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Decision Making in Individual Account Pension Systems

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Decision Making in Individual Account Pension Systems

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M.A., University of Chile, 2006

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An abstract of
A dissertation submitted to the Faculty of the
James T. Laney School of Graduate Studies of Emory University
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Abstract

Decision Making in Individual Account Pension Systems

By Carolina Cristina Cabrita Felix

This dissertation studies different aspects of decision making in individual account pension systems. I use data from Chile, the pioneer country in adopting a fully-funded individual account pension system as the main source of retirement savings for workers.

The first chapter examines the relative importance of health and wealth for the retirement decision in the context of a mature individual account pension system. Overall, health factors seem to be the most important determinant of retirement in Chile, as opposed to recent research for the US that finds that wealth prevails as the main determinant of retirement. This result might be due to the fact that individual account pension systems are age neutral and do not provide real economic incentives for retirement. Besides contributing to knowledge about how pension system structure might affect retirement behavior, results of this research are useful for policymakers around the world considering the adoption of a fully-funded individual account pension system.

The second chapter investigates whether the child bonus policy included in the recent Chilean pension reform generated incentives for women to have children and whether it affected the timing of birth. Results suggest that the child bonus policy increases fertility preferences, but this effect cannot be confirmed for births. Effects on fertility preferences, however, vary for different groups of women. They seem to be stronger for single women, as well as for higher order births. The child bonus policy also seems to have shortened the time to a birth, especially for single women and first births, even though these effects are not statistically significant.

The third chapter investigates the role of financial literacy and pension system knowledge on the retirement savings investment choice of workers. I find that financial literacy and especially pension knowledge present a statistically significant and positive effect on the probability of making an active investment decision, but that only financial literacy affects the choice of investment fund itself. These results suggest that investing in financial and pension system education might be an important strategy for governments to motivate active investment choices and provide workers with tools to make appropriate investment decisions.

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CHAPTER ONE

RETIREMENT DECISION IN INDIVIDUAL ACCOUNT PENSION SYSTEMS

Abstract

This chapter examines the relative importance of health and wealth for the retirement decision in the context of a mature individual account pension system. I use data from Chile, the pioneer country in adopting a fully-funded individual account pension system as the main source of retirement savings for workers. I also examine the effects of spousal characteristics on the retirement decision of married individuals and model retirement as a household decision using multinomial logit models. Overall, health factors seem to be the most important determinant of retirement in Chile, as opposed to recent research for the US that finds that wealth prevails as the main determinant of retirement. This result might be due to the fact that individual account pension systems are age neutral and do not provide real economic incentives for retirement. Besides contributing to knowledge about how pension system structure might affect retirement behavior, results of this research are useful for policymakers around the world considering the adoption of a fully-funded individual account pension system.

I. Introduction

The world's population is aging, and so is the world's workforce. In 1950, 8% of the world's population was 60 years or older. In 2000, this number reached 10%. The Population Division of the United Nations projects that by 2050 older individuals will represent 21% of the world's population, when for the first time the older population (60 years and older) will surpass the younger population (15 years or less) (Population Division, DESA, United Nations, 2001). This phenomenon directly affects labor markets around the world. With a decreasing share of younger workers, an active participation of older workers in labor markets becomes essential. Therefore, it is imperative to understand their labor supply decisions as well as the labor market conditions they face. In this respect, older workers' decisions about when to retire are of vital importance. Extensive evidence on the retirement decision of workers is available for pay-as-you-go (or defined benefit) pension systems, but little is known about this decision in the context of individual account pension systems (or defined contribution). This chapter explores the relative importance of health and wealth for the retirement decision, as well as the role of spousal characteristics for the retirement decision of married workers in individual account systems.

Some societies might consider the retirement of older workers as a positive phenomenon, since it opens vacancies for younger and more productive workers, who may command lower wages. However, given the aging of the workforce worldwide, it more likely represents a substantial loss of human capital for most societies. Besides, early retirement has differing costs depending on the pension system design. In pay-as-you-go (PAYG) systems, early retirement brings public budget challenges due to the

financing of pensions, while in individual account schemes, early retirement might be related to lower pensions, which increase poverty risk in old age.

The literature on determinants of the retirement decision tends to focus on either health or wealth. Studies that incorporate both health and wealth variables in retirement models present contradictory outcomes with respect to their relative importance for the retirement decision. Some studies point to poor health as the main determinant of retirement (Dwyer and Mitchell 1999; McGarry 2004). Others argue that financial incentives outweigh health conditions when individuals choose when to retire (Van Houtven and Coe 2010). Most of this literature, however, uses data from the US.

Workers in the US are generally covered by a public pension system (known as Social Security) and/or by employer-sponsored pension plans. Social Security has a defined benefit scheme, while employer-sponsored pension plans can be either defined benefit or defined contribution schemes. Even though the number of employer-sponsored defined contribution pension plans has been increasing, the number of defined benefit schemes in the US is still higher. Therefore, economic variables used in the literature generally refer to financial incentives embedded in the Social Security system and/or financial incentives provided mostly by defined benefit employer-sponsored plans. Defined benefit schemes usually provide retirement benefits based on the wage received during the working life and the age at claiming of benefits. Individual account (or defined contribution) schemes, however, provide retirement benefits which are directly related to workers' entire wage histories and to the amount of resources accumulated in their individual retirement accounts. Furthermore, while defined benefit schemes usually encourage retirement after a certain point (Gruber and Wise 1999; Coile and Gruber

2000), individual account schemes are essentially age neutral (Friedberg and Webb 2005). Given these distinct characteristics and the different incentives they generate, it is possible that health and economic incentives play different roles in the retirement decision depending upon the design of the pension system.

Recent research has studied not only the effects of own characteristics, but also the effects of spousal characteristics on the retirement decision (Johnson and Favreault 2001; Coile 2004a; Coile 2004b; Van Houtven and Coe 2010), given findings that couples tend to coordinate retirement. The joint retirement of couples has been mostly attributed to complementarities in leisure (Maestas, 2001), even though assortative mating (individuals tend to match with others that have similar labor/leisure preferences) has also been considered as a possible explanation. However, it is also possible that the retirement of one individual increases the labor supply of her spouse. For instance, if a worker decides to retire due to poor health, her spouse might choose to increase labor supply to compensate for the income reduction in the household. This is what has been called in the literature an "added worker effect". Research has found that spousal characteristics have great influence on one's decision to retire and that there are asymmetries in responses by gender. The effects of spousal characteristics on one's retirement decision might also be different in a context where retirement benefits come entirely from the accumulated balance on individual retirement accounts.[1]

This chapter examines the relative importance of health and wealth for the retirement decision in the context of a mature individual account pension system. I use data from Chile, the pioneer country in adopting a fully-funded individual account pension system

[1] Low-income workers might be eligible for welfare pensions. More details are given in Section III (Institutional Setting).

as the main source of retirement savings for workers, more than 30 years ago. I also examine the effects of spousal characteristics on the retirement decision and estimate models of joint labor supply decision of couples. Besides contributing to knowledge with respect to how pension system design might affect retirement behavior, results of this research are useful for policymakers around the world considering the widespread adoption of fully-funded individual account pension systems.

I use several econometric techniques to evaluate the effects of health and wealth on the decision and timing of retirement. Results suggest that in individual account pension systems, contrary to recent findings for the US, health matters more for the retirement decision than wealth. This is also true for married (or partnered) individuals. Multinomial logit models with four possible outcomes for the retirement decision of couples also suggest an important effect of spousal characteristics on couples' decision to retire. However, the result that spousal health conditions matter for the retirement decision found previously for the US data is not confirmed by fixed effects models.

The chapter continues as follows. Section II presents a literature review, while section III describes the Chilean institutional setting. Section IV describes in details the data used in this chapter, and section V presents the empirical methods used. Section VI presents the results of each empirical technique used, while section VII concludes.

II. Previous Literature

The literature on the determinants of the retirement decision has mainly focused on either health (Sickles and Taubman 1986; Bound *et al.* 1999; Coile 2004a; Disney *et al.* 2006) or wealth (Gustman and Steinmeier 2002; Coile 2004b; Coile and Gruber 2007;

Bloemen 2011). Moreover, models that include both health and wealth have found different results with respect to their relative importance for the retirement decision. Dwyer and Mitchell (1999) and McGarry (2004), for instance, find that health is the most important determinant of retirement, while Van Houtven and Coe (2010) have recently found that economic factors matter most for the retirement decision. Most of the literature so far has used US data, so that the retirement decision has been mostly studied in a context where defined benefit pension schemes prevail. In what follows I present a description of the previous literature – first with respect to health and retirement, then with respect to retirement and wealth, and finally a discussion of works that include both health and wealth in retirement models.

Extensive research has been done on the effects of health on the decision to retire, especially for developed countries, such as the US, Australia and the United Kingdom to name a few.[2] The results from these studies point to a strong relationship between health and the decision to stop participating in the labor force.

Sickles and Taubman (1986), for instance, use five biennial panels of males, from 1969 to 1977, in the US Retirement History Survey (RHS) to estimate a structural model of self-assessed health status and retirement. They measure retirement as working or not working full time. Their health measure has four categories that go from having better health than others the same age to dead. Using maximum likelihood estimation and controlling for individual heterogeneity using random effects, they find that health strongly affects the retirement decision.

[2] Australia has a Social Security system of welfare pensions as well as a Superannuation system where employers make contributions to workers' superannuation funds. The UK has a system of basic state pensions, as well as additional pensions to complement the basic state pension, such as occupational pensions and individual pensions.

Several years later, Bound *et al.* (1999) use the first three waves of the HRS to analyze how health affects the transitions of older workers in the labor market. Transitions analyzed include job changes, applications for disability insurance and labor force exits. They focus specifically on how the timing of health shocks affects labor force participation. The authors find that poor health is an important determinant of labor force withdrawal and that declines in health also explain retirement behavior.

There has been a great deal of debate about the type of health measures used in retirement models. Self-reported subjective measures of health generate two main concerns. The first relates to the likely poor comparability across respondents' evaluations, which is associated with measurement error and therefore, with underestimation of health effects on the retirement decision. The second is the possibility of dependence of self-assessed health measures on labor market outcomes, which suggests endogeneity and therefore, overestimation of health effects on the retirement decision. The latter is known in the literature as 'justification bias' - retirees tend to report worse-than-actual health status to justify their preference for retirement.

Nevertheless, Bound (1991) argues that objective measures of health may also produce bias since they are pure measures of health, which are not necessarily correlated with capacity for work. Using data from the RHS, he finds that self-reported measures of health lead to a higher impact of health on retirement than objective measures. He also shows that using objective measures to instrument for self-reported measures may actually increase the bias as compared to when self-reported measures are used alone. He concludes that since these two types of measures lead to biases in opposite directions, they can be used to jointly bound the effect of health on retirement.

Dwyer and Mitchell (1999) also explore the validity of self-reported subjective measures. They obtain ordinary least squares and instrumental variables estimates of retirement models using subjective and objective measures of health status. They find no evidence to support the justification bias, suggesting that self-rated subjective health measures are not endogenous. They also find little evidence of measurement error in objective health measures. Nonetheless, Baker *et al.* (2004), in an interesting study using data from Canada, finds that there are many false positives and false negatives in self-reported objective health measures when comparing them to 'true' health records. They also find evidence that misreported objective health measures are related to labor market status, suggesting the presence of a justification bias.

Evidence of the important effects of health on retirement also exists for other countries. For instance, Disney *et al.* (2006) study the effect of ill health on retirement behavior using data from the British Household Panel Survey, from 1991 to 1998. Following the approach used by Bound *et al.* (1999), they instrument self-reported measures of health using a constructed index of 'health stock'. They use two different econometric approaches. They first use linear and nonlinear fixed effects models to estimate retirement behavior, using both changes in health and individual lagged health as explanatory variables. They secondly estimate a hazard function with non-parametric duration dependence. Results from both techniques find robust evidence that health deteriorations increase the probability of retirement.

Hagan *et al.* (2006) use eight waves of the European Community Household Panel, from 1994 to 2001, to study the effects of health on retirement for nine countries in the European Union. They explore distinct health measures and retirement definitions,

and use discrete-time proportional hazard models. Their findings show that acute changes in health are especially relevant and that financial factors are also important to explain retirement. Moreover, Zucchelli *et al.* (2007) study the relationship between health and retirement using the Household, Income and Labor Dynamics in Australia Survey. They estimate discrete-time hazard models using five waves of the survey, for the period between 2001 and 2005. Besides finding that health is an important determinant of the retirement decision, they conclude that negative health shocks increase the probability of retirement (especially for men), and that partners' characteristics do not have a significant influence in the retirement decision.

A common feature in the above-mentioned studies is a strong positive relationship of poor health with labor force exit among older workers. Another common feature is that in all countries and periods studied, defined benefits pension schemes prevail.

A more recent stream of literature on health and retirement analyzes the role of spousal health conditions on one's retirement. Coile (2004a) is one of the first studies to examine the effects of spousal health shocks on the labor supply of couples. Using the HRS, she finds that health shocks accompanied by a substantial loss of functioning dramatically affect own labor supply, but that the "added worker effect", or the increase in labor supply to compensate for a spouse's decrease in labor supply due to a health shock, is quite small for men and not significant for women. Before Coile (2004a), Johnson and Favreault (2001) analyzed the effect of spousal labor force status on one's retirement, with an emphasis on the effects of a spousal labor force withdrawal due to health problems. The authors use full information maximum likelihood models to deal with the endogeneity of spousal labor force participation and use interaction terms of

spousal labor force status and health as the main variables of interest. They find evidence of an added worker effect when a spouse leaves the labor force due to illness, and therefore, no evidence of retirement for caring for an ill spouse.

The literature relating wealth and/or financial incentives to retirement is also quite extensive. In an influential study, Stock and Wise (1990) use data from a defined benefit plan offered by a large firm to show that it is not only the level of retirement wealth or the accrual of benefits from one more year of work, but the whole stream of future wealth as well as future work that matter for the retirement decision. Their "option value" model suggests that the retirement decision is a function of the difference in utility from retiring today and retiring when utility is maximized.

Using the HRS, Coile (2004b) explores not only the effects of own financial incentives, but also the effects of spousal financial incentives on the retirement decision. Using reduced-form models of retirement, she finds that men and women respond similarly to their own financial incentives, but that men are much more responsive to spousal economic variables than women. Later on, Coile and Gruber (2007) focus on forward-looking models of retirement behavior for males. The authors consider that the option value model proposed by Stock and Wise (1990) might suffer from endogeneity, since the option value is tightly related to wages, which are likely correlated with tastes for work. Therefore, they propose an alternative measure of forward-looking financial incentives, the "peak value", which measures the difference between the maximum possible social security wealth and its current value, in order to evaluate the incentives to keep working. The authors find that both option value and peak value models perform better than simple accrual models. More recently, Bloemen (2011) uses data from the

Netherlands and focus on the effects of private wealth on the retirement decision of males. Using multinomial choice models, the author finds that wealthier men tend to retire earlier.

Retirement models that include both health and wealth factors are harder to find in the literature. Dwyer and Mitchell (1999), using data from the first wave of the US Health and Retirement Survey (HRS) in 1992, find that health affects retirement plans more than economic variables do. The authors also find that people reporting poor health or functional limitations expected to retire between one and two years earlier than average. McGarry (2004) studies the relative importance of health and wealth for the retirement decision. She focuses on workers to avoid the justification bias (discussed earlier in this section) and analyzes the subjective probability of continued work. She finds that health is relatively more important to the retirement decision than economic factors and that self-reported health measures present significant effects on retirement even after objective measures are controlled for.

More recently, Van Houtven and Coe (2010) was the first study to include own wealth and health measures, as well as spousal financial incentives and health shocks, on a reduced-form model of retirement behavior for married individuals. They find that economic factors are the most important determinant of retirement empirically. The authors find that males are half as responsive to spousal economic factors as they are to their own, and that males are also more responsive to their spouses' health shocks than females. They also note that results concerning spousal health shocks differ depending on whether they are estimated by probit models or hazard functions.

A final important remark from the literature concerns the use of reduced-form retirement models. Gustman and Steinmeier (2002) use the first four waves of the HRS to evaluate their effectiveness on the prediction of effects of Social Security policies. They estimate reduced-form retirement probits and linear models for the accumulation of wealth, and conclude that reduced-form retirement models suffer from omitted variable bias. Heterogeneity would come from heterogeneous retirement preferences, time preferences and liquidity constraints. Therefore, they argue that researchers should be aware of the potential bias present in reduced-form retirement models due to unobserved heterogeneity.

The retirement determinants literature so far has a strong focus on the US, where Social Security and employer-sponsored defined benefit plans prevail. Furthermore, recent work presents some important weaknesses. They tend to use contemporaneous covariates with the retirement decision (Coile 2004a; Coile 2004b; Coile and Gruber 2007; Van Houtven and Coe 2010), which might be endogenous. They also do not take into account the possibility of omitted variable bias (such as "taste for work"), as emphasized by Gustman and Steinmeier (2002).

This chapter makes several contributions to the literature. First, it is the first study to investigate the effects of own wealth and health, as well as spousal income and health conditions, on the retirement decision in the context of individual account pension systems. I use data from Chile, the first country to entirely replace its pay-as-you-go pension system by a scheme with individual accounts. Second, I estimate reduced-form retirement models using lagged covariates to avoid endogeneity caused by reverse causality. Third, besides probit and hazard models, I use multinomial logit models to

study the retirement decision as a joint decision made by husbands and wives. Fourth, I take into account (time invariant) unobserved heterogeneity, as suggested by Gustman and Steinmeier (2002), using duration models and panel data techniques.

III. Institutional Setting

Chile went through a major reform of its pension system in 1981, when its pay-as-you-go system was replaced by an individual account scheme based on defined contributions. Individuals who were part of the old scheme could opt whether to change to the new system or not. However, every new worker had to comply with the new rules. The system was recently reformed once more in 2008, but this recent reform was much less profound than the one in 1981. The main objectives of the recent reform were to increase pensions' coverage and improve access to pensions for the most economically disadvantaged groups.

The Chilean pensions system is based on three pillars: the Solidarity Pillar, Contributive Pillar and Voluntary Pillar. The first one has the objective of reducing poverty by providing access to old age and disability pensions for people that for various reasons did not participate in the pensions system or were not able to accumulate enough resources to finance minimum pension benefits. Benefits under the Solidarity Pillar are means-tested. The second pillar is the heart of the system. It mandates regular contributions to individual capitalization accounts for every formal worker, to which they have access when they meet the eligibility criteria to retire.[3] Finally, the voluntary pillar

[3] The 2008 reform introduced a requirement for self-employed workers to contribute to individual accounts, which will become effective gradually. Mandatory contributions from self-employed workers will be fully in place in 2018.

provides an opportunity for individuals who want to increase their savings for retirement over the mandated amount to do so. Tax benefits are offered to encourage this decision.

Under the Contributive Pillar, each worker chooses a pension fund manager (known as AFP - *Administradoras de Fondos de Pension*) and a type of fund where to invest their savings for retirement. There currently exist six different pension fund managers and five different types of fund to choose from. The types of fund vary by the amount of stocks they are allowed to invest in.[4] In the case of workers who do not explicitly choose a type of fund in which to invest their retirement savings, they are assigned to one of the types of fund according to their age.[5]

Workers contribute monthly 10% of earnings to their individual accounts, and must pay a monthly management fee to the respective pension fund manager. At the time of retirement, workers use the accumulated balance on their individual accounts to finance their pensions, which can be paid in the form of life annuities or programmed withdrawals.

The legal retirement age in Chile is 60 years old for women and 65 years old for men. Everyone affiliated with the AFP system has the right (not the obligation) to retire when reaching the legal age of retirement. Pensions received in this case are called old age pensions. However, by meeting certain eligibility requirements, it is possible to retire earlier. In order to be eligible for early retirement, a worker needs to be able to finance a pension that is equal to or greater than 70% of her average taxable income of the last 10 years worked and also equal to or greater than 150% of the minimum pension guaranteed

[4] The types of fund are A, B, C, D and E. Fund A is the riskiest one, with up to 80% of its value invested in variable income, while fund E is allowed to invest only up to 5% of its value in variable income.

[5] Workers up to 35 years old are assigned to fund B, men between 36 and 55 and women between 36 and 50 years old are assigned to fund C. Older workers and pensioners are assigned to fund D. There's no default assignment to funds A and E.

by the government. Until August 2004, workers were required to be able to finance a pension that was at least equal to 50% of the average taxable income from the last 10 years. Nevertheless, law N.19.934 of 21 February 2004 determined that this percentage would gradually increase up to 70% in August 2010. Similarly, until August 2005, workers were required to be able to finance a pension that was at least equal to 110% of the minimum pension guaranteed by the State. However, law N.19.934 also determined a gradually increase of this percentage to 150% in August 2007.

Another way to retire early in Chile is through disability pensions. Workers that have their capacity to work affected by at least one half and who have not yet reached the legal retirement age may apply and possibly receive disability benefits as long as they are covered by the disability and survivorship insurance (DSI). Workers are covered by DSI if they have been contributing to the pension system, and also within the first twelve months after they stop contributing in case of becoming unemployed. Coverage by DSI allows them to apply for disability benefits as well as to leave survivorship pensions for spouses, offspring or parents in case of death. Workers who lose at least two thirds of their capacity to work qualify for receiving full disability benefits, while workers whose loss of capacity to work is between one half and two thirds only qualify for partial disability benefits.

IV. Data

I use data from the Chilean Social Protection Survey (SPS), a nationally representative longitudinal survey with four available waves of data (2002, 2004, 2006

and 2009), linked to administrative data. [6] The SPS contains detailed information on individuals' participation in the labor market and in the pension system. It also contains extensive individual health and household private wealth information. Spousal labor market and health information are also available, but not as detailed as for interviewees. The Chilean SPS contains longitudinal data for approximately 17,000 individuals. The administrative data linked to the SPS contains individual information on the amount and periodicity of contributions made to individual accounts. The type of funds in which retirement savings are invested and the balance of mandatory individual accounts are also available as of December 2009.

I look at transitions across the survey waves (between wave t and wave t+1) from employment or unemployment into retirement. The 2002 SPS wave cannot be used for this analysis due to its lack of private wealth information. Therefore, I only use the 2004, 2006 and 2009 waves of the SPS.

The analysis of the retirement decision is performed separately for men and women. To be included in the sample of analysis, respondents need to be at least 48 years old, affiliated with the individual account pension system, participate in at least two waves of the SPS between 2004 and 2009, and not be retired in 2004. Finally, I consider retirement as a final state, so that only observations before the event of retirement are used. I therefore do not study possible transitions out of retirement back to the labor force. From the original total of 23,649 male person-waves and 23,984 female person-waves of the 2004, 2006 and 2009 SPS waves, the sample that meets the inclusion criteria consists of 2,913 male person-waves (1,833 individuals) and 1,549 female person-waves (1,023

[6] The SPS is only nationally representative since its second wave, in 2004, when individuals not affiliated with the pensions system were included in the sample. This data is publicly available by the Chilean *Subsecretaria de Prevision Social*.

individuals). Table 1.1 shows the exact number of male and female person-waves in each step of the sample construction. Please note that in the final number of person-waves, each wave actually incorporates two waves, since covariates are observed in wave t but the retirement status is observed in wave t+1.

Retirement is defined as a self-declared transition from employment or unemployment to inactivity. It might or might not be accompanied by claiming of pension benefits. In addition, if a person is formally retired (has claimed pension benefits) but declares herself as currently employed or unemployed instead of inactive, she is not considered retired in this analysis. Therefore, the definition of retirement used here is strongly related to participation in the labor force.

Health measures

I use self-reported objective measures of health to analyze its effect on the retirement decision. Following Van Houtven and Coe (2010), I consider three groups of health conditions. *Acute health conditions* include cancer and stroke; *chronic health conditions* include asthma (or emphysema), diabetes, high blood pressure, heart failure, arthritis (or arthrosis) and kidney disease; and finally *mental health conditions* comprise depression and mental disease. I study the effects on the retirement decision of the number (if any) of health conditions of each type a person has. These health measures come from questions stated as "Have you ever been diagnosed with *(respective health condition)* by a doctor?". The number of acute health conditions varies from 0 to 2; the number of chronic health conditions varies from 0 to 6; and the number of mental health conditions varies from 0 to 2. These exact same health conditions (also coming from the

same questions) are used to measure spousal health in retirement models for married (or partnered) individuals.

Wealth measures

I use a set of variables related to wealth in the retirement models, including individual pension wealth and net income, as well as household private wealth and liquid assets. Pension wealth is measured as the sum of the balance in the worker's mandatory and voluntary (if any) individual accounts. I observe the balance in the worker's mandatory individual account as of December 2009 in the administrative data. In order to calculate this balance for previous years, I assume that individuals were affiliated with the same pension fund manager and invested their retirement savings in the same type of fund in the past as they did in December 2009. I also use the corresponding historical returns for each pension fund manager and type of fund, and eliminate the corresponding manager's fee from the individual account balance. Using these assumptions and data, as well as the contributions to mandatory individual accounts observed in the administrative data throughout the period between 2004 and 2009, I am able to calculate the balance in workers' mandatory individual accounts at the moment of the survey interview (month and year). Whenever the balance is missing from administrative records, I use the self-reported balance available from the SPS. To the balance in the mandatory individual account I add the amount of self-reported voluntary savings for retirement (if any) available from the SPS.[7] The latter includes the balance of two different voluntary savings accounts, namely "*ahorro previsional voluntario*" (or APV) and "*cuenta dos*". These two forms of voluntary savings differ in terms of possibility of funds withdrawal

[7] Voluntary savings accounts balances are not available from the administrative data.

and tax benefits provided. To indicate whether an individual has voluntary savings, I use a binary variable that takes value 1 if the person has some type of voluntary savings. Monthly net income from main occupation is also included in the models. Spousal pension wealth data is not available, but spousal monthly net income is included in the retirement models for married (or partnered) individuals.

Household private wealth includes the monetary value of real estate, vehicles, businesses, agricultural equipment and other types of wealth.[8] Household liquid assets include the total balance on bank accounts, savings accounts, investment funds, credit card debts, consumer debts, educational loans and other similar types of debt. All wealth-related variables enter the retirement models in two different forms. The first specification includes their levels and squares, while the second specification divides individuals into four quartiles of wealth when possible. In the latter case, the lowest quartile is always the omitted category.

