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Knowledge, Information, and Retirement Saving Decisions: Evidence from a Large-Scale Intervention in Chile

All over the world, retirement income depends increasingly on individuals' savings choices over their lifetime. While government-sponsored retirement schemes (like the U.S. social security system) provide a reasonable stream of resources for old age, middle- and high-income workers are expected to make their own additional savings arrangements, either through employer-sponsored pension plans, matching contribution schemes such as the 401(k) plans in the United States, or individual savings through tax-favored investment vehicles.[1]

To adequately plan for retirement, individuals need information about their current situation, the different choices available to them, and some minimal mathematical and abstraction capabilities to properly process this information. There is growing concern, however, regarding the low level of financial literacy among the general population. The baby boomer generation does not seem to have accumulated sufficient financial wealth beyond housing, with particularly low asset levels for female-headed households.[2] Even if the lack of financial sophistication could be overcome by the use of retirement planning services, the existing evidence suggests that these services are rarely sought, and when they are, it is mostly by individuals with initially higher

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1. For a recent review of pension financing sources in developing countries, see OECD (2009).

2. Lusardi and Mitchell (2007a); Weir and Willis (2000).

levels of financial literacy.[3] Furthermore, individuals with less exposure to financial planning tend to make "wrong" choices: saving less than required in poorly diversified portfolios or not profiting from tax-favored instruments.[4]

In a defined-contribution scheme, the level of the benefit is not known beforehand, and individuals face uncertainty about how their current savings will translate into future benefits. In this setting, one key piece of information that individuals need to make active decisions to improve their retirement wealth is the pension level they are expected to receive given their current financial wealth and their historical saving behavior. Assuming that individuals can reasonably form an expectation of the income level they would like to receive in old age, the comparison between desired and projected income could induce them to save more, transfer their wealth into more conservative or aggressive portfolios, postpone retirement, or seek retirement planning advice. While it is always possible to make these adjustments, the effectiveness of these choices depends on the time horizon until retirement: while small changes when one is young can have a large impact on retirement, individuals with low asset levels can do little to improve their situation as they approach retirement age, except perhaps postpone their exit from the labor force.

In this article, we exploit a large-scale natural experiment to analyze the impact of a personalized pension projection (PPP), which was sent to practically all Chilean active dependent workers in July 2005, on their retirement saving behavior. The objective of this intervention was to simplify the information received by pension system members, to help them make better decisions. In essence, we compare the saving behavior of individuals during the first twelve months after they received the PPP with that of comparable individuals who were not sent this statement due to some specific administrative rules.

We use this analysis to address two different issues. First, if individuals were well aware of their current financial stance, receipt of this information should have no effect on their retirement-related saving behavior. Our analysis serves as a test of the full-information hypothesis. Second, the large scope of the intervention allows us to look at different subgroups of the population.

3. Lusardi and Mitchell (2008).

4. Lusardi and Mitchell (2007b). According to Greene (2010), approximately half the U.S. workforce does not have a retirement savings plan at work; less than 10 percent of those without plans at work contribute to an individual retirement account (IRA); only 42 percent of adults in the United States have tried to calculate how much they need to save for retirement; and even among those nearing retirement (forty-five to fifty-nine-year-olds), only about half have tried (51 percent).

As mentioned above, the age dimension is particularly important, since the possibility of correcting misalignments between expectations and projections depends crucially on the time horizon until retirement. The gender dimension is also important for the Chilean case, as the actuarial nature of the Chilean pension system tends to directly translate gender differences in the labor market into differences in their old age income: Chilean women tend to work less frequently, receive lower wages for a comparable job, retire earlier, and live longer.[5] We also look for differential impacts among individuals with different income levels (since retirement-related voluntary savings are tax exempt, we would expect a higher effect on individuals with positive marginal tax rates, keeping other factors constant) and with different projected replacement rates (the ratio of the pension to pre-retirement income).

Our results suggest that the new information provided to plan members—namely, the level of pension that they would be able to finance—did change their behavior: the receipt of the statement by individuals increased their probability of making voluntary contributions, particularly in the older group (forty to fifty years of age), by more than 1.3 percentage points. The effect on younger cohorts was smaller, consistent with 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, but individuals with high projected replacement rates present a slightly higher impact than those with lower replacement rates. Overall, these results show how a simple improvement in the information provided by pension administrators can have important effects on individual savings decisions.

Conceptual Framework

Should individuals change their saving behavior when exposed to new information in the form of a personalized pension projection? In the traditional model of consumption and savings decisions, agents maximize lifetime expected utility subject to the amount of income and assets they are able to

5. Some of the differences, however, are offset by noncontributory pension provisions. In particular, the 2008 pension reform, which greatly expanded the poverty prevention pillar, includes a voucher for women for every child. See Fajnzylber (2010) for simulations of the gender impact of the 2008 reforms.

generate and accumulate over the life cycle. As Lusardi and Mitchell point out, a fully rational decisionmaker needs to consider prospective survival probabilities, discount rates, earnings, investment returns, and retirement benefits when making this decision.[6] The economic literature includes a long list of attempts to introduce bounded rationality into the maximization process.[7]

One modification to the standard model takes into account the fact that maximizing agents incur a cost whenever they have to obtain, process, and interpret new information in order to make optimal decisions.[8] The existence of this cost makes agents become rationally inattentive to relevant new information, updating the consumption plan at discrete intervals. Inattentiveness leads to suboptimal savings. The model further implies that there is a planning cost threshold above which agents optimally choose not to make plans, whereas for planning costs below this level, agents choose to follow infrequently updated plans on consumption.

Under this conceptual framework, policymakers may have at least two tools to improve the decisionmaking and active participation of individuals: information dissemination and financial education. With regard to dissemination, policymakers may mandate more information (to increase access) and improve information quality; or they may simplify information (to improve understandability). Financial education programs or campaigns are generally geared toward increasing people's ability to understand the information they have been given. Both types of intervention aim to diminish decisionmakers' planning costs, making them more attentive and increasing the frequency at which plans are updated. In the context of retirement savings, this may imply better financial planning for retirement, more active decisionmaking, and a higher savings rate.

The empirical literature is rapidly growing with the addition of studies that try to measure the impact of information on retirement saving decisions. Chan and Stevens ask why is it that if people are so misinformed, research finds that people react to incentives in the pension system.[9] They find that well-informed individuals are five times more responsive to incentives in pension plans than the average individual. They also find that the behavior of ill-informed individuals is consistent with their own misperception of

6. Lusardi and Mitchell (2009).
7. See, for example, Conlisk (1996).
8. Reis (2006).
9. Chan and Stevens (2008).

pension incentives, rather than their being unresponsive to any incentives. This suggests an important role of providing better information to support better decisions.

However, improving information or making individuals more attentive may not be enough. Research in psychology and economics often finds a disconnection between intention and action. Although individuals may be better informed and pay more attention to their financial situation, inertia may be a powerful force that prevents changes in behavior. This is one of the reasons why modifying the default option may have an important impact on savings.[10] A growing empirical literature measures the effectiveness of these strategies. In general, there is evidence that education campaigns and information dissemination may help improve decisionmaking, but they have limited impact. Duflo and Saez find that attendance to information seminars boosts participation in retirement plans, even among coworkers of the individuals who belonged to the treatment group.[11] This result suggests that information provided through certain channels that allow for social interactions may have spillover effects that make them more effective. Clark and others analyze the effect of financial education seminars offered by the Teachers Insurance and Annuity Association–College Retirement Equities Fund (TIAA-CREF). They find that participants report a significant increase in their intended participation and savings rate in the program, but the effect on actual participation and behavior in the first few months following the seminar is milder, which is consistent with the received information increasing comprehension, but not overcoming inaction.[12] In the context of developing countries, where both financial literacy and the demand for financial services is lower, Cole, Sampson, and Zia find that the provision of a financial literacy program had modest effects on the likelihood of opening a bank savings account for uneducated and financially illiterate households and no significant effect overall.[13] In contrast, small subsidy payments had a significant effect on opening a savings account and were more than twice as cost effective as the financial literacy training.

