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ORIGINAL ARTICLE

Choice of Retirement Funds in Chile: Are Chilean Women More Risk Averse than Men?

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Abstract This study examined the investment decisions of women and men in Chile who were contributing to Chile's mandatory defined contribution (DC) retirement plan, using a large survey of participants (2782 people) conducted in 2009 by Chile's Subsecretariat of Social Protection. The basic research question was whether Chilean women were more risk averse in their retirement investment decisions than Chilean men. Chile's retirement plan offers a default plan for those who do not want to manage their funds. For those wishing to manage their investments, it offers five funds varying in risk from an all bond fund to a fund that is primarily stocks. There was no significant difference in the percentage of men and women choosing the default funds. We used probit analysis to determine what demographic factors affected the choice of the default fund, and found that younger people and men with less education and less income were more likely to choose the default; only age was significant for women. We found no significant gender differences in the fund choices of active investors. We conducted linear regression analysis by gender, where the dependent variable was the fund, with fund 1 having the lowest risk and fund 5 having the highest risk. We found that that the risk taking decreased with age and increased with financial knowledge, psychological risk tolerance, income and unemployment. Chilean women and men seemed similar in their investment decisions.

Keywords Gender differences in risk taking · Chile's retirement plan · Portfolio choice · Defined Contribution Pension Plans

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Introduction

In this study we examine how men and women in Chile invest in their defined contribution (DC) retirement funds before they retire. Chile is an interesting case to study because it was the first country to adopt a DC retirement plan for its mandatory government retirement plan in place of the typical "pay as you go plans" (where taxes collected from workers are immediately used to pay retirees) (Kritzer 2008; Kuné 2001). In Chile, workers can invest in a default plan or they can actively invest their retirement accounts into one of five funds varying from a low risk bond fund to a higher risk stock fund. A large 2009 survey of Chilean pension participants (Subsecretariat of Social Protection of Chile 2009) provided detailed information about Chile's DC pension plan members that allowed us to examine how financial knowledge, psychological risk tolerance, income and other demographic factors influenced men and women's choice of a default fund and, for those actively managing their funds, choice of a fund with a given level of risk. Probit analysis by gender was used to determine what affected male and female participants' choice of a default fund or active management of their funds. Then multiple regression analysis by gender was used on active investors to determine what variables influenced their choice of a risky or less risky fund.

DC retirement plans are gradually replacing defined benefit (DB) retirement plans in many countries both for private plans and, in some countries, for government plans. Both types of retirement plans present problems for women, but DC plans can present more problems (O'Rand and Shuey 2007). A DB plan is usually designed to provide a retirement income based

on a percentage of annual salary at a time close to retirement times the number of years worked. Since women worldwide generally earn less and work fewer years than men (Elborgh-Woytek et al. 2013), this suggests that their retirement income will be lower; however, they will receive that income until they die. DC plans are based on contributions to an individual retirement account while the individual is working. Once the person is retired, he or she has an accumulated asset which he or she can draw down over time or the person can buy an annuity, which guarantees a life-time income (Kritzer 2008). Because contributions to DC plans tend to be a percentage of income and are usually made only when the person is working (Kritzer 2008) they again put women at a disadvantage. Additional problems for women are their longer life expectancy and, in some cases, their earlier retirement age, which means they must spread the income from their retirement assets over a longer period of period of time or pay more for a given annual annuity (Kritzer 2008). Another issue is that many DC plans offer participants a choice of funds which vary in risk and expected returns. More risky funds such as stock funds generally have a higher expected return in the long run than low-risk bond funds (Smart et al. 2014). However, the economics and finance literature, which is discussed below, suggests that women in many countries tend to make less risky investments than men. If this is the case, even a woman who contributes as much to a retirement fund as a man over the same number of years will likely have smaller accumulated assets at the time of retirement. Thus, the choice of risk in a retirement fund is an important issue for women.

We first briefly describe Chile, the workforce environment for Chilean women and Chile's DC pension fund. Then we describe the economics and finance literature on gender differences and other demographic factors affecting portfolio investment, and we develop hypotheses to test on the Chilean data.

Chile and the Workforce Environment for Women

Chile is a relatively small country with a population of 17.6 million. Although it is now a democracy with the highest per capita income in South America (CIA 2014), in 1973 a military coup overthrew the Marxist government of Salvador Allende and established a rightwing dictatorship under General Augusto Pinochet that lasted until 1990. During the mid-1970s, a group of government economists, referred to as the "Chicago Boys" because many had been trained under Milton Friedman and his colleagues at the University of Chicago, instituted market-oriented changes in the Chilean economy. Although this initially caused a large drop in income and employment, eventually the economy began to grow. Despite other crises, such as that caused by the Mexico debt crisis of 1982, the neo-liberal market orientation of the Chilean economy has continued to the present (Prieto Larraín 2011). As part of this neo-liberal focus, in 1981 Chile was the first country to switch from a "pay as you go" government pension plan to individual retirement accounts or a DC plan (Kritzer 2008).

Although Chile had a per capita income of about $21,000 (USD) on a purchasing power parity basis in 2013, it has a very unequal distribution of income; its Gini Index was 52.1 in 2009 (World Bank 2014). Its population is 89 % White and non-indigenous; about 11 % is indigenous, of which the majority are Mapuche. Chile is predominantly Catholic, but Evangelical groups have made inroads, particularly among the poor. Today about 67 % of Chileans are Catholic and 16 % are Evangelical or Protestant; the remainder are other or none (CIA 2014). In a recent study Prieto Larraín (2011) wrote: "Four decades of radical changes…transformed Chile from being one of the most traditional Latin American countries into a modern, liberal, consumer society with a functioning democracy and fairly stable institutions" (p. 5). Chile has made progress this century in reducing poverty and achieving gender equality in terms of access to education, health, legal rights, and politics (Fort et al. 2007). However, abortion is still illegal in Chile and divorce was only permitted as of 2004. There has been a significant decline in the fertility rate and a gradual aging of the population (United Nations 2004).

The situation of Chilean women is somewhat paradoxical in its mixture of traditionalism and modernism. Chilean women are now better educated than Chilean men, with men having a school life expectancy of 15 years and women of 16 years (CIA 2014); the ratio of women to men in tertiary education increased from 91.7 % in 2000 to 111.8 % in 2012 (World Bank 2014). However, Chile has an unusually low labor force participation rate for women; in Latin America, only Mexico has a lower rate (Fort et al. 2007). In 2000 only 39.3 % of women 15 to 64 were in the labor force; this increased to 55.0 % in 2012. Although more women are working today, a greater share is working part time. In 2000, 7.4 % were working part time but in 2012, 24.6 % were (World Bank 2014). Women in low income categories are less likely to work than women in high income categories, particularly in the formal labor market where they can participate in the government's retirement plan (Fort et al. 2007). All these facts mean that women are less likely to have the opportunity to contribute sufficient amounts to a DC retirement plan to have a decent retirement income. It also means that few women will have worked the 20 years needed to be eligible for Chile's guaranteed minimum pension for low income workers which supplements the DC plan (Kritzer 2008).

Given the high education level of women in Chile, several studies have examined why the labor force participation rate remains low for women. Family is very important in Chile. Prieto Larraín (2011) argued that the rapid social change in Chile left people with a feeling of uncertainty, and as a result: "it is the family as an institution that has contributed to fill in the gaps and provide most of the emotional and economic support that individuals need" (p. 199). In addition to

inadequate job training for poor women, inadequate childcare and occupational segregation, Fort et al. (2007) argued: "the relatively traditional values and attitudes regarding gender roles, particularly the mother's role as the principal caregiver, limit women's ability to work" (p. 2).