Other variables

Previous studies suggest that the retirement decision is made jointly within the household (Blau 1997; Blau 1998; Gustman and Steinmeier 2000; Michaud 2003; Coile 2004a; Coile 2004b; Van Houtven and Coe 2010). Therefore, one important factor affecting a worker's decision to retire might be whether her spouse (or partner) participates in the labor force. Previous literature finds evidence of complementarity of leisure among spouses (Maestas 2001) – when one of the members of the couple retires

[8] Whenever an individual does not report the exact monetary value of real estate asset or debt, she is asked to choose among given intervals for this value. In this case, I use the mean value of the interval for calculation of household private wealth. I use this same method for workers who do not report their exact labor income.

(or does not work), the other decides to retire as well so that they can enjoy leisure time together.

I use different specifications to account for spousal labor force participation in the retirement models. In models for all individuals, I use three binary variables that indicate, respectively, whether the worker is *married and the spouse does not work, is married and the spouse works* or *is not married* (reference category). When studying the behavior of married (or partnered) individuals only, I use a dummy variable that indicates whether the spouse currently works. For married individuals, I also estimate multinomial logit models that allow for four mutually exclusive states: *No member of couple retires; spouse retires; individual retires; both members of couple retire*. The reference state in this case is *No member of couple retires*.

I also control for having a health insurance, with three possible categories: no health insurance (reference category), public health insurance and private health insurance.[9] In Chile, formal dependent workers are required to use 7% of their earnings before taxes for the purchase of a health insurance. Self-employed workers and unemployed individuals may voluntarily purchase a health insurance. Other determinants of retirement used in the analysis are age, education level (high school dropout – reference category, high school degree and college degree), work characteristics (self-employment and union membership), number of children, region of residence, longevity expectation and wave dummies. Models for married (or partnered) individuals also control for the age of the spouse.

[9] In Chile, the public health insurance is known as FONASA (*Fondo Nacional de Salud*) and the private health insurance companies are known as ISAPRES (*Instituciones de Salud Previsional*).

V. Methodology

I estimate reduced-form models of retirement behavior. I first estimate retirement models for all individuals in the sample, focusing on the relative importance of wealth and own health conditions for the retirement decision. I then estimate models for married (or partnered) individuals only, focusing on the effects of own health and wealth measures, as well as spousal health and income, for the retirement decision.

The reduced-form models of retirement behavior have the following form:

$$R_{i,t+1} = \beta_0 + \beta_1 H_{i,t} + \beta_2 W_{i,t} + \beta_3 X_{i,t} + e_{i,t} \quad (1);$$

where R is a binary variable that takes value 1 if the individual is retired (or inactive) in wave t+1; H represents a set of own health count variables in wave t, which includes the number (if any) of acute (cancer and/or stroke), chronic (asthma or emphysema, diabetes, high blood pressure, heart failure, arthritis or arthrosis, and/or kidney disease) and mental (depression and/or mental disease) health conditions; W represents a set of wealth variables in wave t, which includes pension wealth, private household wealth, liquid assets, monthly net income and whether the individual has voluntary savings; and finally X represents demographic variables and other control variables, such as spouse's labor force participation. In models for married (or partnered) individuals, X also includes spousal health conditions (number of acute, chronic and mental health conditions), spousal monthly net income and age of spouse. Therefore, covariates in 2004 predict retirement by 2006, and covariates in 2006 predict retirement by 2009. The use of lagged covariates to predict the retirement decision avoids endogeneity of self-reported health measures due to 'justification bias'.

The first empirical strategy I use is discrete-time hazard models, which are essentially probit models where retirement is an absorbing state (after the event of retirement, individuals are dropped out of the sample). I then estimate Weibull hazard models, including models that use a gamma distribution to account for unobserved heterogeneity. This type of parametric duration model has the advantage of allowing for a non-constant hazard rate over time. Both of these empirical strategies are used to estimate models for all individuals, as well as for married (or partnered) individuals only. One advantage of the use of duration models is that they allow for the use of all available transitions of workers to identify the effects of health conditions and economic variables on the timing of retirement.

For married (or partnered) individuals, duration models take spousal participation in the labor force as exogenous. Since previous literature suggests that couples might coordinate retirement in order to enjoy leisure time together, the next estimation strategy uses multinomial logit models to represent retirement as a decision made within the household. The dependent variable in these models takes four possible states: *No member of couple retires; individual retires; spouse retires; both members of couple retire*. The state of reference is *No member of couple retires.*

I finally use fixed effects in linear probability models, which account for (time-invariant) unobserved heterogeneity. This type of models accounts for unobserved "taste for work", for instance, which might bias the coefficients obtained in previous models. As long as "taste for work" is time-invariant, these models should provide unbiased effects of health and wealth variables on retirement. Identification in fixed effects models

comes from within changes: how changes in determinants of retirement between 2004 and 2006 affect retirement behavior between 2006 and 2009.

VI. Results

Descriptive statistics

Table 1.2 shows descriptive statistics by gender for the whole sample of interest (person-waves). Over a two to three-year period, a typical man over 48 years of age has a 10% probability of exiting the labor force, while for a typical woman over 48 this probability is 19%. On average, men are wealthier than women in terms of pension wealth, as well as household net worth. Overall, the percentage of individuals saving voluntarily for retirement is quite small and individuals hold negative liquid assets (or debts).

Table 1.2 also shows that, in general, women present poorer health than men. Women have been diagnosed with more acute, chronic and mental health conditions than men. The average number of acute conditions, which include cancer and stroke (minimum of 0 and maximum of 2), is 0.02 for men and 0.05 for women. While women present more cases of cancer, men present more cases of stroke. Stroke is actually the only health condition studied with a higher incidence on men. With respect to chronic health conditions (asthma or emphysema, diabetes, high blood pressure, heart failure, arthritis or arthrosis, and/or kidney disease), the average number of conditions is 0.59 for men and 0.83 for women. The range for this variable goes from 0 to 6. Women generally show a higher probability of being diagnosed with all kinds of chronic conditions than men, especially high blood pressure and arthritis/arthrosis. In the case of mental health

conditions (depression and/or mental disease), the average number of conditions is 0.05 for men and 0.23 for women, out of a maximum of 2. Females are also much more likely to develop depression than males.

It is important to mention that these gender differences might be due to women visiting more doctors than men. Questions in the Social Protection Survey ask whether individuals have been diagnosed with a certain disease. If women are more likely to consult with a doctor than men, it is possible that they will be more likely to be diagnosed with a disease than men.

Females are also around 1.4 years younger than men, more likely to hold a college degree and more likely not to have a spouse/partner. Figure 1.1 shows the actual retirement age of males and females in the sample. Women tend to retire earlier than men, and their distribution of retirement age is actually bimodal, with peaks at around 52 and 60 years old. For men, peak retirement ages happen at 60 and 66 years old.

Discrete-time hazard models (Probit)

Table 1.3 shows results from discrete-time hazard models separately for males and females. The specifications in columns (1) for males and (3) for females include the level and squared terms of all wealth variables, while in columns (2) for males and (4) for females, levels and squared terms are replaced by quartiles for pension wealth, income and private household wealth.[10] Average marginal effects are shown.

These models show that the presence of one (more) chronic health condition is associated with an increase in the likelihood of retirement by 1.4 to 1.6 percentage points

[10] Quartiles for liquid assets are not used due to clustering of individuals around some values of this variable.

for men. Acute and mental health conditions do not seem to significantly affect the retirement of men in these models. For women, both acute and chronic health conditions increase the likelihood of retirement by 8.1 and 2.6 percentage points respectively, according to column (4). These effects are substantial since they represent, respectively, an increase in the likelihood of retirement of 43% and 14% for women. Similarly to the case of men, the retirement of women does not seem to be affected by mental health conditions.

Contrary to expectations, the models suggest that pension wealth affects the retirement decision negatively. Men in the higher pension wealth quartile are 4.2 percentage points less likely to retire than men in the lowest pension quartile, while the equivalent for women corresponds to 10.6 percentage points. Having saved voluntarily for retirement does not seem to affect significantly the retirement decision. Increases in monthly net income decrease the likelihood of retirement for both men and women, but only for men the effect is statistically significant. Column (1) shows a 7.6 percentage points decrease in the probability of retirement for men due to a CLP1 million increase in earnings from main occupation. Column (2) shows that a man in the highest quartile of earnings is 6.3 percentage points less likely to retire than a man in the lowest quartile. Results for net worth tend to vary depending on the specification used, but generally indicate that it does not affect the retirement decision significantly. Liquid assets affect negatively and significantly the retirement decision of women, but the magnitude of this effect is quite small.

Effects of spouse's labor force status differ for males and females. While for males having a spouse/partner that works significantly decreases the likelihood of

retirement by 4.3 percentage points when compared to not partnered males, for females having a spouse that works is associated with a 7.9 percentage points increase in the likelihood of retirement. Other variables that significantly affect the probability of retirement are age and being unemployed in the previous wave (the latter has a large statistically significant effect for women, but its effect for men depends on the model used).

Weibull hazard models

Tables 1.4 and 1.5 show the results from Weibull hazard models for males and females, respectively. In both tables, columns (1) and (2) show the same specifications with respect to some of the wealth variables as before. Columns (3) and (4) show models with these same specifications, but that take into account unobserved heterogeneity using a gamma distribution. Hazard ratios are shown. Hazard ratios above one indicate a positive effect on the hazard of retirement, while hazard ratios below one indicate a negative effect.

Results from Weibull hazard models for males are quite similar to the ones obtained from discrete-time hazard models, except for the fact that using Weibull models I do not find significant effects of health conditions on time elapsed until retirement for men. These models also suggest a negative effect of pension wealth and income on the retirement hazard. Moreover, these models suggest, as before, that males who have a spouse that works are significantly less likely to retire.

Results for females are also very similar to the ones obtained in the discrete-time hazard models. As before, both acute and chronic health conditions increase the

likelihood of retirement for women. Also as before, the likelihood of retirement decreases with pension wealth. However, other economic variables do not significantly influence time elapsed until retirement for females. Having a partner that works increases the likelihood of retirement for females by 51.4% or 9.8 percentage points.

The shape parameter is greater than one in models for males and females, which suggests that the hazard function is monotonically increasing. Also, the gamma variance is statistically different from zero in models for males, but not for females. This suggests that there is unobserved heterogeneity that is not correlated with the variables of interest in these models for males, but the same is not true for models for females. Therefore, we should care about columns (3) and (4) in Table 1.4 for males, and (1) and (2) in Table 1.5 for females.[11]

Married (or partnered) individuals

Next, I estimate the same hazard models as before for the group of married individuals. This allows for an evaluation of the effects of spousal health conditions and spousal income on one's retirement.

Table 1.6 shows descriptive statistics for married individuals. Married (or partnered) men are less likely to retire than their single counterparts, while married women are more likely to retire than their not partnered counterparts. This table also shows the average values of spousal income, number of spousal health conditions and spousal age. Figure 1.2 shows the distribution of retirement ages among married men and women, which is very similar to the case for all individuals. The peaks also happen at the same retirement ages as in Figure 1.1.

[11] Estimates from semi-parametric Cox proportional hazard models deliver very similar results.

Results from discrete-time hazard models for married individuals, shown in Table 1.7, are very similar to the ones found for all individuals. However, the positive effect of acute health conditions on retirement no longer holds for married women. The magnitude of the effect of the number of chronic health conditions on retirement is higher for married women than for all women. Spousal income does not seem to affect the retirement of either males or females. Spousal acute and chronic health conditions also do not seem to affect the likelihood of retirement for married individuals. Spousal mental health conditions, however, significantly affect the retirement of both males and females. For males, having a wife with a mental health condition decreases the likelihood of retirement by 5.1 percentage points, while for females, having a husband with a mental health condition decreases the likelihood of retirement by 14.1 percentage points. This negative effect on the likelihood of retirement might suggest the existence of an added worker effect (AWE), where the individual needs to keep working or even increase hours of work to compensate for the possible decrease in labor supply of the affected spouse.

The Weibull hazard models for males, shown in Table 1.8, confirm the importance of economic variables for the retirement of men. Moreover, the negative effect of a spousal mental health condition is confirmed. Men with wives that have depression and/or another mental health disease are approximately 63% less likely to retire (5.7 percentage points decrease in likelihood of retirement). Results for the gamma variance are different depending on the model used for estimation. For married females (results shown in Table 1.9), the effect of the number of chronic health conditions on retirement is still positive, but its statistical significance depends on the specification used. With respect to own economic variables, results are consistent with what has been

found in discrete-time hazard models. Once again, a husband's mental health condition significantly affects the retirement decision of women. Considering models that account for unobserved heterogeneity (since the gamma variance is significantly different from zero), a husband's mental health condition decreases the risk of retirement of married women by around 92%. This result shows a higher AWE for women than what was found for men.

Multinomial logit models

Considering that the retirement decision is likely a decision that husbands and wives make jointly, I estimate multinomial logit models that consider four possible states: no one retires, spouse retires, individual retires and both husband and wife retire. For spouses, the Chilean Social Protection Survey only contains information about current work status, with no information about inactivity. Therefore, a spouse is considered retired if she transitions from working to not working. For estimation of these models, the sample is restricted to married individuals whose spouses are working in the first wave they appear in the sample. Table 1.10 presents results for married men (husbands), while Table 1.11 presents results for married women (wives). Odds ratios are shown.

Table 1.10 shows that for married men, a new acute health event significantly decreases the likelihood of retirement. Chronic health conditions positively affect the retirement of the husband (but this effect is not statistically significant), but decrease the likelihood of retirement for the wife. Interestingly, income seems to be the most important variable for the retirement of both members of the couple. The higher the income of each member of the couple is, the smaller the likelihood of both members

retiring. With respect to spousal health conditions, these models suggest that a new spousal acute health condition significantly decreases the likelihood of the husband to retire. Moreover, a spousal mental condition increases the likelihood of the wife's retirement. The latter effect supports the AWE founded earlier. It suggests that when there is a new mental health condition, the individual suffering it is more likely to retire and the spouse to keep working in order to compensate for the loss of income inside the household.

Results for wives are shown in Table 1.11. A new wife's acute health condition significantly decreases the likelihood of both members of the couple retiring, while a new chronic health condition increases the likelihood of retirement of both husband and wife by approximately 52%. Moreover, a new mental health condition decreases the probability of the wife's own retirement by 50%. The husband's income has a large effect on the retirement of the wife. The higher the earnings of the husband, the less likely he is to retire, while the wife is much more likely to retire. The wife is much less likely to retire if her husband has a new acute health condition. Women are also 73% less likely to retire if their spouse presents a new mental health condition.

Fixed effects models

The models presented so far do not account for the possibility of omitted variables that might be correlated with the main variables of interest, such as "taste for work". In order to account for this type of unobserved heterogeneity, I estimate fixed effects models for all individuals, as well as for married individuals only.

Table 1.12 shows descriptive statistics by gender and wave for individuals for which fixed effects models are estimated. While 12% of men retired by 2009, 19% of women did it. On average, there was growth between 2004 and 2006 for most of the wealth variables, except for net worth and liquid assets for men. With respect to health variables, there was an increase in the number of chronic conditions for both men and women. The number of other health conditions also increased for both men and women in this period, except for acute health conditions for men.

Table 1.13 shows the results from fixed effects models for all individuals, separately for men and women. It shows a negative effect of a new acute health condition for both males and females, which amounts to 17.7 percentage points for both groups, as shown by columns (2) and (4). This result differs from results of previously estimated hazard models, which suggest no statistically significant effect for men of a new acute health condition and a positive and statistically significant effect for women. These models also suggest that a new chronic health condition significantly increases the likelihood of retirement for males, by 8.4 percentage points. With respect to wealth variables, results tend to differ depending on the specification used. Women in the third highest pension wealth quartile are 23.1 percentage points more likely to retire than women in the lowest quartile of pension wealth. With respect to income, women in the second highest quartile of monthly net income are 12.6 percentage points more likely to retire than women in the lowest quartile. Moreover, men in the second highest and in the highest quartile of net worth are, respectively, 5.8 and 8.6 percentage points more likely to retire than men in the lowest quartile. The effect of having voluntary savings is negative and stable across models. For men that have saved voluntarily for retirement, the

likelihood of retirement is 7.4 percentage points smaller than for men that have not. For women, the effect goes in the same direction and amounts to 15 percentage points.

Table 1.14 shows descriptive statistics by gender and wave for married individuals, for which the results of fixed effects models are shown on Table 1.15. For men, new acute health conditions still decrease the likelihood of retirement, but this result is no longer valid for women. As in the previous case, a new chronic health condition increases the likelihood of retirement for men. Married men in the second lowest quartile of pension wealth are 13.3 percentage points more likely to retire than men in the lowest quartile. These models confirm the negative effect of income on retirement. Men in the highest quartile of income are 7.4 percentage points less likely to retire than men in the lowest quartile, while women in the highest quartile are 22.3 percentage points less likely to retire than women in the lowest quartile. Furthermore, men in the highest quartile of net worth are 11 percentage points more likely to retire than men in the lowest quartile.

With respect to spousal health shocks, these models reveal that new spousal chronic conditions increase the likelihood of retirement, even more so for women (3.5 percentage points for men and 10.7 percentage points for women). However, a spousal new mental health condition significantly decreases the likelihood of retirement for both men and women, and once again, with a higher effect for women (6.5 percentage points for men and 18.3 percentage points for women). Spousal new acute health conditions do not seem to significantly affect the retirement decision.

VII. Conclusion

This chapter explores the relative importance of health and wealth variables for the retirement decision in the context of individual account pension systems. It also studies the effects of spousal income and spousal health conditions on the decision to retire in this context. For this, I use data from the Chilean Social Protection Survey (2004, 2006 and 2009 waves) linked to administrative data. Chile was the first country to replace a pay-as-you-go pension system by an individual account scheme, making it an interesting case to study the retirement decision.

The health conditions studied include acute conditions (cancer and/or stroke), chronic conditions (asthma or emphysema, diabetes, high blood pressure, heart failure, arthritis or arthrosis, and/or kidney disease) and mental conditions (depression and/or mental disease). Wealth variables include pension wealth, monthly net income, private household wealth, liquid assets and having voluntary savings for retirement. I use several econometric techniques, including discrete-time hazard models, Weibull hazard models, multinomial logit models and fixed effects models.

Results show that, contrary to recent findings for the US, health conditions seem to be more important for the retirement decision than wealth factors in individual account pension systems. Fixed effects models, which account for unobserved heterogeneity which might be correlated with the main variables of interest, show that new acute health conditions decrease the risk of retirement for men and women, a result most likely associated to the expensive cost of treatment of acute health events. New chronic health conditions tend to increase the likelihood of retirement for men, but do not significantly affect the retirement decision of women. Pension wealth had the surprising effect of

delaying retirement in hazard models, but its effect is mostly not statistically significant for men and women in fixed effects models, suggesting that pension wealth might be correlated with omitted variables that hazard functions do not account for. Voluntary retirement savings have the unexpected effect of decreasing the likelihood of retirement for men and women, while increases in net worth tend to increase retirement likelihood for men. Furthermore, contrary to results obtained for the US, Chilean workers do not show evidence of complementarity of leisure for retirement, since being married generally decreases the retirement hazard of males and having a husband that works significantly increases the retirement hazard of women.

Hazard models for married (or partnered) individuals show an important effect of spousal mental health conditions on one's retirement, but this effect is not confirmed by fixed effects models. Multinomial logit models also suggest that spousal income is important for a couple's retirement decision, but this effect is not confirmed by other models.

Overall, health factors seem to be the most important determinant of retirement in Chile, a result contrary to similar models estimated for the US. This is likely due to the fact that individual account pension systems are age neutral and do not provide real economic incentives for retirement. Results suggest that preventive health care might be particularly effective in keeping older workers actively participating in the labor force in the context of individual account pension systems.

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Table 1.1. Sample attrition by male and female person-waves

	Men	Women
Initial sample of person-waves (2004-2009)	23,649	23,984
Older than 48	10,936	11,059
Interviewed in at least two waves	9,888	10,077
Not retired in first wave	7,000	4,050
Affiliated with individual account pension system	4,842	2,699
Observations before retirement	2,913	1,549
Number of individuals	1,833	1,023

Figure 1.1. Age at retirement by gender

Table 1.2. Descriptive statistics by gender (person-waves)

	Male		Female	
	Mean	**St. Dev.**	**Mean**	**St. Dev.**
Retired	0.10	0.30	0.19	0.39
Wealth variables (millions of Chilean pesos)				
Pension wealth	12.74	23.72	8.46	17.38
Monthly net income	0.28	0.50	0.21	0.24
Net worth	24.05	225.97	23.17	141.58
Liquid assets	-0.37	10.93	-0.69	5.03
Has voluntary savings	0.16	0.37	0.15	0.36
Health variables				
Acute health conditions				
Number of acute health conditions (0-2)	0.02	0.12	0.05	0.21
Has been diagnosed with cancer	0.01	0.10	0.04	0.20
Has been diagnosed with stroke	0.01	0.08	0.004	0.06
Chronic health conditions				
Number of chronic health conditions (0-6)	0.59	0.85	0.83	0.99
Has been diagnosed with asthma	0.04	0.20	0.06	0.24
Has been diagnosed with diabetes	0.09	0.29	0.10	0.30
Has been diagnosed with high blood pressure	0.27	0.45	0.35	0.48
Has been diagnosed with heart disease	0.08	0.27	0.10	0.30
Has been diagnosed with arthritis	0.06	0.24	0.19	0.39
Has been diagnosed with kidney disease	0.04	0.19	0.04	0.21
Mental health conditions				
Number of mental health conditions (0-2)	0.05	0.23	0.24	0.43
Has been diagnosed with depression	0.05	0.21	0.23	0.42
Has been diagnosed with mental disease	0.005	0.07	0.01	0.08
Demographics				
Age	55.49	6.18	54.11	5.15
High school dropout	0.54	0.50	0.44	0.50
High school degree	0.31	0.46	0.32	0.47
College degree	0.14	0.35	0.24	0.43
Does not have spouse/partner	0.13	0.33	0.43	0.50
Spouse/partner works	0.25	0.43	0.38	0.49
Spouse/partner does not work	0.62	0.49	0.17	0.37
Number of children	3.12	1.90	2.65	1.85
Expected longevity	77.57	8.68	76.50	8.16
Employment				
Unemployed	0.10	0.31	0.14	0.35
Self-employed	0.30	0.46	0.18	0.38
Union	0.17	0.38	0.19	0.40
Contributes to pension system	0.67	0.47	0.67	0.47
Health insurance				

None	0.07	0.26	0.03	0.18
Public	0.76	0.43	0.78	0.41
Private	0.16	0.37	0.18	0.38
Region of residence				
Region I	0.02	0.14	0.03	0.16
Region II	0.02	0.15	0.03	0.16
Region III	0.02	0.12	0.01	0.12
Region IV	0.04	0.21	0.05	0.21
Region V	0.11	0.31	0.11	0.31
Region VI	0.06	0.23	0.06	0.24
Region VII	0.07	0.26	0.07	0.26
Region VIII	0.14	0.34	0.10	0.30
Region IX	0.05	0.22	0.05	0.22
Region X	0.08	0.27	0.07	0.25
Region XI	0.01	0.07	0.01	0.09
Region XII	0.01	0.08	0.01	0.09
Metropolitan Region	0.38	0.49	0.41	0.49
Number of observations	2,913	2,913	1,549	1,549

Table 1.3. Discrete-time hazard models (Probit)

	Males		Females	
	(1)	(2)	(3)	(4)
Number of acute conditions	0.027	0.030	0.078*	0.081*
	(0.037)	(0.037)	(0.046)	(0.045)
Number of chronic conditions	0.016***	0.014***	0.028***	0.026***
	(0.006)	(0.005)	(0.009)	(0.009)
Number of mental conditions	-0.002	3.57e-05	-0.004	-0.001
	(0.018)	(0.017)	(0.022)	(0.022)
Pension wealth	0.0001		-0.003**	
	(0.0004)		(0.002)	
Pension wealth squared	2.32e-07		7.00e-06**	
	(8.00e-07)		(3.53e-06)	
Pension wealth quartile 2		-0.015		-0.042*
		(0.013)		(0.023)
Pension wealth quartile 3		-0.033***		-0.089***
		(0.013)		(0.024)
Pension wealth quartile 4		-0.042***		-0.106***
		(0.014)		(0.027)
Has voluntary savings	0.017	0.020	-0.027	-0.021
	(0.017)	(0.017)	(0.029)	(0.029)
Income	-0.076**		-0.081	
	(0.032)		(0.130)	
Income squared	0.012**		0.068	
	(0.005)		(0.085)	
Income quartile 2		-0.065***		0.014
		(0.014)		(0.030)
Income quartile 3		-0.064***		-0.021
		(0.015)		(0.033)
Income quartile 4		-0.063***		-0.018
		(0.017)		(0.039)
Net worth	0.001**		0.001	
	(0.000)		(0.001)	
Net worth squared	-2.52e-06***		-6.08e-06*	
	(9.07e-07)		(3.50e-06)	
Net worth quartile 2		-0.024		0.021
		(0.015)		(0.029)
Net worth quartile 3		-0.001		0.039
		(0.016)		(0.030)
Net worth quartile 4		0.007		-0.013
		(0.017)		(0.029)
Liquid assets	-0.001	-0.001	-0.008	-0.008*
	(0.002)	(0.002)	(0.005)	(0.005)
Liquid assets squared	-6.51e-05	-9.27e-05	-0.001	-0.001*
	(4.81e-05)	(7.81e-05)	(0.000)	(0.000)
Spouse/partner works	-0.050***	-0.043***	0.083***	0.079***
	(0.013)	(0.014)	(0.022)	(0.022)
Spouse/partner does not work	-0.019	-0.013	0.037	0.039
	(0.014)	(0.014)	(0.029)	(0.029)

Age	0.011***	0.010***	0.011***	0.011***
	(0.001)	(0.001)	(0.002)	(0.002)
High school degree	-0.015	-0.014	0.043*	0.056**
	(0.012)	(0.012)	(0.023)	(0.023)
College degree	-0.036**	-0.037**	-0.039	-0.025
	(0.016)	(0.015)	(0.029)	(0.031)
Number of children	-0.001	-0.001	0.005	0.004
	(0.002)	(0.002)	(0.005)	(0.005)
Expected longevity	-0.001	-0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Unemployed	0.070***	0.017	0.222***	0.235***
	(0.024)	(0.022)	(0.047)	(0.049)
Self-employed	0.021	0.010	0.056*	0.054*
	(0.014)	(0.013)	(0.030)	(0.030)
Union member	0.008	0.012	-0.020	-0.015
	(0.016)	(0.016)	(0.028)	(0.027)
Contributes to pension system	-0.046***	-0.027*	-0.050*	-0.041
	(0.014)	(0.014)	(0.027)	(0.028)
Public health insurance	0.027	0.028	-0.005	0.002
	(0.019)	(0.018)	(0.048)	(0.047)
Private health insurance	0.055*	0.047	0.016	0.030
	(0.033)	(0.031)	(0.060)	(0.061)
Wave 2006	0.012	0.017*	0.022	0.026
	(0.010)	(0.010)	(0.018)	(0.018)
Observations	2,911	2,911	1,547	1,547
Pseudo R-squared	0.255	0.268	0.182	0.190
Log Likelihood	-704.7	-692.3	-612.9	-607.3

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients on regions of residence and missing variables dummies are not shown.