Related work deals with the effect of providing simplified information, in a format that is easier to understand given the current capabilities of the individual receiving the information. Kozup, Howlett, and Pagano document that

10. See, for example, Choi and others (2002).
11. Duflo and Saez (2003).
12. Clark and others (2006).
13. Cole, Sampson, and Zia (2009).

simplified information about mutual fund characteristics provided in graphical format increases subjects' sensitivity to past performance and influences perceptions and evaluations of different mutual funds.[14] However, Beshears and others find no effect of the actual summary prospectus adopted by the U.S. Securities and Exchange Commission (SEC) on portfolio choices made by participants in an experimental setting.[15] In a study that is more closely related to our paper, Mastrobuoni assesses the impact of a new Social Security statement on information and retirement decisions in the United States.[16] It finds that the introduction of the statement had a significant impact on workers' knowledge about their benefits, but it did not imply an overall improvement in workers' retirement behavior.

Our paper is the first to estimate the impact of an improved and simplified format for providing information on a national scale using a quasi-experimental setting in a defined-contribution context. In our case, the intervention consisted of including a personalized pension projection in the periodic account balance statement sent to members of the mandatory pension plan in Chile. This additional information simplifies the comparison of current saving levels with the level that would be necessary to achieve an implicit target retirement income, which could potentially have an impact on retirement saving decisions. The next sections give more detail about the personalized pension projection (called PPP) and present the impact evaluation methodology and results.

The Personalized Pension Projection

The pension system in Chile has changed significantly throughout its history. In 1980, the traditional pay-as-you-go (PAYG) system was replaced by an individual capitalization scheme, with defined contributions, private management of funds, free choice of Pension Fund Administrators (AFPs) by program participants, and state supervision. The system was defined as mandatory for all dependent workers entering the labor force for the first time and voluntary for those who were affiliated with the old system or who were self-employed.

14. Kozup, Howlett, and Pagano (2008).
15. Beshears and others (2009).
16. Mastrobuoni (2011).

TABLE 1. Knowledge about the Pension System, by Age and Gender
Percent

		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 fund your savings are invested?*	
Age	*Response*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Group 1: individuals aged 20–30	Yes	2	1	72	66	46	42	35	31
	No	98	99	28	34	54	58	64	68
Group 2: men aged 30–55; women aged 30–50	Yes	3	3	73	66	60	50	36	31
	No	97	97	26	34	40	50	63	69
Group 3: men aged 56–63; women aged 51–58	Yes	2	2	66	66	62	51	27	29
	No	98	98	33	34	38	49	70	69

Source: Authors' calculations, based on data from the 2004 Social Protection Survey (*Encuesta de Protección Social,* EPS 2004) (Centro de Microdatos, 2010).

TABLE 2. Knowledge about Retirement Options, by Age and Gender[a]
Percent

		Do you know that you can retire early?		*Would you retire later if you would receive a better pension?*		*Do you know about pension options?*	
Age	*Response*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Group 1: individuals aged 20–30	Yes	53	55	0	0	5	5
	No	47	45	65	100	94	94
Group 2: men aged 30–55; women aged 30–50	Yes	63	60	13	31	10	9
	No	37	40	72	45	89	91
Group 3: men aged 56–63; 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 the 2004 Social Protection Survey (*Encuesta de Protección Social,* EPS 2004) (Centro de Microdatos, 2010).

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

Although the system has been in place for thirty years, recent surveys suggest a strong lack of information about some characteristics of the scheme. Tables 1 and 2 summarize the results of a social protection survey conducted in 2004 that asked a representative sample of members about their knowledge of and participation in the system. The information in the tables is disaggregated into the same age and gender groups that define the different designs for the PPP. The results show that nearly 99 percent of all individuals have

no voluntary savings plan, regardless of age and gender.[17] In addition, about 30 percent 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 are relatively less knowledgeable than older people. With respect to whether they know how their savings are invested, only 30 percent said they know the type of fund in which they are located. Almost 40 percent of the people do not know that they can retire early. Younger participants declare they would not be willing to retire later, even if this involves a better pension, whereas older individuals are more likely be willing to retire later in order to increase their pension. Finally, there is strong ignorance about the different pension vehicles that could be chosen at the time of retirement.

Before the introduction of the PPP annex, the typical statement included the updated account balance and a summary of the contributions made in the previous four-month period. To use this information to estimate the pension to be received, a member would need to make important assumptions and relatively complex calculations. With this in mind, the PPP was developed as a mandatory part of the statement to be included by all AFPs. A clearly standardized calculation methodology was defined, and a simple presentation was designed 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 funds' rate of return, the amount of future contributions, and the contribution density.[18]

To test the level of understanding and the effectiveness of the material, a focus group study was carried out, which provided the guidelines for the design of the final version. As a result, the following two pension forecast scenarios were defined for members over thirty years of age.

—First, members who are more than ten years away from the legal retirement age (women between thirty and fifty years of age and men between thirty and fifty-five years) receive a personalized appendix that forecasts their pension in two extreme scenarios: in the first, the person contributes every month up to legal retirement age, based on the average earnings of

17. As of December 2004, a total of 285,727 voluntary savings accounts existed in the AFP system, representing 3.8 percent of total members at that date. Voluntary participation is higher among active contributors to the pension system, the target population of our impact evaluation.

18. In Chile, the legal retirement age is sixty-five for men and sixty for women. See the appendix for an example of the PPP statement, with a translation into English.

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 percent. The member is then presented with a series of recommendations to increase the value of his or her pension, such as voluntary savings, contributing as a self-employed worker, or delaying retirement.

—Second, members who will reach the legal retirement age in two to ten years (women between fifty-one and fifty-eight years of age and men between fifty-six and sixty-three years) are presented with an appendix explaining the advantages of postponing their pension decision. Again, two forecasts are made for each person. The first assumes that the member contributes for half the months up to the legal retirement age and then retires at that age. In the second forecast, the member contributes for half the months until three years after the legal retirement age (aged sixty-three for women and sixty-eight for men) and then retires at that age. In both cases, the pension fund's real annual rate of return is assumed to be 5 percent.

In the case of plan members under the age of thirty, a decision was made not to make a pension projection, given the low number of contributions made by these individuals. It made more sense to inform them of the great importance of their contributions at an early age in terms of their retirement balances and pensions (close to 40 percent of old age savings, under some standard assumptions).

The PPP has been included in pension fund statements once a year since 2005. For the first two years, the annex was only sent to plan members who had made contributions in the first quarter of the year. Starting in 2007, the projection was sent to all affiliates, regardless of their recent activity (close to 8 million individuals). Our analysis focuses on the first year of the program (2005). According to the administrative records for 2005, more than 3.3 million individuals were sent a PPP annex, of which close to 3 million were ten years away or more from the legal retirement age (see table 3).

