by showing what their current savings would provide in the future, did change their behavior: individuals who received the statement increased the probability of making voluntary contributions, especially in the older group (40-50), by more than 1.3 percentage point and increasing the probability of starting making contributions (conditional on not having done so in the previous year) by more than 0.7 percentage point. The effect on younger cohorts was smaller, consistent with some form of myopia or liquidity constraints. The identification strategies, mostly based on the use of matching estimators built on observed pre-treatment characteristics of individuals who received the PPP and those who were not sent one, were reinforced as a result of applying them to a period when no effect was expected. The identification strategy based on individuals with incorrect addresses was not supported by our indirect test, suggesting that these individuals seem to be less attached to the pension system, in dimensions that are not correctly captured by their observed characteristics.

The potential impact that the PPP might have on the decision to retire is another central concern for the system. It will be left for analysis in future work, once enough time has passed since the first statement was sent, giving individuals the opportunity to change their retirement behavior, something that could have potentially been reinforced by repeated receipt of the information. Future work will also address potential differential effects on voluntary savings by income or projected replacement rates.

The launching of the PPP followed a debate about the advantages of providing more information in a context of low financial education against the risk that individuals may interpret these official projections as promises about their future pensions, something that cannot be guaranteed in defined contribution systems. The results presented here provide a strong argument for continuing and improving on this policy. The implication that better information is able to improve savings decisions reinforces the importance that regulators and pension providers should give to this issue.

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<sup>18</sup> For recent international experiences on information provided in DC pension systems see Rinaldi and Giacomel (2008)

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## Appendix 1 – Description of PPP for the different age groups

### *A1.1. - PPP for young members (between 20 and 29 years old)*

In the case of members between 20 and 29 years old, a decision was made not to make a pension projection, as the exercise seemed meaningless considering the low number of contributions made by these individuals. It made more sense to inform them and make them clearly aware of the importance of their contributions at an early age and the great importance that these contributions have on retirement balances and pensions (close to 40% of old age savings, under some standard assumptions).<sup>19</sup>

Three other messages were included in this flyer:

- “Verify that your employer is paying your contributions every month and for your entire wage. Check your quarterly AFP statement.”
- “If you are a self-employed worker, make your contributions directly in your AFP.”
- “When you contribute, you and your family are protected by the survivorship and disability insurance. Be aware of its coverage and benefits.”

### *A1.2. - PPP for middle-aged members (men between 30 and 55 and women between 30 and 50 years old)*

Members who are above 30 but ten or more years away from their legal retirement age, receive a Personalized Pension Projection, as long as they are not retired or applying for disability benefits.

This group of people is presented with two PPP scenarios:

#### a. Scenario A:

It provides a PPP in the event the member stops contributing today and retires at the legal retirement age. A 5% real annual rate of return on the funds in the individual account is considered in all projected scenarios.

The methodology for calculating the balance at retirement considers the projected balance in the individual capitalization account for compulsory contributions, the balance in the individual capitalization account for voluntary contributions, the balance in the individual capitalization account for agreed deposits and the final value of Recognition Bonds, if appropriate.<sup>20</sup> The formula is the following:

$$B_A = (B_{CCICO} + B_{CCICV} + B_{CCIDC}) \cdot (1 + r_{simulation})^{(months)} + RB \cdot (1 + r_{RB})^{(months)}$$

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<sup>19</sup> See appendix 2.1 for an example of the PPP flyer for young members.

<sup>20</sup> Agreed deposits are special contributions made by employers that are tax exempt but that cannot be withdrawn until retirement. The recognition bond is an obligation signed by the State in recognition for the contributions the member made to the old PAYG system before switching to the AFP system. It earns a fixed 4% annual real rate of return and is deposited in the workers account at the legal retirement age.

where:

$B_A =$	Member's projected balance under scenario A
$B_{CCICO} =$	Balance in the individual capitalization account of compulsory contributions (CCICO), at the statement closing date.
$B_{CCICV} =$	Balance in the individual capitalization account of voluntary contributions (CCICV), at the statement closing date.
$B_{CCIDC} =$	Balance in the individual capitalization account of deposits agreed (CCIDC), at the statement closing date.
$r_{simulation} =$	Average monthly return used in the projected pension: 0,004074123784 (5% annual)
$months =$	It is the difference in months between the legal age of retirement and the statement closing date.
$RB =$	Present value of the Recognition Bond, at the statement closing date.
$r_{RB} =$	Monthly adjustment rate of Recognition Bond: 0,0033273739782 (4% annual)

b. Scenario B:

It provides a PPP in the event the members contributes every month until the legal retirement age, when he or she retires.