The gender earnings gap in Chile is also high despite some improvement over time (Fort et al. 2007). A recent study suggested that the unexplained hourly wage premium for Chilean men was about 10 to 20 % for those at the lower range of earnings and 40 to 80 % for those in the highest earnings groups (Ñopo 2012). Ñopo (2012) concluded "the earnings gender gap is proportionately larger among highly paid people, people with university education, directors, older workers, married workers, and part-time workers" (p. 134). Thus even when women are working, they earn less and contribute less to their individual retirement accounts. Still another issue is that the normal retirement age for women is 60 while it is 65 for men (Kritzer 2008).

Chile's Pension Fund System

The Chilean pension system changed dramatically in 1981 when a system based on individual capital accounts was introduced. The new system is a mandatory DC plan that requires all workers to save 10 % of their monthly salaries in individual accounts, which are administered by private agents called Pension Fund Administrators (AFPs). Since the end of 2002 workers have been able to choose among five funds characterized by their risk, Funds A, B, C, D and E, with Fund A having the greatest risk (mostly stocks) and Fund E having the least risk (mostly bonds). The AFPs must comply with the restrictions of risk for each fund, which are shown in Appendix 1. The AFPs publish their investment portfolios by fund every month and must send all members a report with the details of their individual accounts every quarter. Because the plan now offers funds that vary considerably in risk, the choice of fund is also an important factor in determining the value of individual accounts at retirement. If Chilean women choose a less risky fund, this is another factor that can reduce their retirement income.

Members can change funds whenever they wish without a charge; they can also hold assets in two funds. The only restrictions are with respect to age; people within 10 years of normal retirement age cannot hold their assets in the riskiest fund, Fund A. Since the normal retirement age in Chile for women is 60 and for men 65, women 51 and over and men 56 and over cannot invest in Fund A. People who are already retired can only choose among the less risky Funds C, D and E.

If new workers do not choose a fund when they enter the system, they are assigned a default fund according to age and gender; the rules of assignment are shown in Table 1. Over time the default fund will be changed automatically according to age and gender to less risky funds; thus it follows the model of a "life-cycle fund" described later. The change in portfolio by age is gradual; the change in the funds is 20 % per year, so that after 5 years the transition to a new fund is completed (Barrientos and Ruiz 2011; Berstein et al. 2013). Older people, particularly those in the default plan, are therefore more limited in their ability to invest in risky funds. The percentage of people in default plans seems to have dropped substantially from about 86 % in 2002 (Tapia and Yermo 2007) to around 35 % in 2009 (Kristjanpoller and Olson 2014).

Table 1 Default funds by age and gender; fund A (5) is most risky and fund E (1) is least risky

Gender	Age range	Default fund
Men		
	35 or less	B (4)
	36 to 55	C (3)
	56 and over	D (2)
Women		
	35 or less	B (4)
	36 to 50	C (3)
	51 and over	D (2)

Chile's five pensions funds are labeled A to E, where A is the most risky and E is the least risky. The numbers in parentheses are those we use to indicate risk in our regression analysis. 1 is the least risky fund and 5 is the most risky fund. As people age they are moved to less risky funds, thus the default plan is similar to a life-cycle investment plan.

Gender and Risk Taking

Investing in financial assets, including retirement funds, generally involves taking some amount of risk. The safest investment may be in the bonds of the U.S., German or Japanese government, but there are still risks of inflation reducing their value or, for a foreign investor, the risk that the currency of the investment will fall in value. Corporate bonds are riskier than government bonds as there is the possibility of bankruptcy and equity investments (stocks) are still riskier because dividends and appreciation depend on the residual income (profits) of the firm. However, the economics and finance literature has shown that there is normally a positive relationship between risk and expected return; over the long term riskier assets usually generate larger accumulated values (e.g., Smart et al. 2014). Therefore, willingness to make risky investments can be an important factor in determining the retirement income from a DC plan.

There has been substantial research in psychology and economics on gender differences in risk taking. (See Byrnes et al. 1999; Croson and Gneezy 2009; Eckel and Grossman 2008 for reviews of this literature.). Byrnes et al. (1999) performed a meta-analysis on 150 psychology studies of

gender differences in risk taking conducted between 1967 and 1997 and found that about 60 % showed that men tended to take more risks than women, but the remaining showed little or no difference by gender. However, they also found that gender differences were relatively small and varied according to context and age. Although they did not discuss where the studies were conducted, it appears from the list of references that most studies were done in the U.S. or perhaps in Western Europe. Croson and Gneezy (2009) reviewed gender differences in risk preferences from a number of economic experiments that appeared to have been conducted in the U.S. or Western Europe. They found that men were more risk prone than women, but less so among managerial samples. They also cautioned that there is a publication bias in favor of studies that find gender differences over those that do not and that gender differences in risk taking may vary by ethnic group.

A number of economic and finance studies have examined differences in risk-taking between men and women in their actual investment behavior. Studies have found that women are less likely to invest in stocks (Almenberg and Dreber 2012 [Sweden]; Dwyer et al. 2002 [U.S.]; Halko et al. 2012) [Finland]); less likely to hold large shares of stocks in their portfolios (Agnew et al. 2003 [U.S.]; Barber and Odean 2001 [U.S.]; Halko et al. 2012 [Finland]; van Rooij et al. 2011 [Netherlands]); less likely to trade stocks (Barber and Odean 2001 [U.S.]); and less likely to plan for retirement (See Lusardi and Mitchell 2008 [U.S.], 2011a [Germany, Italy, Japan, Netherlands, New Zealand, Russia, Sweden, U.S.]). However, Säve-Söderbergh (2012) observed that the overall gender difference in risky investments for her Swedish sample was small and that the major difference was for those choosing the most risky portfolios.

There are a number of problems with these real world studies. One is the need to control for other variables besides gender that may affect risk taking. Information about investors is often limited and omission of important variables can lead to biased results. Another issue is that investors may treat retirement assets differently than they treat voluntary financial or real assets. Although studies of gender differences in investment have been done in many countries, most of the studies have been done in high income countries such as the ones listed above. (Russia is an exception as its income is lower and it is still transitioning from a command economy.) The 2009 survey of a large sample of Chile's pension investors allowed us the opportunity to look at risk taking in investment in a DC plan in a country at a lower income level than the U.S., Japan or Western Europe.

Other Demographic Variables that May Affect Risk Taking in Investment

Age has often been included as a control variable in investment studies. A common argument, particularly for retirement funds, is that older people are more risk averse because they have less time to recover any losses (Grable and Lytton 1998). In some empirical studies it appeared that older people invested less in equity as they aged (Agnew et al. 2003 [U.S.]; Calvet et al. 2007 [Sweden]; Dwyer et al. 2002 [U.S.]). In their study of Finnish bank clients, Halko et al. (2012) found age had a negative effect on equity allocations but, after controlling for income and wealth, its coefficient was no longer statistically significant. Säve-Söderbergh (2012) looked at the decisions of Swedish investors when DC retirement plans were introduced in 2000; she found that the youngest and oldest investors tended to have less risky portfolios than those of middle age. Other studies have found age was not a significant factor in explaining equity investment (Almenberg and Dreber 2012 [Sweden]; Bernasek and Shwiff 2001 [U.S.]; Sundén and Surette 1998 [U.S]; van Rooij et al. 2011 [Netherlands]).

Marital status is often thought to affect risk taking in investments. Some have argued that married people are likely to have more responsibility and thus will be more risk averse in their investments than singles (Grable and Lytton 1998). However, the findings on marital status are not consistent (Arano et al. 2010 [U.S.]; Halko et al. 2012 [Finland]; Papke 1998 [U.S.]; Säve-Söderbergh 2012 [Sweden]; Sundén and Surette 1998 [U.S.]; van Rooij et al. 2011 [Netherlands]). For example, in a study of university employees in Colorado (U.S.), Bernasek and Shwiff (2001) found that men and women with a spouse or partner had a lower share of equity in their defined contribution (DC) accounts than single people, but Agnew et al. (2003) found that married participants in large U.S. sample of 401(k) participants held more equity. Gerrans and Clark-Murphy (2004) surveyed Australians with a choice of DC funds with different risk characteristics. The gender results differed considerably depending on marital status and age. Women who were informed about the fund choices were more likely to choose a risky fund. Marital status was not significant in studies of Swedish (Säve-Söderbergh 2012), Dutch (van Rooij et al. 2011), and Finnish investors (Halko et al. 2012).