When we analyze some of the information provided in these statements, such as taxable earnings, 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 (see table 4). Women have taxable earnings equivalent to 80 percent of men's taxable earnings. They are also less likely to have contributed in the previous year and have estimated pensions that are, on average, less than half the level of the men's pensions under each projection scenario. This

TABLE 3. Universe of Members Who Were Sent a Personalized Pension Projection in 2005

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

TABLE 4. Average Characteristics of Men and Women Who Were Sent a PPP Annex in 2005

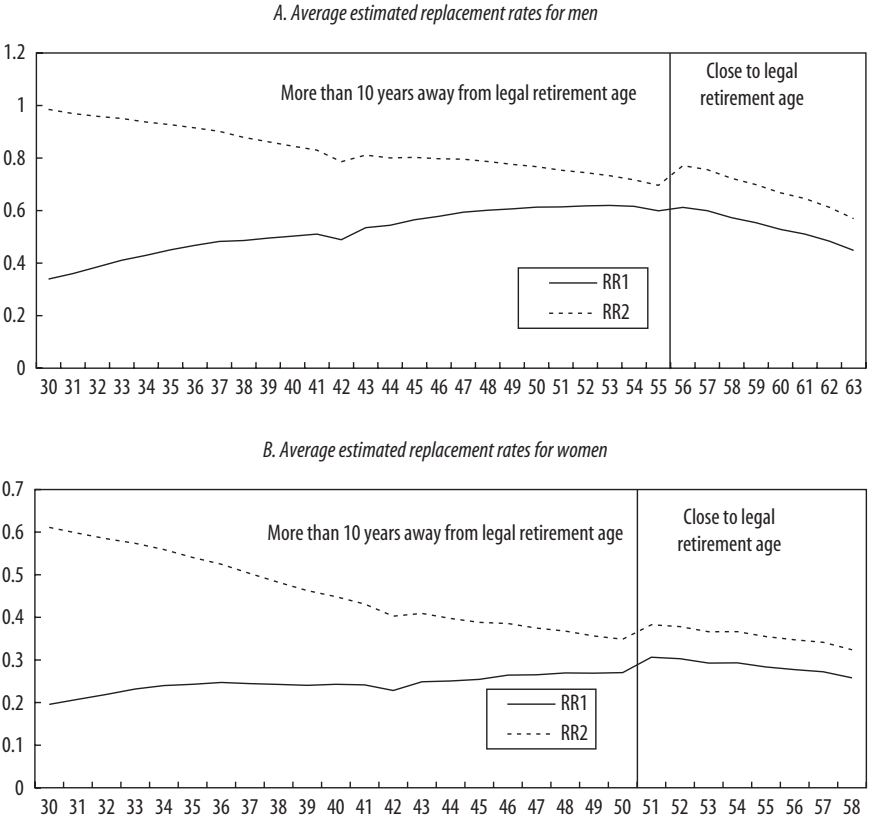
Variable	*Women*	*Men*	*All*	*Ratio of women to men (%)*
Average taxable earnings (Ch$)	$ 273,399	$ 341,369	$ 314,635	80
No. months with contributions in last year	7.72	8.88	8.43	87
Estimated pension (Ch$) (PPP1)	$ 68,065	$ 162,355	$ 125,268	42
Estimated pension (Ch$) (PPP2)	$ 126,096	$ 276,616	$ 217,412	46
Replacement rate (PPP1)	0.35	0.50	0.44	70
Replacement rate (PPP2)	0.57	0.84	0.73	68

feature of the Chilean pension system has been previously documented.[19] It largely reflects the low (formal) labor market participation of women and interruptions in their work history associated with taking care of children and relatives.

The average replacement rates by age obtained from the information sent in this statement are shown in figure 1. The vertical line divides the age groups to which different statements are sent. Men under fifty-five years of age and women under fifty are sent a statement such as the one shown in the appendix, where the estimated pension is provided under the two alternative scenarios: no further contributions until the legal retirement age (RR1) and contributions in all remaining periods (RR2). For older workers, the extreme scenarios are to retire at the legal retirement age or three years later. The small spike in the replacement rate in the baseline scenario when moving from one age group to the next corresponds to the effect of assuming a 50 percent contribution density until the legal retirement age rather than no contributions. The spike in the alternative scenario shows the effect of postponing retirement by three years (assuming a 50 percent density) rather than having a 100 percent 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. Moreover, in the first age group, on

19. See for example Berstein and Tokman (2005); Fajnzylber (2010).

FIGURE 1. Estimated Replacement Rates from the 2005 PPP Statements



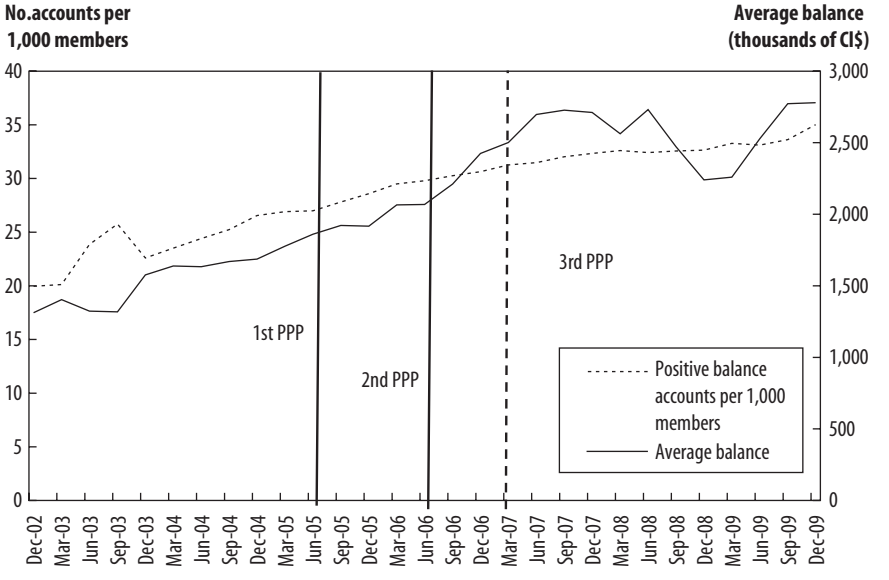
Source: Authors' calculations, based on administrative data from the Chilean Pensions Supervisor.

average, older individuals receive pension estimations that are more similar in both scenarios than those of younger individuals.

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 saving behavior of individuals who received the statement. We concentrate on middle-aged individuals (between thirty and fifty years old), who received two different

FIGURE 2. Voluntary Savings Accounts in AFPs: Number and Average Balance



Source: Authors' calculations, based on Chilean Pensions Supervisor Statistical Bulletins.

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 the estimated amount is deemed insufficient, the individual can take remedial actions, such as starting or increasing voluntary contributions. We look at the probability of making voluntary contributions after receiving the PPP as our outcome variable of interest. In the Chilean pension system, members can make voluntary contributions in addition to the mandatory savings made in AFPs. Since the beginning of the system, this option has been available at the same AFP that the individual chose for the mandatory contributions, and starting in 2002 a capital markets reform allowed banks, insurance companies, mutual funds, and other financial institutions to offer investment vehicles for voluntary pension savings. As of June 2005, 83 percent of all voluntary accounts were managed by AFPs. A little less than 200,000 accounts with a positive balance existed in AFPs, which is equivalent to twenty-seven members with voluntary savings per 1,000 members in the pension system. Figure 2 shows the evolution of the

number of accounts per 1,000 members and the average balance of these accounts. The figure shows that the introduction of the PPP coincides with a subsequent increase in the number of accounts with a positive balance per 1,000 members, while the second and third mailing of the PPP coincide with subsequent increases in the average account balance. Although the timing of these changes is indicative, further analysis is needed to identify whether the introduction of the PPP had any causal impact on voluntary savings.