Table 1.4. Weibull hazard models for males (Hazard ratios)

	No heterogeneity		Gamma heterogeneity	
	(1)	(2)	(3)	(4)
Number of acute conditions	1.758	1.805	1.868	2.032
	(0.805)	(0.859)	(0.816)	(0.939)
Number of chronic conditions	1.049	1.026	1.105	1.080
	(0.073)	(0.069)	(0.078)	(0.077)
Number of mental conditions	0.879	0.825	0.851	0.800
	(0.192)	(0.188)	(0.204)	(0.203)
Pension wealth	0.996		0.996	
	(0.006)		(0.005)	
Pension wealth squared	1.000		1.000	
	(0.000)		(0.000)	
Pension wealth quartile 2		0.883		0.814
		(0.171)		(0.172)
Pension wealth quartile 3		0.716*		0.648**
		(0.142)		(0.136)
Pension wealth quartile 4		0.443***		0.423***
		(0.111)		(0.109)
Has voluntary savings	0.911	0.952	0.960	1.031
	(0.182)	(0.195)	(0.195)	(0.219)
Income	0.349**		0.335**	
	(0.151)		(0.159)	
Income squared	1.194***		1.200***	
	(0.071)		(0.083)	
Income quartile 2		0.428***		0.390***
		(0.098)		(0.097)
Income quartile 3		0.353***		0.310***
		(0.080)		(0.081)
Income quartile 4		0.394***		0.352***
		(0.106)		(0.105)
Net worth	1.010**		1.012***	
	(0.004)		(0.004)	
Net worth squared	1.000***		1.000***	
	(0.000)		(0.000)	
Net worth quartile 2		0.665**		0.646**
		(0.124)		(0.140)
Net worth quartile 3		1.014		1.017
		(0.202)		(0.230)
Net worth quartile 4		1.072		1.188
		(0.216)		(0.271)
Liquid assets	0.988	0.979	0.990	0.982
	(0.033)	(0.033)	(0.036)	(0.036)
Liquid assets squared	0.999	0.999	0.999	0.998
	(0.001)	(0.001)	(0.002)	(0.002)
Spouse/partner works	0.545***	0.575**	0.499***	0.513**
	(0.116)	(0.126)	(0.125)	(0.134)
Spouse/partner does not work	0.916	0.939	0.892	0.916
	(0.145)	(0.154)	(0.158)	(0.171)

Age	1.125***	1.113***	1.136***	1.127***
	(0.011)	(0.012)	(0.014)	(0.015)
High school degree	0.693**	0.749*	0.695**	0.733*
	(0.111)	(0.121)	(0.123)	(0.135)
College degree	0.518**	0.506**	0.515**	0.504**
	(0.146)	(0.138)	(0.151)	(0.149)
Number of children	0.952	0.955	0.966	0.968
	(0.030)	(0.030)	(0.031)	(0.032)
Expected longevity	0.986*	0.988*	0.986*	0.987
	(0.008)	(0.007)	(0.008)	(0.008)
Unemployed	1.923***	1.177	2.022***	1.167
	(0.378)	(0.283)	(0.444)	(0.310)
Self-employed	1.134	0.945	1.175	0.998
	(0.177)	(0.155)	(0.202)	(0.181)
Union member	1.051	1.152	1.011	1.102
	(0.197)	(0.221)	(0.224)	(0.255)
Contributes to pension system	0.587***	0.738*	0.561***	0.697**
	(0.087)	(0.119)	(0.095)	(0.125)
Public health insurance	1.177	1.069	1.143	1.046
	(0.372)	(0.337)	(0.371)	(0.345)
Private health insurance	1.762	1.467	1.680	1.366
	(0.637)	(0.544)	(0.685)	(0.570)
Constant	0.0001***	0.0004***	5.32e-05***	0.0002***
	(8.09e-05)	(0.0004)	(4.70e-05)	(0.0002)
Shape parameter rho	3.229	3.279	3.374	3.515
	(0.156)	(0.154)	(0.200)	(0.222)
Gamma variance			0.327	0.470
			(0.215)	(0.264)
Observations	2,913	2,913	2,913	2,913
Log Likelihood	-530.5	-514.6	-529.2	-512.6
Number of groups			1,833	1,833

Robust seeform in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients on regions of residence and missing variables dummies are not shown.

Table 1.5. Weibull hazard models for females (Hazard ratios)

	No heterogeneity		Gamma heterogeneity	
	(1)	(2)	(3)	(4)
Number of acute conditions	1.693**	1.615*	1.693**	1.690*
	(0.408)	(0.410)	(0.427)	(0.525)
Number of chronic conditions	1.132**	1.103*	1.132**	1.136*
	(0.059)	(0.060)	(0.060)	(0.083)
Number of mental conditions	0.857	0.882	0.857	0.880
	(0.129)	(0.134)	(0.124)	(0.150)
Pension wealth	0.964***		0.964***	
	(0.013)		(0.011)	
Pension wealth squared	1.000***		1.000**	
	(0.000)		(0.000)	
Pension wealth quartile 2		0.669**		0.571**
		(0.111)		(0.136)
Pension wealth quartile 3		0.448***		0.356***
		(0.099)		(0.122)
Pension wealth quartile 4		0.343***		0.273***
		(0.098)		(0.106)
Has voluntary savings	0.774	0.825	0.774	0.810
	(0.179)	(0.191)	(0.175)	(0.205)
Income	0.442		0.442	
	(0.456)		(0.484)	
Income squared	1.922		1.922	
	(1.298)		(1.644)	
Income quartile 2		1.081		1.050
		(0.217)		(0.249)
Income quartile 3		0.782		0.761
		(0.196)		(0.218)
Income quartile 4		0.868		0.786
		(0.251)		(0.280)
Net worth	1.006		1.006	
	(0.006)		(0.006)	
Net worth squared	1.000		1.000	
	(0.000)		(0.000)	
Net worth quartile 2		1.136		1.212
		(0.211)		(0.281)
Net worth quartile 3		1.262		1.349
		(0.234)		(0.319)
Net worth quartile 4		0.968		1.004
		(0.211)		(0.258)
Liquid assets	0.974	0.965	0.974	0.956
	(0.036)	(0.044)	(0.046)	(0.057)
Liquid assets squared	0.997	0.996	0.997	0.996
	(0.003)	(0.003)	(0.004)	(0.005)
Spouse/partner works	1.547***	1.514***	1.547***	1.758**
	(0.216)	(0.212)	(0.222)	(0.389)
Spouse/partner does not work	1.227	1.226	1.227	1.394
	(0.225)	(0.225)	(0.214)	(0.337)

Age	1.063***	1.057***	1.063***	1.074***
	(0.012)	(0.013)	(0.012)	(0.023)
High school degree	1.305*	1.458**	1.305*	1.505**
	(0.189)	(0.224)	(0.187)	(0.262)
College degree	0.797	0.855	0.797	0.834
	(0.201)	(0.226)	(0.204)	(0.248)
Number of children	1.036	1.030	1.036	1.029
	(0.033)	(0.034)	(0.033)	(0.040)
Expected longevity	0.999	0.998	0.999	1.000
	(0.008)	(0.008)	(0.007)	(0.009)
Unemployed	2.198***	2.400***	2.198***	2.899***
	(0.492)	(0.551)	(0.484)	(0.905)
Self-employed	1.418*	1.417*	1.418*	1.456*
	(0.254)	(0.262)	(0.254)	(0.312)
Union member	0.852	0.853	0.852	0.828
	(0.194)	(0.195)	(0.199)	(0.216)
Contributes to pension system	0.729*	0.788	0.729*	0.752
	(0.126)	(0.143)	(0.127)	(0.160)
Public health insurance	1.220	1.241	1.220	1.310
	(0.344)	(0.346)	(0.346)	(0.452)
Private health insurance	1.761	1.701	1.761	2.001
	(0.675)	(0.667)	(0.680)	(0.972)
Constant	0.001***	0.002***	0.001***	0.001***
	(0.001)	(0.002)	(0.001)	(0.001)
Shape parameter rho	3.203	3.228	3.203	3.537
	(0.150)	(0.150)	(0.170)	(0.396)
Gamma variance			0.000001	0.641
			(0.001)	(0.675)
Observations	1,549	1,549	1,549	1,549
Log Likelihood	-453.0	-447.4	-453.0	-447.1
Number of groups			1,023	1,023

Robust seeform in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients on regions of residence and missing variables dummies are not shown.

Table 1.6. Descriptive statistics by gender for married individuals (person-waves)

	Male		Female	
	Mean	**St. Dev.**	**Mean**	**St. Dev.**
Retired	0.09	0.29	0.21	0.41
Wealth variables (millions of Chilean pesos)				
Pension wealth	13.15	24.13	9.48	21.22
Monthly net income	0.29	0.52	0.22	0.25
Net worth	19.50	48.60	28.44	188.11
Liquid assets	-0.28	11.04	-0.63	3.56
Has voluntary savings	0.17	0.37	0.14	0.34
Spousal income	0.06	0.26	0.20	0.28
Health variables				
Acute health conditions				
Number of acute health conditions (0-2)	0.02	0.12	0.05	0.21
Has been diagnosed with cancer	0.01	0.10	0.04	0.19
Has been diagnosed with stroke	0.01	0.08	0.01	0.08
Spousal number of acute health conditions (0-2)	0.02	0.14	0.02	0.15
Chronic health conditions				
Number of chronic health conditions (0-6)	0.59	0.86	0.84	1.01
Has been diagnosed with asthma	0.04	0.20	0.06	0.23
Has been diagnosed with diabetes	0.10	0.30	0.10	0.30
Has been diagnosed with high blood pressure	0.27	0.44	0.35	0.48
Has been diagnosed with heart disease	0.08	0.27	0.10	0.30
Has been diagnosed with arthritis	0.06	0.24	0.19	0.39
Has been diagnosed with kidney disease	0.04	0.19	0.04	0.20
Spousal number of chronic health conditions (0-6)	0.57	0.86	0.43	0.71
Mental health conditions				
Number of mental health conditions (0-2)	0.04	0.21	0.23	0.42
Has been diagnosed with depression	0.04	0.20	0.23	0.42
Has been diagnosed with mental disease	0.00	0.04	0.00	0.03
Spousal number of mental health conditions (0-2)	0.10	0.30	0.05	0.22
Demographics				
Age	55.43	6.09	53.55	4.82
Spousal age	51.78	7.92	56.14	7.73
High school dropout	0.53	0.50	0.42	0.49
High school degree	0.32	0.47	0.32	0.47
College degree	0.15	0.35	0.25	0.43
Spouse/partner Works	0.29	0.45	0.70	0.46
Number of children	3.27	1.78	2.91	1.77
Expected longevity	77.6	8.62	76.45	8.12
Employment				
Unemployed	0.10	0.29	0.16	0.36

Self-employed	0.29	0.46	0.18	0.38
Union	0.17	0.38	0.19	0.39
Contributes to pension system	0.69	0.46	0.66	0.47
Health insurance				
None	0.07	0.25	0.03	0.18
Public	0.76	0.43	0.78	0.42
Private	0.17	0.38	0.19	0.39
Region of residence				
Region I	0.02	0.14	0.02	0.15
Region II	0.02	0.15	0.02	0.15
Region III	0.01	0.12	0.01	0.10
Region IV	0.04	0.20	0.04	0.21
Region V	0.10	0.31	0.13	0.34
Region VI	0.06	0.23	0.06	0.24
Region VII	0.07	0.26	0.07	0.26
Region VIII	0.14	0.34	0.11	0.31
Region IX	0.05	0.22	0.05	0.22
Region X	0.08	0.27	0.06	0.24
Region XI	0.00	0.06	0.01	0.10
Region XII	0.01	0.08	0.01	0.08
Metropolitan Region	0.39	0.49	0.40	0.49
Number of observations	2,498	2,498	857	857

Figure 1.2. Age at retirement of married individuals, by gender

Table 1.7. Discrete-time hazard models for married individuals (Probit)

	Males		Females	
	(1)	(2)	(3)	(4)
Number of acute conditions	0.026	0.029	0.073	0.086
	(0.040)	(0.040)	(0.058)	(0.058)
Number of chronic conditions	0.016***	0.014***	0.032**	0.029**
	(0.006)	(0.006)	(0.014)	(0.014)
Number of mental conditions	-0.022	-0.019	-0.029	-0.030
	(0.021)	(0.021)	(0.034)	(0.033)
Pension wealth	0.0002		-0.003	
	(0.0004)		(0.002)	
Pension wealth squared	6.87e-08		6.05e-06	
	(7.88e-07)		(4.98e-06)	
Pension wealth quartile 2		-0.013		-0.090***
		(0.014)		(0.033)
Pension wealth quartile 3		-0.031**		-0.123***
		(0.013)		(0.032)
Pension wealth quartile 4		-0.041***		-0.149***
		(0.015)		(0.037)
Has voluntary savings	0.020	0.024	-0.001	0.012
	(0.017)	(0.017)	(0.046)	(0.046)
Income	-0.102***		-0.176	
	(0.034)		(0.200)	
Income squared	0.016***		0.195	
	(0.005)		(0.138)	
Income quartile 2		-0.054***		0.003
		(0.015)		(0.041)
Income quartile 3		-0.064***		-0.031
		(0.015)		(0.043)
Income quartile 4		-0.053***		-0.038
		(0.017)		(0.056)
Net worth	0.001***		0.0004	
	(0.000)		(0.001)	
Net worth squared	-3.32e-06***		-3.48e-06	
	(8.75e-07)		(4.93e-06)	
Net worth quartile 2		-0.003		0.016
		(0.018)		(0.042)
Net worth quartile 3		0.013		-0.013
		(0.019)		(0.040)
Net worth quartile 4		0.031		-0.031
		(0.020)		(0.043)
Liquid assets	-0.002	-0.003	-0.018	-0.015
	(0.002)	(0.002)	(0.011)	(0.009)
Liquid assets squared	-0.0002	-0.0002	-0.001	-0.001
	(0.0001)	(0.0001)	(0.001)	(0.001)
Age	0.011***	0.010***	0.015***	0.013***
	(0.001)	(0.001)	(0.003)	(0.003)
High school degree	-0.010	-0.010	0.050	0.066**
	(0.012)	(0.012)	(0.032)	(0.032)

College degree	-0.022	-0.029*	-0.032	-0.0003
	(0.018)	(0.016)	(0.046)	(0.050)
Number of children	-0.0001	-0.001	0.006	0.003
	(0.003)	(0.003)	(0.008)	(0.008)
Expected longevity	-0.001	-0.001	0.001	0.001
	(0.001)	(0.001)	(0.002)	(0.002)
Unemployed	0.056**	0.019	0.166**	0.169***
	(0.025)	(0.024)	(0.066)	(0.063)
Self-employed	0.020	0.009	0.044	0.031
	(0.014)	(0.014)	(0.044)	(0.043)
Union member	-0.002	0.006	-0.029	-0.022
	(0.015)	(0.015)	(0.039)	(0.038)
Contributes to pension system	-0.030**	-0.012	-0.066	-0.053
	(0.014)	(0.014)	(0.042)	(0.041)
Public health insurance	0.023	0.023	0.077	0.078
	(0.023)	(0.022)	(0.064)	(0.061)
Private health insurance	0.051	0.034	0.059	0.065
	(0.038)	(0.035)	(0.094)	(0.093)
Spouse/partner works	-0.031	-0.031	0.015	-0.002
	(0.020)	(0.020)	(0.050)	(0.050)
Spousal income	0.054	0.099	0.184	0.243
	(0.136)	(0.139)	(0.225)	(0.216)
Spousal income squared	-0.056	-0.105	-0.219	-0.239
	(0.102)	(0.108)	(0.173)	(0.160)
Spousal number of acute conditions	0.070	0.059	-0.018	-0.038
	(0.047)	(0.045)	(0.078)	(0.076)
Spousal number of chronic conditions	0.007	0.009	0.003	0.005
	(0.006)	(0.006)	(0.019)	(0.019)
Spousal number of mental conditions	-0.050**	-0.051**	-0.134**	-0.141**
	(0.019)	(0.020)	(0.068)	(0.068)
Spousal age	-0.0003	-0.0001	-0.002	-0.001
	(0.001)	(0.001)	(0.002)	(0.002)
Wave 2006	0.019*	0.024**	0.001	0.010
	(0.011)	(0.011)	(0.026)	(0.026)
Observations	2,485	2,485	848	848
Pseudo R-squared	0.265	0.273	0.177	0.193
Log Likelihood	-561.6	-555.5	-364.2	-357.0

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients on regions of residence and missing variables dummies are not shown.

Table 1.8. Weibull hazard models for married males (Hazard ratios)

	No heterogeneity		Gamma heterogeneity	
	(1)	(2)	(3)	(4)
Number of acute conditions	1.489	1.523	1.537	1.558
	(0.760)	(0.799)	(0.812)	(0.827)
Number of chronic conditions	1.082	1.055	1.154*	1.101
	(0.081)	(0.078)	(0.093)	(0.088)
Number of mental conditions	0.852	0.831	0.735	0.736
	(0.211)	(0.212)	(0.245)	(0.248)
Pension wealth	0.998		0.998	
	(0.006)		(0.006)	
Pension wealth squared	1.000		1.000	
	(0.000)		(0.000)	
Pension wealth quartile 2		0.826		0.780
		(0.183)		(0.185)
Pension wealth quartile 3		0.614**		0.580**
		(0.144)		(0.136)
Pension wealth quartile 4		0.403***		0.392***
		(0.116)		(0.114)
Has voluntary savings	1.024	1.169	1.062	1.196
	(0.224)	(0.252)	(0.244)	(0.273)
Income	0.241***		0.206***	
	(0.116)		(0.115)	
Income squared	1.259***		1.285***	
	(0.081)		(0.102)	
Income quartile 2		0.415***		0.406***
		(0.107)		(0.110)
Income quartile 3		0.326***		0.310***
		(0.081)		(0.086)
Income quartile 4		0.395***		0.385***
		(0.127)		(0.134)
Net worth	1.015***		1.017***	
	(0.005)		(0.005)	
Net worth squared	1.000***		1.000***	
	(0.000)		(0.000)	
Net worth quartile 2		0.878		0.911
		(0.201)		(0.242)
Net worth quartile 3		1.102		1.160
		(0.251)		(0.312)
Net worth quartile 4		1.374		1.535
		(0.305)		(0.428)
Liquid assets	0.959	0.947	0.963	0.951
	(0.041)	(0.037)	(0.053)	(0.047)
Liquid assets squared	0.997	0.996	0.997	0.996
	(0.003)	(0.003)	(0.005)	(0.004)
Age	1.142***	1.124***	1.159***	1.135***
	(0.017)	(0.017)	(0.021)	(0.021)
High school degree	0.714*	0.743	0.726	0.739
	(0.134)	(0.140)	(0.149)	(0.152)

College degree	0.636	0.545**	0.644	0.547*
	(0.189)	(0.158)	(0.211)	(0.177)
Number of children	0.926*	0.929*	0.955	0.950
	(0.037)	(0.037)	(0.039)	(0.039)
Expected longevity	0.981**	0.983*	0.982*	0.983*
	(0.009)	(0.009)	(0.010)	(0.009)
Unemployed	1.826***	1.175	1.926**	1.227
	(0.426)	(0.317)	(0.507)	(0.366)
Self-employed	1.083	0.889	1.124	0.946
	(0.191)	(0.171)	(0.223)	(0.196)
Union member	0.938	1.071	0.908	1.072
	(0.200)	(0.234)	(0.230)	(0.271)
Contributes to pension system	0.679**	0.870	0.642**	0.833
	(0.113)	(0.157)	(0.124)	(0.166)
Public health insurance	1.275	1.116	1.221	1.085
	(0.519)	(0.454)	(0.524)	(0.463)
Private health insurance	1.809	1.332	1.741	1.239
	(0.834)	(0.635)	(0.898)	(0.643)
Spouse/partner works	0.584	0.585	0.509	0.521
	(0.197)	(0.205)	(0.221)	(0.226)
Spousal income	2.325	3.430	3.798	5.265
	(5.485)	(8.261)	(12.017)	(16.517)
Spousal income squared	0.339	0.222	0.217	0.144
	(0.714)	(0.468)	(0.717)	(0.468)
Spousal number of acute conditions	1.603	1.417	1.667	1.428
	(0.577)	(0.493)	(0.726)	(0.625)
Spousal number of chronic conditions	1.008	1.009	0.962	0.968
	(0.064)	(0.066)	(0.081)	(0.084)
Spousal number of mental conditions	0.403***	0.368***	0.397***	0.363***
	(0.105)	(0.101)	(0.115)	(0.107)
Spousal age	0.991	0.995	0.992	0.997
	(0.011)	(0.011)	(0.012)	(0.012)
Constant	8.92e-05***	0.0004***	2.77e-05***	0.0002***
	(8.37e-05)	(0.0004)	(3.12e-05)	(0.0002)
Shape parameter rho	3.371	3.426	3.586	3.618
	(0.182)	(0.178)	(0.246)	(0.260)
Gamma variance			0.461	0.401
			(0.285)	(0.324)
Observations	2,498	2,498	2,498	2,498
Log Likelihood	-414.1	-404.0	-412.5	-403.3
Number of groups			1,589	1,589

Robust seeform in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients on regions of residence and missing variables dummies are not shown.

Table 1.9. Weibull hazard models for married females (Hazard ratios)

	No heterogeneity		Gamma heterogeneity	
	(1)	(2)	(3)	(4)
Number of acute conditions	1.375	1.307	1.309	1.892
	(0.435)	(0.455)	(0.716)	(1.178)
Number of chronic conditions	1.148*	1.122	1.245*	1.208
	(0.084)	(0.086)	(0.165)	(0.178)
Number of mental conditions	0.699	0.683	0.772	0.823
	(0.159)	(0.159)	(0.260)	(0.301)
Pension wealth	0.964**		0.955**	
	(0.018)		(0.017)	
Pension wealth squared	1.000**		1.000**	
	(0.000)		(0.000)	
Pension wealth quartile 2		0.473***		0.171***
		(0.104)		(0.069)
Pension wealth quartile 3		0.387***		0.119***
		(0.125)		(0.068)
Pension wealth quartile 4		0.203***		0.048***
		(0.086)		(0.033)
Has voluntary savings	0.985	1.106	1.078	1.322
	(0.315)	(0.363)	(0.490)	(0.657)
Income	0.185		0.082	
	(0.263)		(0.168)	
Income squared	5.982**		9.218	
	(5.238)		(13.848)	
Income quartile 2		0.753		0.595
		(0.199)		(0.273)
Income quartile 3		0.756		0.848
		(0.246)		(0.461)
Income quartile 4		0.769		0.639
		(0.298)		(0.475)
Net worth	1.000		1.008	
	(0.008)		(0.012)	
Net worth squared	1.000		1.000	
	(0.000)		(0.000)	
Net worth quartile 2		1.141		1.286
		(0.296)		(0.575)
Net worth quartile 3		0.905		0.775
		(0.231)		(0.357)
Net worth quartile 4		0.738		0.687
		(0.230)		(0.365)
Liquid assets	0.934	0.945	0.895	0.878
	(0.057)	(0.055)	(0.068)	(0.081)
Liquid assets squared	0.996	0.997	0.996	0.996
	(0.005)	(0.004)	(0.005)	(0.006)
Age	1.063***	1.040*	1.151***	1.121***
	(0.023)	(0.024)	(0.050)	(0.046)
High school degree	1.227	1.391	1.304	1.363
	(0.241)	(0.290)	(0.377)	(0.454)

College degree	0.855	1.039	0.831	0.917
	(0.318)	(0.384)	(0.408)	(0.528)
Number of children	1.034	1.022	1.018	0.990
	(0.046)	(0.052)	(0.071)	(0.079)
Expected longevity	1.002	1.007	1.004	1.009
	(0.010)	(0.011)	(0.015)	(0.017)
Unemployed	1.498	1.443	2.243*	2.519*
	(0.493)	(0.422)	(1.024)	(1.228)
Self-employed	1.211	1.073	1.363	1.382
	(0.297)	(0.282)	(0.537)	(0.590)
Union member	0.731	0.697	0.505	0.453
	(0.220)	(0.207)	(0.232)	(0.224)
Contributes to pension system	0.733	0.815	0.550	0.660
	(0.178)	(0.206)	(0.232)	(0.290)
Public health insurance	1.706	1.646	2.173	2.382
	(0.792)	(0.769)	(1.647)	(2.019)
Private health insurance	1.745	1.493	2.498	2.357
	(1.049)	(0.885)	(2.274)	(2.421)
Spouse/partner works	1.013	0.947	1.469	1.481
	(0.328)	(0.319)	(0.767)	(0.774)
Spousal income	3.310	3.907	0.699	0.852
	(4.817)	(5.601)	(1.530)	(1.884)
Spousal income squared	0.265	0.293	0.557	0.534
	(0.276)	(0.277)	(0.948)	(0.925)
Spousal number of acute conditions	1.224	0.956	1.206	0.636
	(0.700)	(0.564)	(0.963)	(0.620)
Spousal number of chronic conditions	0.852	0.849	0.740	0.743
	(0.104)	(0.105)	(0.141)	(0.156)
Spousal number of mental conditions	0.392**	0.358**	0.138**	0.075***
	(0.172)	(0.158)	(0.126)	(0.068)
Spousal age	1.000	1.010	0.995	1.012
	(0.014)	(0.016)	(0.021)	(0.024)
Constant	0.001***	0.003***	1.66e-05***	4.10e-05***
	(0.002)	(0.004)	(4.27e-05)	(9.66e-05)
Shape parameter rho	3.055	3.135	4.468	5.412
	(0.158)	(0.157)	(0.860)	(0.677)
Gamma variance			2.432	3.253
			(1.424)	(0.947)
Observations	857	857	857	857
Log Likelihood	-277.9	-268.9	-275.4	-258.4
Number of groups			591	591

Robust seeform in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients on regions of residence and missing variables dummies are not shown.