Education may increase risk taking for a couple of reasons (Grable and Lytton 1998). Better educated individuals may have a better understanding of financial markets. Better educated people are also likely to earn more and, as discussed below, higher income is thought to lead to more risk taking. Education has been found to increase the willingness of investors to choose equity in some studies (Almenberg and Dreber 2012 [Sweden]; Calvet et al. 2009 [Sweden]; Dwyer et al. 2002 [U.S.]; Halko et al. 2012 [Finland]; van Rooij et al. 2011 [Netherlands]), but in others education has not been significant (Agnew et al. 2003 [U.S.]; Kristjanpoller and Olson 2014; Sundén and Surette 1998 [U.S.]).

Income and wealth may be positively correlated with risk taking because people with high income or high wealth are

more able to self-insure against potential losses (e.g., Cicchetti and Dubin 1994). Some studies have found that income and/or accumulated wealth positively affect equity investments (Almenberg and Dreber 2012 [Sweden]; Calvet et al. 2007 [Sweden]; Dwyer et al. 2002 [U.S.]; Halko et al. 2012 [Finland]; Iyengar and Kamenica 2010 [U.S.]; van Rooij et al. 2011 [Netherlands]; Säve-Söderbergh 2012 [Sweden]), but Halko et al. (2012) also found a negative effect for income after controlling for attitudes towards risk. In a very detailed study of Swedish twins, Calvet and Sodini (2014) found that investment in risky assets was an increasing function of liquid financial wealth (excluding retirement assets and real estate). In addition, they developed a human capital variable based on the present value of future income and found it had a significant positive effect on investment in risky assets.

Financial Knowledge and Willingness to Take Risks

Two other variables that appear to affect investment decisions are financial literacy and a psychological measure of risk tolerance. Financial knowledge is thought to increase risk taking in investments because a person with financial knowledge understands that the relation between risk and returns (Lusardi 2012). A number of studies have looked at the effect of financial knowledge on willingness to invest in equity, share of equity and retirement planning. (A good review of many of these studies can be found in van Rooij et al. 2011). These studies have generally found that more financial knowledge leads investors to hold equity or to hold greater shares of equity in their portfolio (thus increasing the risk of the portfolio) and increases the probability of planning for retirement. Many studies have argued that on average women, younger and older people (as opposed to middle-aged people), less educated people, and people with low incomes and little wealth have less financial knowledge (Agnew and Szykman 2005 [U.S]; Almenberg and Säve-Söderbergh 2011 [Sweden]; Atkinson and Messy 2012 [14 countries]; Lusardi 2012 [OECD countries]; van Rooij et al. 2011 [Netherlands]).

Studies have tried to control for financial knowledge in a number of ways. A few studies focused on the investment strategies of men and women managing mutual funds since these men and women are likely to have similar financial education (Atkinson et al. 2003; Niessen and Ruenzi 2006). These found that there were only slight gender differences compared to those of retail investors. Other studies used very basic measures of numeracy, compound interest, inflation and risk diversification to measure financial knowledge. For example, Lusardi and Mitchell (2008) developed three basic questions on compound interest, inflation and risk diversification that were used in a special module of the 2004 U.S. Health and Retirement Study (HRS) and then in many other surveys in the U.S. and other countries (see Lusardi 2012 for more details). A special issue of the *Journal of Pension Economics and Finance* (see Lusardi and Mitchell 2011a) was devoted to how these three basic measures of financial literacy (or other very similar measures), along with demographic variables, affected retirement planning in eight different countries. (See Alessie et al. 2011 [Netherlands]; Almenberg and Säve-Söderbergh 2011 [Sweden]; Bucher-Koenen and Lusardi 2011 [Germany]; Crossan et al. 2011 [New Zealand]; Fornero and Monticone 2011 [Italy]; Klapper and Panos 2011 [Russia]; Lusardi and Mitchell 2011b [U.S.]; Sekita 2011 [Japan].) The studies found different but generally low levels of basic financial literacy. They generally found that women, the less educated, the young and the old had less financial literacy. In some countries, financial knowledge also varied by racial, ethnic, religious or regional groups. In the majority of countries financial literacy was positively related to retirement planning. In their study of the United States (Lusardi and Mitchell 2011b) the survey data included a question asking respondents to assess their own financial knowledge on a scale of 1 to 7. The correlation between actual and self-assessed knowledge was positive but low. In a survey of university students Goldsmith and Goldsmith (1997) found women scored lower than men on measures of self-perceived investment knowledge and actual investment knowledge. The correlation between perceived and actual knowledge was positive and significant (r=.50). Wang (2009) surveyed a convenience sample of adult Americans with many occupational backgrounds and also found a significant positive correlation between subjective and objective financial knowledge, and positive correlations of both these measures with risk taking. He found that women scored lower than men on all three measures.

Almenberg and Dreber (2012) examined gender differences in stock market participation (excluding pensions) for a representative sample of 1300 Swedes. In addition to age, education, income, and willingness to take risks, their control variables included a measure of basic financial literacy (six numeracy questions) and a measure of advanced financial literacy (six questions—one on inflation, one on risk diversification, and four on stocks and bonds); some of the questions were developed by Lusardi and Mitchell (Lusardi 2012). Using a series of probit regressions, they found that the negative gender coefficient was reduced by half and was only marginally significant when they added education and income variables (age was also included but was not significant). Adding the measure of basic financial knowledge made the gender coefficient statistically insignificant. When the advanced financial knowledge variable was added, both measures of financial literacy were still statistically significant and the gender coefficient was reduced to zero. The authors argued that causation for the basic financial knowledge should be from the knowledge to stock market participation, whereas the causation between stock market participation and advanced financial literacy could be in either direction.

Van Rooij et al. (2011) also had a basic and advanced measure of financial knowledge. They asked 5 basic questions and 11 advanced financial questions, then used factor analysis and developed two indices of financial knowledge. In their multivariate analysis of stock market participation, the coefficient of advanced financial literacy was large, positive and statistically significant; the coefficient for basic literacy was positive but not statistically significant. The gender coefficient decreased in size when advanced financial literacy was added to the regression but it was still statistically significant. Because advanced financial knowledge was likely to be correlated with stock market participation, they used instrumental variables on financial knowledge and then run Generalized Method of Moments regressions. In these regressions the advanced financial literacy coefficient was large, positive and statistically significant. The gender coefficients were not statistically significant and most other variables were not significant except income and, in one regression, wealth and some measures of daily use of economics.

Dwyer et al. (2002) used the sum of correct answers to 12 questions on stock, bonds and mutual funds to measure financial literacy. Although all subjects in their study held mutual funds, the average score for women (6.2) was significantly below that for men (7.7). Adding this measure of relatively advanced financial knowledge to the ordered probit regressions reduced the size of the gender coefficients and, in two of the three analyses, made the gender coefficient statistically insignificant. Halko et al. (2012) asked Finnish investors and finance graduate students to compare their investment knowledge to that of an investment advisor for bank clients or peers for students on a five-point scale ranging from "my knowledge is considerably worse" (1) to "my knowledge is considerably better" (5). In a logit model to explain participation in the stock market, which included risk attitudes, neither gender nor self-assessed investment knowledge was statistically significant. Gender and investment knowledge were also not significant in a regression to explain the share of equity assets in their portfolios.