Given the design of the PPP, a number of identification strategies are potentially available to estimate the impact of this intervention on voluntary saving behavior. Given our outcome of interest and the rules under which the first statement was delivered to participants, we focus on whether a participant received or did not receive the PPP. Only individuals who made contributions in January–April 2005 were sent the July 2005 statement containing the first PPP. Of these, some individuals did not receive the statement, due to problems with their addresses. Our treatment group consists of those who actually received the statement, while our control group is the individuals who were not sent the statement. We thus exclude from the analysis the individuals who were sent the statement but did not receive it.[20] Controlling for differences in the observable 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.

Using the July 2005 delivery of the personalized pension projection has several advantages. It is the first time that members were exposed to this piece of information, so we can estimate the impact of being shown this particular pension projection with no previous intervention. Since the PPP was sent only to individuals with contributions in the first quarter of 2005, it provides us with a potential control group of members who did not make a contribution in that particular quarter, but who have made contributions recently. This is not the case, for example, with the 2007 delivery, which was sent to all members.

The basic idea behind this strategy is that individuals who were not sent a statement provide a control group for the individuals who did receive it. As

20. Approximately 8 percent of all statements were returned by the AFP postal services, with the most common reason being an outdated address in the AFP records. We performed a parallel analysis to the one presented in this article using returned statements as a control group, but the selectivity bias turned out to be much stronger than the control group used here, and these results were not included. This indicates that maintaining an updated address in the AFP is a proxy for low attachment to the pension system, and the group with undeliverable statements is thus systematically different from a random group of participants who may or may not be interested in increasing their pension savings.

this source of identification is not necessarily exogenous to the outcomes of interest (old-age saving decisions), we use nonexperimental techniques to address potential selectivity biases. This is explained in more detail in the following sections.

Data

To implement this strategy, we compiled a database for treated individuals (who received a statement) and control individuals (who were not sent a statement). Nearly 3.3 million statements were sent to active members in July 2005. We merge this database with administrative records for a representative sample of pension fund members collected by the Pensions Supervisor, which includes information on contributions to individual accounts (both mandatory and voluntary), balances, transfers, and in general any account activity of a total of around 24,000 individuals.[21] This allows us to observe the level of savings and contributions in both mandatory and voluntary accounts of the individuals in our treatment and control groups, both before and after the intervention (the mailing of the personalized pension projection). This sample is representative of all the members in the pension system as of December 2003 and was constructed for the purpose of applying the Social Protection Survey, which is a longitudinal survey with a first wave in 2002 (based on a representative sample of pension system members as of August 2001) and a second wave in 2004 (which updated the sample through to December 2003 and also included nonmembers to make it nationally representative).[22]

The main concern with using the submission status as a source of identification (that is, using individuals who were not sent a statement as a control group) is the possibility that individuals who did not contribute in a particular quarter might be different in dimensions related to saving behavior (for example, the degree of job stability). To limit the analysis to groups that are likely to be similar, we restrict the sample to individuals who presented at least one compulsory contribution after 2003. This ensures that both the treatment and control groups are composed of individuals who recently contributed to the pension system and increases the likelihood that not contributing in the quarter that defines eligibility for receiving the statement is a random event.

21. This database, called Affiliate Pension Histories, has been used to project pension outcomes in other studies. More details on this database can be found in Berstein, Larraín, and Pino (2006).

22. Further details on the survey and its sample can be found in Centro de Microdatos (2010).

TABLE 5. Pretreatment Characteristics of the Treatment and Control Groups[a]

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 in the 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 in 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 2004 and June 2005	0.976	0.689	(23.56)***
Average balance in compulsory savings account (in Ch$ thousand)	23,259.899	12,213.425	(13.90)***
Average balance in voluntary savings account (in Ch$ thousand)	109,992	3,976	(4.91)***
Positive balance in voluntary savings	0.052	0.010	(11.33)***
No. observations ($n = 8,940$)	7,472	1,468	

***Statistically significant at the 1 percent level.

a. The treatment group includes individuals between the ages of thirty and fifty who received a PPP statement; the control group comprises individuals in the same age group who did not receive a PPP statement. Robust *t* statistics are in parentheses.

Table 5 shows some of the characteristics of both the individuals who received the statements and those who did not, in the thirty-to-fifty age group. The main outcome of interest is a variable equal to one if an individual made voluntary contributions in one AFP voluntary pension savings account (known in Spanish as an APV account) during the twelve months following the receipt of the PPP statement. The one-year lagged version of this variable is presented in the first row of the table.

This table was constructed using a sample of individuals for whom it was possible to observe the contributions and savings both before and after the introduction of the PPP. A number of measures were constructed to capture potential pretreatment differences in observable characteristics between the two groups.

The comparisons suggest that the two groups are statistically different in practically all dimensions, which requires the use of quasi-experimental techniques to account for potential unobservable differences. In particular, people who received the PPP tend to be older, have a higher density of contributions and higher salaries, and be more likely to make voluntary contributions, which is our outcome of interest. All these results are expected, since making regular compulsory contributions (the main reason for being

sent a statement) is probably correlated with being more attached to pension savings in general.

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 by individuals) is in estimating what would have happened in the counterfactual situation in which the individual had not been exposed to the intervention (that is, did not receive the statement). This is only possible if we can either observe the behavior of an individual both before and after the intervention or 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 that is very similar to the treated individuals is a difficult task, because 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 toward making use of rich information about pretreatment observable characteristics to control for unobservable differences that may be correlated with the potential outcomes of interest.[23]

An important segment of the literature assesses the performance of alternative matching estimators based on randomized experiments and Monte Carlo simulations. Dehejia and Wahba claim that simple cross-section matching estimators perform well when trying to replicate treatment effects based on experimental evidence.[24] Smith and Todd find that their results are very sensitive to the sample used and the variables included to estimate the propensity score.[25] Based on Monte Carlo simulations, Zhao reports that propensity score matching performs relatively well when the correlations between covariates and the participation indicator are high, but when the sample size is too small, propensity score matching does not perform well compared with other

23. See for example Rosenbaum and Rubin (1983), Dehejia and Wahba (1999), Heckman, Ichimura, and Todd (1998), or Abadie and Imbens (2002). See Imbens and Wooldridge (2009) for a recent survey of this literature.

24. Dehejia and Wahba (1999).

25. Smith and Todd (2005).

matching estimators.[26] He also finds that matching on covariates using the Mahalanobis metric is relatively robust under different settings.

In our case, we use the concept of overlap introduced by Rosenbaum and Rubin to discard treated individuals who do not have a reasonable counterfactual set to choose from in the control group.[27] 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 pretreatment characteristics). This means fitting a logit model using the presence in the treated group (having received a statement) as the dependent variable and the pretreatment variables presented in table 5 as covariates. Each group of the population is treated independently, which means that the propensity score is estimated independently for each age group. For the balancing property to be satisfied, several interactions between these variables were introduced as covariates in the model. The final specifications chosen were the most parsimonious ones that satisfied the balancing property for each age group. A common support restriction was then imposed for each specification. This explains why the number of observations of the two subgroups does not necessarily add up to the sample size in the thirty to fifty age group. The result of this exercise is presented in table 6.

If properly estimated, the propensity score should contain all the relevant information for assessing the overlap condition.[28] Figure 3 shows the distribution of propensity scores for treated and control units, for the thirty to fifty age group. As expected, treated individuals present more mass close to one, whereas the propensity score for untreated individuals is more widely spread along the entire interval.

With the overlap condition in mind, we selected the region of common support by dropping the treated units with a propensity score below the control units' minimum propensity score and the control units with a propensity score below the treated units' maximum. As a result, individuals with a propensity score below 0.0930 or above 0.9978 were dropped from the sample in this age group.

Next, we estimated the average treatment effects on the treated for each age group. For this step, we used four different methods.