Table 1.10. Multinomial logit models for husbands (Base outcome: No one retires)

	Spouse retires		Individual retires		Both retire	
	(1)	(2)	(3)	(4)	(5)	(6)
Number of acute conditions	1.362	1.459	0.000***	0.000***	1.133	1.164
	(0.804)	(0.877)	(0.000)	(0.000)	(1.048)	(1.002)
Number of chronic conditions	0.813**	0.789***	1.534	1.556	1.027	0.961
	(0.068)	(0.066)	(0.519)	(0.487)	(0.174)	(0.157)
Number of mental conditions	0.993	1.029	0.334	0.295	0.677	0.682
	(0.336)	(0.345)	(0.415)	(0.344)	(0.407)	(0.409)
Pension wealth	0.999		0.982		0.981	
	(0.008)		(0.060)		(0.019)	
Pension wealth squared	1.000		1.000		1.000	
	(0.000)		(0.000)		(0.000)	
Pension wealth quartile 2		0.954		1.494		1.446
		(0.247)		(1.624)		(0.625)
Pension wealth quartile 3		1.326		1.586		1.068
		(0.330)		(1.475)		(0.464)
Pension wealth quartile 4		0.992		3.301		0.590
		(0.277)		(3.128)		(0.312)
Has voluntary savings	0.732	0.755	1.431	1.424	0.873	1.053
	(0.142)	(0.147)	(1.420)	(1.212)	(0.352)	(0.409)
Income	2.144		0.240		3.258	
	(1.174)		(3.156)		(5.001)	
Income squared	1.002		0.072		0.694	
	(0.041)		(1.263)		(0.407)	
Income quartile 2		0.669		0.000***		0.297**
		(0.233)		(0.000)		(0.163)
Income quartile 3		0.690		0.283		0.251**
		(0.240)		(0.362)		(0.140)
Income quartile 4		0.887		0.053		0.450
		(0.357)		(0.132)		(0.288)
Net worth	1.006		0.977		1.007	
	(0.004)		(0.019)		(0.011)	
Net worth squared	1.000*		1.000		1.000	
	(0.000)		(0.000)		(0.000)	
Net worth quartile 2		0.849		2.164		0.613
		(0.201)		(2.085)		(0.292)
Net worth quartile 3		0.895		0.773		0.797
		(0.220)		(0.772)		(0.364)
Net worth quartile 4		1.336		2.122		1.687
		(0.361)		(2.086)		(0.793)
Liquid assets	0.992	0.993	0.819	0.892	0.907	0.878
	(0.010)	(0.010)	(0.225)	(0.124)	(0.069)	(0.071)
Liquid assets squared	1.000	1.000	0.998	1.000	0.993	0.992
	(0.000)	(0.000)	(0.008)	(0.000)	(0.005)	(0.006)
Age	1.022	1.024	1.331***	1.320***	1.224***	1.218***
	(0.021)	(0.021)	(0.115)	(0.106)	(0.041)	(0.043)

High school degree	0.717*	0.724*	1.178	0.996	0.720	0.699
	(0.122)	(0.122)	(0.862)	(0.639)	(0.258)	(0.256)
College degree	0.519**	0.565**	0.680	0.739	0.500	0.453
	(0.156)	(0.160)	(0.823)	(0.584)	(0.299)	(0.243)
Number of children	1.056	1.067	0.877	0.959	1.031	1.057
	(0.049)	(0.050)	(0.125)	(0.205)	(0.084)	(0.090)
Expected longevity	1.001	1.002	0.923***	0.925*	0.977	0.978
	(0.008)	(0.008)	(0.027)	(0.041)	(0.019)	(0.019)
Unemployed	1.831	1.168	5.241	1.355	5.767***	1.723
	(0.678)	(0.530)	(11.589)	(2.310)	(3.564)	(1.151)
Self-employed	0.804	0.800	0.797	0.678	1.605	1.223
	(0.156)	(0.153)	(0.960)	(0.844)	(0.562)	(0.456)
Union member	0.986	0.963	1.000	0.907	1.190	1.393
	(0.194)	(0.194)	(1.525)	(0.960)	(0.436)	(0.532)
Contributes to pension system	1.208	1.235	0.750	0.639	0.957	1.111
	(0.244)	(0.258)	(0.650)	(0.583)	(0.365)	(0.448)
Public health insurance	1.436	1.419	11867787***	5272312***	1.893	1.804
	(0.424)	(0.419)	(13662840)	(3975912)	(1.469)	(1.387)
Private health insurance	1.289	1.367	6167833***	4958082***	2.428	2.111
	(0.502)	(0.517)	(7608742)	(6351576)	(2.133)	(1.842)
Spousal income	0.000***	0.000***	2,934	4,719*	0.000***	0.001***
	(0.000)	(0.000)	(14245)	(22016)	(0.001)	(0.002)
Spousal income squared	24.379***	18.916***	0.000	0.000	20.778***	14.282***
	(13.750)	(8.784)	(0.001)	(0.002)	(12.949)	(12.370)
Spousal number of acute conditions	0.543	0.556	0.000***	0.000***	2.494	2.409
	(0.313)	(0.310)	(0.000)	(0.000)	(1.499)	(1.350)
Spousal number of chronic conditions	1.015	1.019	0.998	1.057	1.144	1.172
	(0.092)	(0.093)	(0.426)	(0.427)	(0.159)	(0.171)
Spousal number of mental conditions	1.686**	1.659**	0.871	0.659	0.679	0.597
	(0.411)	(0.409)	(0.808)	(0.671)	(0.290)	(0.269)
Spousal age	1.057***	1.059***	0.985	0.989	1.068***	1.078***
	(0.015)	(0.015)	(0.040)	(0.046)	(0.026)	(0.027)
Wave 2006	1.913***	1.907***	4.856**	6.917*	3.588**	3.947***
	(0.337)	(0.346)	(3.538)	(7.026)	(1.818)	(2.008)
Constant	0.020***	0.023***	0.000***	0.000***	0.000***	0.000***
	(0.023)	(0.028)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	1,317	1,317	1,317	1,317	1,317	1,317
Pseudo R-squared	0.307	0.311	0.307	0.311	0.307	0.311
Log Likelihood	-873.5	-869.0	-873.5	-869.0	-873.5	-869.0

Robust seeform in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients on regions of residence and missing variables dummies are not shown.

Table 1.11. Multinomial logit models for wives (Base outcome: No one retires)

	Spouse retires		Individual retires		Both retire	
	(1)	(2)	(3)	(4)	(5)	(6)
Number of acute health conditions	0.354*	0.415	1.210	1.061	0.000***	0.000***
	(0.197)	(0.237)	(0.542)	(0.502)	(0.000)	(0.000)
Number of chronic health conditions	0.967	1.001	1.225	1.207	1.555**	1.523*
	(0.130)	(0.137)	(0.155)	(0.159)	(0.345)	(0.360)
Number of mental health conditions	1.359	1.341	0.495*	0.497*	0.550	0.454
	(0.420)	(0.426)	(0.203)	(0.202)	(0.395)	(0.339)
Pension wealth	1.008		0.939		0.960	
	(0.014)		(0.041)		(0.032)	
Pension wealth squared	1.000		1.000		1.000	
	(0.000)		(0.000)		(0.000)	
Pension wealth quartile 2		1.430		0.601		0.290
		(0.479)		(0.215)		(0.241)
Pension wealth quartile 3		0.869		0.342**		0.346
		(0.358)		(0.180)		(0.241)
Pension wealth quartile 4		1.240		0.111***		0.113**
		(0.520)		(0.082)		(0.104)
Has voluntary savings	1.100	1.138	0.942	1.069	1.620	1.369
	(0.449)	(0.470)	(0.515)	(0.585)	(1.372)	(1.230)
Income	0.349		0.031		54.022	
	(0.617)		(0.079)		(232.424)	
Income squared	2.208		82.043**		0.032	
	(2.519)		(171.773)		(0.151)	
Income quartile 2		2.016		0.857		4.987**
		(0.865)		(0.361)		(3.871)
Income quartile 3		2.100		0.453		2.834
		(0.993)		(0.230)		(2.622)
Income quartile 4		1.340		0.486		4.037
		(0.787)		(0.308)		(4.150)
Net worth	1.006		0.973		1.017	
	(0.012)		(0.017)		(0.014)	
Net worth squared	1.000		1.000		1.000	
	(0.000)		(0.000)		(0.000)	
Net worth quartile 2		1.418		1.119		1.315
		(0.594)		(0.447)		(1.172)
Net worth quartile 3		1.044		0.896		0.534
		(0.441)		(0.338)		(0.516)
Net worth quartile 4		1.573		0.305**		1.319
		(0.707)		(0.153)		(1.036)
Liquid assets	0.930	0.942	0.786	0.839	0.886	0.911
	(0.054)	(0.058)	(0.174)	(0.118)	(0.123)	(0.123)
Liquid assets squared	0.997	0.997	0.991	0.996	0.997	0.997
	(0.002)	(0.002)	(0.016)	(0.008)	(0.003)	(0.003)
Age	0.993	1.000	1.082*	1.072	1.216***	1.188***
	(0.037)	(0.040)	(0.049)	(0.051)	(0.063)	(0.074)

High school degree	0.975	0.965	1.704*	2.015**	1.751	2.077
	(0.291)	(0.294)	(0.547)	(0.667)	(1.216)	(1.523)
College degree	1.022	1.051	0.512	0.693	0.940	1.363
	(0.428)	(0.467)	(0.282)	(0.392)	(0.712)	(1.066)
Number of children	1.057	1.078	0.992	0.984	1.240	1.165
	(0.085)	(0.092)	(0.093)	(0.091)	(0.208)	(0.186)
Expected longevity	1.026*	1.026*	1.024	1.026	0.995	1.007
	(0.015)	(0.015)	(0.017)	(0.018)	(0.031)	(0.030)
Unemployed	1.040	1.699	1.949	2.358*	5.264	5.309
	(0.522)	(0.893)	(0.965)	(1.063)	(6.703)	(6.892)
Self-employed	1.472	1.468	1.030	0.992	2.104	1.626
	(0.625)	(0.612)	(0.450)	(0.423)	(2.010)	(1.414)
Union member	1.079	1.161	0.281**	0.324*	1.938	2.056
	(0.370)	(0.405)	(0.181)	(0.210)	(1.207)	(1.343)
Contributes to pension system	1.606	1.379	0.653	0.710	1.227	0.934
	(0.623)	(0.558)	(0.250)	(0.280)	(1.157)	(0.873)
Public health insurance	0.427	0.440	2.417	2.529	0.566	0.525
	(0.382)	(0.384)	(2.182)	(2.321)	(0.722)	(0.643)
Private health insurance	0.411	0.452	1.112	1.624	0.650	0.455
	(0.398)	(0.430)	(1.142)	(1.775)	(0.932)	(0.587)
Spousal income	0.011***	0.013***	125.532**	87.199**	0.007**	0.009
	(0.014)	(0.017)	(278.680)	(181.707)	(0.018)	(0.028)
Spousal income squared	6.118*	5.360*	0.009**	0.023**	6.046	5.942
	(5.867)	(5.284)	(0.021)	(0.042)	(7.863)	(8.539)
Spousal number of acute health conditions	0.597	0.719	0.000***	0.000***	1.308	0.979
	(0.483)	(0.531)	(0.000)	(0.000)	(1.348)	(1.086)
Spousal number of chronic health conditions	1.079	1.122	0.974	0.951	1.216	1.253
	(0.194)	(0.202)	(0.207)	(0.207)	(0.374)	(0.375)
Spousal number of mental health conditions	0.963	1.074	0.313*	0.272**	1.002	0.978
	(0.440)	(0.508)	(0.205)	(0.177)	(1.224)	(1.259)
Spousal age	1.106***	1.108***	1.010	1.012	1.055*	1.064**
	(0.028)	(0.028)	(0.027)	(0.028)	(0.032)	(0.032)
Wave 2006	1.281	1.205	1.474	1.581*	0.896	1.163
	(0.329)	(0.306)	(0.394)	(0.437)	(0.386)	(0.565)
Constant	0.001***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.001)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)
Observations	624	624	624	624	624	624
Pseudo R-squared	0.243	0.258	0.243	0.258	0.243	0.258
Log Likelihood	-509.9	-499.6	-509.9	-499.6	-509.9	-499.6

Robust seeform in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients on regions of residence and missing variables dummies are not shown.

Table 1.12. Descriptive statistics by gender and wave

	Male		Female	
	2004	**2006**	**2004**	**2006**
Retired	0.00	0.12	0.00	0.19
Wealth variables (millions of Chilean pesos)				
Pension wealth	11.54	14.62	8.46	9.61
Monthly net income	0.26	0.29	0.21	0.23
Net worth	29.25	18.98	21.26	18.3
Liquid assets	-0.32	-0.35	-0.63	-0.59
Has voluntary savings	0.14	0.20	0.13	0.19
Health variables				
Acute health conditions				
Number of acute health conditions (0-2)	0.01	0.01	0.04	0.05
Has been diagnosed with cancer	0.01	0.01	0.03	0.05
Has been diagnosed with stroke	0.00	0.01	0.00	0.00
Chronic health conditions				
Number of chronic health conditions (0-6)	0.53	0.67	0.73	0.91
Has been diagnosed with asthma	0.04	0.05	0.05	0.06
Has been diagnosed with diabetes	0.08	0.10	0.08	0.11
Has been diagnosed with high blood pressure	0.25	0.32	0.31	0.37
Has been diagnosed with heart disease	0.07	0.09	0.08	0.11
Has been diagnosed with arthritis	0.06	0.07	0.17	0.21
Has been diagnosed with kidney disease	0.03	0.04	0.04	0.05
Mental health conditions				
Number of mental health conditions (0-2)	0.04	0.06	0.22	0.27
Has been diagnosed with depression	0.04	0.05	0.21	0.26
Has been diagnosed with mental disease	0.00	0.00	0.01	0.01
Demographics				
Age	54.76	56.82	53.60	55.63
High school dropout	0.55	0.55	0.45	0.45
High school degree	0.30	0.31	0.29	0.31
College degree	0.15	0.14	0.25	0.25
Does not have spouse/partner	0.13	0.13	0.45	0.44
Spouse/partner works	0.26	0.24	0.38	0.35
Spouse/partner does not work	0.61	0.63	0.16	0.19
Number of children	3.09	3.25	2.65	2.75
Expected longevity	77.23	78.09	76.07	76.82
Employment				
Unemployed	0.09	0.10	0.09	0.11
Self-employed	0.25	0.27	0.13	0.15
Union	0.16	0.17	0.15	0.21
Contributes to pension system	0.68	0.69	0.73	0.71
Health insurance				

None	0.10	0.06	0.03	0.03
Public	0.73	0.79	0.78	0.80
Private	0.17	0.15	0.20	0.17
Region of residence				
Region I	0.02	0.02	0.03	0.03
Region II	0.02	0.02	0.02	0.02
Region III	0.01	0.01	0.02	0.02
Region IV	0.05	0.05	0.05	0.05
Region V	0.11	0.11	0.11	0.11
Region VI	0.06	0.06	0.07	0.06
Region VII	0.08	0.08	0.08	0.08
Region VIII	0.14	0.14	0.11	0.11
Region IX	0.05	0.05	0.05	0.06
Region X	0.08	0.08	0.07	0.07
Region XI	0.00	0.00	0.01	0.01
Region XII	0.00	0.00	0.01	0.01
Metropolitan Region	0.37	0.37	0.39	0.39
Number of observations	1,080	1,080	526	526

Table 1.13. Fixed effects models

	Males		Females	
	(1)	(2)	(3)	(4)
Number of acute health conditions	-0.167***	-0.177***	-0.187***	-0.177***
	(0.039)	(0.040)	(0.051)	(0.049)
Number of chronic health conditions	0.088***	0.084***	-0.008	-0.015
	(0.031)	(0.031)	(0.046)	(0.045)
Number of mental health conditions	0.022	0.026	0.032	0.029
	(0.078)	(0.078)	(0.091)	(0.092)
Pension wealth	-0.001		-0.004	
	(0.001)		(0.002)	
Pension wealth squared	1.52e-06		8.34e-06*	
	(1.91e-06)		(5.05e-06)	
Pension wealth quartile 2		0.078		0.168
		(0.072)		(0.126)
Pension wealth quartile 3		0.053		0.231*
		(0.072)		(0.137)
Pension wealth quartile 4		0.004		0.143
		(0.072)		(0.141)
Has voluntary savings	-0.071**	-0.074**	-0.136***	-0.150***
	(0.029)	(0.029)	(0.043)	(0.039)
Income	0.017		0.052	
	(0.032)		(0.242)	
Income squared	-0.001		0.053	
	(0.002)		(0.130)	
Income quartile 2		0.009		0.126**
		(0.050)		(0.060)
Income quartile 3		0.007		0.077
		(0.052)		(0.067)
Income quartile 4		-0.035		0.035
		(0.057)		(0.073)
Net worth	-2.51e-05		-0.001	
	(0.0003)		(0.001)	
Net worth squared	3.08e-09		6.06e-07	
	(2.47e-08)		(4.50e-07)	
Net worth quartile 2		0.058*		0.002
		(0.032)		(0.057)
Net worth quartile 3		0.028		-0.056
		(0.035)		(0.052)
Net worth quartile 4		0.086**		-0.049
		(0.038)		(0.053)
Liquid assets	-8.44e-05	0.0001	-0.005	-0.008
	(0.001)	(0.001)	(0.005)	(0.005)
Liquid assets squared	-6.32e-07	-1.59e-06	-0.001***	-0.001***
	(5.79e-06)	(5.40e-06)	(0.000)	(0.000)
Spouse/partner works	-0.034	-0.037	-0.034	-0.024
	(0.049)	(0.048)	(0.109)	(0.102)
Spouse/partner does not work	-0.048	-0.050	-0.003	0.006
	(0.046)	(0.044)	(0.113)	(0.106)

Age	0.051***	0.052***	0.074***	0.070***
	(0.006)	(0.006)	(0.014)	(0.014)
High school degree	-0.049*	-0.045*	0.058	0.064
	(0.027)	(0.027)	(0.060)	(0.057)
College degree	-0.127***	-0.121**	0.098	0.114*
	(0.049)	(0.049)	(0.063)	(0.062)
Number of children	0.019	0.021	0.086	0.103**
	(0.022)	(0.022)	(0.053)	(0.052)
Expected longevity	-0.001	-0.001	-0.002	-0.001
	(0.001)	(0.001)	(0.003)	(0.003)
Unemployed	-0.008	-0.011	0.076	0.134*
	(0.042)	(0.060)	(0.075)	(0.074)
Self-employed	0.035	0.030	-0.031	-0.012
	(0.030)	(0.030)	(0.059)	(0.058)
Union member	-0.013	-0.015	-0.032	-0.016
	(0.030)	(0.031)	(0.036)	(0.037)
Contributes to pension system	-0.044	-0.043	-0.028	-0.041
	(0.034)	(0.034)	(0.052)	(0.051)
Public health insurance	0.046	0.044	-0.031	-0.013
	(0.036)	(0.036)	(0.105)	(0.102)
Private health insurance	0.092	0.079	-0.002	0.016
	(0.065)	(0.066)	(0.119)	(0.116)
Constant	-2.762***	-2.898***	-3.984***	-4.060***
	(0.303)	(0.314)	(0.702)	(0.705)
Observations	2,082	2,082	1,013	1,013
R-squared	0.150	0.161	0.180	0.199
Number of folio	1,065	1,065	522	522
Log Likelihood	848.2	861.8	229.1	241.3

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Note: Coefficients on regions of residence and missing variables dummies are not shown.

Table 1.14. Descriptive statistics by gender and wave for married individuals

	Male		Female	
	2004	**2006**	**2004**	**2006**
Retired	0.00	0.12	0.00	0.18
Wealth variables (millions of Chilean pesos)				
Pension wealth	11.92	14.68	10.38	10.92
Monthly net income	0.27	0.30	0.23	0.25
Net worth	19.04	20.02	26.56	20.02
Liquid assets	-0.34	-0.25	-0.63	-0.62
Has voluntary savings	0.14	0.20	0.11	0.15
Spousal income	0.06	0.07	0.19	0.19
Health variables				
Acute health conditions				
Number of acute health conditions (0-2)	0.01	0.02	0.03	0.04
Has been diagnosed with cancer	0.01	0.01	0.02	0.03
Has been diagnosed with stroke	0.01	0.01	0.01	0.01
Spousal number of acute health conditions (0-2)	0.01	0.02	0.02	0.03
Chronic health conditions				
Number of chronic health conditions (0-6)	0.54	0.69	0.76	0.94
Has been diagnosed with asthma	0.04	0.05	0.04	0.05
Has been diagnosed with diabetes	0.09	0.11	0.08	0.12
Has been diagnosed with high blood pressure	0.26	0.32	0.34	0.39
Has been diagnosed with heart disease	0.07	0.09	0.09	0.12
Has been diagnosed with arthritis	0.06	0.07	0.17	0.21
Has been diagnosed with kidney disease	0.03	0.04	0.05	0.05
Spousal number of chronic health conditions (0-6)	0.42	0.79	0.32	0.53
Mental health conditions				
Number of mental health conditions (0-2)	0.04	0.05	0.20	0.27
Has been diagnosed with depression	0.03	0.05	0.20	0.27
Has been diagnosed with mental disease	0.00	0.00	0.00	0.00
Spousal number of mental health conditions (0-2)	0.05	0.15	0.04	0.09
Demographics				
Age	54.71	56.76	53.11	55.15
Spousal age	51.12	53.24	55.96	57.81
High school dropout	0.55	0.55	0.46	0.45
High school degree	0.30	0.31	0.28	0.28
College degree	0.15	0.14	0.26	0.27
Spouse/partner works	0.30	0.28	0.70	0.67
Number of children	3.23	3.40	2.91	3.04
Expected longevity	77.3	78.1	76.36	76.8
Employment				
Unemployed	0.10	0.08	0.11	0.11
Self-employed	0.24	0.28	0.14	0.14

Union	0.16	0.17	0.13	0.23
Contributes to pension system	0.69	0.70	0.70	0.71
Health insurance				
None	0.09	0.05	0.03	0.02
Public	0.73	0.79	0.76	0.79
Private	0.18	0.16	0.21	0.19
Region of residence				
Region I	0.02	0.02	0.02	0.02
Region II	0.02	0.02	0.02	0.02
Region III	0.01	0.01	0.01	0.01
Region IV	0.05	0.05	0.04	0.04
Region V	0.11	0.11	0.14	0.14
Region VI	0.06	0.06	0.06	0.06
Region VII	0.08	0.08	0.08	0.08
Region VIII	0.14	0.14	0.11	0.11
Region IX	0.05	0.06	0.05	0.05
Region X	0.08	0.08	0.05	0.06
Region XI	0.00	0.00	0.01	0.01
Region XII	0.00	0.00	0.01	0.01
Metropolitan Region	0.37	0.37	0.4	0.39
Number of observations	909	909	266	266

Table 1.15. Fixed effects models for married individuals

	Males		Females	
	(1)	(2)	(3)	(4)
Number of acute conditions	-0.138***	-0.176***	-0.211**	-0.218**
	(0.042)	(0.045)	(0.088)	(0.087)
Number of chronic conditions	0.076**	0.076**	0.103	0.097
	(0.033)	(0.032)	(0.068)	(0.068)
Number of mental conditions	0.008	0.008	0.063	0.071
	(0.079)	(0.079)	(0.122)	(0.117)
Pension wealth	0.0004		-0.0004	
	(0.002)		(0.003)	
Pension wealth squared	-4.35e-07		2.24e-06	
	(2.48e-06)		(5.48e-06)	
Pension wealth quartile 2		0.067		-0.218**
		(0.071)		(0.091)
Pension wealth quartile 3		0.023		-0.097
		(0.071)		(0.134)
Pension wealth quartile 4		-0.023		-0.148
		(0.072)		(0.133)
Has voluntary savings	-0.064**	-0.068**	-0.238**	-0.211**
	(0.030)	(0.030)	(0.095)	(0.084)
Income	0.013		0.176	
	(0.042)		(0.429)	
Income squared	-0.0003		0.019	
	(0.006)		(0.238)	
Income quartile 2		-0.023		0.214**
		(0.039)		(0.084)
Income quartile 3		-0.041		0.128
		(0.041)		(0.093)
Income quartile 4		-0.072		-0.006
		(0.050)		(0.136)
Net worth	0.0003		0.001	
	(0.001)		(0.001)	
Net worth squared	-4.48e-07		-1.25e-07	
	(1.18e-06)		(5.15e-07)	
Net worth quartile 2		0.039		0.004
		(0.033)		(0.079)
Net worth quartile 3		0.008		-0.027
		(0.036)		(0.073)
Net worth quartile 4		0.091**		-0.012
		(0.036)		(0.077)
Liquid assets	-0.003	-0.002	0.004	0.002
	(0.002)	(0.002)	(0.005)	(0.005)
Liquid assets squared	1.17e-05	1.12e-05	-0.0002	-0.0002
	(9.53e-06)	(9.33e-06)	(0.0002)	(0.0002)
Age	0.039***	0.042***	0.071***	0.070***
	(0.011)	(0.012)	(0.016)	(0.016)
High school degree	-0.039	-0.036	0.138*	0.133*
	(0.029)	(0.028)	(0.080)	(0.075)

College degree	-0.069	-0.061	0.258***	0.278***
	(0.050)	(0.049)	(0.098)	(0.096)
Number of children	0.020	0.023	-0.005	0.001
	(0.024)	(0.024)	(0.041)	(0.040)
Expected longevity	-0.002*	-0.002*	-0.003	-0.002
	(0.001)	(0.001)	(0.004)	(0.004)
Unemployed	-0.022	-0.060	-0.056	0.038
	(0.043)	(0.050)	(0.113)	(0.111)
Self-employed	0.055*	0.048	-0.082	-0.056
	(0.030)	(0.030)	(0.089)	(0.081)
Union member	-0.014	-0.015	0.004	0.012
	(0.032)	(0.033)	(0.052)	(0.053)
Contributes to pension system	-0.034	-0.032	-0.019	-0.042
	(0.036)	(0.036)	(0.083)	(0.072)
Public health insurance	0.023	0.016	0.253	0.256*
	(0.037)	(0.037)	(0.160)	(0.152)
Private health insurance	0.084	0.078	0.145	0.129
	(0.061)	(0.061)	(0.184)	(0.171)
Spouse/partner works	0.015	0.008	0.041	0.016
	(0.023)	(0.023)	(0.074)	(0.070)
Spousal income	-0.041	-0.022	-0.053	0.052
	(0.067)	(0.069)	(0.289)	(0.294)
Spousal income squared	0.002	0.001	-0.024	-0.134
	(0.007)	(0.008)	(0.171)	(0.169)
Spousal number of acute conditions	0.105	0.125	0.042	-0.044
	(0.103)	(0.103)	(0.085)	(0.088)
Spousal number of chronic conditions	0.030	0.025	-0.008	-0.011
	(0.018)	(0.018)	(0.055)	(0.053)
Spousal number of mental conditions	-0.041	-0.042	-0.057	-0.054
	(0.038)	(0.037)	(0.092)	(0.098)
Spousal age	0.007	0.008	-0.005	-0.004
	(0.010)	(0.011)	(0.005)	(0.006)
Constant	-2.454***	-2.672***	-3.612***	-3.576***
	(0.348)	(0.350)	(0.812)	(0.812)
Observations	1,818	1,818	532	532
R-squared	0.159	0.174	0.247	0.292
Number of folio	909	909	266	266
Log Likelihood	774.6	790.3	144.9	161.3

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Note: Coefficients on regions of residence and missing variables dummies are not shown.