The methodology for calculating the projected balance is similar to the previous case, except for the projected balance originated in future contributions:

$$B_B = (B_{CCICO} + B_{CCICV} + B_{CCIDC}) \cdot (1 + r_{simulation})^{(months)} + RB \cdot (1 + r_{RB})^{(months)} + (0,1 \cdot TE - FF) \cdot \sum_{i=1}^{months} (1 + r_{simulation})^i$$

where:

$B_B =$	Member's projected balance under scenario B
$TE =$	Taxable earnings (see Appendix 1).
$FF =$	Fixed fee (FF) that is charged to the member by his or her AFP.

***A1.3. - PPP for members close to retirement age (men between 56 and 63 years old and women between 51 and 58 years old)***

Members who are less than 10 years away from the legal retirement age but at least two years away from it (as long as they are not retired or applying for disability benefits) receive a PPP annex similar to the previous case, but assuming a fixed 50% density of contributions and under two different scenarios for the age of retirement: the legal age and three years after that.



These affiliates are presented two PPP scenarios:

a. Scenario C:

It provides a PPP in the event the member contributes half of the months until the legal age of retirement and assuming that person starts withdrawing funds at that age.

The methodology is similar to scenario B, but with an adjustment in the future stream of contributions, accounting for the 50% density assumption:

$$B_C = (B_{CCICO} + B_{CCICV} + B_{CCIDC}) \cdot (1 + r_{simulation})^{(months)} + RB \cdot (1 + r_{RB})^{(months)} + d \cdot (0,1 \cdot TE - FF) \cdot \sum_{i=1}^{months} (1 + r_{simulation})^i$$

where:

$$B_C = \text{Member's projected balance in the scenario C}$$

$$d = \text{Member's contributions density} = 0,5$$

b. Scenario D:

It provides a similar projection but postponing retirement for three after the legal age:

$$B_D = (B_{CCICO} + B_{CCICV} + B_{CCIDC}) \cdot (1 + r_{simulation})^{(months+36)} + RB \cdot (1 + r_{RB})^{(months)} \cdot (1 + r_{simulation})^{36} + d \cdot (0,1 \cdot TE - FF) \cdot \sum_{i=1}^{months+36} (1 + r_{simulation})^i$$

where:

$$B_D = \text{Member's projected balance in the scenario D}$$

#### ***A1.4. - Transforming projected balances into a pension flow***

In all the projections, the PPP is calculated as the first payment of a programmed withdrawal schedule, under the following rules:

- Current mortality tables are used to calculate the programmed withdrawal, using the actualization factor for the year in which the member reaches legal retirement age.

- The programmed withdrawal discount rate is calculated using the following formula:

$$t_{PW} = 0,8 \cdot t_{LA} + 0,2 \cdot r_{annual\_simulation}$$

where:

$$\begin{aligned} t_{PW} &= \text{Discount rate of programmed withdrawal} \\ t_{LA} &= \text{5-year average of the implicit interest rates on life annuities.} \\ r_{annual\_simulation} &= \text{Annual real rate of return used in the projected pension: 5\%} \end{aligned}$$

- In the case of women it is assumed that they do not have legal beneficiaries, while men's calculations assume the presence of a spouse 2 years younger.<sup>21</sup>

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<sup>21</sup> According to the regulation at the time of implementation of the PPP, women were not allowed to leave survivorship benefits to their husbands, unless they were disabled, while men always left a pension to their surviving wife. Starting in October 2008, all men will be beneficiaries of surviving pensions, disregarding their disability status.

## Appendix 2 – Definition of Taxable Earnings (TE)<sup>22</sup>

The taxable earning used in the projection is based on the average (CPI adjusted) earnings reported in the last 6 contributions. It is important to emphasize that the TE does not correspond to the average taxable earning of the last 6 periods (which could include months in which contributions were not recorded), but the average salary of the last 6 times the member contributed. For example, if an affiliate in the year 2004 only contributed in September for a monthly salary of \$ 120,000, and during 2003 contributed each month for salary of \$ 150,000, its Average Taxable Earnings for December 2004 is \$145,000.

$$\left[ \frac{120000 + 150000 + 150000 + 150000 + 150000 + 150000}{6} = 145000 \right]$$

To do this calculation, the Administrators must consider the contributions made until 3 years before the closing date for the statement. If the member had less than 6 contributions in this period, it will average the ones they have.