—A simple ordinary least squares (OLS) regression using all the pretreatment variables as covariates. The specification used can be interpreted as the average treatment effect (ATE) on the treated, under the additional

26. Zhao (2004).
27. Rosenbaum and Rubin (1983).
28. Rosenbaum and Rubin (1983).

TABLE 6. Estimation of the Propensity Score for Receiving a Statement[a]

Variable	*Age 30–50*	*Age 30–39*	*Age 40–50*
Age as of June 2005	−0.162	6.000	0.057
	(−1.76)*	(15.686)***	(2.00)**
Contributions made in 2005			2.182
			(7.47)***
Male * Contributions made in 2005			−0.42
			(3.81)***
Density of contributions between age 20 and June 2005	2.297	2.076	2.223
* Contributions made in 2005	(6.41)***	(3.697)***	(3.19)***
Density of contributions between age 20 and June 2005 * Voluntary savings in 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 in 2005 (Ch$ million)	0.985		1.521
	(1.37)		(1.42)
Average covered wage in 2005 (Ch$ million) * Contributions made in 2005	1.711	2.242	
	(2.10)**	(2.388)**	
Age as of June 2005 * Contributions made in 2005	0.034	0.032	
	(7.26)***	(4.219)***	
Average covered wage in 2005 (Ch$ million)	5.143		7.149
	(5.79)***		(7.19)***
Average squared covered wage in 2005 (Ch$ million)	−6.093	−4.028	−6.352
	(−9.97)***	(−6.224)***	(−7.01)***
Contributions made in 2005 * Positive voluntary account balance	0.802		5.071
	(1.33)		(1.76)*
Average covered wage in 2005 (Ch$ million) * Positive voluntary account balance	1.408		6.743
	(1.53)		(3.58)***
Density of contributions between age 20 and June 2005		−9.873	3.78
		(−5.211)***	(1.26)
Voluntary savings in previous year * Average covered wage in 2005 (Ch$ million)			−3.843
			(−2.49)**
Density of contributions between age 20 and June 2005 * Age as of June 2005		0.281	−0.097
		(5.394)***	(−1.49)
Age as of June 2005 * Positive voluntary account balance		0.163	−0.127
		(2.640)***	(−2.08)**
Age squared as of June 2005	0.002	−0.087	
	(1.55)	(−15.670)***	
Age as of June 2005 * Male	−0.01	−0.045	
	(−4.10)***	(−1.697)*	
Average covered wage in 2005 (Ch$ million) * Male	0.503		
	(1.39)		
Contributions made 2005 * Positive balance in voluntary savings		−4.096	
		(−2.498)**	
Positive balance in voluntary savings * Density of contributions between age 20 and June 2005		−1.774	
		(−1.493)	

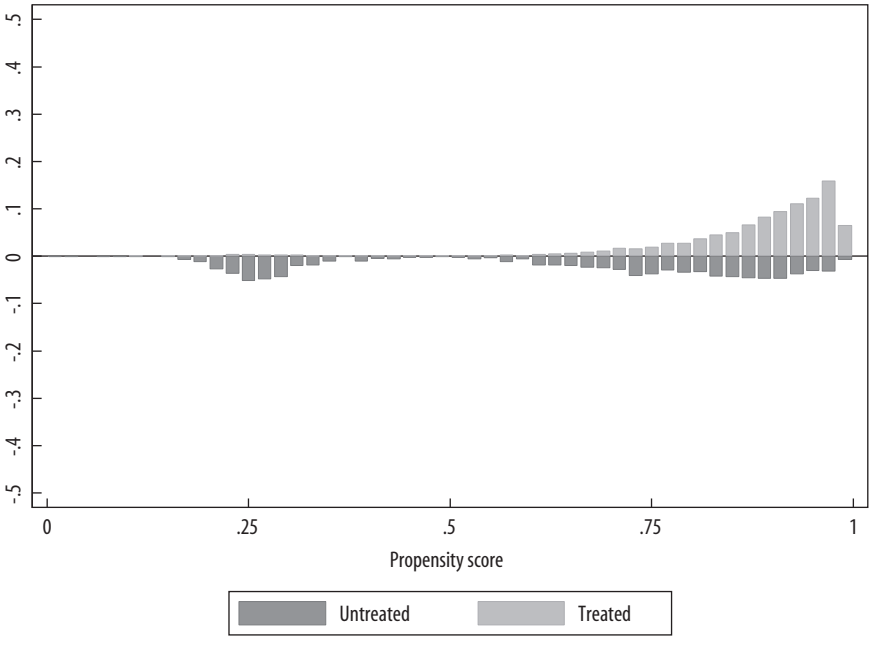
(*continued*)

TABLE 6. Estimation of the Propensity Score for Receiving a Statement[a] (*Continued*)

Variable	*Age 30–50*	*Age 30–39*	*Age 40–50*
Male		1.304	
		(1.460)	
Average covered wage in 2005 (Ch$ million) * Age as of June 2005		0.090	
		(3.067)***	
Constant	2.264	−104.350	−4.506
	(1.24)	(−15.751)***	(−3.44)***
No. observations	8,940	4,988	4,469
Balancing property satisfied	yes	yes	yes

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.
a. The dependent variable is a dummy variable that takes the value of one if the individual received a statement and zero if the statement was not sent. Robust *z* statistics are in parentheses.

FIGURE 3. Propensity Score Distribution among Treated and Control Groups[a]



Source: Authors' calculations.
a. The treatment is the receipt of the PPP annex.

assumptions that the conditional expectations of the potential outcomes are linear in the observable characteristics and the treatment effect is constant.[29]

—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.[30]

—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 score within a certain neighborhood of the treated person.[31]

—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.[32]

Results

In this section, we present estimators using the methodologies described above, applied to the full sample (ages thirty to fifty) and two subgroups (ages thirty to thirty-nine and forty to fifty). The distinction is relevant given that pension saving decisions become increasingly important the closer individuals are to retirement age.

29. Alternatively, one could allow for treatment to vary with the observable characteristics 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. The OLS results are included here as a reference, as they are not our preferred estimators; they do not necessarily perform correctly in balancing differences between treated and control units. Furthermore, there is a long-standing debate over the advantages and disadvantages of linear probability models (LPM) against more parametric alternatives like probit or logit models. See, for example, Rosenthal (1989) or Heckman and Snyder (1977) for theoretical rationalizations of linear probability models, and Amemiya (1977) or Horrace and Oaxaca (2006) for a set of sufficient conditions under which the LPM would be unbiased and consistent. The main advantage of LPM is the ability to perform inference without the distributional assumptions required for logit or probit models. The main disadvantages are related to the fact that LPM-estimated probabilities are not bounded on the unit interval, and the linear model is, by construction, heteroskedastic.

30. All the estimations were performed using the statistical package Stata. Propensity score matching estimators were implemented using routines developed by Becker and Ichino (2002).

31. More specifically, we use a 0.05 radius in the implementation of this estimator.

32. For a discussion on matching estimators using Stata, see Abadie and others (2004). In our estimations, we use one nearest neighbor, the Mahalanobis metric for calculating distances between vectors of covariates, and the bias-corrected version of the matching estimator. We present heteroskedasticity-consistent standard errors using four matches in a second matching stage. We impose exact matching on gender and five-year age groups.

