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Chile: early retirement, impatience and risk aversion

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About one third of all Chileans take early retirement. As retirement age approaches, people become more aware of the health issues associated with that stage of life. This reduces their uncertainty about their future quality of life and may lead to a relative increase in impatience. This article offers a theoretical examination of how future life expectancy affects relative levels of impatience in ways that may increase the probability of early retirement. The empirical findings for Chile show that the greater people's future life expectancy is, the less likely they will be to take early retirement. The article also looks at how risk aversion increases relative impatience as a consequence of people's uncertainty as to whether or not they will enjoy a good quality of life in the years ahead. The empirical findings point to a positive correlation between risk aversion and early retirement via the mechanism of life expectancy.

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I

Introduction

Although the current tendency in pension policy is to raise the retirement age, early retirement is fairly common in Chile. Of all those who retired in 2006, 35% did so early.¹ According to data from the country's pension fund management companies (AFPS), people who opt to start drawing their pensions early are doing so at age 55, on average. From a public policy standpoint, the reasons behind these retirement decisions therefore merit examination. This article offers a new perspective on the important role which impatience and risk aversion may play in early retirement decisions.

People who retire early receive smaller pensions than they would if they retired at the age established by law, and they have to use those pensions to cover their living expenses over a greater number of years, on average (Nalebuff and Zeckhauser, 1985). Given that the number of pensioners is rising every year and that 35% are retiring early, it is important to understand how risk aversion influences the decision to retire early.²

In Chile, in order to take early retirement,³ a person must have belonged to the new pension system for at least five years and must have accumulated pension funds equal to or greater than 62%⁴ of the taxable income declared over the past 10 years. Requirements such as these may have little impact on the impatience factor at the individual level, however.

A person who has reached an age at which he or she must decide whether to retire early or to wait until the legally mandated age is more aware of the loss of

cognitive and motor abilities that can occur as people grow older. Accordingly, the value placed on the years that they have left to live (future life expectancy) can generate differences in relative levels of impatience. Uncertainty about the quality of life that they may enjoy in the future can lead risk-averse individuals to prioritize present consumption over future consumption. This article offers evidence that the higher an individual's level of risk aversion is, the greater that person's relative level of impatience will be.

In this analysis, a person's decision as to when to retire is represented by an aggregate utility model over two periods, such that a social-security contributor who retires at the beginning of the first period is doing so early, whereas one who retires at the start of the second period is doing so at the legally established age. Thus, the legally mandated age defines the break between the two periods. The estimation procedure used here involves a discrete choice model which distinguishes only between whether or not the individual takes early retirement. This procedure follows the structure suggested by the theoretical model, with the aim being to identify the impact that the perception of future quality of life, based on future life expectancy (Bleichrodt and Quiggin, 1999), has in terms of the level of impatience that leads people to retire early.

The results show that those who retire early are using a higher intertemporal discount rate, which could be attributable to their perceived future life expectancy. Some evidence is also found that the higher the level of risk aversion, the greater the degree of impatience to take early retirement, which may reflect uncertainty about future quality of life.

The rest of this article is structured as follows: after this introduction, section II offers a brief review of the regulatory context and the existing data and literature. Section III sets forth the theoretical framework and the estimation model used. Section IV presents the empirical analysis, description of variables and empirical findings, as well as some possible extensions of the model and other considerations. Section V concludes.

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¹ Pensions Oversight Agency, Chile.

² According to the results of the Social Protection Survey (EPS), the percentage of pensioners rose from 13.3% in 2004 to 14.5% in 2006.

³ Act No. 19.943.

⁴ Under Act No. 19.943, this percentage was raised to 70% on 19 August 2010.

II

Review of the literature on pensions

Prior to 1980, Chile had a pay-as-you-go pension system. At that point, however, it consolidated its structural pension-system reform programme.⁵ This reform allowed it to phase out the pay-as-you-go system and to replace it with a fully funded system based on individual accounts. Unlike its predecessor, this financing mechanism relies on market returns.