Finally, several studies used psychological measures of risk tolerance to explain investment in equity assets. Sundén and Surette (1998) measured attitudes toward risk by the willingness of each household to take above average (average/below average) risk in exchange for above average (average/below average) return. Those willing to take above average risk were significantly more likely to invest mostly in stocks, and less likely to invest mostly in bonds. Those willing to take average risk were also significantly less likely to invest mostly in bonds. Kapteyn and Teppa (2011) used three measures of risk attitudes to explain portfolio choices. They found that self-assessed psychological measures of risk tolerance and precaution were better at predicting portfolio choices than their more economically rigorous measures of risk tolerance. Almenberg and Dreber (2012) included a question on general psychological willingness to take risks on a 10-point scale that was similar to the 11-point scale tested by Dohmen et al. (2011) and found it to be a good predictor of various types of risk taking, including financial risk taking. Like Dohmen et al. (2011), Almenberg and Dreber (2012) found that women scored significantly lower on this scale than men, and they concluded that this gender gap could not entirely be explained by differences in financial literacy. In their probit regressions to explain stock market participation (described above), they included this risk measure in a regression along with basic financial knowledge and with and without advanced financial knowledge. The coefficient for psychological willingness to take risks was statistically significant but adding it after basic financial knowledge did not affect the gender coefficient (the addition of basic financial knowledge eliminated the statistical significance of the gender coefficient).

Halko et al. (2012) investigated and validated the 11-point risk measures of Dohmen et al. (2011) on a group of Finnish investors, investment advisors and finance students. They found that the self-reported general risk measure and the financial risk measure were much better predictors of financial risk taking than traditional measures of risk such as certainty equivalents. Even among investment savvy individuals in Finland, a country known for ranking very high in gender equality, women's willingness to take financial risks was significantly less than men's; they participated less in the stock market and, when they did, they held smaller shares of equity in their portfolios. In a logit analysis of stock market participation of the investors and students, financial risk attitude was the most important explanatory variable; gender and their self-reported measure of financial knowledge were not statistically significant. Although the raw data showed the men's average share of equity was 40 % and women's was 20 %, the gender coefficient in an OLS regression was statistically insignificant when risk attitude was included in the regression. Halko et al. (2012) also investigated risk attitudes and risky investments of more than 85,000 Finnish bank clients. In this case, the risk measure was a 5-point scale on the clients' self-reported willingness to take financial risk. Among this group women were also significantly less willing to take risk and the willingness of men and women to take risk declined with age. In the analysis of stock market participation, the gender coefficient was not significant when the risk attitude variable was included in the regression. With respect to the share of equity in their portfolios, the gender coefficient continued to be statistically significant when risk attitude was included, but the gender coefficient was reduced in magnitude.

Default Plans for Passive Investors

Traditional rational economic theory argues that participants in DC retirement plans will choose the savings rates and

asset allocations that will maximize their life-time utility. However, research in behavioral economics suggests that participants' decisions are often not optimum for a variety of reasons including overconfidence, excessive optimism and illusion of control (Kahneman and Riepe 1998); status quo bias (Samuelson and Zeckhauser 1988); lack of knowledge and information overload (Agnew and Szykman 2005); heuristic decision-making (Benartzi and Thaler 2007); inertia (Madrian and Shea 2001); and hyperbolic discounting, procrastination, and nominal loss aversion (Benartzi et al. 2007). (See Tapia and Yermo 2007 for a good review of the behavioral economic literature and its impact on pension funds.) As a result, economists such as Thaler and Sunstein (2003) have argued for "libertarian paternalism", which allows for choice but provides defaults that encourage participants to choose what is likely to be in their best interest. Where DC plans are voluntary, as many in the United States are, this has meant encouraging employers to offer automatic enrollment with the possibility of opting out, rather than opting in, and to set automatic default contribution rates that are likely to provide a reasonable retirement income. It also means encouraging employers or other plan providers to offer default portfolios that provide reasonable expected returns at what might be considered by most to be acceptable risk (Beshears et al. 2009). Some researchers also recommend limiting the number of portfolio choices to avoid information overload (Agnew and Szykman 2005; Byrne et al. 2007; Cronqvist and Thaler 2004; Iyengar et al. 2003).

As noted earlier, investment funds with a high proportion of equity assets are riskier than bond or money market funds but they tend to generate higher returns in the long run. There is disagreement in the theoretical and applied economics literature as to whether retirement assets should have constant equity shares or should be life-cycle or target-date funds that reduce the percentage of equity assets as a participant approaches retirement age. Theoretical studies such as Merton (1969) and Samuelson (1969) argued for a constant share of risky assets in a portfolio regardless of age. Other studies such as those of Bodie et al. (1992) and Viceira (2001) developed models that suggested people should invest more in equity while working than when retired, thus supporting the life-cycle view. Basu and Drew (2010) ran simulations of terminal wealth under different asset allocation strategies in Australia. They found that strategies with high allocations to equities outperformed life-cycle plans with little more downside risk. Booth and Yakoubov (2000) also found no evidence that life-cycle funds are beneficial.

Despite different findings for optimal portfolios in academic studies, life-cycle and/or target-date funds are now offered in a number of plans and are mandated in some countries. Latin American countries, including Chile, offer a limited number of portfolios and require the default investments to have a life-cycle strategy (Tapia and Yermo 2007). As of April 2005, the United Kingdom requires default funds to use some form of life-cycle fund (Byrne et al. 2007). Sweden's default plan for its Premium Pension System introduced in 2000 had one portfolio regardless of age, but as of May 2010 a life-cycle default plan is required (Dahlquist et al. 2012). In the United States, the original default funds were very conservative bond or money market funds (Agnew and Szykman 2005; Mitchell et al. 2008). However, the Pension Protection Act of 2006 permitted equity funds to be used as default funds. In 2007 the U.S. Department of Labor allowed a new class of default investments to improve portfolio allocations among default participants. These investments, called qualified default investment alternatives (QDIAs), include target-date funds (Mitchell et al. 2009). Professionally managed allocations, particularly target date funds, are changing the portfolio strategies in U.S. DC plans (Bapat and Utkus 2012) and are shifting the responsibility for portfolio management back to employers (Mitchell and Utkus 2012). If a default plan is a mandated life-cycle plan like Chile's is, then anyone choosing the default will be investing in less risky assets as he or she approaches retirement age.

The share of participants choosing default portfolios varies considerably across countries and over time. When the Swedish government first began offering DC plans in 2000, it actively encouraged choice and about two-thirds of initial participants chose their own portfolios from 460 possibilities (Sundén 2006); however, by 2003 92 % of new enrollees chose the default portfolio (Cronqvist and Thaler 2004). Gallery and Gallery (2005) reported that only about 10 % of Australians exercised investment choice in their DC investment portfolios despite a limited number of options. DC participants in the United States seem to be gradually shifting to more reliance on default plans (Mitchell et al. 2008). Mitchell and Utkus (2012) reported that in 2010 70 % of DC plans offered target-date funds and 36 % of all participants held positions in these funds. In Chile, when the choice of five funds was first offered in 2002, only 14 % made active choices but the percentage has increased overtime (Kristjanpoller and Olson 2014; Tapia and Yermo 2007). Participants in some places such as those in Sweden and Latin America are primarily passive investors while investors in Central and Eastern Europe and Hong Kong are far more active (Tapia and Yermo 2007).

There have been a few studies that try to analyze the type of participants who choose default plans and/or life-cycle portfolios for their DC retirement assets. Madrian and Shea (2001) looked at the behavior of participants in a large U.S. corporation before and after the company introduced automatic enrollment into its DC plan. The majority of new participants under automatic enrollment tended to enroll in the default plan, which was at that time a money-market fund. Women, younger employees, and lower income groups were more likely to choose the default. Cronqvist (2006) looked at the

choice of active or passive investment in Swedish DC funds when they were first offered in 2000. Although his focus was primarily on the impact of advertising on active investment, he found that investors with higher incomes and more money to invest and women investors were more likely to choose active investment over the default; older people were more likely to choose the default. Mitchell et al. (2009) used data on 250,000 participants from 258 DC plans offered by Vanguard in the United States. They looked at participants who voluntarily chose life-cycle funds when they were introduced. Compared to the total sample, the life-cycle participants were younger, more female, earned less and had lower 401(k) balances. In an earlier paper on the same data, Mitchell and her co-authors (Mitchell et al. 2008) argued that pure life-cycle investors were more likely to be those with low financial literacy because of the higher information costs to them of making active investments. A later study on Vanguard plans offering target-date funds found similar demographic results and also found a greater enrollment in target-date funds during the Financial Crisis of 2008 (Mitchell and Utkus 2012). In a series of experiments, Agnew and Szykman (2005) found that individuals with low financial knowledge were more likely to choose the default fund than those with high knowledge. In another experimental study, Morrin et al. (2012) found those who claimed little financial knowledge were more likely to choose a target-date fund.