If there are no contributions made during this period for a particular individual, the legal minimum wage in effect at the closing date for the statement will be used as TE.

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<sup>22</sup> Based on Circular 1332 of the Superintendency of Pension Fund Administrators (SAFP). Available in [www.safp.cl](http://www.safp.cl).

## Appendix 3.1 – Examples of PPP – Young workers



- Preocúpate que tu empleador pague tus cotizaciones todos los meses por el total de tu remuneración. Revisa tu cartola de AFP
- Si eres independiente, cotiza directamente en tu AFP
- Al cotizar, además, tú y tu familia están protegidos por un seguro de invalidez y muerte. Infórmate de su cobertura y beneficios.

## Appendix 3.2 – Examples of PPP – Middle aged members

### Su futuro está en sus manos, ¡Infórmese hoy de su pensión!

#### Datos Personales:

Nombre: Estanislao Francisco Ruiz Reyes  
RUT: 9.546.779-4  
Edad: 43

#### Información a 30 de Abril de 2005

Monto acumulado \$ 7.137.584  
Bono de Reconocimiento \$ 460.815  
Promedio 6 últimas remuneraciones \$ 317.419

Importante: En los últimos 12 meses, usted cotizó: 6 meses

#### ¿Qué pasaría con su pensión si usted...

	Recibiría una Pensión Estimada de
...no cotiza nunca más y se pensiona a los 65 años?	\$113.018
...sigue cotizando todos los meses por una remuneración de \$ 317.419 hasta pensionarse a los 65 años?	\$176.054

Para el cálculo de la Pensión Estimada se considera una ganancia de sus ahorros del 5% al año y como beneficiario una esposa 2 años menor.

#### Usted puede mejorar su pensión:

- Si es independiente, puede cotizar directamente en su AFP.
- Recuerde que puede pensionarse después de cumplir la edad legal. Si posterga su jubilación, aumenta el monto de su pensión.
- Infórmese sobre el Ahorro Previsional Voluntario (APV) y la Cuenta de Ahorro Voluntario (Cuenta 2).
- Existe una pensión mínima garantizada por el Estado de \$77.077. Si su pensión estimada es inferior a este monto, infórmese sobre los requisitos para obtener este beneficio.

Si desea obtener una proyección de pensión más detallada, contáctese con su AFP en:

AFP xxxxxxxx    www.afpxxxx.cl    F: 800-xxx-xxxx

 GOBIERNO DE CHILE  
SUPERINTENDENCIA DE AFP  
www.safp.cl

ASOCIACION  
**AFP**  
www.afp-ag.cl

### Appendix 3.3 – Examples of PPP – Members close to retirement age (Female version)

## Su futuro está en sus manos, ¡Infórmese hoy de su pensión!

**Datos Personales:**  
  
Nombre: Marcia Alejandra Rivas Valenzuela  
RUT: 7.546.779-4  
Edad: 53

**Información a 30 de Abril de 2005**  
  
Monto acumulado \$ 8.023.185  
Bono de Reconocimiento \$ 2.342.087  
Promedio 6 últimas remuneraciones \$ 271.378

**Importante:** En los últimos 12 meses, usted cotizó: **11 meses**

### ¿Qué pasaría con su pensión si usted...

	Recibiría una Pensión Estimada de
...se pensiona a los <b>60</b> años?	<b>\$97.039</b>
...se pensiona a los <b>63</b> años?	<b>\$123.164</b>


Para el cálculo de la Pensión Estimada se considera una ganancia de sus ahorros del 5% al año y que usted cotiza la mitad de los meses hasta pensionarse.

**Usted puede mejorar su pensión:**


- Si es independiente, puede cotizar directamente en su AFP.
- Recuerde que puede pensionarse después de cumplir la edad legal. Si posterga su jubilación, aumenta el monto de su pensión.
- Infórmese sobre el Ahorro Previsional Voluntario (APV) y la Cuenta de Ahorro Voluntario (Cuenta 2).
- Existe una pensión mínima garantizada por el Estado de \$77.077. Si su pensión estimada es inferior a este monto, infórmese sobre los requisitos para obtener este beneficio.

Si desea obtener una proyección de pensión más detallada, contáctese con su AFP en:

AFP xxxxxxxx    [www.afpxxxx.cl](http://www.afpxxxx.cl)    F: 800-xxx-xxxx



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