Part of the literature on pensions focuses on examining the factors that may lead people to start drawing their pensions before the legally mandated age. Some authors have posited that the likelihood that people will decide to take early retirement increases as their social security benefits rise (Mitchell and Phillips, 2000), as their level of additional savings increases (Au, Mitchell and Phillips, 2005) and as their perception of their own health status diminishes (Hammitt, Haninger and Treich, 2005). Some studies use simulations to work out the reasons for this kind of retirement decision. For example, Poterba, Rauh and Venti (2005) maintain that the future marginal utility could be quite high even for a low-risk household if its members succeed in diversifying their investments in such a way as to permit them to take early retirement. Taking a different approach, Diamond and Köszegi (2003) propose a quasi-hyperbolic model as a basis for arguing that a lack of self-control influences retirement behaviour and, in particular, the decision to retire early.

Early retirement decisions may also be influenced by the business cycle. For example, a period of high unemployment may further diminish the chances that people nearing retirement age have of finding a job and thereby prompt them to retire early (Hairault, Langot and Soprasedu, 2010). Another possibility is that a recessionary phase of the business cycle may depress wages to such an extent that it increases the likelihood of early retirement in the presence of an endogenous labour supply (Chai and others, 2009). On the other hand, a downswing in the business cycle may drive down the rates of return at which future pension payments can be calculated, thereby making the prospect of drawing on retirement pensions ahead of time less attractive and thus encouraging people to delay their retirement.

People's perception of their health and future life expectancy are very closely related. French (2005) finds evidence that people's state of health, or their uncertainty as to the likelihood that they will remain healthy in the future, influences their decision about when to retire. Guiso and Paiella (2006) find that the level of risk aversion provides a basis for predicting a series of household decisions, including the decision to take early retirement. Risk tolerance is also positively correlated with people's perception of their own state of health and future life expectancy (Hammitt, Haninger and Treich, 2005). This study will therefore seek to arrive at a formal expression of the integration of risk aversion into early retirement decisions, together with people's perceptions of their state of health and life expectancy, based on their assessment of their future quality of life.

⁵ Decree-Law No. 3500.

III

Theoretical model and empirical strategy

A model that provides a formal expression of the influence that impatience and risk aversion exert on early retirement decisions is presented below. This represents an analytical formalization of the decision to retire early or to wait until the legally mandated

age based on a simple two-stage life-cycle model. In this model, then, if a person takes early retirement, he or she does so during the first of these time periods; if not, then the person retires during the second time period.

Let us take $U(\cdot)$ to represent the aggregate utility under conditions of linear separability, while $u(\cdot)$ ⁶ will represent the utility in a given period, such that $u'(C_t) > 0$ and $u''(C_t) < 0$. It is also assumed that the utility function for each period is isoelastic (constant relative risk aversion, or CRRA), such that σ represents the CRRA, ρ is the intertemporal discount rate, which will be written as the discount factor $\beta(H, \sigma)$ and is linked to risk aversion σ and life expectancy H .

The maximization of individual welfare consists of:

$$\max_{C_t, C_{t+1}} U(C_t, C_{t+1}, \sigma, \rho, H) = u(C_t, \sigma) + \beta(H, \sigma) \cdot u(C_{t+1}, \sigma) \quad (1)$$

Subject to: $C_t + A_t \leq Y_t + \lambda \cdot B$

$$C_{t+1} \leq (1+r) \cdot A_t + (1+s)(1-\lambda) \cdot B \quad A_t \geq 0$$

where r represents the market interest rate and s represents the rate of return offered by AFPs. B corresponds to the amount of pension funds that a person has accumulated, while λ is the portion that a person receives when he or she retires, which may vary depending on how early an age the person retires at. If a person waits until the legally mandated age, λ will be zero (0). Finally, A_t represents the initial level of assets.

In order to incorporate the value placed on life expectancy and risk aversion into the measurement of relative impatience, the discount factor is defined as $\beta(H, \sigma) = \delta \cdot \phi(H, \sigma)$. The parameter δ is a constant that represents the distortion in the discount factor generated by the difference between the values that different individuals place on their quality of life. In the case of the function $\phi(H, \sigma)$, it is assumed that, for a given level of risk aversion $\lim_{H \rightarrow 0} \phi(H, \sigma) = 0$, which means that if a person does not expect to live much longer, his or her only chance to have a better quality of life is in the present. In addition, it is assumed that $\lim_{H \rightarrow \infty} \phi(H, \sigma) = 1$, which indicates that future quality of life does not compete with present quality of life.