Based on the preponderance of the findings in the literature, we make the following hypotheses with respect to gender differences in DC investment in Chile.

Hypotheses regarding financial knowledge and psychological risk tolerance

H1a: Women will have lower basic financial knowledge and less psychological tolerance for risk than men.

H1b: Willingness to take risks will decrease with age for both men and women. We tested this hypothesis by regressing the risk tolerance measure on age separately for men and women.

Hypotheses regarding choice of the default plan

H2a: Women will be more likely than men to invest in the default plan. The default plan provides funds of moderate risk, and thus might be expected to be more preferred by women than men, who would prefer more risky options. As a further exploratory analysis, we examined differences in the percentage of men and women holding default funds by age category.

H2b: Men and women who have lower basic financial knowledge and less psychological tolerance for risk, and who are younger, have less education, and have lower income will be more likely to invest in the default plan. Unemployment may have a negative effect on choice of a default fund if it is picking up the effects of a temporary reduction in income due to unemployment. We test this hypothesis using these as explanatory variables in probit analyses for men and women. The dependent variable equals 1 if the person is in a default fund and 0 otherwise.

Hypotheses regarding choice of pension funds varying from a low risk bond fund to a higher risk stock fund.

H3a: Women will invest in lower risk funds than men.

H3b: Men and women who have more basic financial knowledge and greater psychological risk tolerance will invest in riskier pension funds. Men and women who are younger and have a higher income will also invest in riskier pension funds. Unemployment may have a positive effect on risky investment if it picks up the effect of temporarily reduced income due to loss of a job. Marital status may affect willingness to invest in risky funds, but we do not make a projection of the direction of effect. This theory is tested using these variables in multiple regression analysis for men and women where the dependent variable is the fund chosen, measured from 1 for least risky and 5 for most risky fund.

Method

Sample

The data utilized in this study were obtained from the *Survey of Social Protection* (SSP) *2009* (Subsecretariat of Social Protection of Chile 2009). We have almost complete data for 1662 of the 5,385 men (30.9 %) and 1120 of the 4,445 women (25.2 %) in the survey who were part of the AFP (we lost 12 men and 10 women in the probit and regression analysis because these individuals did not report their psychological risk tolerance). There are two reasons for these low percentages: we excluded people not contributing because they were not working or were not working in the formal economy or they were self-employed and did not have to contribute; and we excluded people who did not know what fund they were in. (See Kristjanpoller and Olson 2014 for more information on the sample.) The data include: the fund selected, a measure of basic financial knowledge, a measure of psychological risk tolerance and general background information on the participants including gender, age, marital status, average monthly

income over the last year, unemployment, and educational level. Average monthly income for the year before the survey is referred to as net salary, expressed in Chilean pesos (CLP) and tabulated according to the 12 ranges used by the Subsecretariat of Social Protection of Chile (2009). For our analysis we reduced the income categories to four: 0 to 300,000 CLP; 300,001 to 700,000 CLP; 700,001 to 1,000,000 CLP; and 1,000,001 CLP and above. (As of November 2014, there were about 590 pesos to the U.S. dollar.) Education level was classified in six categories: no education; eighth grade or less; high school education; technical education; university studies; and graduate studies. Since few in the study had no education, we combined that category with eighth grade or less. In our analysis the education and income categories were converted to dummy variables with the defaults being the lowest levels of education and income. Gender is a dummy variable equal to 1 for women and 0 for men. There are four dummy variables for marital status: single, married or cohabiting, divorced and widowed; the default is single.

The mean demographic variables for men and women in the sample are shown in Table 2. Women had a significantly higher average education level than the men, and the average income of the men is significantly higher than that of the women. Women were significantly more likely to be unemployed than the men. Seventy-three percent of the men were married versus 52 % of the women; this difference is statistically significant.

Measures

The 2009 survey asked respondents to answer several questions indicating their basic financial literacy (devised by Lusardi and Mitchell 2007a, b; and used by Hastings and Tejeda-Ashton2008; Hastings et al. 2011). Financial literacy was measured by the number of correct answers to survey questions. Since there were a number of questions, we selected only those seven that are related to basic financial knowledge. The questions used can be found in Appendix 2. These questions measure numeracy and an understanding of compound interest, inflation and diversification of risk as described in the literature review. Since the questions are relatively basic, we assumed that the direction of causality is from financial knowledge to choice of fund.

Following the general psychological risk tolerance measure of Dohmen et al. (2011), the survey asked the following question (translated from Spanish): "On a scale of 0 to 10 where 0 signifies you are not disposed to assume risk and 10 signifies you are very disposed to take risk, how do you describe yourself on this scale?" ("En una escala de 0 a 10 donde 0 significa que no está dispuesto a sumir riesgo y 10 significa está muy dispuesto a tomar riesgo, ¿Cómo se describe a Usted mismo en esta escala?")

Table 2 Mean values of the sample variables by gender

Variable	Mean Men	Std. dev.	Mean Women	Std. dev.
Fund (1 to 5)	3.55	1.18	3.49	1.20
Default fund (=1)	.36	.48	.34	.47
Financial literacy (1 to 7)	3.24[a]	1.67	2.97[a]	.29
Willingness to take risks (0 to 10)	6.01[a]	2.96	5.68[a]	2.96
Age	43.49[a]	10.54	42.14[a]	10.23
Education mean (1 to 5)	2.61[a]	.97	2.86[a]	.93
Eighth grade or less	.12	.33	.06	.24
High school	.36	.48	.29	.45
Technical education	.32	.47	.39	.49
University education	.18	.39	.23	.42
Graduate education	.01	.12	.02	.15
Income mean (1 to 12)	5.18[a]	3.05	3.90[a]	3.00
0 to 300,000CLP	.26	.44	.47	.50
300,001 to 700,000CLP	.40	.49	.28	.45
700,001 to 1,000,000CLP	.16	.37	.13	.34
1,000,001 CLP and above	.18	.39	.12	.33
Unemployed (=1)	.06[a]	.25	.09[a]	.29
Single	.19	.39	.32	.47
Married/cohabiting	.73[a]	.45	.52[a]	.50
Divorced	.07	.26	.14	.35
Widowed	.01	.08	.02	.15
Total	1662		1120	

For Fund, 1 represents Fund E, the least risky fund, and 5 represents Fund A, the most risky fund. The means for education and income were computed using the original narrower categories in the *Survey of Social Protection*. There were 6 categories for education and 12 for monthly income. CLP stands for the Chilean peso. In November 2014 the price of a U.S. dollar was about 580 CLP

[a] Gender differences are statistically significant at the .01 confidence level using a *t*-test

Results

Differences in Basic Financial Knowledge and Risk Tolerance

Table 2 shows mean values for basic financial knowledge and psychological risk tolerance by gender. The means for men are significantly higher than the means for women. This supports hypothesis H1a: that women have less basic financial knowledge and are less willing to take risks than men. Table 3 shows the results of a regression analysis of psychological risk tolerance as a function of age for men and women separately. The results show that willingness to take risks significantly decreased with age for both men and women. Thus hypothesis H1b is also supported.