CHAPTER TWO

CHILD BONUS AND FERTILITY:
EVIDENCE FROM THE 2008 CHILEAN PENSION REFORM

Abstract

In March of 2008 Chile approved Law No. 20,255, which introduced several changes to its existing individual account pension system. One of the most popular measures included in this law is the introduction of a "child bonus", a cash transfer to women's individual retirement accounts for each child born alive or adopted, to which they have access once they reach 65 years of age. The child bonus was created with the aim of reducing a significant pension gender gap, which exists due to, among other reasons, women's prolonged absence from the labor market related to childcare. This chapter investigates whether the child bonus policy included in the recent Chilean's pension reform generated incentives for women to have children and whether it affected the timing of birth. Results suggest that the child bonus policy increases desired fertility, but this effect cannot be confirmed for actual births. Effects on fertility preferences, however, vary for different groups of women. They seem to be stronger for single women, as well as for higher order births. The child bonus policy also seems to have shortened the time to a birth, especially for single women and first births, even though these effects are not statistically significant.

I. Introduction

In March of 2008, Chile approved Law No.20,255, which introduced several changes to its existing individual account pensions system (Superintendence of Pensions, 2009). One of the most popular measures included in this law is the introduction of a "child bonus", a cash transfer to women's individual retirement accounts for each child born alive or adopted (or an increase in women's Basic Solidarity Pension), to which mothers have access when they reach 65 years old.[12] Therefore, the Chilean child bonus intends to increase the amount of pension benefits women receive. It was created with the aim of reducing the significant pension gender gap existent in Chile, which is due to, among other reasons, the prolonged absence of women from the labor market related to childcare.[13] However, if the child bonus has the unintended side effect of incentivizing women to have (more) children, it could actually contribute to keeping women out of the labor force longer. Furthermore, since the child bonus yields returns from the time of child's birth until the woman reaches 65 years of age, it might represent an incentive for women to have children earlier. This chapter investigates whether the child bonus policy introduced by the recent Chilean pension reform generated incentives for women to enter motherhood and/or increase family size, as well as affecting the timing of birth.

The Chilean child bonus consists of a deposit to the mother's individual retirement account or an increase in the mother's Basic Solidarity Pension, for each child born alive or adopted, of an amount equivalent to 18 monthly pension contributions based on the

[12] The Basic Solidarity Pension (PBS) is a non-contributory pension introduced by the 2008 pension reform, which replaced the PASIS (Assistential Pensions, or *Pensiones Asistenciales*). It is given to the 60% poorest individuals of the population who did not contribute to the pensions system or were not able to accumulate enough funds in their individual retirement accounts to finance a pension.

[13] For more information about the Chilean pension gender gap, please see Fajnzylber (2010).

minimum wage plus the average (from all pension fund managers in the market) nominal annual yield of Fund C since the child was born until the mother reaches 65 (Superintendence of Pensions, 2009).[14] For children born before July 1st 2009, interest accrues only from this latter date onwards. The child bonus is granted to women who are affiliated with the private pension system or are entitled to survivor pension benefits under the private system.[15] However, since affiliation with the private system is a simple process, even women who are not initially members of the private system can get access to the child bonus by affiliating with the system prior to their retirement at age 65. The child bonus became effective on July 1st, 2009.

The Chilean child bonus is the first policy ever implemented of this kind and has unique characteristics. Child bonuses have been introduced in other countries as a pro-natalist measure, to boost fertility and help families with the costs of childbearing. Australia, Canada, Czech Republic, Lithuania and Singapore are examples of countries that have baby bonuses in the form of cash transfers to help families with the costs of childrearing. In common with the Chilean child bonus, they have the feature that both involve a monetary payment associated with the birth of a child. However, in other countries the child bonus is an immediate (or short-term) payment associated with a birth, whereas in Chile, it is a long-term monetary payment that comes in the form of higher pension benefits. Calculations from the Chilean Superintendence of Pensions show that for a woman who is 20 years old when the policy became effective, has her first child at

[14] The pension contribution in Chile is 10% of the worker's taxable income. The Chilean private pension system has five different types of pension funds for workers to invest their retirement savings. The riskiest one is fund A and the most conservative one is fund E. C is the fund with intermediate risk. Fund B is considered risky and fund D, conservative.

[15] For this latter condition, they also need to be beneficiaries of the Solidarity Pension Payment (known as APS), which is a payment from the Chilean government to complement the pension for individuals from the poorest 60% of the population with very low pension benefits.

21, and her second child at 25, pension benefits can increase up to 37% due to the child bonus (Superintendence of Pensions, 2009).

The literature on fertility suggests two main roles for children (Billari & Galasso, 2009). Children can be considered either consumption goods (Becker & Barro, 1988; Barro & Becker, 1989) or investment goods (Boldrin & Jones, 2002). The first approach suggests that parents get direct utility from having and raising children, while the second approach suggests an old-age security motive, where children are expected to provide for their parents when they get older (Billari & Galasso, 2009).[16] The Chilean child bonus theoretically enhances both motives for having a child by increasing the marginal benefit of having a baby (either as a consumption good or as an investment good), which could produce a positive impact on whether a woman decides to become a mother and on how many children a woman plans to have.[17] Therefore, we could observe a positive effect of the child bonus on first births (due to a higher marginal benefit of the first child), and possibly an even stronger effect for higher order births, since it is considered that the marginal cost of having another child decreases with the number of children one already has (Milligan, 2005; Drago *et al.*, 2009). Furthermore, women who are mothers are already entitled to a bonus per child born alive or adopted. Consequently, as long as children are normal goods, this positive income effect might also increase demand for children. Nevertheless, recent research has found that increases in household income might induce parents to increase the quality instead of the quantity of children. This would make the effect on higher order births likely ambiguous. On one hand, mothers

[16] Billari and Galasso (2009) use pension reforms in Italy to assess which motive for having children is more important in the Italian society, and find that the old-age security motive prevails.

[17] The child bonus increases the direct utility from children due to the cash transfer associated with it (even if it happens well into the future), and it also increases mothers' pensions, which contributes to children's role of providing mothers with old-age security.

could use the monetary incentive associated with births to increase their family size. On the other hand, mothers could use the benefits generated by previous births to improve the quality of their children, instead of having more children. Finally, the Chilean child bonus might also create an incentive for women to have children earlier, since interest on the bonus amount start accruing from the moment the child is born until the mother reaches 65.

It is important to note that the above discussed effects should only be observed if women are forward-looking and value these long-term benefits. If women, however, heavily discount the future, it is possible that the child bonus will not have an impact on fertility.

This study contributes to the literature on the effects of economic incentives on fertility in the following ways. First, it investigates for the first time the effects of an innovative policy implemented in Chile, which establishes substantial monetary incentives directly associated with children born alive or adopted in the form of increases in pension benefits. Second, it contributes to the understanding of how much forward-looking agents are and how much they discount future benefits. Since benefits from having children are not received until a long time into the future, response to these long-term incentives constitutes evidence of a forward-looking behavior of agents.

Given the almost universal nature of the child bonus established by the 2008 Chilean pension reform, identification of its effects on fertility is not trivial. For this reason, I use two different identification strategies to assess the effects of the child bonus on fertility preferences (desire for children in the future) and births. I use data from the Chilean Social Protection Survey (SPS), a nationally representative longitudinal survey with four

waves of data, of which three were before the introduction of the child bonus (2002, 2004 and 2006) and one after its introduction (2009). I first use data from the fourth wave (2009) to identify the effect of the child bonus on fertility preferences using knowledge about the introduction of the policy for identification.[18] I then use all available waves of the SPS in a difference-in-differences (DD) framework (Angrist & Krueger, 1999). I define treatment and control groups using households' income in 2006 (before the introduction of the policy), exploring the fact that given the amount of the bonus, low-income women should be considerably more affected than high-income women. I finally use a duration analysis to investigate the effects of the child bonus on the timing of birth.

Results suggest the child bonus policy has increased fertility preferences, but this positive effect cannot be confirmed for births. Effects on fertility preferences, however, vary for different groups of women. They seem to be stronger for single women, as well as for higher order births. Results show weak evidence of a shortened time to birth due to the child bonus policy, especially for single women and first births. These results suggest that fertility and labor market outcomes for Chilean women should be closely observed in order to guarantee that the child bonus policy will attain the objectives it was established for. These results also confirm women as forward-looking agents who place value on future benefits.

The chapter proceeds as follows. The following section describes the related literature, while section III describes in details the characteristics of the child bonus policy in Chile. Section IV describes the identification strategy I use. Section V describes

[18] Previous studies suggest that fertility intentions are a very good predictor of subsequent behavior (Schoen *et al*., 1999).

the data, while section VI describes the results. Section VII discusses the main results and concludes.

II. Related Literature

The literature relevant to this study relates both to the effects of child bonuses (as pro-natalist measures) on fertility, as well as to the effects of economic incentives on fertility decisions (where these incentives produce unintended side effects on fertility). This is the case, for instance, of the Aid to Families with Dependent Children (AFDC) and the Earned Income Tax Credit (EITC) in the US, and the Working Families Tax Credit (WFTC) in the UK. The literature that investigates the effects of economic incentives on fertility decisions is extensive. Even though results tend to vary, they point to a significant effect of financial incentives on fertility outcomes. The literature on the effects of child bonuses on fertility is much less extent, but also finds positive effects of these monetary incentives on fertility.

This is the first chapter that studies the effects of the Chilean child bonus policy on fertility outcomes, as well as the first to study the effects of a policy with the specific characteristics of the Chilean child bonus. Its main differentiating characteristic is the fact that the mother has access to the child bonus only long after she gives birth (when she is 65 years old), which makes it distinct from all other existing types of child bonus. In what follows, I describe some of the related previous studies. The first group of studies focuses on the effects of welfare on fertility decisions, while the second group shows reported effects of child bonuses on fertility.

In an extensive review of the available literature, Moffitt (1998) points out that studies about the effects of welfare on fertility often disagree, either finding positive effects or no effects at all. He shows that most studies use cross-state variation of the level of benefits to identify the effects of welfare programs on fertility, while other studies use cross-state changes over time, variations within states or a time-series approach. According to the studies reviewed by this author, the effects of welfare on fertility seem to be higher among white women in the US.

More recently, Ohinata (2008) analyses the effect of the introduction of the UK Working Families Tax Credit (WFTC) on fertility decisions using data from the British Household Panel Survey and a difference-in-differences approach. The author's findings suggest that the probability of a birth decreased and the timing between births increased for single women. For married women, the policy did not affect the probability of having a first child, but speeded up the birth of a second child.

Baughman and Dickert-Conlin (2009) examine the effect of expansions of the US Earned Income Tax Credit (EITC) that took place in the 90's on fertility outcomes. They use birth records from the period between 1990 and 1999 to explore cross-state variation in the level of tax credit benefits. The authors find that EITC expansions produced only small reductions on higher order childbearing of white women.

Billari and Galasso (2009) study the effect on fertility of two parallel pension reforms in Italy in the 90's. Both reforms lowered pension benefits for individuals who had less than 15 years of contribution to the system, leaving the ones with at least 15 years of contribution unchanged. They find that these reforms produced a positive impact on fertility, increasing fertility rate by over 10%. They consider this result as evidence of an

old-age security motive for fertility, since a consumption motive would have predicted a decrease in the fertility rate.

With respect to direct cash incentives to have children, Drago *et al.* (2009) investigate whether the Australian baby bonus, a cash payment to mothers (independent of income level, age, or number of children) increased fertility intentions and ultimately the fertility rate in Australia. The authors find an increase in the fertility rate of 3.2% due to the baby bonus. They also find a stronger effect for second births. With respect to fertility intentions, the authors find that these are lower for women who already have children, who are older and single, but higher for married women who are out of the labor force, as well as for more educated and high-earning women.

Finally, Day and Dowrick (2010) use a theoretical model for the choice of quantity and quality of children and find that the introduction of a lump sum baby bonus (such as the one implemented in Australia) increases fertility, but that any further increase in fertility would need the lump sum baby bonus to increase faster than household income.

The related literature seems to suggest a positive and significant effect of welfare and financial incentives on fertility. However, contrary to the Chilean case, all of the above mentioned studies refer to short-term benefits. In this study, I explore whether long-term benefits associated with having children could produce similar effects.

III. Child Bonus in Chile

Upon assuming the Presidency of Chile in March of 2006, President Michelle Bachelet formed an Advisory Council for Pension Reform - a committee composed by experts whose task was to make a diagnosis of the pension system and suggest ways to

improve it (Superintendence of Pensions, 2009). Four months later, the Advisory Council released its final report to the government and to the public. In December of 2006, President Bachelet sent the Pension Reform Bill to the Congress, which approved it in the following month (Centro de Microdatos, 2010). The Pension Reform Law was finally enacted in March of 2008, with its first measures implemented in July of the same year. Most of the Advisory Council's proposals, with improvements by the Chamber of Deputies and the Senate, were included in the Pension Reform Law (Superintendence of Pensions, 2009).

The idea of a child bonus first came out in the Advisory Council's report. The Council's proposal was to offer a subsidy to child birth corresponding to 12 monthly contributions based on the minimum wage to mothers who belong to the 60% poorest of the population (Comision Marcel, 2006). [19] The child bonus finally established by Law No.20,255 consists of a deposit to the mother's individual retirement account (or an increase in the mother's Basic Solidarity Pension), for each child born alive or adopted, of an amount equivalent to 18 monthly contributions based on the minimum wage plus the average nominal annual yield of Fund C (from all pension fund managers in the market) since the child was born until the mother reaches 65, with no income restrictions (Superintendence of Pensions, 2009). For women who are recipients of the Basic Solidarity Pension, Solidarity Pension Payment or survivorship benefits, the amount of the bonus is added to these benefits.

The child bonus became effective on July 1st, 2009. For births happening after this date, returns on the bonus amount start accruing from the time of birth, while for births

[19] The current minimum wage in Chile is CLP193,000, which corresponds to approximately USD411, as of September 2012.

before this date, returns on the bonus amount start accruing from July 1st, 2009 onwards. Moreover, only women who retire after this date and are at least 65 years old can have access to the child bonus.

Women who have a legal right to the child bonus are those who are affiliated with the individual account pension system and are not affiliated with any other pension system; those who receive either a Basic Solidarity Pension or a Solidarity Pension Payment; or women that even though not affiliated with the private pension system receive a survivorship benefit and have the right to a Solidarity Pension Payment.[20] One last requirement for getting the child bonus refers to residency. Mothers need to live in Chile for at least 20 years, continuously or with gaps, starting at the age of 20. Additionally, mothers need to live in Chile for at least 4 out of the prior 5 years to apply for the bonus. These eligibility conditions make the child bonus practically universal, since women can easily become affiliated with the private pension system and therefore have access to the bonus.[21]

Chile has very similar fertility levels to the ones observed in developed countries, with the average number of children per woman at 1.92 in 2008 (Instituto Nacional de Estadisticas, 2010). Figure 2.1 shows the evolution of the birth rate in Chile for the period 1997 to 2008. It shows a steady decrease in the birth rate since 1997 until 2006, from 17.9 to 14.2 births per 1,000 people. In 2007, however, this downward trend was reversed and the birth rate continued to increase in 2008, when it reached 14.8 births per 1,000 people. This reversion coincides with a period when the 2008 pension reform (and the

[20] The Solidarity Pension Payment (APS) is a payment from the Chilean government to complement the pension for individuals from the 60% poorest of the population with very low pension benefits.

[21] The 2008 pension reform also made it simpler by creating the "voluntary affiliate" figure, which allows any person who does not work on a paid activity to voluntarily enroll in the system since October 2008.

child bonus policy) was being discussed in Congress and was constantly debated in the media.

Figure 2.2 suggests that most of the increase in birth rates after 2007 might be attributed to out-of-wedlock births, which have increased proportionately more than births inside of marriages since 2007. In 2006, there were 95,807 births inside of marriages and 146,893 births out of marriages. In 2010, births to married couples were only 84,983, while out-of-wedlock births were 178,516. These figures suggest that in case of a positive effect of the child bonus policy on fertility, it might have affected fertility outcomes of single women more than married women.

IV. Empirical Strategy

In order to assess whether the introduction of the child bonus in the Chilean Pension System generated incentives for women to have children, I first estimate the following equation using a probit model for all women, as well as separate probit models for single, married, women with no children, women with only one child, and women with at least two children.

$$P(FP_i = 1/X_i) = \beta_1 KCB_i + \beta_2 E_i \equiv X_i\beta \qquad (1)$$

The dependent variable in (1), fertility preferences (FP_i), takes value 1 if the woman is considering having children in the future and 0 otherwise. The main independent variable of interest, knowledge about the child bonus (KCB_i), takes value 1 if the woman responds she knows about the existence of a child bonus and 0 otherwise. E_i represents a set of demographic controls, which includes age, age squared, marital status, number of children, whether the woman has at least one son (to account for the

possibility of preference for boys), whether she has at least one son and one daughter (to account for the possibility of wanting to have children of both genders), education level, whether the woman is employed, whether she is a house owner and whether she is in poor health.

A concern with this specification is the potential endogeneity of the knowledge variable, due to both reverse causality and unobserved factors correlated with knowledge about the child bonus and fertility preferences. It might be possible that a woman who considers having children in the future is more likely to know about the child bonus policy, just because she is naturally more interested in the topic and/or she might get informed by someone who knows that she considers having kids in the future. Moreover, I cannot observe some relevant characteristics, such as whether the woman likes children and whether she has a real desire to be a mother. Therefore, I use an instrumental variables approach to correct for the potential endogeneity of the knowledge variable.

I use whether the woman knows about the 2008 pension reform, as well as the amount of her knowledge about the system's rules, as instruments for whether she has heard about the child bonus policy. The former is likely a relevant instrument since women who have heard about the 2008 pension reform have also likely heard about the child bonus. Furthermore, it is likely an exogenous instrument since it is expected not to be correlated with the real preferences of women for having children, especially after holding constant age, marital status, education and other demographics. The latter is also likely a relevant instrument, since the amount of knowledge a woman has about the pension system should represent her interest in pension related issues, and is therefore likely positively correlated with knowledge about the child bonus. Due to the same

reasons argued for the first instrument, pension knowledge should also be an exogenous instrument.

Given the binary nature of both the dependent and endogenous variables, I estimate bivariate probit models for all women, as well as for single, married, women with no children, women with only one child, and women with at least two children. The bivariate probit models take the following form:

$$P(KCB_i = 1) = P(\beta_1 KPR_i + \beta_2 PK_i + \beta_3 D_i + \upsilon > 0) \qquad (2)$$

$$P(FP_i = 1) = P(\beta_1 KCB_i + \beta_2 D_i + \varepsilon > 0) \qquad (3)$$

In (2), KPR_i and PK_i are knowledge about the 2008 pension reform and pension knowledge, respectively. The remaining variables are defined in the same way as in (1). KPR_i, PK_i and D_i are observable characteristics independent of (υ,ε) and υ and ε are random error terms. The assumption that υ and ε are distributed normal with $E(\upsilon)=0$, $E(\varepsilon)=0$, $Var(\upsilon)=1$, $Var(\varepsilon)=1$ and $Cov(\upsilon,\varepsilon)=\rho$ allows for the possibility that the unobserved determinants of knowledge about the child bonus are correlated with the unobserved determinants of fertility preferences.

The second group of models uses a difference-in-differences (DD) framework to investigate the effects of the child bonus policy on fertility outcomes (fertility preferences and births). DD models use a treatment group (individuals affected by the policy) and a control group (individuals not affected or less affected by the policy), as well as observations from before and after the introduction of the policy, to identify its effects. The models estimated are of the following form:

$$P(y_{it} = 1) = \alpha + \beta_1 Treatment_{it} + \beta_2 Post_{it} + \beta_3 Treatment_{it} * Post_{it} + \beta_4 D_{it} + u_{it} \quad (4)$$

I use two different dependent variables. The first one relates to fertility preferences and is defined exactly in the same way as before (considering having children in the future). Moreover, in this framework, I also use whether the woman gave birth to a child between waves as a dependent variable. When the dependent variable is fertility preferences, it is contemporaneously measured with the independent variables. When the dependent variable is births, data from the current wave are used to predict a birth between the current and the following wave. For instance, data from the 2002 wave predict births that occur between 2002 and 2004; data from the 2004 wave predict births that occur between 2004 and 2006, and so on.

I define the treatment group using women's monthly household income in 2006. Since the child bonus corresponds to 18 contributions based on the minimum wage in place at the month when the child is born (a total amount of 1.5 minimum wages), I consider women as "treated" if their monthly household income is smaller or equal to 3 times the minimum wage. Women whose monthly household income is higher than 5 times the minimum wage are the control group. This considers that, given the amount of the child bonus, women in low-income households are more likely to be affected by the economic incentive that it represents than women in high-income households. Moreover, since the child bonus policy might as well affect women's labor market participation and therefore their household income, I use income in 2006 (before the introduction of the policy) to define the treatment and control groups. The minimum wage in place between

July 1st, 2006 and June 30th, 2007 in Chile was CLP135,000 (net minimum wage: CLP108,000).

Since the child bonus policy was established in March of 2008, data from the 2002, 2004 and 2006 waves are included in the "before" period, while data from 2009 are used as the "after" period. However, when studying the effects of the child bonus on fertility preferences, it is also possible to account for the possibility of an "announcement effect". The first time the idea of the introduction of a child bonus was presented to the Chilean society was in July of 2006. The majority of the interviews corresponding to the 2006 wave of the Social Protection Survey were performed between November of 2006 and January of 2007. Therefore, considering 2006 as part of the "after" period allows me to investigate the possibility of an announcement effect. When accounting for the possibility of an announcement effect, I use monthly household income in 2004 to define the treatment and control groups, for the same reasons explained above.

For identification of heterogeneous effects of the child bonus across birth parity and for single and married women, I use interactions of the "post*treatment" variable of interest with variables that represent birth parity and marital status.

I finally analyze the effects of the child bonus on the timing of birth using a discrete-time probit model. For this model, observations are pooled together and women are dropped out of the sample once the event of interest (in this case, a birth) happens. I do this analysis separately for women who already have children and for women who have no children in 2002.

V. Data

The data I use in this study comes from the Chilean Social Protection Survey (SPS). The SPS is a nationally and regionally representative survey that contains extensive individual information about participation in the labor market and in the social protection system, as well as socioeconomic characteristics. It contains longitudinal data for approximately 18,000 individuals, who were first interviewed in 2002, with follow-ups in 2004, 2006 and 2009. Since the child bonus policy was established in March of 2008, the SPS contains data from both before and after the policy introduction.

I restrict the sample used in the first set of models to women between 18 and 44 years of age who participated in the 2009 wave of the SPS. For the second set of models, I also restrict the sample to women between 18 and 44 years of age, but only include those women who are observed in all four waves of the SPS. I only exclude observations for which dependent variables (fertility preferences or births) and/or instrumental variables used in the analysis (knowledge about the pension reform and amount of knowledge about the pension system) are missing. I fill in the very few cases of missing values for independent variables with the means of these variables. The final sample used in the first set of models includes 2,057 women, while for the second set of models there are 1,207 women.

Table 2.1 shows the means of the variables considered in this analysis for all women in the sample using the 2009 wave of the SPS. The means are presented separately for women who knew about the existence of a child bonus and for women who did not know about this benefit. The exact question they were asked regarding the child bonus was: “Do you know or have heard about the bonus per each child born alive?”.

Table 2.1 clearly shows the popularity of this measure. While 80% of women know about this specific policy, only 35% of them responded positively to a question on whether they had heard about the 2008 pension reform. Women who know about the child bonus policy are more likely to know about the pension reform than women who do not know about the existence of a child bonus policy. There are also differences between these two groups with respect to their knowledge about the pension system rules. Based upon the number of correct/positive answers to a set of 10 general questions about the pension system, women who know about the existence of the child bonus have also more knowledge about the pension system in general. The questions I use to construct the pension knowledge variable are detailed in the Appendix.

Table 2.1 also shows that women who know about the child bonus policy are slightly more likely to consider having children in the future, although this difference is not statistically significant. This variable is the one I use to represent fertility preferences. It comes from the following question asked in the SPS: "Do you consider having children in the future?". Women who know about the child bonus are also less likely to be high school dropouts, and more likely to be older and to have a college degree. They are also more likely to be married, have more children and be employed, although these are not statistically different from the values observed for women who report not having heard about the child bonus.