Proposition 1. The function $\phi(H, \sigma)$ is defined as increasing and convex in H , $\frac{\partial \phi}{\partial H} > 0$ and $\frac{\partial^2 \phi}{\partial H^2} < 0$. It is also defined as decreasing and concave in σ , $\frac{\partial \phi}{\partial \sigma} < 0$ and, $\frac{\partial^2 \phi}{\partial \sigma^2} < 0$.

In view of how tight the credit market is at present, it is assumed that individuals in this economy are faced with liquidity constraints.

Some of the factors mentioned in the literature that could account for a decline in future marginal utility are the non-contributory element in the social security system, financial risks and a person's state of health. Social security and the financial market are not under any one person's control. Nonetheless, a person's perception of his or her state of health is used as a basis for calculating future life expectancy. In fact, Engen, Gale and Uccello (1999) show that a failure to take this element into account places serious limitations on estimates for temporal consumption models. Alternatively, it may be that this condition is attributable to different people's psychological make-up as reflected in their attitude about the years to come.

In the proposed model, $\phi(H, \sigma)$ represents the future value that an individual places on his or her future life expectancy, which is similar to the concept of longevity as described in Bleichrodt and Quiggin (1999), or to the incorporation of a person's state of health into the intertemporal discount factor as described by Nordhaus (2002). The idea is to establish the future discount rate that people will use based on their assessment of their future psychological and physical state.

The constraints expressed in the model for equation (1) can be summed up as:

$$C_t + \frac{1}{1+r} C_{t+1} \leq Y_t + B + \frac{(s-r)}{(1+r)} (1-\lambda) \cdot B$$

For the sake of simplicity, we will call this $R = 1+r$. It is assumed that people will use up all of their assets by the time that they die. On the other hand, if $s < r$, then everyone—regardless of their degree of risk aversion or impatience—will take early retirement, since the model will be offering them a better financial option, no matter what they decide to do with their assets after retirement. Thus, the decision to take early retirement is relevant only if the rate of return on the person's individual account is higher or equal to the market rate.⁷

The condition for equilibrium in the problem shown in equation (1) thus comes down to:

⁷ Business cycles have an impact on both the rate of return for an individual's account and the market rate of return, mainly via a levelling effect which may also alter rate differentials. Nonetheless, downswings in the business cycle that lead to a drop in the rates of return used to calculate future pensions may discourage people from retiring either at the legally mandated age or earlier. This presupposes that they expect rates of return to increase in the short term, however, and does not affect people's propensity to retire based on the difference between market rates and the rates for individual accounts.

⁶ It is assumed that the function satisfies the Inada conditions $\lim_{C \rightarrow \infty} u'(C) = 0$ and $\lim_{C \rightarrow 0} u'(C) = \infty$.

$$TMS = -(1 + r) = -R$$

$$TMS = -\frac{\partial U / \partial C_t}{\partial U / \partial C_{t+1}} = -\frac{u'(C_t, \sigma)}{\delta \cdot \phi(H, \sigma) \cdot u'(C_{t+1}, \sigma)} = -R \quad (2)$$

$$\frac{u'(C_t, \sigma)}{\delta \cdot \phi(H, \sigma) \cdot u'(C_{t+1}, \sigma)} = R$$

At the same time, the ratio between future and present consumption must be lower for people who decide to take early retirement, A, than it is for those who decide to wait until the legally mandated age, L. This occurs because the former are substituting a higher level of present consumption for a lower level of future consumption. This is expressed in equation (3).

$$\frac{C_{t+1}^A}{C_t^A} < \frac{C_{t+1}^L}{C_t^L} \quad (3)$$

Thus, if the utility function is isoelastic,⁸ as in $u(C_t, \sigma) = C_t^{1-\sigma} / (1-\sigma)$, and consumption levels are greater than unity and the risk-aversion index is $\sigma > 1$, then:

$$\frac{u'(C_t^A, \sigma)}{u'(C_{t+1}^A, \sigma)} < \frac{u'(C_t^L, \sigma)}{u'(C_{t+1}^L, \sigma)} \quad (4)$$

However, equation (2) should hold both for people who retire early and for those who wait until the legally mandated age:

$$\frac{u'(C_t^A, \sigma)}{\delta \cdot \phi_A(H^A, \sigma^A) \cdot u'(C_{t+1}^A, \sigma)} = \frac{u'(C_t^L, \sigma)}{\delta \cdot \phi_L(H^L, \sigma^L) \cdot u'(C_{t+1}^L, \sigma)} = R \quad (5)$$

Thus $0 < \phi_A(H^A, \sigma^A) < \phi_L(H^L, \sigma^L) < 1$, which indicates that people who take early retirement are more impatient and so tend to discount future revenues more heavily. This difference in discounting may occur because of: (i) a difference in the value ascribed to the remaining years of life expectancy;⁹ (ii) differences in life expectancy; or (iii) a difference in the level of risk aversion.