TABLE 7. OLS Estimators of the Average Treatment Effect[a]

Variable	*Age 30–50*	*Age 30–39*	*Age 40–50*
Treatment status (1 if received a PPP statement)	0.003	0.004	0.001
	(1.91)*	(1.461)	(0.60)
Voluntary savings in the previous year	0.706	0.728	0.686
	(20.21)***	(14.555)***	(14.25)***
Age as of June 2005	0.000	–0.001	0.000
	(1.78)*	(–1.143)	(0.18)
Male	–0.004	–0.003	–0.005
	(–1.83)*	(–0.864)	(–1.520)
Average covered wage in 2005 (Ch$ million)	0.043	0.045	0.041
	(5.35)***	(3.874)***	(3.85)***
Density of contributions between age 20 and June 2005	–0.009	–0.011	–0.003
	(2.06)**	(–1.964)**	(0.590)
Contributions made in 2005	–0.001	0.000	–0.002
	(–0.970)	(0.142)	(–1.230)
Positive balance in voluntary savings	0.068	0.066	0.065
	(4.93)***	(3.138)***	(3.71)***
Constant	0.011	0.016	–0.007
	(1.420)	(0.992)	(–0.330)
No. observations	8,937	4,972	4,461
R squared	0.55	0.520	0.55

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.
a. The dependent variable is a dummy variable that takes the value of one if the individual received a statement and zero if the statement was not sent. The control group comprises individuals who were not sent a statement. Robust *t* or *z* statistics are in parentheses.

Table 7 presents the detailed results of the OLS estimator applied to the three age groups. We use the same variables included in table 6. The outcome of interest (the dependent variable) is a dummy variable equal to one if the person made at least one contribution to an AFP individual voluntary savings account in the twelve months following the receipt of the PPP statement (July 2005 to June 2006). As the table shows, the average treatment effect is positive on all specifications, but statistically significant only in the thirty to fifty age group. The estimated effect is 0.3 percent in this case: that is, the probability that an individual who received a statement will make voluntary contributions in the next twelve months is approximately 0.3 percentage point higher than for individuals who did not receive it. Considering that only 1.75 percent of individuals between the ages of thirty and fifty made voluntary contributions to an AFP from July 2004 to June 2005, the estimated marginal effect of receiving a PPP statement is quite significant, amounting to a 17 percent increase in the probability of making voluntary contributions.

TABLE 8. Alternative Estimators of the Average Treatment on the Treated[a]

Method	*Age 30–50*	*Age 30–39*	*Age 40–50*
Regression (OLS)	0.003	0.004	0.001
	(1.91)*	(1.461)	(0.600)
Nearest neighbor propensity score matching	0.018	0.006	0.022
	(4.211)***	(0.873)	(3.605)***
Propensity score radius (0.05) matching	0.014	0.012	0.020
	(4.965)***	(2.413)***	(5.261)***
Matching on covariates, exact gender and age group	0.009	0.006	0.0137
	(5.69)***	(1.9)***	(11.28)***
No. observations	8,937	4,972	4,461

*Statistically significant at the 10 percent level.

***Statistically significant at the 1 percent level.

a. The dependent variable is a dummy variable that takes the value of one if voluntary savings were made in the first year after the PPP statement was sent and zero otherwise. Robust *t* or *z* statistics are in parentheses.

The control variables included in the regression suggest that the probability of making voluntary contributions is strongly serially correlated (in that having made contributions in the previous year is a strong predictor), but it also increases with age, taxable earnings, and whether the voluntary savings account had a positive at the beginning of the period. Women are generally more likely to make voluntary contributions. These results are consistent with the most common way of making voluntary contributions, namely, through automatic tax-exempt payroll deductions made by employers which naturally increase with the covered wage.

Using the same covariates included in the previous specifications, table 8 repeats the OLS results, together with results on the average treatment effects on the treated from the different matching estimators introduced in the previous section. The results suggest, in a highly consistent manner, that the receipt of the PPP statement had a positive effect on the probability of making voluntary contributions in the next twelve months. The average impact ranges from 0.1 percentage point to 2.2 percentage points, being significantly different from zero (at least at a 10 percent significance level) in all but one specification. Estimators based on propensity score matching suggest larger impacts than regression estimators, but similar to those based on matching on covariates. The main difference between the matching results based on propensity scores and those based on covariates is the restriction, in the latter case, that matching on gender and age group be exact (that is, that control individuals are searched only within the same gender*age cell of the treated members). In fact, the results of covariate matching specifications that do

TABLE 9. Average Treatment Effect on the Treated, Conditional on Not Having Made Contributions in the Previous Year[a]

Method	*Age 30–50*	*Age 30–39*	*Age 40–50*
Regression (OLS)	0.003	0.003	0.002
	(4.02)***	(1.329)	(1.74)*
Nearest neighbor propensity score matching	0.008	0.008	0.007
	(7.512)***	(1.672)	(5.117)***
Propensity score radius (0.05) matching	0.008	0.008	0.007
	(7.512)*	(2.632)***	(5.117)***
Matching on covariates, exact gender and age group	0.0059	0.008	0.0071
	(4.55)***	(7.07)***	(7.01)***
No. observations	8,771	4,893	4,374

*Statistically significant at the 10 percent level.
***Statistically significant at the 1 percent level.
a. The dependent variable is a dummy variable that takes the value of one if voluntary savings were made in the first year after the PPP statement was sent, conditional on not having made contributions in the previous year, and zero otherwise. Robust *t* or *z* statistics are in parentheses.

not require exact matching (not reported here) were very similar to those produced using propensity score matching. The observed difference could imply that the true propensity score is not well approximated by the estimated logit model. Consequently, 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 for the forty to fifty age group, compared with 0.6 percentage point for the thirty to thirty-nine age group and 0.9 percentage point for the overall thirty to fifty age group. The 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 them. 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 9 presents the same type of results for a subsample of individuals who did not make voluntary contributions in the year prior to receiving the statement (July 2004 to June 2005). This could be interpreted as a difference-in-differences estimator, conditional on individuals who did not make 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 were not sent a statement) provides us with an estimate of 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 pretreatment differences in the voluntary saving behavior of treated and control groups.

The results are positive and significant in all specifications, but smaller than in the previous case, with the impact of the PPP on the probability of initiating voluntary contributions ranging from 0.2 percentage point to 0.8 percentage point. Our preferred estimator (matching on covariates, with exact coincidence of gender and age group) suggests a moderate but strongly significant effect (0.8 and 0.7 percentage point for the thirty-to-thirty-nine and forty-to-fifty age groups, respectively) of receiving the statement on the probability of starting to make voluntary contributions. These results suggest that while the personalized pension projection had an overall larger effect on making voluntary contributions among older cohorts, it may have had a stronger impact on commencing voluntary savings among younger cohorts.

Robustness Check

All the results presented in the previous section rely on the main identifying assumption that after controlling for similar observed characteristics, treatment is ignorable, that is, it can be considered independent of the 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 (that is, if conditional on observed controls, individuals who did not receive the PPP are systematically different from treated individuals in ways that are correlated with the outcome of interest), then they should persist once we move all the measurements backward. If, on the contrary, the estimates cannot be associated with endogenous selection, we should not be able to reject the hypothesis that they are equal to zero.

Table 10 presents the equivalent estimators to table 8, but applied to the data one year prior to the actual implementation (pretreatment variables measured for the period from July 2003 to June 2004 and the outcome variable

TABLE 10. Counterfactual Estimators of the Average Treatment Effect on the Treated[a]

Method	*Age 30–50*	*Age 30–39*	*Age 40–50*
Regression (OLS)	−0.004	−0.004	−0.004
	(−1.310)	(−1.224)	(−1.000)
Nearest neighbor propensity score matching	0.008	0.008	0.008
	(1.426)	(1.171)	(0.886)
Propensity score radius (0.05) matching	0.009	0.007	0.015
	(2.595)**	(1.452)	(2.910)**
Matching on covariates, exact gender and age group	−0.009	−0.0015	−0.011
	(−1.570)	(−0.26)	(−1.370)
No. observations	7,793	4,510	3,776

**Statistically significant at the 5 percent level.

a. The dependent variable is a dummy variable that takes the value of one if voluntary savings were made in the first year after the PPP statement was sent and zero otherwise. For the counterfactual, all variables are measured one year earlier. Robust *t* or *z* statistics are in parentheses.

measured from July 2004 to June 2005).[33] In most of the specifications, we cannot reject the null hypothesis that the effects were equal to zero. In our view, this provides a strong test that our results (particularly those based on matching on covariates) reflect the causal impact of receiving a PPP statement on the voluntary savings decision of AFP affiliates.