Table 2.2 shows fertility preferences for different groups of women. Single women have higher fertility intentions than married women (which likely reflects the fact that single women have fewer children), while fertility intentions decrease with the number of children a woman already has. Married women who know about the child

bonus seem to want children in the future more than their less knowledgeable counterparts, while the same happens with women who already have children, but these differences are not statistically significant. These relationships are further explored in the next section.

Table 2.3 explores the characteristics of women who constitute the sample used in the second set of models (difference-in-differences framework). As expected, Table 2.3 shows that fertility intentions decrease as women age. It also shows that between 2002 and 2004, 16% of women gave birth to a child; between 2004 and 2006, 9% of them had a baby, and this same percentage of women had a child between 2006 and 2009.

Table 2.4 shows summary statistics for the treatment and control groups at each available wave of the Social Protection Survey. Women in the control group are slightly older than women in the treatment group and are much more likely to be married. This is likely a consequence of the definition of the treatment and control groups, which is based on household monthly income. Women in couples are more likely to have higher household monthly income, since it might include wages from both the husband and the wife. Women in the control group are also more educated than women in the treatment group. Treatment women are more likely to have more children and to be in poor health than women who participate in the control group.

For identification in a DD model, it is not necessary for treatment and control groups to present similar means of variables, but it is necessary for them to exhibit similar trends in the variables of interest. Table 2.4 shows that these trends are similar before the introduction of the child bonus policy for both fertility preferences and births, which decline over time for both groups. After the introduction of the child bonus, an

analysis of mean values shows that fertility preferences for both groups decline (even though the reduction is greater for the control group), and births decline for the treatment group but increase for the control group.

VI. Results

Table 2.5 presents the results from probit and bivariate probit models for all women, as well as for different groups of women. Probit models suggest a positive effect of knowing about the child bonus policy on considering having children in the future for all women, as well as for married women and women with only one child. However, since these estimates are likely biased due to the potential endogeneity of knowledge about the child bonus, I concentrate on the results from the bivariate probit models, which use knowledge about the 2008 pension reform and the amount of knowledge about the pension system as instruments.

For all women, the bivariate probit model suggests an important effect of knowing about the child bonus on fertility preferences. This effect amounts to 12.7 percentage points (a 42.3% increase in the mean probability of considering having children in the future) and is statistically significant at a 5% level. The Wald test for $\rho=0$ rejects the hypothesis that knowledge about the child bonus is exogenous at a 10% level.

The analysis for different groups of women shows there are substantial differences among these groups. For single women, the effect of knowledge about the child bonus policy amounts to 23.6 percentage points (a 62.1% increase in the mean probability of considering having children in the future for single women). The Wald test for $\rho=0$ also rejects the exogeneity hypothesis at a 1% level. For married women,

however, estimates do not show a statistically significant effect of knowledge about the child bonus on fertility preferences, but the Wald test for $\rho=0$ does not reject the exogeneity hypothesis. Probit estimates suggest an increase of 7.1 percentage points of married women's fertility preferences due to knowledge about the child bonus (a 30.9% increase).

Across birth parity, effects also differ. The bivariate probit model suggests an effect of 40.8 percentage points of knowledge of the child bonus on fertility preferences for women who have no children (an increase of 58.3% in the mean probability of considering having children in the future for women who are not mothers yet), although once again the Wald test for $\rho=0$ does not reject the exogeneity hypothesis. The probit model does not suggest a statistically significant effect of the child bonus on women's willingness to entering motherhood. Nevertheless, the child bonus seems to encourage higher order births. The effect for mothers of one child amounts to 8.5 percentage points (21.8% increase), and the effect for mothers of at least two children are also positive, even though not statistically significant.

Moreover, these models present consistent results with respect to the effects of the number of children a woman has and her age on fertility preferences. Considering all women, each existing additional child reduces the likelihood of considering having more children by 10.4 percentage points, while being one year older increases this probability by 4.7 percentage points. However, as expected, the effect of age decreases as women get older. Being in poor health also reduces the probability of considering having children in the future by 4 percentage points. All other covariates do not seem to play a significant role on fertility intentions.

Table 2.6 shows the first stage of the bivariate probit models. For all different groups of women, knowledge about the pension reform and the amount of knowledge they have about the pension system have a positive and significant effect on knowledge about the child bonus policy.

Table 2.7 presents results from DD models. Results suggest a positive effect of the child bonus on fertility preferences for women who have at least 2 children. The child bonus is associated with an increase of 5.3 percentage points in the probability of considering having children in the future for these women. This estimate is very similar to the one obtained from the probit model (4.9 percentage points), even though in that case it was not statistically significant. For women who have no children, however, the effect is negative, but not statistically significant. This effect is also similar to the one obtained from the probit model for women who have not yet entered motherhood. Nonetheless, for women who have only one child, the effect of the child bonus is negative and statistically significant, decreasing fertility preferences by 7.4 percentage points. This last result differs from the one obtained from the probit model.

Moreover, when we analyze the effects of the child bonus separately for single and married women, the child bonus seems to increase the probability of single women to consider having children in the future, while it decreases married women's fertility preferences, even though these results are not statistically significant. These effects reinforce previous results of a positive effect for single women, but differ from the previously found positive results for married women.

Analysis of the effects of the child bonus on births does not show a statistically significant effect for any groups of women across birth parities, but it shows a

statistically significant reduction on the probability of birth for married women by 5.2 percentage points.

The last three columns of Table 2.7 investigate whether there was an announcement effect of the child bonus policy on fertility preferences by using year 2006 as part of the post period. Results do not suggest a statistically significant effect for women with one child, even though this effect is positive. However, for women with no children, results suggest a statistically significant decrease of 9.1 percentage points on fertility preferences when we consider the announcement period. For women who already have at least two children, however, estimates suggest a 6.4 percentage points increase on fertility preferences since the announcement period. Across marital status, even though estimates indicate a positive effect of the child bonus on fertility preferences, these estimates are not statistically significant.

Table 2.8 shows the effects of the child bonus on the timing of birth for women who are already mothers and for women who have not yet entered motherhood. For women with children, the child bonus seems to have shortened the time to a birth (positive estimates, indicating an increase in the exit rate), even though this effect is not statistically significant. Moreover, it seems to have shortened the time to birth for single women, but increased the time to birth for married women, even though these effects are also not statistically significant. For women who are not yet mothers, the effect of the child bonus on the time to birth also seems to be positive and even stronger, even though not statistically significant. This effect is observed for both single and married women, but is much stronger for single women.

VII. Conclusion

This chapter investigates whether an extremely popular measure included in the 2008 Chilean pension reform, the child bonus granted to women as a deposit to their individual retirement accounts when they reach 65 years of age for every child born alive or adopted, generates incentives for women to have children as well as whether it affects the timing of birth. The main reason why this is relevant is because if it does indeed incentivize women to have children, it might counteract the main objective why it was created in the first place – to reduce the pension gender gap and compensate women for their prolonged absences from the labor market due to childcare.

I first use differences in knowledge about the existence of this policy to identify its effects on fertility preferences of women across birth parity and marital status. Due to the potential endogeneity of knowledge about the child bonus policy, I use knowledge about the pension reform and knowledge about the pension system's rules as instrumental variables in bivariate probit models. I then use difference-in-differences models taking into account the fact that due to the monetary amount of the child bonus, women in low-income households are more likely affected by the policy than women in high-income households. Therefore, I use monthly household income in 2006 to define treatment and control groups. I finally use discrete-time probit models to analyze the effects of the child bonus policy on the timing of birth for women across birth parity and marital status.

Results suggest a positive effect of the Chilean child bonus on fertility preferences, but this effect cannot be confirmed for births. Results also suggest that effects are greater for single women, as well as for higher order births. With respect to the

timing of birth, results suggest that the child bonus shortens time to birth, especially for single women and first births, even though these effects are not statistically significant.

These results contribute to the existing literature by showing that not only short-term but also long-term benefits may influence fertility choices. They also suggest that this policy might produce the unintended side effect of an increase in family sizes, which might actually raise the amount of time women spend out of the labor force. Therefore, fertility and labor market outcomes for Chilean women should be closely observed in order to guarantee that the child bonus policy will attain its objectives.

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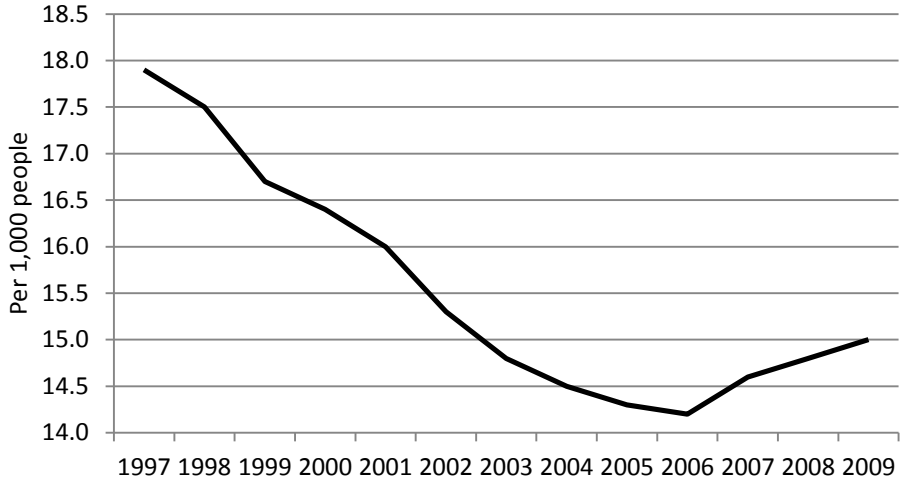
Figure 2.1. Chile: Birth Rate (1997-2009)



Source: Estadisticas Vitales Informe Annual 2009, INE

Figure 2.2. Number of Births (2006-2011)

Source: Servicio de Registro Civil e Identificación

Table 2.1. Summary statistics (2009)

Variables	*All*	*Does not know about child bonus*	*Knows about child bonus*	*P-value* [a]
Considers having children in the future	0.30	0.29	0.30	0.68
Knows about child bonus	0.80	0.00	1.00	.
Knows about pensions reform	0.35	0.14	0.40	0.00
Pensions knowledge	3.59	2.76	3.80	0.00
Age	35.51	35.00	35.64	0.05
Married	0.55	0.52	0.56	0.22
Number of children	1.68	1.63	1.70	0.35
Has at least one son	0.58	0.56	0.58	0.34
Has at least one son and one daugther	0.33	0.34	0.33	0.89
High school dropout	0.16	0.19	0.15	0.04
High school degree	0.59	0.61	0.58	0.39
College degree	0.25	0.20	0.27	0.01
Employed	0.66	0.65	0.67	0.54
House owner	0.65	0.66	0.65	0.91
Poor health	0.24	0.24	0.24	0.83
Observations	2,057	412	1,645	

[a] P-value of difference in means between women who know and who don't know about the existence of a child bonus

Table 2.2. Fertility preferences for different groups of women

Groups of women	*All*	*Does not know about child bonus*	*Knows about child bonus*	*P-value* [a]
Single women	0.38	0.39	0.38	0.74
Married women	0.23	0.20	0.24	0.20
Women with no children	0.70	0.73	0.70	0.52
Women with one child	0.39	0.35	0.41	0.26
Women with two or more children	0.10	0.07	0.10	0.20

[a] P-value of difference in means between women who know and who don't know about the existence of a child bonus

Table 2.3. Summary statistics by waves

Variables	*2002*	*2004*	*2006*	*2009*
Considers having children in the future	0.48	0.38	0.30	0.23
Had a birth between this wave and the next one	0.16	0.09	0.09	.
Age	29.99	32.40	34.44	36.87
Married	0.56	0.57	0.60	0.58
Number of children	1.50	1.67	1.76	1.85
Has at least one son	0.54	0.59	0.61	0.64
Has at least one son and one daugther	0.28	0.33	0.36	0.38
High school dropout	0.19	0.18	0.18	0.17
High school degree	0.64	0.60	0.60	0.60
College degree	0.17	0.22	0.22	0.23
Employed	0.59	0.63	0.63	0.65
House owner	0.68	0.70	0.72	0.68
Poor health	0.25	0.24	0.23	0.25
Observations	1,207	1,207	1,207	1,207

Table 2.4. Summary statistics for treatment and control groups

	2002		*2004*		*2006*		*2009*	
Variables	*Treatment*	*Control*	*Treatment*	*Control*	*Treatment*	*Control*	*Treatment*	*Control*
Considers having children in the future	0.47	0.52	0.38	0.36	0.28	0.33	0.22	0.21
Had a birth between this wave and the next one	0.14	0.20	0.09	0.08	0.08	0.11	.	.
Age	29.73	30.74	32.14	33.16	34.14	35.34	36.61	37.65
Married	0.49	0.71	0.49	0.77	0.47	0.89	0.50	0.81
Number of children	1.51	1.40	1.67	1.61	1.77	1.71	1.85	1.84
Has at least one son	0.54	0.43	0.60	0.50	0.62	0.53	0.64	0.57
Has at least one son and one daugther	0.28	0.25	0.32	0.31	0.35	0.33	0.37	0.37
High school dropout	0.25	0.05	0.24	0.04	0.23	0.07	0.22	0.05
High school degree	0.65	0.54	0.62	0.49	0.63	0.45	0.62	0.47
College degree	0.10	0.41	0.13	0.47	0.14	0.48	0.15	0.48
House owner	0.66	0.68	0.70	0.67	0.71	0.72	0.66	0.74
Poor health	0.29	0.18	0.28	0.17	0.26	0.17	0.29	0.18
Observations	796	193	796	193	796	193	796	193

Table 2.5. Effects of knowledge about child bonus on fertility preferences

	All		*Single*		*Married*		*No children*		*One child*		*At least two children*	
Variables	*Probit*	*Bivariate Probit*	*Probit*	*Bivariate Probit*	*Probit*	*Bivariate Probit*	*Probit*	*Bivariate Probit*	*Probit*	*Bivariate Probit*	*Probit*	*Bivariate Probit*
Knows about child bonus	**0.0416****	**0.1269****	**0.0136**	**0.2360*****	**0.0708****	**-0.1411**	**0.0016**	**0.4080*****	**0.0848***	**0.1598**	**0.0493**	**0.0132**
	(0.0191)	**(0.0532)**	**(0.0264)**	**(0.0654)**	**(0.0282)**	**(0.3676)**	**(0.0423)**	**(0.0452)**	**(0.0435)**	**(0.1727)**	**(0.0349)**	**(0.0774)**
High school degree	-0.0264	-0.0304	-0.0544	-0.0603	-0.0039	0.0057	0.0013	0.0029	0.0381	0.0428	-0.0516*	-0.0323
	(0.0258)	(0.0259)	(0.0371)	(0.0407)	(0.0360)	(0.0340)	(0.0736)	(0.0747)	(0.0611)	(0.0637)	(0.0301)	(0.0215)
College degree	0.00884	0.0001	-0.0067	-0.0156	0.0176	0.0383	0.0433	0.0204	0.0925	0.0955	-0.0594*	-0.0388
	(0.0280)	(0.0281)	(0.0390)	(0.0427)	(0.0403)	(0.0458)	(0.0754)	(0.0768)	(0.0682)	(0.0676)	(0.0343)	(0.0280)
Employed	0.0209	0.0203	0.0255	0.0208	0.0187	0.0138	-0.0275	-0.0170	-0.0012	-0.0028	0.0462	0.0311*
	(0.0178)	(0.0175)	(0.0265)	(0.0289)	(0.0238)	(0.0219)	(0.0469)	(0.0408)	(0.0382)	(0.0403)	(0.0284)	(0.0178)
House owner	-0.0112	-0.011	-0.0127	-0.0145	-0.0119	-0.0109	-0.0370	-0.0012	0.0510	0.0537	-0.0448*	-0.0289*
	(0.0159)	(0.0159)	(0.0233)	(0.0252)	(0.0221)	(0.0201)	(0.0397)	(0.0385)	(0.0375)	(0.0391)	(0.0232)	(0.0162)
Age	0.0499***	0.0474***	0.0550**	0.0464*	0.0484*	0.0423*	0.133***	0.0894***	0.0253	0.0284	0.0817**	0.0547**
	(0.0176)	(0.0176)	(0.0245)	(0.0269)	(0.0255)	(0.0232)	(0.0295)	(0.0298)	(0.0405)	(0.0427)	(0.0369)	(0.0252)
Age squared	-0.0011***	-0.0011***	-0.0012***	-0.0011***	-0.0011***	-.0010***	-0.0026***	-0.0018***	-0.0009	-0.0010	-0.0015***	-0.0010***
	(0.0003)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0003)	(0.0004)	(0.0005)	(0.0006)	(0.0006)	(0.0005)	(0.0004)
Married	-0.0012	-0.0021					-0.008	0.0039	0.0400	0.0433	0.0124	0.0088
	(0.0166)	(0.0166)					(0.0430)	(0.0371)	(0.0354)	(0.0365)	(0.0276)	(0.0183)
Number of children	-0.103***	-0.1036***	-0.104***	-0.1052***	-0.100***	-0.0869***					-0.0436*	-0.0285**
	(0.0126)	(0.0129)	(0.0175)	(0.0205)	(0.0179)	(0.0214)					(0.0234)	(0.0144)
Has at least one son	-0.0049	-0.0067	0.0054	0.0064	-0.0162	-0.0018			0.0578*	0.0643*	0.00158	0.0026

	(0.0202)	(0.0200)	(0.0302)	(0.0325)	(0.0270)	(0.0358)			(0.0350)	(0.0360)	(0.0370)	(0.0252)
Has at least one son												
and one daughter	-0.0177	-0.0145	-0.0399	-0.0493	-0.0081	-0.0203					-0.0287	-0.0203
	(0.0250)	(0.0250)	(0.0411)	(0.0445)	(0.0320)	(0.0345)					(0.0292)	(0.0211)
Poor health	-0.0404**	-0.0398**	-0.0281	-0.0188	-0.0523*	-0.0415	-0.0879*	-0.0212	-0.0348	-0.0385	-0.0476*	-0.0325
	(0.0196)	(0.0202)	(0.0277)	(0.0304)	(0.0273)	(0.0299)	(0.0502)	(0.0458)	(0.0463)	(0.0503)	(0.0275)	(0.0208)
Observations	2,057	2,057	923	923	1,134	1,134	416	416	547	547	1,094	1,094
Pseudo R-squared	0.3856		0.3945		0.3534		0.3235		0.2096		0.1896	
Wald test of rho=0												
(P-value)		0.0974		0.003		0.6324		0.1726		0.6921		0.767

Notes: Average marginal effects are reported. Standard errors in parentheses. *** p<0.01 ** p<0.05 * p<0.1

Table 2.6. Effects of pension knowledge on knowledge about child bonus

Variables	All	Single	Married	No children	One child	At least two children
Dependent variable: Knows about child bonus						
Knows about pension reform	0.152***	0.186***	0.124***	0.201***	0.122***	0.143***
	(0.013)	(0.017)	(0.019)	(0.026)	(0.025)	(0.020)
Pension knowledge	0.032***	0.040***	0.027***	0.024**	0.041***	0.031***
	(0.005)	(0.007)	(0.007)	(0.010)	(0.009)	(0.007)
High school degree	-0.010	-0.061	0.027	-0.076	-0.069	0.007
	(0.024)	(0.040)	(0.030)	(0.091)	(0.060)	(0.029)
College degree	-0.004	-0.0991*	0.067*	-0.063	-0.115	0.033
	(0.031)	(0.052)	(0.034)	(0.096)	(0.077)	(0.039)
Employed	-0.023	-0.012	-0.035	-0.029	-0.032	-0.019
	(0.019)	(0.029)	(0.025)	(0.048)	(0.036)	(0.026)
House owner	-0.014	-0.018	-0.002	-0.060	0.002	-0.003
	(0.018)	(0.027)	(0.024)	(0.043)	(0.033)	(0.025)
Age	0.009	0.039	-0.034	0.025	-0.035	-0.002
	(0.018)	(0.025)	(0.027)	(0.035)	(0.034)	(0.034)
Age squared	-0.0001	-0.001	0.001	-0.0003	0.001	2.46e-05
	(0.0003)	(0.0004)	(0.0004)	(0.0005)	(0.0005)	(0.0005)
Married	0.014			0.001	-0.002	0.024
	(0.017)			(0.042)	(0.032)	(0.024)
Number of children	0.013	-1.41e-06	0.027**			0.016
	(0.010)	(0.016)	(0.012)			(0.014)
Has a least one son	0.023	-0.027	0.066**		-0.037	0.080**
	(0.022)	(0.035)	(0.029)		(0.033)	(0.037)
Has at least one son and one daughter	-0.043	0.026	-0.0950**			-0.0657*
	(0.028)	(0.040)	(0.038)			(0.036)
Poor health	0.015	-0.010	0.035	-0.042	0.022	0.030
	(0.020)	(0.030)	(0.026)	(0.048)	(0.040)	(0.025)
Observations	2,057	923	1,134	416	547	1,094
Pseudo R-squared	0.08	0.12	0.07	0.12	0.09	0.08

Notes: Average marginal effects are reported. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2.7. Effects of child bonus on fertility preferences and births

Variables	*Considers having children in the future*			*Had a birth*			*Considers having children in the future*[1]		
Year 2004	-0.0316	-0.0340	-0.0309	0.0583**	0.0584**	0.0576**	-0.0541	-0.0501	-0.0541
	(0.0297)	(0.0294)	(0.0297)	(0.0274)	(0.0274)	(0.0275)	(0.0338)	(0.0338)	(0.0339)
Year 2006	-0.0580	-0.0610	-0.0570	0.171***	0.172***	0.168***	0.0277	0.0217	0.0278
	(0.0495)	(0.0487)	(0.0495)	(0.0512)	(0.0512)	(0.0513)	(0.0332)	(0.0333)	(0.0335)
Post	-0.0724	-0.0720	-0.0718				-0.130	-0.107	-0.130
	(0.0766)	(0.0754)	(0.0767)				(0.0905)	(0.0908)	(0.0910)
Post*Treatment	**0.0037**	**-0.0679**	**0.0280**	**-0.0403**	**-0.0467**	**-0.0269**	**0.0126**	**-0.0912***	**0.0128**
	(0.0306)	**(0.0481)**	**(0.0340)**	**(0.0281)**	**(0.0376)**	**(0.0298)**	**(0.0346)**	**(0.0466)**	**(0.0366)**
Post*Treatment*One child		**-0.0060**			**0.0054**			**0.0363**	
		(0.0492)			**(0.0350)**			**(0.0414)**	
Post*Treatment*Two children		**0.121*****			**0.0085**			**0.155*****	
		(0.0426)			**(0.0334)**			**(0.0361)**	
Post*Treatment*Married			**-0.0475***			**-0.0252**			**-0.0005**
			(0.0277)			**(0.0208)**			**(0.0263)**
High school degree	-0.0193	-0.0215	-0.0186	-0.0261	-0.0262	-0.0243	0.0002	-0.0016	0.0003
	(0.0365)	(0.0364)	(0.0364)	(0.0295)	(0.0295)	(0.0297)	(0.0360)	(0.0357)	(0.0359)
College degree	-0.0166	-0.0181	-0.0165	-0.0400	-0.0399	-0.0391	0.00193	0.00252	0.00194
	(0.0431)	(0.0430)	(0.0430)	(0.0354)	(0.0355)	(0.0356)	(0.0425)	(0.0423)	(0.0425)
House owner	-0.0189	-0.0198	-0.0179	-0.0103	-0.0103	-0.0097	-0.0153	-0.0163	-0.0153

	(0.0172)	(0.0171)	(0.0172)	(0.0153)	(0.0153)	(0.0152)	(0.0183)	(0.0182)	(0.0183)
Age	0.0226	0.0369*	0.0199	0.0794***	0.0806***	0.0763***	0.0300	0.0520**	0.0299
	(0.0192)	(0.0200)	(0.0192)	(0.0208)	(0.0216)	(0.0207)	(0.0203)	(0.0211)	(0.0203)
Age squared	-0.0005**	-0.0007***	-0.0005**	-0.0013***	-0.0013***	-0.0012***	-0.0005**	-0.0008***	-0.0005**
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0003)	(0.0002)
Married	0.0507**	0.0609**	0.0623**	0.0093	0.0096	0.0163	0.0472*	0.0561**	0.0475*
	(0.0235)	(0.0237)	(0.0242)	(0.0249)	(0.0250)	(0.0255)	(0.0254)	(0.0255)	(0.0278)
Poor health	-0.0045	-0.0057	-0.0052	-0.0393***	-0.0394***	-0.0390***	-0.0067	-0.0093	-0.0067
	(0.0172)	(0.0172)	(0.0172)	(0.0133)	(0.0134)	(0.0133)	(0.0185)	(0.0184)	(0.0185)
Number of children	-0.290***	-0.304***	-0.289***	-0.703***	-0.704***	-0.701***	-0.261***	-0.287***	-0.261***
	(0.0427)	(0.0443)	(0.0426)	(0.0634)	(0.0647)	(0.0635)	(0.0415)	(0.0433)	(0.0415)
Has at least one son	-0.0749	-0.0566	-0.0763	-0.0406	-0.0401	-0.0428	-0.0739	-0.0504	-0.0739
	(0.0636)	(0.0647)	(0.0637)	(0.0734)	(0.0744)	(0.0734)	(0.0655)	(0.0664)	(0.0655)
Has at least one son and one daughter	-0.0869	-0.109*	-0.0847	0.0061	0.0054	0.0082	-0.109*	-0.146**	-0.109*
	(0.0613)	(0.0619)	(0.0613)	(0.0716)	(0.0716)	(0.0714)	(0.0645)	(0.0657)	(0.0646)
Constant	0.763*	0.533	0.803**	0.0834	0.0663	0.120	0.469	0.167	0.469
	(0.409)	(0.415)	(0.409)	(0.422)	(0.426)	(0.420)	(0.448)	(0.455)	(0.448)
Observations	3,956	3,956	3,956	2,967	2,967	2,967	3,676	3,676	3,676
R-squared	0.175	0.180	0.175	0.456	0.456	0.457	0.150	0.158	0.150
Number of folio	989	989	989	989	989	989	919	919	919

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[1]This model considers years 2006 and 2009 as post periods to investigate whether there was an announcement effect.