⁸ Constant Relative Risk Aversion (CRRA).

⁹ This difference is probably due to the fact that persons who retire early would presumably enjoy the first years of their remaining years of life more than the people who wait until the legally mandated age would.

If equally risk-averse individuals ($\sigma^A = \sigma^L = \sigma$) have the same perceived life expectancy ($H^A = H^L = H$), then, if some of them decide to take early retirement, it follows that they value their remaining years of life differently ($\phi_A(H, \sigma) < \phi_L(H, \sigma)$). Since life expectancy equates to a person's remaining years of life, then the idea of enjoying a better quality of life in the present than in the future is equivalent to a lower future valuation of life expectancy (a lower discount factor). On the other hand, a person might be setting an equal value on the years that remain to him or her ($\phi(H^A, \sigma) = \phi(H^L, \sigma)$), in which case, if the person wishes to take early retirement, then that person must believe that he or she has fewer years left to live ($H^A < H^L$).

If we assume that two people have the same future life expectancy ($H^A = H^L = H$) and risk-aversion coefficients of σ_0 and σ_1 , respectively, then they will be risk averse if $\sigma_0 > 1$ and $\sigma_1 > 1$. However, if $\sigma_0 < \sigma_1$, then the first person will be less risk-averse than the second. Thus, from equations (3) and (4), it follows that:

$$\frac{u'(C_t^j, \sigma_1)}{u'(C_{t+1}^j, \sigma_1)} < \frac{u'(C_t^j, \sigma_0)}{u'(C_{t+1}^j, \sigma_0)} \quad \forall j = A, L \quad (6)$$

This new condition is shown in equation (7), where (b) and (c) represent the equilibrium condition set up in (5), while (a) represents the equilibrium condition for an individual who decides to take early retirement but who is more risk averse than the level defined in (b).

$$\frac{\underbrace{u'(C_t^A, \sigma_1)}_{(a)}}{\delta \cdot \phi_A(H^A, \sigma_1) \cdot u'(C_{t+1}^A, \sigma_1)} = \frac{\underbrace{u'(C_t^A, \sigma_0)}_{(b)}}{\delta \cdot \phi_A(H^A, \sigma_0) \cdot u'(C_{t+1}^A, \sigma_0)} = \frac{\underbrace{u'(C_t^L, \sigma_0)}_{(c)}}{\delta \cdot \phi_L(H^L, \sigma_0) \cdot u'(C_{t+1}^L, \sigma_0)} = R \quad (7)$$

In order for equation (7) to hold, it is necessary that:

$$0 < \phi_A(H^A, \sigma_1) < \phi_A(H^A, \sigma_0) < \phi_L(H^L, \sigma_0) < 1$$

Thus, if a person retires early, it is because he or she discounts the future more heavily. The smaller discount factor is due to the difference in the present value placed on future life expectancy. This difference is heightened by a greater degree of risk aversion owing to the level of uncertainty as to whether the person will have a good quality of life in the future.

IV

An empirical strategy for identifying the determinants of early retirement

While the theoretical model tells us something about the expected behaviour of people when the time comes to decide when to retire, taking into account their future life expectancy and degree of risk aversion, the hypotheses derived from that model are not directly measurable by econometric means. The following empirical strategy is designed to provide a simple, estimable way of incorporating the characteristics of the theoretical model.

The decision as to whether to retire early or at the legally mandated age can be presented as a discrete choice, with a rational individual opting for the alternative that will provide a greater level of utility. It is generally agreed that indirect utility should be taken into account in analysing discrete choices, since this internalizes the constraints associated with income and other restrictions (Deaton and Muellbauer, 1980; Hensher, Barnard and Truong, 1988).