Table 3 Regression analysis of willingness to take risk as a function of age and age squared

	Men	Women
Age	−.051*** (−6.17)	−.028*** (−2.65)
_constant	8.287*** (22.15)	6.935*** (15.00)
Number	1052	736
Log likelihood	−2619.7	−1840.8
R squared	.034	.010

Choice of the Default Plan or Active Management

Table 2 shows that 34 % of women and 36 % of the men held default funds, but this difference is not statistically significant. Table 4 shows the percentage of men and women who were in default funds by age categories corresponding to the default rules. We separated out the age bracket 51 to 55 because the default for women 51 and over is Fund D (2 in terms of risk) whereas Fund D does not become the default for men until they are 56 or over; in most of our analysis we excluded this age group because of the different defaults for men and women. Although Table 2 shows that the percentages of men and women holding default funds were not significantly different, Table 4 suggests that men 35 and under were more likely to hold default funds while women 36 to 50 and particularly women 56 and over were more likely to hold a default fund. However, a chi squared test on the data (excluding those 51 to 55) was not significant. Therefore, Hypothesis 2a, that women will be more likely to invest in the default, is not supported.

We used probit analysis by gender to test whether men and women who were younger and had less financial knowledge, less risk tolerance, less education and less income were more likely to choose a default, The dependent variable was 1 if the person held a default fund and 0 if he or she was actively managing his or her fund. The results are shown in Table 5. We ran the analysis on men and women of all ages, and then we repeated the analysis for three age groups corresponding to the different default categories: 35 and younger, 36 to 50, and 56 and older.

Looking first at men and women of all ages, it appears that the probit analysis has more significant results for men than for women; only age is statistically significant for women.

Table 4 Percentage of men and women holding default funds by age categories

Age	Men	Women
−35	45 %	41 %
36–50	34 %	36 %
51–55	44 %	15 %
56−	21 %	27 %

Financial knowledge and willingness to take risks have the expected negative signs for men and women, but are not significant. The age coefficients for both men and women are negative and statistically significant, indicating that older people were less likely to choose the default fund. The coefficients for high school and technical education are positive and significant for men, indicating that these men were more likely to choose the default plan than those with a university or graduate education. However, the default educational group is those with eighth grade or less education, and therefore these men without much education were more likely to actively manage their funds than men with a high school or technical education. The education coefficients for women all have the signs and absolute magnitudes to suggest that better educated women were less likely to invest in the default funds, but the coefficients are not significant. The income coefficients for both men and women are negative and increasing in absolute magnitude, as the theory predicts, but only the coefficients for men are significant. This supports the prediction that men in higher income groups were more likely to actively manage their retirement funds. The unemployment coefficients are both negative but not statistically significant. Thus, only parts of hypothesis 2B are strongly supported; these are that younger people are more likely to choose the default than older people, and, for men, that the lower the income level the more likely the man is to choose the default.

In the probit analysis for men and women 35 and under, the coefficients for financial knowledge and willingness to take risks are again not significant. The education variables seem more important than the income variables, at least for men. The education variables all have the predicted negative signs; men with a university or graduate education were significantly more likely to actively manage their funds than less educated men. The education results for women also have the predicted signs but only the coefficient for high school education is significant and the magnitude of this coefficient suggests that women with a high school education were more likely to manage their retirement funds than better-educated women. The income coefficients have the predicted signs but only the coefficient for women earning more than a million CLP a month is significant.

The results for people 36 to 50 are fairly similar to the overall group, perhaps because it is the largest group, but now willingness to take risks is marginally significant for men, indicating risk takers are more likely to manage their funds. Only one coefficient for women, graduate education, is marginally significant. The unemployment coefficient for men is negative, and now statistically significant. For the men over 56, the education coefficients are the reverse of those for younger men. The fact that the coefficients for education are positive and increasing in magnitude with the level of education indicates that better educated older men are more likely to choose a default fund. This contradicts Hypothesis 2b. The

Table 5 Probit analysis of demographic characteristics affecting the choice of default or active manage (default=1)

	All ages		35 and younger		36 to 50		56 and older	
	Men	Women	Men	Women	Men	Women	Men	Women
Financial knowledge	−.033 (−1.59)	−.037 (−1.44)	−.048 (1.13)	−.013 (−.27)	−.0218 (−.70)	−.0586 (−1.55)	−.031 (−.54)	.010 (.12)
Willingness to take risks	−.033 (−.37)	−.012 (−.91)	.021 (.93)	−.017 (−.68)	−.029* (−1.79)	−.016 (−.81)	−.026 (−.83)	−.031 (−.81)
Age	−.006** (−2.00)	−.013*** (−3.22)	–		–		–	
Education variables								
High school	.273** (2.48)	−.053 (−.32)	−.301 (−.90)	−.713* (−1.66)	.361** (2.11)	−.251 (−.93)	.478* (1.81)	.037 (.10)
Technical education	.273** (2.32)	.071 (.42)	−.442 (−1.32)	−.388 (−.92)	.398** (2.20)	−.260 (−.33)	.559* (2.86)	−.004 (−.01)
University education	−.049 (−.34)	−.119 (−.62)	−.828** (−2.32)	−.570 (−1.27)	.094 (.42)	−.495 (−1.92)	.604* (.17)	−.311 (−.35)
Graduate education	.279 (.94)	−.240 (−.69)	−5.043*** (−13.31)	−.703 (−.87)	.484 (1.04)	−1.127* (−1.89)	.905 (1.61)	−.471 (−.62)
Monthly income variables								
300,001 to 700,000 CLP	-.213** (−2.38)	−.031 (−.30)	.092 (.52)	−.209 (−1.24)	−.353** (−2.58)	−.019 (−.13)	−.510** (−2.18)	.351 (.98)
700,001 to 1,000,000 CLP	−.254** (−2.29)	−.188 (−1.32)	−.014 (−.06)	−.231 (−.92)	−.501*** (−2.94)	−.272 (−1.31)	−.762** (−.35)	.894* (1.92)
1,000,001 CLP and above	−.526*** (−4.29)	−.223 (−1.37)	−.193 (−.81)	−.629** (−2.05)	−1.094*** (−4.25)	−.069 (−.28)	−.948*** (−2.65)	−.066 (−.15)
Unemployed	−.235 (−1.64)	−.061 (−.42)	.443 (1.55)	−.362 (−1.29)	−.530** (−2.53)	.038 (.19)	−.980* (−1.81)	−.272 (−.52)
_constant	−.102 (−.49)	−.386 (−1.41)	−.316 (−.89)	−.589 (−1.30)	.088 (−.75)	−.245 (−.96)	.547** (2.15)	.547 (1.42)
Number of obs.	1650	1110	428	340	773	508	241	135
Log likelihood	−1048.3	−693.6	−279.7	−223.5	−477.6	−322.0	−115.3	−73.86
Chi-squared	62.66	28.83	899.7	12.89	35.07	16.18	15.43	9.66
Pseudo R^2	.030	.022	.051	.028	.036	.029	.063	.057

***, ** and * indicate the coefficients are statistically significant at the .01, .05 and .10 confidence levels

income coefficients for men are negative and significant as predicted. The results for women 56 and over have only one significant coefficient, for income in the next to the highest category and the sign indicates women in this income bracket are more likely to choose the default. The coefficients for unemployment are both negative, as predicted but only the one for men is marginally significant. Thus, there is less support for hypothesis H2b for people 56 and older than for the younger groups.

Choice of Funds for Active Managers

Next we look at gender differences in the choice of funds that varied in risk. Table 2 shows no statistically significant difference in the funds held by men and women, but that number includes default funds. Table 6 shows the number of men and women invested in each fund by age group. The numbers in bold show those invested in the default funds for each age group within gender. We then computed the mean active fund and percentage of *active* investors in each fund by age group and gender. For people 35 and under, 63.0 % of the men and 61.1 % of the women were invested in Fund A, the most risky fund. The percent invested in the least risky fund, Fund E were both about 6 %. Thus young men and women seemed to be making the same kind of risk allocations. The differences are only slightly larger for the 36 to 50 group, with 42.6 % of the men and 38.8 % of the women in fund A and 8.7 % of the men and 10.3 % of the women in the lowest risk fund. Skipping the 50 to 55 group because of the difference in the default, we see quite a large difference in risk taking for the men and women 56 or over. There were still 9.3 % of the men in Fund A and only 3.0 % of the women. On the low risk side, 22.3 % of the men and 33.3 % of the women were in Fund E. This information suggests that hypothesis 3a, that women will be more risk averse in their investments than men, may hold for older Chilean women; however, *t*-tests did not find statistically significant differences for the average fund in each age category or overall. Thus we must reject the hypothesis 3a that active female investors are more risk averse than active male investors.