Table 2.8. Effects of child bonus on timing of birth

Variables	*Women with children*			*Women with no children*	
Year 2004	-0.0370***	-0.0370***	-0.0365***	-0.0523*	-0.0545*
	(0.0124)	(0.0124)	(0.0124)	(0.0288)	(0.0286)
Year 2006	-0.0267	-0.0323*	-0.0313	-0.121***	-0.135***
	(0.0278)	(0.0193)	(0.0270)	(0.0453)	(0.0431)
Treatment	-0.0213	-0.0233	-0.0174	0.0548	0.0673
	(0.0191)	(0.0177)	(0.0192)	(0.0512)	(0.0541)
Post*Treatment			**0.0495**	**0.0971**	**0.150**
			(0.0442)	**(0.106)**	**(0.116)**
Post*Treatment* One child		**0.0046**			
		(0.0332)			
Post*Treatment* Two children		**0.0168**			
		(0.0356)			
Post*Treatment* Married			**-0.0786*** **		**-0.136*** **
			(0.0162)		**(0.0262)**
High school degree	-0.0337**	-0.0334**	-0.0351**	0.0622	0.0697
	(0.0150)	(0.0150)	(0.0148)	(0.0582)	(0.0568)
College degree	-0.0276	-0.0272	-0.0287	0.0894	0.0984
	(0.0190)	(0.0191)	(0.0187)	(0.0735)	(0.0727)
House owner	0.0115	0.0115	0.0129	0.0051	0.0131
	(0.0139)	(0.0139)	(0.0139)	(0.0338)	(0.0341)
Age	0.0065	0.0073	0.0015	-0.0286	-0.0305
	(0.0127)	(0.0129)	(0.0128)	(0.0264)	(0.0264)
Age squared	-0.0002	-0.0002	-0.0001	0.0003	0.0004
	(0.0002)	(0.0002)	(0.0002)	(0.0004)	(0.0004)
Married	0.0635***	0.0637***	0.0845***	0.246***	0.306***
	(0.0180)	(0.0181)	(0.0211)	(0.0665)	(0.0748)
Poor health	-0.0268*	-0.0267*	-0.0264*	-0.0381	-0.0394
	(0.0150)	(0.0150)	(0.0150)	(0.0381)	(0.0383)
Number of children	-0.0230***	-0.0239***	-0.0229***		
	(0.0084)	(0.0088)	(0.0084)		
Has at least one son	0.004	0.0037	0.004		
	(0.0157)	(0.0159)	(0.0156)		
Has at least one son and one daughter	-0.0300*	-0.0303*	-0.0307*		
	(0.0176)	(0.0179)	(0.0174)		
Observations	2,582	2,582	2,582	582	582

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix

Here I present the questions from the 2009 wave of the Chilean Social Protection Survey I use to construct the pension knowledge instrument.

Pension Knowledge

1. Do you know which percentage of your income is monthly discounted (was discounted or would be discounted) for the pension system?
    a. Yes → Which percentage?
    b. No
2. According to the law, at which age can a man retire? What about a woman?
3. Do you know how pensions are calculated at the AFPs?
    a. According to the wage of the last years
    b. Considering the balance of the individual account, retirement age or other elements
    c. I don't know
4. Do you know or have heard about the Voluntary Savings for Retirement that operates since year 2002?
    a. Yes
    b. No
5. Do you know how much is accumulated in your individual account?
    a. Yes
    b. No

6. Who pays the variable fees?
    a. The participant with her wage
    b. The participant with her pension fund
    c. The employer
7. Do you know or have heard about the Multifunds?
    a. Yes
    b. No
8. Do you know how many types of fund exist?
    a. Yes → How many?
    b. No
9. Do you know which are the different types of payout of old age pensions?
    a. Yes
    b. No
10. Do you know that by fulfilling certain requisites, you can opt to retire early?
    a. Yes
    b. No

CHAPTER THREE

THE ROLE OF FINANCIAL LITERACY AND PENSION KNOWLEDGE ON THE INVESTMENT OF RETIREMENT SAVINGS

Abstract

This chapter investigates the role of financial literacy and pension system knowledge on the retirement savings investment choice of workers using data from the 2006 and 2009 waves of the Chilean Social Protection Survey. Only 33 percent of Chilean workers have made an active investment decision with respect to their retirement savings. I find that financial literacy and especially pension knowledge present a statistically significant and positive effect on the probability of making an active investment decision, but that only financial literacy affects the choice of investment fund itself. These results suggest that investing in financial and pension system education might be an important strategy for governments to motivate active investment choices and provide workers with tools to make appropriate investment decisions in accordance with personal characteristics.

I. Introduction

Since 1981, when Chile replaced its defined benefit pension system by a defined contribution scheme based on individual accounts, many countries (mainly in Latin America and Central and Eastern Europe) have followed its example. A fundamental aspect of this type of pension scheme is that it places great responsibility on workers, since they are required to make decisions on several important issues related to their savings for retirement. For instance, workers are required to choose a pension fund administrator, to decide how to invest their savings for retirement and also how to receive pension benefits in the payout phase. Among these, the way they choose to invest their retirement savings is likely to be the most important choice, given the long accumulation phase in which interest is accrued in individual accounts. Therefore, the way savings are invested is a main determinant of the accumulated balance in workers' individual accounts, and is ultimately a fundamental determinant of future pension benefits. Choosing how to invest savings for retirement is not a simple task, though. It requires not only specific cognitive skills, such as mathematical and financial knowledge, but also some understanding of how the pension system works. This chapter investigates whether and to what extent financial literacy and pension system knowledge are related to active retirement savings investment decisions, and studies further whether these variables influence deviations from investment in default funds.

The extent of the choices given to individuals with respect to retirement savings investment varies among countries. Some countries, such as Sweden and Australia, give almost unlimited investment choices to workers (Tapia & Yermo, 2007). In Sweden, for instance, by the end of 2006, there were 776 available funds for workers to invest their

retirement savings (Tapia & Yermo, 2007). Investment options also abound for 401(k) savings in the US. Latin American countries and most Central and Eastern European countries offer much fewer choices. Chile has five different pension funds for workers to choose from, while Peru has three and Mexico only two. In some countries workers are allowed to split their savings among two or more types of funds. Since for many workers the choice of how to invest retirement savings is a complicated task, a common practice among countries is to offer a default fund for workers who do not actively choose how to invest their savings for retirement.

Given the array of investment options available, making an active choice might be extremely beneficial to workers if due to personal characteristics, such as age, income level and risk preference, another investment fund would be a better option than the default fund. The default fund is not the optimal choice for everyone. Empirical evidence shows, however, that workers are not likely to actively choose how to invest their retirement savings. Madrian and Shea (2001), for instance, point out that 71% of US workers choose the default investment alternative in their 401(k) and suggest that individuals tend to understand default options as advice. Engstrom and Westerberg (2003) show that in Sweden, 67% of individuals made an active investment decision when the Swedish Premium pension system was launched in 2000, a result they call "reversed investment behavior", since it is very different from what US studies about 401(k) participation find.[22] Nevertheless, active investment choice in the rounds that

[22] Weaver (2005) attributes this high participation of Swedish workers partly to the large amount of money that was to be placed in individual accounts (contributions accrued between 1995 and 1998) and to a massive media campaign.

followed for new entrants in the labor market declined substantially, being less than 10% in the 3 rounds between 2003 and 2005 (Weaver, 2005).[23]

Behavioral economics has possible explanations for the small number of workers that make active retirement savings investment decisions. If individuals have bounded rationality and/or bounded willpower, they might not rationalize how important saving for retirement is and not act on important features of the pension system, such as investment.[24] Individuals might also procrastinate and not have enough willpower to make active investment choices, prefering the easiest way instead, which in this case is to adopt the default investment fund.

Along these lines, an individual will more likely make an active choice if the perceived expected benefits of doing so are higher than the costs of gathering enough information to be able to make an informed choice. This would suggest that individuals with higher levels of education, more knowledge about the pension system and higher numerical ability might be more likely to make active investment choices, since their information costs are likely lower than the ones faced by less knowledgeable individuals. Reinforcing this argument, Engstrom and Westerberg (2003) find that previous experience with financial investment increases the probability of making an active investment decision in the Swedish pension system.

Of equal interest is the question of how "active investors" invest their retirement savings. In particular, it is interesting to observe whether they invest according to what a life cycle model would suggest – riskier investments early in the accumulation phase and more conservative investments as retirement approaches. Palme *et al.* (2005) study the

[23] For a discussion of possible reasons for this decline, please see Weaver (2005).
[24] See Thaler & Mullainathan (2001).

investment choice of Swedish workers in the Premium pension system and find that the relationship between income and risk is U-shaped: low and high-income earners take on more risk than their middle-income counterparts.

This chapter contributes to the literature in two ways. It uses a relatively new dataset, the Chilean Social Protection Survey, which mirrors the US Health and Retirement Survey, but includes workers of all ages. Contrary to US and Swedish workers, Chilean workers do not count on a public component for their pension benefits, and rely entirely on their individual accounts to finance retirement.[25] Moreover, this is the first study to examine the role of pension system knowledge, as well as financial literacy, on the retirement savings investment decision. As the following section shows, financial literacy has been related in the literature to several pension outcomes, but seldom to investment choices. Pension system knowledge, however, has been less explored. This is the first research to examine the link between pension system knowledge and investment choice.

The chapter continues as follows. In section II, I present a review of the relevant literature, while in section III a description of the Chilean pension system is presented. Section IV describes the data, while section V describes the methodology I use. Results are discussed on section VI and section VII concludes.

II. Previous Literature

Recent literature has explored the relationship between both financial literacy and pension knowledge with pension outcomes. Lusardi and Mitchell (2007a, 2007b, 2007c,

[25] Except for solidarity pensions, which are granted to individuals that belong to the 60% poorest population and who are not able to finance a minimum pension with the balance on their individual accounts once they reach the legal retirement age.

2008) have done extensive work showing that financial literacy is key for retirement planning and preparedness using different sources of US data. They show that more financially literate individuals are more likely to have thought about retirement (2007a, 2007b), and are more likely to plan for retirement (2007c). They also find that less financially literate women are less likely to plan for retirement and be successful planners (2008).

More recently, the positive and statistically significant relationship between financial literacy and retirement planning has been confirmed using data from several other countries (Alessie *et al.*, 2011 for the Netherlands; Bucher-Koenen & Lusardi, 2011 for Germany; Klapper & Panos, 2011 for Russia). Nevertheless, Crossan *et al*. (2011) find no evidence of an effect of financial literacy on thinking about financial planning for retirement in New Zealand. [26]

The relationship between financial literacy and pension plan participation has also been investigated. Agnew *et al*. (2009) explore the effects of financial literacy and trust in financial institutions on 401(k) savings behavior using survey and administrative data from three U.S. firms, two of which have automatic enrollment plans. They find that both financial literacy and trust have sizable effects on the decision to participate in 401(k) plans. Fornero and Monticone (2011) also find a positive and significant impact of financial literacy on pension plan participation using data from the Bank of Italy's Survey on Household Income and Wealth.

Banks and Oldfield (2007) examine how numerical ability and other cognitive functions affect wealth and retirement savings outcomes for a sample of near-retirement

[26] Authors claim this lack of effect might be a result of the retirement income security provided by a strong public pension system in New Zealand.

English workers. The authors find that numerical ability, represented by an index constructed using five basic numeracy questions, is strongly correlated with savings for retirement and asset holdings. Workers with higher numerical literacy are 15 percentage points more likely to hold shares and 11 percentage points more likely to own a private pension than their less numerate counterparts.

Hung *et al*. (2009) analyze the relationship between financial literacy and several aspects of individual choices related to retirement. Using data from the RAND American Life Panel, they also find support for a positive relationship between financial literacy and how much a respondent has thought about retirement. Moreover, they find a positive relationship between financial literacy and planning on how to spend down retirement assets. They do not, however, find a strong effect of financial literacy on contributions to DC plans or on making common investment mistakes, such as holding portfolios with no stocks. Higher levels of financial literacy have also been associated with lower rates of annuitization in the payout phase for both defined benefit and 401(k) pension plans in the U.S. (Clark *et al.*, 2010).

These studies show that there is a close relationship between financial literacy and pension outcomes in general. The relationship between pension knowledge and pension outcomes, however, has been much less explored.

One study that examines the relationship between pension knowledge and retirement savings is Landerretche and Martinez (2011). The authors analyze how pension knowledge affects the retirement savings of Chilean workers. They find that workers who are more knowledgeable about the pension system are more likely to engage in other types of financial savings, but not within the pension system's voluntary pillar. They also

find that more literate workers are more likely to switch the type of pension fund they invest in and are more likely to contribute voluntarily to the system in the case of self-employed workers.

In this chapter, I add to this literature by investigating the role of financial literacy, and most importantly, of pension specific knowledge on the investment of retirement savings. I study how these two cognitive factors affect whether the worker makes an active investment decision and further, whether they affect deviations from the corresponding default option for the worker's age. This is a crucial issue since a substantial part of workers' pensions depends on how their savings for retirement are invested, and therefore, it is extremely important to understand how this decision is made.

III. Chilean Pension System

Chile went through a major reform of its pension system in 1981, when its pay-as-you-go system was replaced by an individual account scheme based on defined contributions. Individuals who were part of the old scheme could opt whether to change to the new system or not. However, every new worker had to comply with the new rules. The system was reformed again in 2008, but the recent changes were much less profound. The main objectives of the recent reform were to increase pensions' coverage and improve the access to pensions for the most economically disadvantaged groups.

The Chilean pension system is based on three pillars: a Solidarity Pillar, a Contributive Pillar and a Voluntary Pillar. The Solidarity Pillar has the objective of reducing poverty by providing access to old age and disability pensions for people that did not participate in the pension system or were not able to finance a minimum pension

with the balance on their individual accounts. The Contributive (and main) Pillar is the heart of the system. It mandates regular contributions to individual capitalization accounts for all dependent workers, to which they have access when they meet the eligibility criteria to retire. Finally, the Voluntary Pillar provides an opportunity for individuals who want to increase their savings for retirement over the mandated amount to do so. Tax benefits are offered to encourage this decision.

Under the Contributive Pillar, each worker chooses a pension funds manager (known as *Administradoras de Fondos de Pension*, or AFP) and up to two types of fund where to invest their savings for retirement. In the case of a split of retirement savings between two funds, workers are free to choose the percentage to direct to each type of fund. The contribution rate is not a choice variable, though. Workers are required to contribute monthly 10% of their earnings to their individual accounts, and they also pay a monthly management fee to their pension fund manager, which includes the payment for a disability and survivorship insurance. At the time of retirement, workers use the accumulated balance on their individual accounts to finance their pensions. The latter can take the form of life annuities or programmed withdrawals, or a combination of the two.[27]

There currently exist five different pension funds managers and five different types of fund to choose from. The latter vary by the amount of stocks they are allowed to invest in. The types of fund are A (riskiest), B (risky), C (intermediate), D (conservative) and E (most conservative). Fund A is the riskiest one, with up to 80% of its value invested in variable income, while fund E, the most conservative, is allowed to invest only up to 5%

[27] The legal age of retirement in Chile is 60 years old for women and 65 years old for men. Everyone affiliated with the AFP system (Contributive Pillar) has the right (not the obligation) to retire when reaching the legal age of retirement. However, by meeting certain eligibility requirements, it is possible to retire earlier.

of its value in variable income. Funds B, C and D are allowed to invest up to 60%, 40% and 20% in stocks, respectively. The five types of fund reproduce a desirable life cycle investment: Younger workers, who have a longer time until retirement, can optimally choose to invest in the riskier funds (given that stocks are a long-term type of investment), while older workers approaching retirement should optimally invest in the more conservative funds, since they might not have enough time to recover from potential losses.[28] Workers that do not explicitly choose a type of fund where to invest their savings (do not make an "active choice") are assigned to one of the types of fund according to their age. Workers up to 35 years old are assigned to fund B, men between 36 and 55 and women between 36 and 50 years old are assigned to fund C. Older workers and pensioners are assigned to fund D. Furthermore, older workers are not allowed to invest in fund A, and retirees cannot invest in either of the riskier funds. Table 3.1 illustrates the investment options for workers in the Chilean pension system.

IV. Data

The data I use for this study comes from the third (2006) and fourth (2009) waves of the Chilean Social Protection Survey (SPS). The SPS is a nationally and regionally representative survey that contains extensive individual information about participation in the labor market and in the social protection system, as well as socioeconomic characteristics. It also contains a detailed set of questions that evaluate how well informed participants are about several aspects of the pension system, as well as

[28] An example is the recent world financial crisis, which hit the retirement accounts of many workers approaching retirement, who might end up delaying it.

questions that measure the financial knowledge of respondents and their level of risk aversion. The SPS contains longitudinal data for 16,443 individuals in 2006 and 14,463 individuals in 2009. They were first interviewed in 2002, with follow-ups in 2004, 2006 and 2009.

I restrict the sample to individuals who are affiliated with the private pension system, who are employed either full or part-time and who are not retired yet. I exclude individuals for whom information about an active investment decision and/or pension knowledge is missing. The sample size for 2009 after these restrictions is 4,648 individuals. The exact steps towards the construction of the final sample are detailed in Table 3.2.

The questions I use to determine whether the participant has made an active investment choice in the 2009 survey are the following: "When you joined the system or when the multifunds were introduced in 2002, did you choose a type of fund for your retirement savings?" If the answer is yes, I consider that the participant has made an active decision with regard to her retirement savings investment. If the answer is no, I then focus on the answer to the following question: "After this assignment or initial choice, have you changed the type of fund?" If the participant answers positively, I consider she has made an active choice. In 2006, participants were asked a different question: "Have you chosen in which type of fund to put your retirement savings?" Respondents who answer this question positively are considered to have made an active investment choice. In both waves of the SPS, participants are also asked in which type of fund their retirement savings are in. For the cases when participants have their savings

split between two funds (the maximum allowed by law), I only consider the riskier one for the purposes of this study.

I measure pension knowledge using answers to ten different questions that assess general knowledge about the pension system. For instance, one question asks whether the participant knows which percentage of her income is contributed monthly to her individual retirement account. Another question asks whether the participant knows who is responsible for paying the variable management fee to the pension funds manager. According to the number of correct answers to these questions, each participant is given a score that varies between 0 and 10.

Figure 3.1 shows the distribution of pension knowledge scores across individuals in the sample. I divide workers into three different groups. I consider workers with a score between 0 and 3 as having a low level of pension knowledge. In the same manner, workers with a score between 4 and 6 have an intermediate level of knowledge, while workers with a score higher than 6 have a high level of pension knowledge. The exact questions I use to construct these variables are listed in Appendix.

I use a similar approach to construct financial literacy variables. They are based on six math and finance questions, which require participants to calculate a percentage, do a division, use the notion of compound interest and show some familiarity with finance concepts. The distribution of financial knowledge scores among workers is shown in Figure 3.2. Just as in the case of pension knowledge, I divide workers into three groups of knowledge. I consider workers have a low level of financial knowledge if their score is between 0 and 2. A score of 3 or 4 corresponds to an intermediate level of knowledge, while 5 or 6 corresponds to a high level of financial knowledge. The exact questions I use

are also listed in Appendix. Moreover, Appendix shows the question I use to determine whether the respondent is risk averse. I consider the respondent as risk averse if she chooses Alternative A in all three situations.

Table 3.3 shows the means of the variables of interest for all workers, as well as separately for the ones that have made an active investment decision and the ones that have not. The last column of Table 3.3 shows the p-value of a test of equality of means between both groups of workers. Thirty-three percent of workers in the 2009 sample actively chose how to invest their retirement savings. Workers that make an active decision have more knowledge about the pension system and higher numerical ability on average. Moreover, workers who make an active investment choice have a higher level of education than the ones that do not. Forty-three percent of workers who choose how to invest their retirement savings have a college degree, whereas only 19% of the ones that do not choose have this same level of education. Furthermore, workers who make an active investment decision earn on average 76.5% more than the ones that do not. Women are less likely to make an active choice than men.

Work related variables also differ between the two groups. Workers who have not made an active decision are more likely to be blue collar and self-employed workers. On the other hand, workers who have made an active choice are more likely to work in a large company and to be unionized.

Among workers who made an active decision, 65.6% chose a riskier fund than the correspondent default for their age, while 14.4% chose a more conservative fund. Table 3.4 shows descriptive statistics for workers who chose a riskier, the same, or a more conservative fund than the correspondent default option for their age. Workers with

higher financial literacy, higher pension knowledge and a college degree tend to choose riskier funds. The same is true for workers with higher net wealth and monthly earnings. Women tend to be more conservative investors, and, surprisingly, workers who choose to deviate from the default option to a riskier fund are slightly older on average.

V. Empirical Methodology

V.1 Active investment choice

In order to study the active investment decision of workers, I first estimate logit models for all individuals, as well as for men and women separately, using data from the 2009 wave. These models estimate the following equation:

$$P(y_i = 1/X_i) = \beta_1 PK_i + \beta_2 FL_i + \beta_3 I_i + \beta_4 R_i + \beta_5 W_i + \beta_6 E_i \equiv X_i\beta \quad (1)$$

The dependent variable in (1) takes value 1 if the worker has made an active investment decision and 0 otherwise. The independent variables include pension knowledge dummy variables for low, intermediate and high level of pension knowledge (PK); financial literacy dummy variables for low, intermediate and high level of financial literacy (FL); a dummy variable that takes value 1 if the worker has another type of financial investment and 0 otherwise (I); a dummy variable that takes value 1 if the worker is risk averse and 0 otherwise (R); a set of work related variables, such as being a blue collar worker, being unionized, working for a large company and being self-employed (W); and finally E represents a set of demographic controls, which include age, age squared, gender, dummies for educational level, marital status, number of children, monthly income, net wealth and whether the participant currently contributes to the system. Table 3.5 shows the results of the logit models.

I then estimate fixed effects models using data from both the 2006 and 2009 waves of the Chilean Social Protection Survey. Fixed effects models have the advantage of accounting for any time-invariant unobservable variables that might affect an active investment decision, such as individual ability and willpower. Table 3.6 shows summary statistics for individuals who participate in both rounds of the SPS. Between 2006 and 2009, the level of financial literacy among workers showed some improvement on average, but the same was not observed for pension knowledge. The apparent worsening of workers' pension knowledge level might be a result of the pension reform implemented in 2008, which possibly produced confusion among workers with respect to main aspects of the system. [29]

V.2. Choice of type of pension fund

For the sample of workers that made an active investment choice, I estimate a multinomial logit model that investigates whether and how financial literacy and pension knowledge affect the choice of type of fund. In particular, I study whether workers choose a riskier, more conservative or the same pension fund as the corresponding default option for their age. The multinomial logit model takes the following form:

$$P(y = j/X) = exp(X\beta_j)/\left[1 + \sum_{h=1}^{J} exp(X\beta_h)\right],$$

j=riskier, default, more conservative (2)

The dependent variable in (2) takes value 1 if the worker chooses a riskier fund than the corresponding default option for her age, 2 if the choice is the same as the default option for her age, and 3 if the chosen fund is more conservative than the corresponding

[29] For more information about the 2008 Chilean Pension Reform, please see Superintendence of Pensions (2009).

default option for her age. The covariates I use in the estimation of equation (2) are exactly the same as the ones in equation (1).

All models are estimated for all workers, as well as separately for men and women. This last distinction is important since it has been extensively reported in the literature that men and women present different investment behavior, with women usually found to be more conservative investors.

VI. Empirical Results

VI.1 Active investment choice

Table 3.5 presents the results of the logit models for an active investment decision for all workers, as well as for men and women separately. These results show that higher levels of financial literacy and pension knowledge are strongly correlated with active retirement savings investment choices, even after controlling for education and income levels. High financial literacy is associated with a 4.5 percentage point higher probability of making an active choice (a 13.6% increase in this probability) as compared to a worker with low financial literacy, while a high level of pension knowledge is associated with an increase in the probability of making an active choice of 30.9 percentage points with respect to a worker with low pension knowledge, or a 93.6% increase in the probability of making an active decision.

The analysis by gender shows an interesting difference between men and women. Results suggest that although higher levels of pension knowledge produce a positive effect for both men and women, it is stronger for men, while the contrary occurs with financial literacy. Moreover, the logit model for all workers shows that women are 4.6

percentage points less likely to make an active investment choice than men. Another interesting result is the one obtained for risk aversion. Risk averse men are 2.8 percentage points less likely to make an active investment choice, while risk averse women are 4.2 percentage points more likely to decide how to invest their retirement savings.

The fixed effects models on Table 3.7, which identify the effect of the knowledge variables through within individual variation over time, also report statistically significant and positive associations of higher levels of financial literacy and pension knowledge with an active investment choice, with similar magnitudes of effects of financial literacy, but smaller effects of pension knowledge. According to the fixed effects model for all workers, a high level of financial literacy is associated with a 3.9 percentage point higher probability of making an active choice than a low level, while a high level of pension knowledge is associated with a 10.9 percentage point higher probability of an active choice when compared to a low level of knowledge. These smaller magnitudes are most likely a consequence of controlling for unobserved heterogeneity (or fixed effects), such as ability and willpower, which might be correlated with pension knowledge and financial literacy.

Differently from the logit models shown in Table 3.5, the fixed effects models suggest that financial literacy affects more the decision of men than that of women, while the contrary is true for pension knowledge. The analysis by gender using fixed effects models do not suggest a statistically significant effect of high financial literacy for women, but do suggest a positive and significant effect of financial literacy for men and of pension knowledge for both men and women, with a greater effect for women.

These models confirm the importance of accounting not only for financial literacy, but also for pension system specific knowledge when studying the effects of knowledge and information on pension outcomes. These models also confirm the expected importance of education and income for this decision, both strongly associated with active choices. Also interesting to note are the strong positive effects of an increase in the worker's number of children and of being unionized on the probability of making an active choice.

VI.2. Choice of type of pension fund

Table 3.8 shows the results of the multinomial logit models for the choice of pension fund.[30] Results are relative to the corresponding default option according to the worker's age. Once again, results are presented for all workers, as well as for men and women separately.

The easiest way to interpret results from a multinomial logit model is using odds ratios. These give the change in the odds of choosing a riskier or more conservative pension fund relative to the default option according to the worker's age (the omitted category) when there is a unit change in the covariate of interest.