Using an empirical approach, we take the dichotomous variable Y , which represents the retirement decision and is equal to 1 if the person decides to take early retirement. This will be the case if the latent, indirect utility of retiring early, U_A^* , is greater than it would be if the person waits until the legally mandated age, U_L^* . Otherwise, the retirement decision variable will be zero (0), as shown here:

$$Y = \begin{cases} 1 & \text{si } U_A^* > U_L^* \\ 0 & \text{si } U_A^* \leq U_L^* \end{cases} \quad (8)$$

Equation (8) shows the conditions under which a person decides to take early retirement or to wait until the legally mandated age, bearing in mind that one of the parameters for the utility function is risk aversion.

Taking the utility function defined in equation (1), we introduce a latent variable to represent the indirect utility function for individual i and decision j :

$$U_{ij}^*(\cdot) = u(C_{ij,t}^*, \sigma_i) + \delta \cdot \phi_j(H_i, \sigma_i) \cdot u(C_{ij,t+1}^*, \sigma_i) \quad (9) \\ \forall i = 1, \dots, n; j = A, L$$

where the intertemporal discount rate is represented by $\beta(H, \sigma) = \delta \cdot \phi(H, \sigma)$, as explained in detail in section III.

It is assumed that both groups have the same future life expectancy. Using that as a basis, an ad hoc assumption is made concerning the valuation of life expectancy, such that:

$$\phi_j(H_i, \sigma_i) = \phi(H_i, \sigma_i | a_j) = 1 - H_i^{-a_j/\sigma_i} \quad (10) \\ \forall i = 1, \dots, n; j = A, L; a_j > 0$$

It will also be assumed that the members of both groups believe that they will live the same number of years, and the difference in their discount factors will therefore stem from the difference in their valuations of their remaining years of life, as represented by the parameter a_j in equation (10).

The function described in equation (10) fulfils Proposition No. 1, such that, at a constant level of risk aversion, people will behave as shown in figure 1. Parameter a_j stands for the value that they place on the years remaining to them, which could be interpreted as the value ascribed to their future quality of life; thus: $a_A < a_L$.

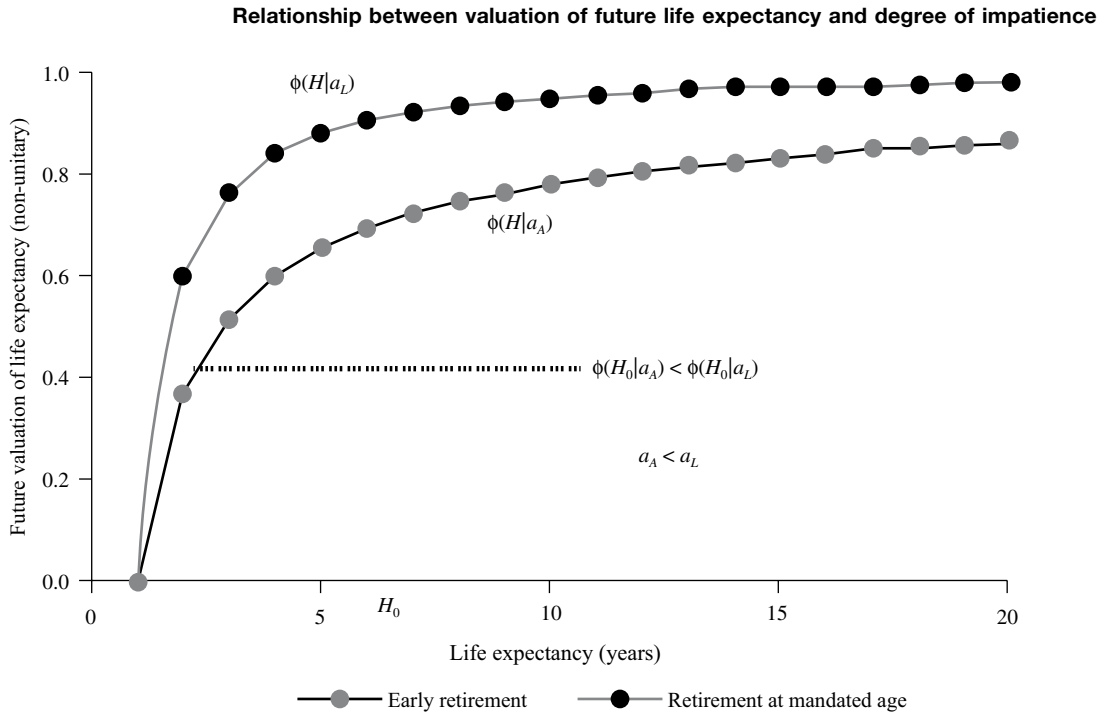
If the same assessment of future life expectancy H is maintained but the level of risk aversion changes from σ_0 to a less risk-averse σ_1 , i.e., $\sigma_0 < \sigma_1$, then a higher value is placed on future years of life. This is shown in figure 2.