We ran multiple regression analysis on all ages and then by three age groups to see what variables affected willingness to invest in risky assets. The dependent variable was the fund chosen, measured from 1 for Fund E to 5 for Fund A. The explanatory variables were financial knowledge, psychological willingness to take risks, age, marital status, income category and unemployment. The results are shown in Table 7. For all ages combined, the coefficients for financial risk are

Table 6 Investments in funds by gender and age categories and percentage of active investment in each non-default fund

	E (1)	D (2)	C (3)	B (4)	A (5)	Total	Total active	Mean active fund
Men								
35 or less	15	17	55	**194**	148	429	235	4.06
36 to 50	45	60	**265**	190	219	779	514	3.93
51 to 55	22	20	**93**	31	45	211	118	3.48
56 and over	43	**50**	96	36	18	243	193	2.97
Average over all ages								3.73
Percent active in each fund								
35 or less	6.38	7.23	23.40	**Default**	62.98		235	
36 to 50	8.75	11.67	**Default**	36.96	42.61		514	
51 to 55	19.64	16.95	**Default**	26.27	38.14		118	
56 and over	22.28	**Default**	49.74	18.65	9.33		193	
Women								
35 or less	13	17	49	**139**	124	342	203	4.01
36 to 50	34	45	**183**	123	128	513	330	3.81
51 to 55	13	**19**	55	31	12	130	111	3.26
56 and over	33	**36**	35	28	3	135	99	2.63
Average over all ages								3.63
Percent active in each fund								
35 or less	6.40	8.37	24.14	**Default**	61.08		203	
36 to 50	10.30	13.64	**Default**	37.27	38.79		330	
51 to 55	11.71	**Default**	49.55	27.93	10.81		111	
56 and over	33.33	**Default**	35.35	28.28	3.03		99	

The numbers in bold are those invested in the default funds. These are not included in the mean active fund and the percent active in each fund. Gender differences in the mean funds were not statistically significant

Table 7 Multiple regression analysis on demographic factors affecting choice of retirement funds for all participants and by age groups

	All ages		35 and under		36 to 50		56 and over	
	Men	Women	Men	Women	Men	Women	Men	Women
Financial knowledge	.052** (2.10)	.048 (1.49)	−.035 (−.57)	.048 (.74)	.066* (1.84)	.055 (1.15)	.109** (2.34)	.0175 (.20)
Willingness to take risk	.030** (2.14)	.060*** (3.77)	.054 (1.60)	.093*** (2.78)	.038* (1.93)	.042* (1.74)	.020 (.73)	.114*** (2.90)
Age	−.040*** (−9.98)	.041*** (1.97)	–	–	–	–	–	–
Married	.185* (1.67)	−.152 (−1.43)	−.229 (−1.30)	−.384* (−1.94)	.182 (1.06)	−.084 (−.48)	.511 (1.43)	−.100 (−.28)
Divorced	.215 (1.28)	−.125 (−.80)	.101 (.23)	−.189 (−.55)	−.140 (−.58)	−.092 (−.38)	1.071** (2.56)	−.569 (−1.37)
Widowed	.143 (.40)	.384 (1.48)	–	.693*** (3.83)	.629*** (3.33)	−.147 (−.12)	.415 (.73)	.675 (1.56)
Income variables								
300,001 to 700,000 CLP	.127 (1.03)	.244* (1.92)	−.107 (−.41)	−.075 (−.32)	.316* (1.66)	.595*** (3.12)	−.055 (−.25)	.092 (.24)
700,001 to 1,000,000 CLP	.477*** (3.28)	.564*** (3.98)	.319 (1.05)	.430 (1.49)	.801*** (3.89)	.606** (2.59)	.221 (.66)	1.083*** (1.63)
1,000,000 CLP and above	.740*** (5.53)	.506*** (3.45)	.777*** (2.86)	.905*** (3.50)	.723*** (3.42)	.573** (2.22)	.452* (1.83)	.204 (.62)
Unemployed	.227 (1.22)	.323** (1.98)	.008 (.02)	.008 (.02)	.399 (1.55)	.278 (1.06)	.241 (.60)	−.092 (−.15)
Constant	4.665*** (19.59)	4.737*** (18.29)	4.031*** (6.99)	3.764*** (10.99)	2.898*** (11.70)	3.098*** (12.34)	1.805*** (4.40)	1.993*** (4.94)
Number of observations	1052	736	234	201	510	326	191	99
Log likelihood	−1739.9	−1209.8	−385.5	−326.7	−829/6	−549.8	−297.0	−155.4
R squared	.155	.162	.086	.147	.089	.057	.101	.172

***, ** and * indicate the coefficients are statistically significant at the .01, .05 and .10 confidence levels

positive as predicted but only significant for men. On the other hand, the coefficient for willingness to take risks is positive and significant for both men and women; the coefficient for women twice as large as for men. Thus hypothesis H3a, that financial knowledge and willingness to take risks are correlated with risk taking, is largely supported.

Ages for both men and women have similar negative coefficients and are statistically significant, indicating that older Chileans tended to invest in less risky funds. The coefficient for married men is positive and marginally significant; the coefficient for married women is negative but not statistically significant. Thus, there is some evidence that married men tended to make more risky investments while married women made less risky investments. The income coefficients are all positive and all are statistically significant except for men in one income categories. This shows that the higher the incomes of men and women the more likely both were to actively manage their retirement funds. The coefficients for unemployed have the predicted positive signs, but only the coefficient for women is statistically significant. Thus most of hypothesis 3b, that younger people and people with more income are more likely to invest in risky funds and that marital status can affect choice of risky investments is supported.

For those 35 and under, very few variables have significant coefficients. The coefficient for women's willingness to take risks is large, positive and statistically significant; the coefficient for men is positive but not significant. The coefficients for married men and women are both negative and the one for women is marginally significant. The coefficient for widowed women is positive, large and statistically significant; given the small number of widowed women in the whole sample, this probably reflects a few outliers. For income, only the coefficients for the highest bracket are statistically significant and the coefficients for the income category 300,001 to 700,000 CLP have the wrong signs. Thus in this age bracket there is less support for hypothesis 3b.

For those 36 to 50, the coefficients for financial knowledge and willingness to take risks are all positive, and three are marginally significant. The coefficient for married men is positive and the coefficient for married women is negative, but neither is statistically significant. Widowed men were now likely to take greater risks than their married or single counterparts; this again may reflect a few outliers. The coefficient for married women is negative, but is not statistically significant. The coefficients for income are all positive and all but one are statistically significant. They generally indicate that men and women with higher incomes were more willing to take risks. Thus, hypothesis 3b is generally supported for this age group. For the oldest group (56 and over), only a few coefficients are significant for either men or women. The financial knowledge coefficient for men is positive and statistically significant. The coefficient for willingness to take risk for women is positive and statistically significant. The coefficients for married men and women have the usual signs but are not significant. Divorced older men were more likely to invest in risky assets. Five of the six income coefficients are positive but only two are significant. Women in the 700,001 to 1million CLP categories tended to invest in more risky assets than those in the highest income category. The unemployment coefficients are not significant. There is some support for hypothesis 3b in this age group, but not so much as for the group from 36 to 50.

Discussion

To summarize our results for the combined age groups, we found that Chilean women had significantly less financial knowledge and were less willing to take risks than men. Psychological willingness to take risks declined with age for men and women. Thus both H1a and H1b were supported.