Results suggest that high financial literacy is associated with a smaller probability of investing in a more conservative fund than the default fund for all workers as well as for women. This effect is not statistically significant for men. In general, the odds ratios suggest that higher financial literacy imply a higher probability of investing in a riskier fund and a smaller probability of investing in a more conservative fund. Pension

[30] A Hausman test for the Independence of Irrelevant Alternatives assumption suggests that the null hypothesis of independence cannot be rejected. Therefore, I proceed with the multinomial logit instead of a multinomial probit model.

knowledge, on the other hand, does not seem to have a statistically significant effect on a deviation from the default option.

These results once again confirm the conservativeness of women as investors. They are 30.8% less likely to invest in a riskier fund than choosing the default fund when compared to men. Moreover, higher levels of education are strongly associated with deviations from the default option. Higher monthly earnings are also associated with higher odds of choosing riskier funds than the default fund. With respect to age, results show that men and women present different behaviors. Although men are more likely to invest in riskier funds as they grow older (and wealthier), women are significantly less likely to deviate from the default choice.

VII. Conclusion

This chapter investigates the role of financial literacy and pension system knowledge on the retirement savings investment decision of workers using data from the 2006 and 2009 waves of the Chilean Social Protection Survey. By 2009, only 33 percent of workers had made an active investment decision. This low active participation of Chilean workers is in accordance with previous findings for the US and Sweden (except for the first year of implementation of the Swedish Premium Pension System). Fixed effects models, which control for the unobserved heterogeneity of workers, suggest a statistically significant and positive role of financial literacy and pension knowledge on the probability of actively choosing a type of pension fund. A higher level of financial literacy is associated with a 3.9 percentage point higher probability of actively choosing how to invest the retirement savings than a low level. The impact of a higher level of

pension knowledge is 2.8 times higher. Education and the level of monthly earnings are other important factors affecting the probability of actively choosing the type of retirement savings investment. When men and women are studied separately, we note that financial literacy has a greater effect on the choice of men than on the choice of women. Nevertheless, the effect of pension knowledge is higher than that of financial literacy for both men and women.

In accordance with previous results for the US (Papke, 1998), workers tend to choose riskier investments when they deviate from the default option. Among workers who made an active choice, 65.6% chose a riskier fund than the corresponding default option for their age, 20% chose the same as the default option for their age, and the remaining 14.4% chose a more conservative fund. Higher financial literacy is associated with less conservative investments, while pension knowledge does not seem to significantly affect the choice of pension fund itself. Results also confirm the common knowledge of women being more conservative investors, since they are significantly less likely to invest in riskier funds.

Finally, results suggest that financial literacy and pension system knowledge play a larger role in a possible active retirement savings investment choice than in the choice itself, where other variables, such as age, education and income seem to play a more important role. Investing in financial education and especially in pension system education might be a good strategy for governments to motivate workers to make the important decision of how to invest their retirement savings, and would give them tools to better choose the appropriate option according to their individual characteristics.

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Figure 3.1. Distribution of pension knowledge in 2009 by gender

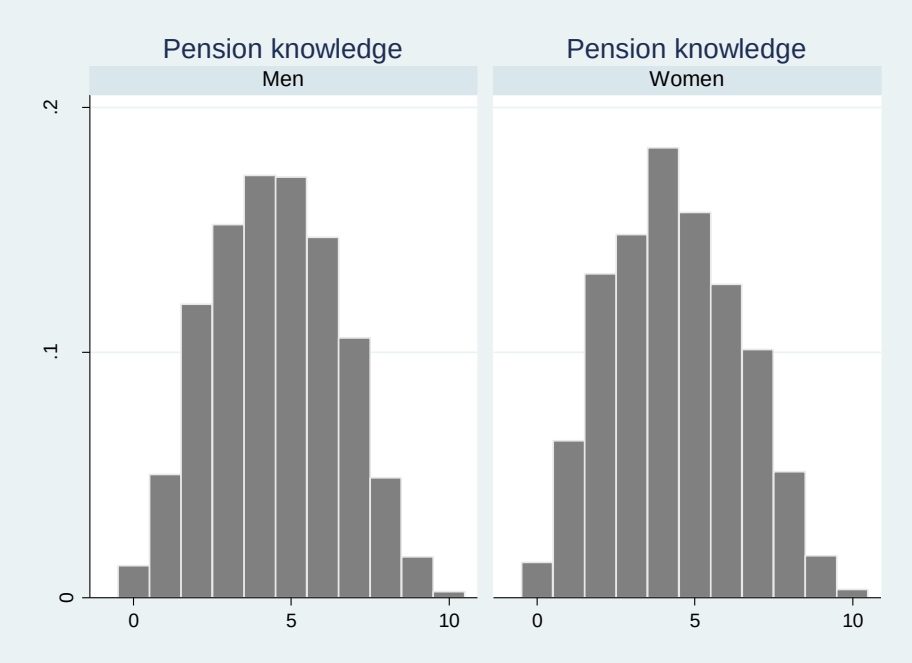

Figure 3.2. Distribution of financial literacy in 2009 by gender

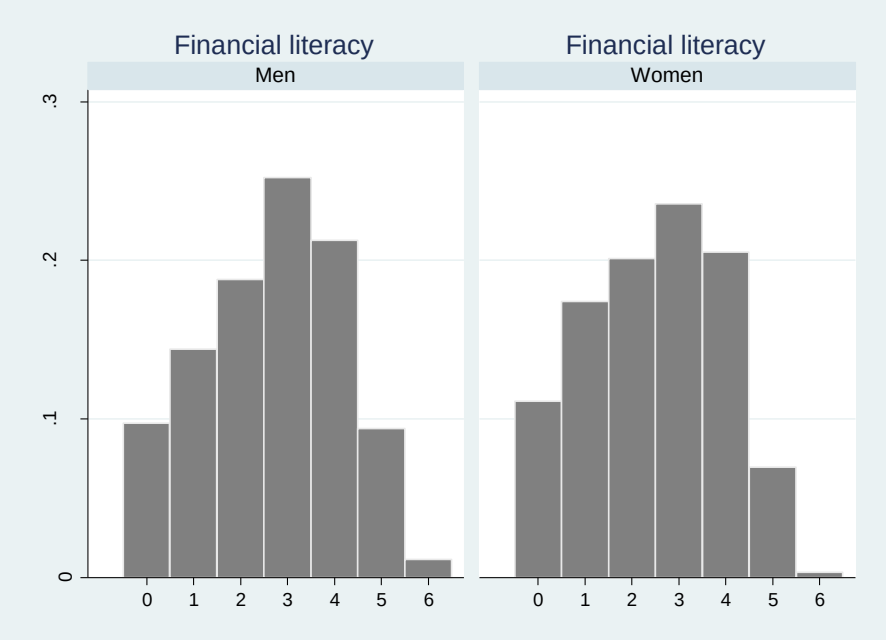

Table 3.1. Investment options for women and men according to their ages

Men		**35 or less**	**36 to 55**	**56 and older**	**Retirees**
Women		**35 or less**	**36 to 50**	**51 and older**	**Retirees**
Investment options	Fund A			X	X
	Fund B	**Default**			X
	Fund C		**Default**		
	Fund D			**Default**	
	Fund E				

X	Not allowed to choose
	Allowed to choose
Default	Assigned automatically

Source: Chilean Superintendency of Pensions

Table 3.2. Sample attrition for men and women (2009)

	Men	Women
Initial sample	7077	7386
Not retired	5395	5891
Affiliated with individual account pension system	4676	4085
Active investment choice not missing	3406	2816
Employed	3031	1939
Pension knowledge not missing	2839	1809

Table 3.3. Summary statistics by active investment decision (2009)

Variables	*All*	*No Active Choice*	*Active Choice*	*P-value*
Active choice	0.33	0.00	1.00	.
Low financial literacy	0.45	0.52	0.31	0.00
Intermediate financial literacy	0.46	0.41	0.54	0.00
High financial literacy	0.09	0.07	0.14	0.00
Low pension knowledge	0.34	0.45	0.13	0.00
Intermediate pension knowledge	0.48	0.45	0.55	0.00
High pension knowledge	0.17	0.10	0.32	0.00
Other investment	0.34	0.30	0.41	0.00
Risk averse	0.67	0.68	0.65	0.10
High school dropout	0.21	0.26	0.09	0.00
High school degree	0.53	0.55	0.48	0.00
College degree	0.27	0.19	0.43	0.00
Female	0.39	0.40	0.37	0.05
Age	42.48	42.51	42.43	0.79
Married	0.63	0.62	0.66	0.04
Number of children	1.87	1.91	1.80	0.01
Net wealth	18.64	19.39	17.12	0.75
Contributes to pension	0.82	0.77	0.92	0.00
Monthly earnings	356270	284025	501368	0.00
Self-employed	0.16	0.19	0.10	0.00
Blue collar worker	0.49	0.56	0.33	0.00
Union member	0.22	0.17	0.32	0.00
Large firm	0.15	0.12	0.21	0.00
Number of observations	4648	3103	1545	

[1] P-value of t-test of comparison of means for workers who have and have not made an active investment decision.

Table 3.4. Summary statistics by choice of type of fund (2009)

Variables	*All*	*Riskier than default*	*Default*	*More conservative than default*
Low financial literacy	0.29	0.26	0.34	0.40
Intermediate financial literacy	0.55	0.57	0.54	0.52
High financial literacy	0.15	0.18	0.12	0.09
Low pension knowledge	0.10	0.10	0.11	0.10
Intermediate pension knowledge	0.55	0.52	0.62	0.61
High pension knowledge	0.35	0.39	0.27	0.29
Other investment	0.42	0.42	0.42	0.38
Risk averse	0.65	0.64	0.68	0.69
High school dropout	0.08	0.07	0.12	0.06
High school degree	0.47	0.44	0.51	0.56
College degree	0.45	0.49	0.37	0.38
Female	0.36	0.33	0.43	0.42
Age	42.32	43.55	39.38	40.77
Married	0.65	0.69	0.58	0.60
Number of children	1.79	1.86	1.57	1.79
Net wealth	16.60	18.51	11.31	15.21
Contributes to pension	0.93	0.94	0.92	0.92
Monthly earnings	505412	574184	357933	396551
Self-employed	0.10	0.10	0.12	0.07
Blue collar worker	0.32	0.29	0.36	0.37
Union member	0.32	0.32	0.34	0.32
Large firm	0.22	0.23	0.18	0.21
Number of observations	1373	901	274	198

Table 3.5. Logit models for active investment decisions (Average marginal effects)

	All		Men		Women	
Variables	**(1)**	**(2)**	**(1)**	**(2)**	**(1)**	**(2)**
Intermediate financial literacy	0.074***	0.037***	0.078***	0.034*	0.064***	0.039*
	(0.014)	(0.014)	(0.019)	(0.018)	(0.021)	(0.021)
High financial literacy	0.097***	0.045*	0.093***	0.027	0.103***	0.073*
	(0.024)	(0.024)	(0.031)	(0.030)	(0.038)	(0.037)
Intermediate pension knowledge		0.169***		0.167***		0.157***
		(0.017)		(0.022)		(0.027)
High pension knowledge		0.309***		0.347***		0.248***
		(0.023)		(0.029)		(0.036)
Other investment	0.057***	0.040***	0.075***	0.055***	0.028	0.015
	(0.013)	(0.013)	(0.017)	(0.017)	(0.019)	(0.019)
Risk averse	-0.001	-0.001	-0.028*	-0.028*	0.045**	0.042**
	(0.014)	(0.013)	(0.017)	(0.016)	(0.021)	(0.021)
High school degree	0.088***	0.054***	0.084***	0.050**	0.112***	0.075*
	(0.021)	(0.020)	(0.024)	(0.023)	(0.043)	(0.043)
College degree	0.168***	0.109***	0.176***	0.111***	0.188***	0.129**
	(0.029)	(0.027)	(0.036)	(0.034)	(0.056)	(0.054)
Female	-0.046***	-0.039***				
	(0.014)	(0.014)				
Age	0.012**	0.009*	0.011*	0.006	0.020**	0.019**
	(0.005)	(0.005)	(0.007)	(0.007)	(0.008)	(0.008)
Age squared	-0.000**	-0.000*	-0.000	-0.000	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Married	0.007	0.007	-0.010	-0.016	0.018	0.024
	(0.014)	(0.014)	(0.020)	(0.019)	(0.020)	(0.020)
Number of children	-0.006	-0.004	-0.002	0.001	-0.014	-0.015
	(0.006)	(0.006)	(0.007)	(0.007)	(0.010)	(0.010)
Net wealth	-0.000*	-0.000	-0.000*	-0.000*	-0.000**	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Contributes to pension	0.102***	0.083***	0.107***	0.085***	0.086**	0.078**
	(0.024)	(0.023)	(0.030)	(0.029)	(0.038)	(0.038)
Log monthly earnings	0.125***	0.101***	0.124***	0.098***	0.117***	0.095***
	(0.012)	(0.012)	(0.015)	(0.014)	(0.022)	(0.021)
Self-employed	-0.045**	-0.028	-0.032	-0.012	-0.062*	-0.053
	(0.021)	(0.021)	(0.026)	(0.026)	(0.036)	(0.037)
Blue collar worker	-0.083***	-0.069***	-0.070***	-0.055***	-0.117***	-0.102***
	(0.015)	(0.015)	(0.018)	(0.018)	(0.027)	(0.027)
Union member	0.089***	0.078***	0.130***	0.115***	0.032	0.028
	(0.015)	(0.015)	(0.019)	(0.019)	(0.022)	(0.022)
Large firm	0.024	0.011	0.007	-0.008	0.047*	0.036
	(0.019)	(0.019)	(0.024)	(0.024)	(0.029)	(0.029)
Observations	4,642	4,642	2,834	2,834	1,808	1,808
Pseudo R-squared	0.152	0.188	0.155	0.197	0.161	0.190
Log Likelihood	-2504	-2397	-1540	-1464	-945.7	-912.8

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.6. Summary statistics by active investment decision (2006 & 2009)

	2006				2009			
Variables	*All*	*No active choice*	*Active choice*	*P-value*[1]	*All*	*No active choice*	*Active choice*	*P-value*[1]
Active choice	0.22	0.00	1.00	.	0.40	0.00	1.00	.
Low financial literacy	0.48	0.53	0.30	0.00	0.44	0.53	0.31	0.00
Intermediate financial literacy	0.41	0.39	0.49	0.00	0.46	0.41	0.55	0.00
High financial literacy	0.11	0.08	0.20	0.00	0.10	0.06	0.15	0.00
Low pension knowledge	0.28	0.35	0.04	0.00	0.31	0.43	0.11	0.00
Intermediate pension knowledge	0.53	0.53	0.51	0.39	0.50	0.47	0.55	0.00
High pension knowledge	0.19	0.12	0.44	0.00	0.19	0.10	0.34	0.00
Other investment	0.36	0.33	0.48	0.00	0.35	0.31	0.41	0.00
Risk averse	0.66	0.68	0.61	0.00	0.67	0.68	0.67	0.40
High school dropout	0.21	0.25	0.05	0.00	0.20	0.28	0.07	0.00
High school degree	0.53	0.55	0.45	0.00	0.53	0.55	0.49	0.00
College degree	0.26	0.20	0.50	0.00	0.27	0.17	0.43	0.00
Female	0.36	0.36	0.39	0.07	0.36	0.36	0.37	0.38
Age	40.49	40.55	40.29	0.54	42.95	43.04	42.82	0.54
Married	0.65	0.64	0.69	0.02	0.65	0.64	0.67	0.12
Number of children	1.82	1.85	1.75	0.08	1.89	1.93	1.83	0.04
Net wealth	14.54	13.62	17.69	0.01	20.85	23.60	16.66	0.50
Contributes to pension	0.86	0.83	0.96	0.00	0.86	0.81	0.94	0.00
Monthly earnings	350763	288791	565120	0.00	378558	294275	507331	0.00
Self-employed	0.16	0.18	0.09	0.00	0.14	0.17	0.10	0.00
Blue collar worker	0.45	0.52	0.22	0.00	0.47	0.57	0.31	0.00
Union member	0.21	0.17	0.31	0.00	0.24	0.18	0.34	0.00
Large firm	0.20	0.17	0.30	0.00	0.16	0.12	0.21	0.00
Number of observations	3041	2359	682		3041	1838	1203	

[1] P-value of t-test of comparison of means for workers who have and have not made an active investment decision.

Table 3.7. Fixed effects models for active investment decisions

	All		***Men***		***Women***	
Variables	***(1)***	***(2)***	***(1)***	***(2)***	***(1)***	***(2)***
Intermediate financial literacy	0.049***	0.041***	0.056***	0.048***	0.038**	0.032*
	(0.012)	(0.012)	(0.016)	(0.016)	(0.019)	(0.019)
High financial literacy	0.050**	0.039**	0.067***	0.055**	0.021	0.013
	(0.020)	(0.020)	(0.025)	(0.025)	(0.034)	(0.033)
Intermediate pension knowledge		0.053***		0.043**		0.070***
		(0.014)		(0.017)		(0.023)
High pension knowledge		0.109***		0.110***		0.114***
		(0.020)		(0.026)		(0.032)
Other investment	0.017	0.012	0.016	0.012	0.015	0.012
	(0.013)	(0.012)	(0.016)	(0.016)	(0.020)	(0.020)
Risk averse	-0.005	-0.006	-0.008	-0.010	0.001	0.000
	(0.012)	(0.012)	(0.015)	(0.015)	(0.020)	(0.020)
High school degree	0.053*	0.051*	0.065*	0.063*	0.012	0.016
	(0.029)	(0.029)	(0.034)	(0.034)	(0.054)	(0.054)
College degree	0.078**	0.077**	0.067	0.064	0.063	0.069
	(0.035)	(0.035)	(0.046)	(0.045)	(0.060)	(0.059)
Married	-0.021	-0.020	-0.034	-0.033	-0.000	0.002
	(0.021)	(0.021)	(0.027)	(0.027)	(0.033)	(0.033)
Number of children	0.197***	0.199***	0.190***	0.189***	0.210***	0.215***
	(0.029)	(0.028)	(0.038)	(0.038)	(0.044)	(0.044)
Net wealth	-0.000	-0.000	0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Contributes to pension	0.011	0.007	-0.008	-0.011	0.051	0.048
	(0.022)	(0.022)	(0.027)	(0.027)	(0.038)	(0.038)
Log monthly earnings	0.064***	0.063***	0.072***	0.071***	0.049**	0.048**
	(0.015)	(0.015)	(0.018)	(0.018)	(0.024)	(0.024)
Self-employed	-0.033	-0.030	-0.019	-0.017	-0.073**	-0.065*
	(0.021)	(0.021)	(0.026)	(0.026)	(0.036)	(0.036)
Blue collar worker	0.021	0.022	0.019	0.020	0.025	0.024
	(0.020)	(0.020)	(0.024)	(0.024)	(0.040)	(0.040)
Union member	0.091***	0.088***	0.085***	0.081***	0.101***	0.099***
	(0.017)	(0.017)	(0.022)	(0.022)	(0.028)	(0.028)
Large firm	-0.032*	-0.033**	-0.039*	-0.041*	-0.019	-0.020
	(0.017)	(0.017)	(0.022)	(0.022)	(0.028)	(0.027)
Constant	-0.957***	-0.985***	-1.048***	-1.065***	-0.757**	-0.807***
	(0.188)	(0.188)	(0.241)	(0.240)	(0.306)	(0.305)
Observations	6,074	6,074	3,857	3,857	2,217	2,217
R-squared	0.045	0.054	0.044	0.053	0.053	0.065
Number of folio	3,041	3,041	1,932	1,932	1,109	1,109
Log Likelihood	1101	1131	651.9	669.8	460.5	474.4

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.8. Multinomial logit models for choice of investment funds (Base outcome: Same as default)

	All		Men		Women	
Variables	Riskier than default	More conservative than default	Riskier than default	More conservative than default	Riskier than default	More conservative than default
Intermediate financial literacy	1.094	0.717	1.269	0.840	1.001	0.627
	(0.185)	(0.153)	(0.288)	(0.241)	(0.263)	(0.207)
High financial literacy	1.065	0.448**	1.008	0.505	1.315	0.355*
	(0.265)	(0.158)	(0.329)	(0.226)	(0.531)	(0.217)
Intermediate pension knowledge	0.769	1.076	0.589	0.918	1.046	1.151
	(0.188)	(0.349)	(0.201)	(0.408)	(0.387)	(0.567)
High pension knowledge	1.018	1.166	0.780	0.892	1.316	1.442
	(0.272)	(0.415)	(0.291)	(0.438)	(0.531)	(0.773)
Other investment	0.924	0.803	1.070	0.995	0.779	0.680
	(0.140)	(0.160)	(0.221)	(0.267)	(0.186)	(0.214)
Risk averse	0.905	1.036	0.956	0.880	0.787	1.511
	(0.146)	(0.220)	(0.195)	(0.232)	(0.216)	(0.582)
High school degree	1.997**	2.858***	1.681	1.949		
	(0.556)	(1.133)	(0.534)	(0.835)		
College degree	1.976**	2.663**	1.727	2.336	1.126	0.733
	(0.631)	(1.191)	(0.678)	(1.207)	(0.297)	(0.256)
Female	0.692**	1.007				
	(0.120)	(0.230)				
Age	1.034	0.916	1.277***	1.068	0.768**	0.746**
	(0.069)	(0.076)	(0.108)	(0.114)	(0.092)	(0.108)
Age squared	1.000	1.001	0.998**	1.000	1.003**	1.003**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Married	1.179	0.985	1.210	1.121	1.163	0.892
	(0.192)	(0.209)	(0.276)	(0.332)	(0.280)	(0.279)
Number of children	1.054	1.170*	0.944	1.057	1.136	1.295*
	(0.076)	(0.109)	(0.090)	(0.129)	(0.134)	(0.195)
Net wealth	1.006**	1.006	1.008	1.000	1.006	1.009*
	(0.003)	(0.004)	(0.006)	(0.008)	(0.004)	(0.005)
Contributes to pension	0.925	0.561	0.994	0.628	0.924	0.385
	(0.298)	(0.230)	(0.395)	(0.322)	(0.541)	(0.274)
Log monthly earnings	2.095***	1.524**	2.532***	1.461	1.779***	1.887**
	(0.302)	(0.277)	(0.508)	(0.364)	(0.398)	(0.549)
Self-employed	0.629*	0.380**	0.541*	0.387**	0.975	0.313
	(0.168)	(0.151)	(0.174)	(0.182)	(0.513)	(0.259)
Blue collar worker	0.910	1.350	0.846	1.161	0.938	1.949
	(0.174)	(0.335)	(0.188)	(0.335)	(0.400)	(0.966)
Union member	0.667**	0.785	0.625**	0.737	0.742	0.980
	(0.111)	(0.170)	(0.138)	(0.210)	(0.195)	(0.338)
Large firm	1.346	1.276	1.007	1.331	1.907*	0.987
	(0.289)	(0.352)	(0.286)	(0.473)	(0.653)	(0.457)
Constant	0.000***	0.010*	0.000***	0.001*	0.157	0.146
	(0.000)	(0.026)	(0.000)	(0.003)	(0.546)	(0.654)
Observations	1,372	1,372	876	876	496	496
Pseudo R-squared	0.0751	0.0751	0.0957	0.0957	0.0698	0.0698
Log Likelihood	-1114	-1114	-657.1	-657.1	-438.2	-438.2

seEform in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix

Here I present the questions from the 2006 and 2009 waves of the Chilean Social Protection Survey I use to construct the pension knowledge, financial literacy and risk aversion variables.

Questions used for Pension Knowledge variables

11. Do you know which percentage of your income is monthly discounted (was discounted or would be discounted) for the pensions system?
    a. Yes → Which percentage?
    b. No

12. According to the law, at which age can a man retire? What about a woman?

13. Do you know how pensions are calculated at the AFPs?
    a. According to the wage of the last years
    b. Considering the balance of the individual account, retirement age or other elements
    c. I don't know

14. Do you know or have heard about the Voluntary Savings for Retirement that operates since year 2002?
    a. Yes
    b. No

15. Do you know how much is accumulated in your individual account?
    a. Yes
    b. No

16. Who pays the variable fees?
    a. The participant with her wage
    b. The participant with her pension fund
    c. The employer

17. Do you know or have heard about the Multifunds?
    a. Yes
    b. No

18. Do you know how many types of fund exist?
    a. Yes → How many?
    b. No

19. Do you know which are the different types of payout of old age pensions?
    a. Yes
    b. No

20. Do you know that by fulfilling certain requisites, you can opt to retire early?
    a. Yes
    b. No

Questions used for Financial Literacy variables

1. If the possibility of getting a disease is 10%, how many people out of 1,000 would get the disease?

2. If 5 people have the winner numbers of the lottery and the prize is 2 million pesos, how much would each one of them receive?

3. Suppose that you have $100 in a savings account, and the interest rate obtained for these savings is 2% per year. If you keep the money for 5 years in the account, how much will you have at the end of these 5 years?
    a. More than $102
    b. Exactly $102
    c. Less than $102
    d. Does not know/Does not answer

4. Let's say that you have $200 in a savings account. The account accumulates 10% of interests per year. How much will you have in the account after two years?

5. Suppose that you have $100 in a savings account, which has an interest of 1% annually. You also know that the inflation rate is of 2% annually. After 1 year, if you take the money out of the account, you will be able to buy:
    a. More than $100
    b. Exactly $100
    c. Less than $100
    d. Does not know/Does not answer

6. Is the following sentence true or false? "Buying one share of a company is less risky than buying with the same money various shares of different companies."
    a. True
    b. False

Questions used for Risk Aversion variable

Suppose that you, as the only source of income of your household, need to choose between the following two jobs. Which alternative would you choose in these three situations?

First Situation:

Alternative A: A job with fixed and stable earnings for the entire life.

Alternative B: A job where you have the same possibility of earning double or only ¼ of the earnings for the entire life.

Second Situation:

Alternative A: A job with fixed and stable earnings for the entire life.

Alternative B: A job where you have the same possibility of earning double or only ½ of the earnings for the entire life.

Third Situation:

Alternative A: A job with fixed and stable earnings for the entire life.

Alternative B: A job where you have the same possibility of earning double or only 3/4 of the earnings for the entire life.