Alternative Outcomes

In all specifications presented so far, the outcome of interest has been whether the individual made at least one voluntary contribution in the twelve months following the receipt of the PPP. In this section, we present three alternative outcomes related to voluntary saving behavior in the same period: the number of months in which the person made a contribution to voluntary pension savings, or APV, account (Y2); the number of months in which the person made contributions to a nonpension voluntary savings account in an AFP (Y3); and whether the person made contributions to any voluntary saving account (pension or nonpension) in an AFP (Y4).[34]

Table 11 presents the average impact on these outcomes under the different estimators, for the thirty to fifty age group. Under our preferred estimator (matching on covariates), receiving the PPP would increase the number of months with positive APV contributions by 0.043, the number of months with

33. We lose some of the original observations since not all information, especially income, is available for the pretreatment year in this case.

34. These accounts are similar to the APV accounts but without tax exemption or withdrawal penalties. They are also known as second accounts (*Cuenta 2*). Given our data, we can only look at savings accounts managed by AFPs. In June 2005, however, 80 percent of the funds invested in APV accounts were managed by AFPs.

TABLE 11. Average Treatment Effect on the Treated for Alternative Outcomes of Interest[a]

	Dependent variable		
Method	*No. months with voluntary retirement contributions (Y2)*	*No. months with voluntary contributions to savings account (Y3)*	*No. months with any voluntary contributions (Y4)*
Nearest neighbor propensity score matching	0.045 (0.613)	0.081 (0.917)	0.022 (1.94)*
Propensity score radius (0.05) matching	0.039 (0.930)	0.408 (6.87)***	0.045 (6.251)***
Matching on covariates, exact gender and age group	0.043 (3.1)***	0.288 (3.52)***	0.038 (4.85)***
No. observations	8,456	8,456	8,456

*Statistically significant at the 10 percent level.
***Statistically significant at the 1 percent level.
a. Robust *t* or *z* statistics are in parentheses.

positive contributions to a nonpension voluntary savings account by 0.288, and the probability of making at least one contribution to any voluntary savings account (pension or nonpension) by 3.8 percentage points. These results may reflect the design differences between the two savings mechanisms (APV and savings account). While an APV account receives favorable tax treatment, individuals face penalties if they withdraw part or all of the balance before retirement. In contrast, nonpension savings accounts have no tax incentives (which are irrelevant for middle- and low-income workers, who are exempt from income taxes) and provide liquidity in the form of a maximum number of withdrawals per year (usually three or four). This means that a nonpension savings account could be a more appealing savings vehicle for low-income and younger individuals.

Results for Subgroups of the Population

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

The legal retirement age is different for women and men in Chile: sixty-five for men and sixty for women. Since pension projections are based on these ages, the higher life expectancy of women at retirement means that they generally tend to have lower pensions than men. At the same time, the shorter

time to retirement might also contribute to a greater sense of urgency among women who receive the projection. We therefore expect to see a greater effect among women than men.

Voluntary contributions receive a tax benefit only if the individual is in an income bracket where he or she has to pay taxes. We therefore 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 12 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 monthly taxable income above Ch$409,158 in 2005), and by the projected replacement rate (above or below the median replacement rate among the treated). Estimation was restricted to individuals in the forty to fifty age range and conditioned on not having made voluntary contributions in the previous year.

As expected, the impact on women is significantly larger than on men, potentially reflecting a higher sense of urgency caused by the receipt of the projection, given that the pensions shown in the projections are much lower than those for men (see figure 1). Also consistent with our prior beliefs, individuals who receive a positive tax benefit from 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 rates present a slightly higher impact than those with lower replacement rates.[35]

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 the system's twenty-five years of existence, members were exposed to

35. 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, information on recognition bonds was not available to construct an appropriate estimate of pension wealth when the projection was made. (Recognition bonds, called *bonos de reconocimiento* in Chile, are bonds that were issued to individuals who switched from the old pay-as-you-go system to the current defined-contribution scheme; they represent the debt arising from contributions made to the old pension organizations by affiliates of the new AFP system.) 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.

TABLE 12. Average Treatment Effect on the Treated for Alternative Subgroups, Conditioned on Not Having Made Contributions in the Previous Year: Sample Aged Forty to Fifty[a]

Method	*Men*	*Women*	*Tax exempt*	*Not tax exempt*	*High replacement rate*	*Low replacement rate*
Regression (OLS)	0.000	0.004	0.002	0.010	0.000	0.003
	(0.07)	(1.92)*	(2.14)**	(1.99)**	(0.05)	(2.10)**
Nearest neighbor propensity score matching	0.006	0.010	0.003	0.021	0.008	0.007
	(3.615)***	(3.622)***	(2.832)***	(4.286)***	(3.328)***	(3.885)***
Propensity score radius (0.05) matching	0.006	0.010	0.003	0.022	0.008	0.007
	(3.615)***	(3.622)***	(2.832)***	(4.287)***	(3.328)***	(3.885)***
Matching on covariates, exact gender and age group	0.006	0.010	0.003	0.021	0.008	0.007
	(5.30)***	(4.74)***	(3.68)***	(5.84)***	(4.80)***	(5.88)***
No. observations	2,767	1,599	3,481	887	1,687	2,692

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

a. The dependent variable is a dummy variable that takes the value of one if voluntary savings were made in the first year after the PPP statement was sent, conditional on not having made contributions in the previous year, and zero otherwise. Robust *t* or *z* statistics are in parentheses.

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 starting or increasing their 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 their 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 the individual decisions of participants in defined-contribution pension systems.[36]

Our results suggest that the new information showing what current savings would provide in terms of a future pension did change participants' behavior: among individuals who received the statement, the probability of making voluntary contributions increased by more than 1.3 percentage points, especially in the older group (forty to fifty), and the probability of starting to make contributions (conditional on not having done so in the previous year) increased by more than 0.7 percentage point. Considering that the average probability of making voluntary contributions in the previous year was 2.1 percent among the treated group, these effects are quite significant. Given that the most common channel for making this type of contribution is through automatic payroll discounts, individuals who start to save tend to do so for a long time.[37]

The effect on younger cohorts was smaller, consistent with some form of myopia or liquidity constrains. The identification strategy, mostly based on the use of matching estimators built on observed pretreatment characteristics of individuals who received the PPP and those who did not, was reinforced as a result of applying it to a period when no effect was expected.

The recent literature on behavioral economics suggests that inertia is so strong that improving information is unlikely to result in significant changes

36. For recent international experiences on information provided in defined-contribution pension systems, see Rinaldi and Giacomel (2008).