With respect to choice of the default funds, we did not find that women were more likely to choose the default than men; thus hypothesis H2a was not supported. There was some evidence that young women might be more likely to choose the default than young men while older women were more likely, but the differences were not statistically significant. There were mixed results for the other explanatory variables in hypothesis H2b. The hypothesis that younger men and women would be likely to choose the default was strongly supported. Only a few coefficients for education were significant and some of the coefficients had the wrong sign. Thus the predictions for education were not supported. The coefficients for income had the predicted signs and magnitudes but only the coefficients for men were significant. The coefficients for unemployment had the predicted signs but were not significant.

It is worth comparing these results with our earlier study (Kristjanpoller and Olson 2014) where we tried to predict what variables would explain active investment for men and women combined. One can argue that if men and women generally make DC investment decisions in the same manner, then the combined results may be stronger because the number of observations is greater. On the other hand, if men and women make decisions in a different manner, then separate analysis of men and women may give better results. In the earlier study we found that people with more financial knowledge were less likely to invest in the default plan and, in contrast to the current study, the coefficient was marginally significant. The older study found the higher the psychological risk tolerance, the less likely to invest in the default but, like the current study, the coefficient was not significant. The earlier study also found that younger people were significantly more likely to choose the default and the higher the income level the significantly less likely people

were to choose the default. Unemployed people were less likely to invest in the default but the coefficient was also not statistically significant. In the earlier study some of the education variables also had signs that were different from the predictions and only a few coefficients were significant. The earlier study included other explanatory variables—dummy variables for marital status and dummy variables for accumulated savings in the plan. None had been found in the literature review to predict the choice of a default fund and none was statistically significant in the earlier study; therefore, we did not include these variables in the current study. The earlier study also included a dummy variable for being a woman and this variable indicated that women were significantly less likely to choose the default variable. In our current study, we were not able to find a significant difference between men and women. In sum, our current findings for men are similar to the earlier findings for both men and women combined. In contrast, none of the coefficients for women in the current study are significant except for age. Part of the difference may be that our sample size for women was smaller (1110) and thus it was harder to get significant results, but it may also indicate that there were other variables that affected women's choice of the default that we did not include in the analysis.

Our primary interest in the current study was whether women who were active investors were as willing as men to invest in risky funds. We did not find statistically significant differences, and thus we rejected hypothesis 3a that Chilean women were more risk averse in their DC investments than Chilean men. Chilean women appeared to take similar risks even though their average psychological risk tolerance was significantly lower than men's. Looking at hypothesis 3b, the coefficients for financial knowledge and willingness to take risks were all positive, meaning that higher scores on these variables tended to lead to riskier investments, but the financial knowledge coefficient was not significant for women. The age coefficients indicated that risky investments decreased significantly with age for men and women; however, it should be noted that women 51 and over and men 56 and over were theoretically not allowed to invest in Fund A, the most risky fund (a few in these age groups did still have investments in Fund A). This restriction could have forced older active investors to make less risky investments than they preferred. Income coefficients were all positive and significant (except for one income category for men), and generally increased with the level of income. Unemployment also had the predicted positive coefficients but was only significant for women. Therefore, hypothesis 3b was generally supported. We predicted that marital status might affect risk taking but did not predict the direction of the results. We found that being married seemed to increase the risk taking of men and decrease the risk taking of women, but the significance levels were marginal or not significant. In general, it appears that the investment decisions of Chilean men and women were influenced by the explanatory variables in a similar manner.

Our earlier study (Kristjanpoller and Olson 2014) also looked at the choice of risky funds but combined men and women, used ordered probit rather than regression analysis, and included education and savings categories. Despite the differences in methodology and the inclusion of additional variables, the results were quite similar. Greater basic financial knowledge and greater psychological risk tolerance led to investment in riskier funds. Income coefficients were positive and significant, and increased in magnitude with higher income categories, indicating that people with higher incomes tended to make more risky investments. Unemployment had a positive and significant coefficient. Married women were more risk averse than single women. The earlier study combined men and women but included a dummy variable for women. The coefficient for women was positive and marginally significant, suggesting that women were slightly more likely to take risks other things being equal. None of the education variables had significant coefficients. The savings coefficients were negative whereas based on the literature review we had predicted that higher savings should lead to more risky investment. We concluded that the savings variables were probably picking up age and income effects because accumulated savings depended closely on age and prior income. We did run regressions with education and savings in them for the current paper, but got the same results that the education coefficients were not significant and the savings variables had the wrong signs. Therefore, we excluded them from the final analysis. We showed in the earlier paper that education was a strong predictor of income and therefore indirectly affected risk taking.

In the introduction to this study, we observed that one problem with DC pension plans is that women might make less risky investments than men, and this would have negative effects on their retirement income. Fortunately, this was not the case for Chilean women in 2009. However, as we described earlier, Chilean women face many other problems that are likely to keep their retirement incomes considerably lower than men. Their salaries are lower, their labor force participation is unusually low and their normal retirement age is 60 versus 65 for men. Given that the mandatory contribution is 10 % of income, Chilean women will generally contribute smaller amounts over fewer years than men. Unless they have worked for 20 years, poorer women will also not be eligible for the guaranteed minimum pension. Pension reform is on the agenda of President Michelle Bachelet (Mitchell 2014), who was elected a second time in 2014 (she served as president between 2006 and 2010), but as long as women have low labor force participation rates, retire earlier than men and earn less than men, a DC retirement plan is likely to keep them at a serious disadvantage.

Appendix 1

Table 8 Maximum and minimum variable return assets permitted by fund

Fund	Maximum permitted	Required minimum
A	80 %	40 %
B	60 %	25 %
C	40 %	15 %
D	20 %	5 %
E	5 %	0 %

Variable return investments are primarily stocks. The percentages in the table can be interpreted as follows. Fund A, the most risky fund, must have at least 40 % of its assets invested in stocks (or equivalent) and no more than 80 % in stocks. The rest of the assets must be in fixed income assets such as bonds. Fund E, the least risky fund, can have no more than 5 % of its assets in stocks or other variable return assets

Appendix 2. Questions Related to Basic Financial Knowledge

1. If there exists a 10 % probability, how many of 1000 persons will contract a disease?
2. Five people win a prize of 2 million. How much will each one receive?
3. You have $100 in a savings account with a 2 % annual interest rate. How much will you have at the end of 5 years?
4. You have $200 in a savings account. The account accumulates 10 %. How much will you have in the account at the end of 2 years?
5. If the AFP "A" had a profitability of 15 % the past year and the AFP "B" had a profitability of 20 %, which AFP will have the greater profitability next year?
6. You possess a savings account that delivers interest of 1 % annually and you know that the rate of inflation is 2 % annually. After 1 year you will be able to buy….?
7. "To buy shares of one company is less risky than to use the same amount of money to buy various shares of different companies". True or False.

The following are the questions in the original Spanish.

1. Si existe un 10 % de probabilidad ¿cuántas personas de 1.000 contraerían la enfermedad?
2. 5 personas ganan un premio de dos millones, ¿cuánto recibiría cada una?
3. Ud. tiene $100 en una cuenta de ahorro, a una tasa de 2 % anual ¿cuánto tendrá al término de estos 5 años?
4. Ud. tiene $200 en una cuenta de ahorro. La cuenta acumula 10 por ciento ¿Cuánto tendrá en la cuenta al cabo de 2 años?
5. Si una AFP "A" tuvo rentabilidad de 15 % el año pasado, y la AFP "B" tuvo una rentabilidad de 20 % ¿cuál AFP tendrá la mayor rentabilidad el próximo año?
6. Ud. posee $100 en una cuenta de ahorro, la que entrega un interés de un 1 % anual y Ud. sabe que la tasa de inflación es de 2 % anual. Después de un año usted podrá comprar……
7. "Comprar una acción de una empresa es menos riesgoso que comprar con el mismo dinero varias acciones de distintas empresas", Verdadero o falso.

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