37. The long-run impact of this action on the replacement rate is uncertain, as the impact might vary over time and individuals. A simple calculation for the average individual among the treated group (age forty, with $23 million in the compulsory savings account, a wage of $312,000 a year, a contribution density of 57 percent and an assumed 4 percent real interest rate) suggests that starting voluntary contributions (equivalent to 10 percent of covered wages) at age forty implies a 12.8 percent higher replacement rate (relative to the alternative of never making voluntary contributions).

in actual savings decisions.[38] However, our results suggest that simplified information may help individuals to better align their savings plans with their retirement income goals, even in systems with mandatory participation or automatic enrollment. Improved information is attractive given its relatively low cost when compared with massive financial education or awareness campaigns. That this strategy is able to yield positive behavioral impacts makes it a valid option in the array of tools available for policymakers to increase the level of retirement savings. As more studies that evaluate the impact of different strategies to increase retirement savings become available, policymakers may have better information on which to base their decisions about what strategies to adopt.

The results presented here are appropriate for the treated units only, that is, those individuals who were targeted by the campaign because of their recent contribution history. This is precisely the group that we would expect to be more sensitive to this type of campaign, given their savings capacity and active involvement in the pension system. The intervention exploited here does not inform us about other potential obstacles to making voluntary contributions. The impacts by subgroup, however, show that individuals who are not tax exempt are more likely to be affected by the intervention, suggesting that liquidity constraints, education, or other unobservable characteristics correlated with income might play a role in the decision to make voluntary contributions.

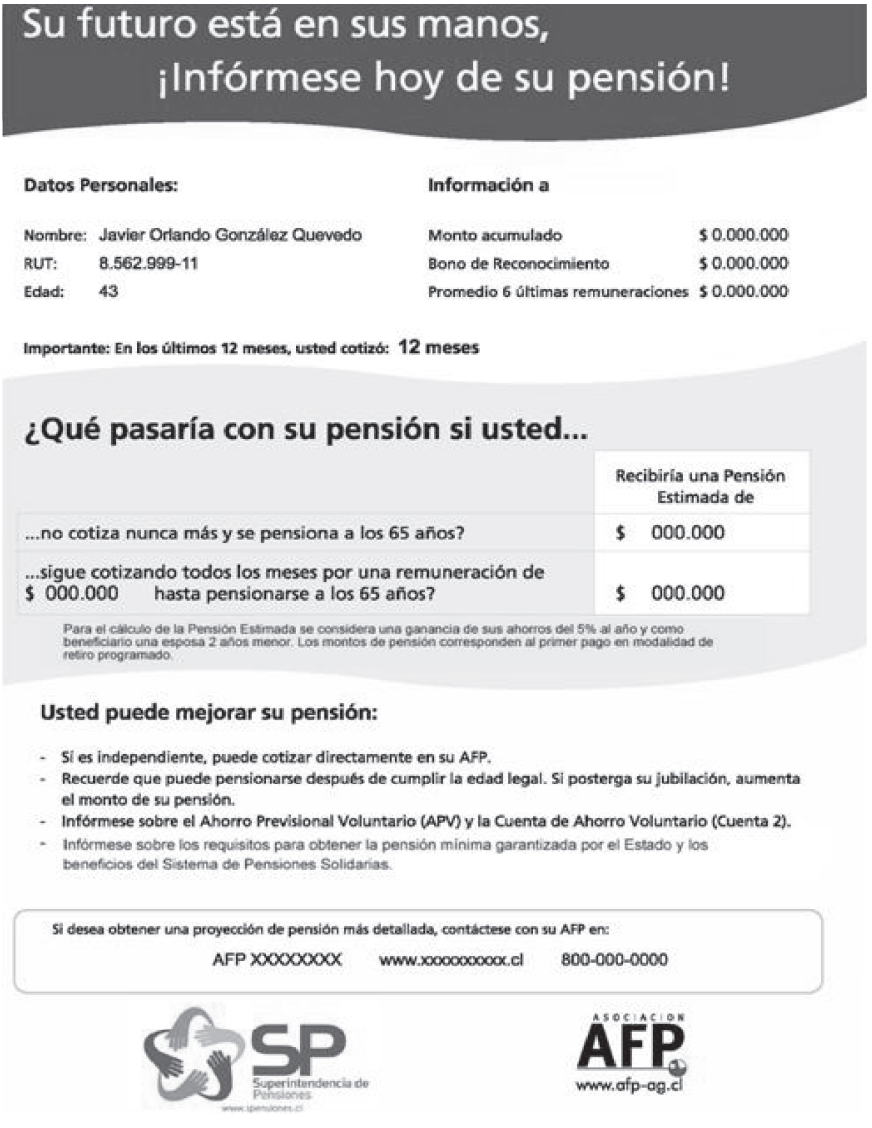
The launching of the PPP followed a debate about the advantages of providing more information in a context of low financial education. One issue raised in the debate was the risk that individuals might interpret these official projections as promises about their future pensions, something that cannot 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.

Appendix: PPP Design

Figure A1 presents the current model (in Spanish) for men between thirty and fifty-five and women between thirty and fifty. It is available online at www.spensiones.cl/compendio/577/w3-propertyvalue-3523.html. Figure A2 provides an English translation.

38. See, for example, Thaler (1994); Madrian and Shea (2001).

FIGURE A1. Sample PPP Annex, 2005



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

Datos Personales:

Nombre: Javier Orlando González Quevedo
RUT: 8.562.999-11
Edad: 43

Información a

Monto acumulado	$ 0.000.000
Bono de Reconocimiento	$ 0.000.000
Promedio 6 últimas remuneraciones	$ 0.000.000

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

¿Qué pasaría con su pensión si usted...

	Recibiría una Pensión Estimada de
...no cotiza nunca más y se pensiona a los 65 años?	$ 000.000
...sigue cotizando todos los meses por una remuneración de $ 000.000 hasta pensionarse a los 65 años?	$ 000.000

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. Los montos de pensión corresponden al primer pago en modalidad de retiro programado.

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).
- Infórmese sobre los requisitos para obtener la pensión mínima garantizada por el Estado y los beneficios del Sistema de Pensiones Solidarias.

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

AFP XXXXXXXX www.xxxxxxxxxx.cl 800-000-0000

SP Superintendencia de Pensiones www.spensiones.cl

ASOCIACION AFP www.afp-ag.cl

Source: Chilean Pensions Supervisor (www.spensiones.cl/compendio/577/w3-propertyvalue-3523.html).

FIGURE A2. English Translation of Sample PPP Annex, 2005[a]

Your future is in your hands, Inform yourself about your pension!

Personal information		**Information as of**	**April 30, 2005**
Name	First Last (man)	**Accumulated balance**	$ 7.131.584
ID	x.xxx.xxx-x	**Recognition bond**	$ 460.815
Age	43	**Average last 6 monthly incomes**	$ 317.419

Important: In the last 12 months, you contributed: 6 months

What would your pension be if you …

	You would receive an estimated monthly pension of
… stop contributing and retire at **age 65?**	**$113.018**
… keep contributing every month for **$317.419** and retire at **age 65?**	**$176.054**

For the calculation of the estimated pension, we assume a 5% return on your savings and that you have a spouse two years younger.

You can improve your pension:

- If you are self-employed, you can contribute directly to your AFP.
- Remember that you can retire after reaching the legal retirement age. If you delay your retirement, your pension will increase.
- Inform yourself about the Voluntary Pension Savings (VPS) and the Voluntary Savings Account (*Account 2*).
- There exists a minimum pension guaranteed by the State of $77.077. If your estimated pension is below this amount, inform yourself about the prerequisites to obtain this benefit.

If you desire a more detailed pension projection, contact your AFP at:
AFP xxxxxxx www.**afp**xxxx.cl **Phone**: 800-xxx-xxx

Pensions Supervisor Logo Association of AFP Logo

Source: Authors' translation.

a. All figures in Chilean pesos, 1US$ = Ch$582.87 as of 4/30/2005.

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