Now, if (10) is substituted for (9), a broader expression of indirect utility is obtained.

$$U_{ij}^*(\cdot) = \underbrace{u(C_{ij,t}^*, \sigma_i) + \delta \cdot u(C_{ij,t+1}^*, \sigma_i)}_{(I)} - \underbrace{\delta \cdot H_i^{-a_j/\sigma_i} u(C_{ij,t+1}^*, \sigma_i)}_{(II)} \quad (11)$$

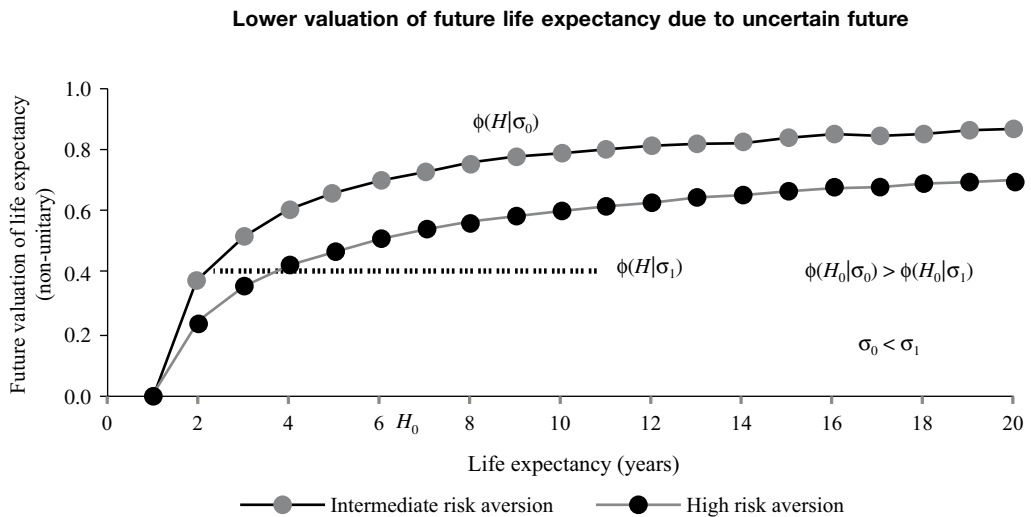
Component (I) gives the classic discount model for two periods of time. Component (II) is an additional term for the “loss” of utility of future consumption due to the assessment of the present vis-à-vis future life expectancy.

FIGURE 1



Source: Original calculations.

FIGURE 2



Source: Original calculations.

In order to make the model subject to estimation and since components (I) and (II) of equation (11) are additionally separated, approximations for each component are defined:

$$U_{ij}^*(\cdot) = \underbrace{\gamma_{ij} \cdot X_{ij}}_{(III)} + \underbrace{\alpha_{ij} \cdot h_i + \lambda_{ij} \cdot \sigma_i \cdot h_i}_{(IV)} \quad (12)$$

$$\forall i = 1, \dots, n; j = A, L$$

Thus, the term (III) represents the traditional linear approach to the two-period temporal consumption model described in (I). This corresponds to the set of attributes that define individual preferences, as represented by the vector X . It also sets up a structural framework for the utility function. This frame of reference makes it possible to control for other individual preferences (embodied in vector X) that can influence the utility function and, accordingly, the decision to retire based on a linear function as approached from a semi-restricted perspective.

Component (II) of equation (11) was proxied using component (IV) of equation (12), with the aim being to capture part of its non-linearity. Thus, $h_i = \ln(H_i)$ and parameter α_{ij} represent the decrease in future utility generated by the increased discount rate involved in placing a greater value on the initial years of life that are left, with this term being affected by both the scope and the sign of changes in a_j . This should be negative and greater in absolute terms than it is for people who decided to retire early. What is more, the parameter λ_{ij} represents the value placed on life expectancy vis-à-vis future risk, since the persons involved are risk averse. Combining future life expectancy and risk aversion is a helpful way to show how increased risk aversion bolsters decisions to take early retirement. This is because the aversion focuses on the risk of not being able to have a good quality of life in the future, while avoiding the influence of other types of risk, such as financial risk. The decision to take early retirement is therefore a probability that can be expressed as follows:

$$\Pr(Y_i = 1) \approx \Pr(U_A^* - U_L^* \approx \Gamma_i \cdot X_i + \gamma_i \cdot h_i + \Lambda_i \cdot \sigma_i \cdot h_i > \varepsilon_A - \varepsilon_L) \quad (13)$$

$$\Pr(Y_i = 1) \approx \Pr(\Gamma_i \cdot X_i + \Omega_i \cdot h_i + \Lambda_i \cdot \sigma_i \cdot h_i > \varepsilon_i)$$

where $\Gamma_i = \gamma_i^A - \gamma_i^L$, $\Omega_i = \alpha_i^A - \alpha_i^L$ and $\Lambda_i = \lambda_i^A - \lambda_i^L$. In this binary specification for the model, the working

hypothesis stands out clearly. First of all, since people taking early retirement have to have been more impatient than those who waited until the legally mandated age (assuming that all other factors remain constant), then $\Omega_i < 0$. By the same token, the effect of risk aversion on the variability of utility is reflected in the hypothesis in which $\Lambda_i > 0$; this shows (everything else remaining constant) that the greater the degree of risk aversion, the greater the propensity to take early retirement will be.

1. Early retirement in Chile

In Chile, not everyone can take early retirement. Early retirement is a possibility only for those whose work is classified as heavy labour¹⁰ and those who have been registered in the current (new) pension system for at least five years.

Since 1993, members of the social security system have had the option of retiring before the legally mandated retirement age,¹¹ provided that they have built up enough capital in their individual retirement account to provide them with a monthly pension equivalent to over 110% of the current minimum wage.¹² In 2008, the pension system reform entered into effect.¹³ This reform introduced a “solidarity pillar” to provide coverage to all Chileans who do not have pension-system savings. It is also designed to improve the individual funded accounts system, as well as to provide incentives for voluntary payments into the system so that people will have larger pensions in the future.

However, people with individual funded pension accounts can now take early retirement if the size of their pension will be equal to or greater than 70%¹⁴ of their average declared earnings and revenues over the 10-year period ending in the month in which they would retire. It must also be equal to or greater than 150% of the current level of the basic solidarity old-age pension (PBSV).

When they retire, members of the pension system must also decide whether to opt for a programmed pension schedule, a life annuity or a mixture of the two. People who switched from one pension system to the other and still have their pension recognition bonds may be more

¹⁰ National Ergonomics Commission (CEN).

¹¹ Article 64 of Act No. 100.

¹² These percentages were modified by Act No. 19.943, which entered into force in August 2004.

¹³ Decree-Law No. 20.255

¹⁴ This percentage has applied since August 2010. For the period from August 2006 to August 2007, it was 58%. For further details, see the Pension Superintendency of Chile at: <http://safp.cl>.

inclined to wait until the legally mandated retirement age, which is when these bonds reach their full value.

On the other hand, people who have a voluntary pension account (APV) may be more inclined to take early retirement, since this will increase their chances of meeting future requirements.

Because greater restrictions on early retirement¹⁵ are being phased in, people may also be more likely to retire early, since, if they wait until the following year, they may no longer meet the requirements for doing so.

The only available source of information for a detailed analysis of the empirical evidence for Chile concerning retirees and those eligible for early retirement is the Social Protection Survey (EPS). The 2006 version of this survey covers people aged 18 and over (a total population of 12,426,437 – 50.9% of whom are women and 49.1% of whom are men). At the time of the survey, 12.6% of this population reported that they were unemployed, 57% said that they were working, and the remaining 30.4% were classified as economically inactive.¹⁶

¹⁵ Act No. 19,943.

¹⁶ The way the question about occupational status is phrased in the EPS differs from the wording used in employment surveys taken by the National Statistics Institute (INE) or the occupational survey administered by the University of Chile. In the EPS, respondents classify their own occupational status, whereas in the other employment surveys, it is the poll-taker who does so. Because of this difference, in the EPS a large number of individuals self-report themselves as unemployed, whereas many of those same people would have been classified as

The results of the 2006 EPS indicate that average monetary income begins to decline at age 50, as shown in figure 3. This decline begins at just around the time that people begin to decide to take early retirement.

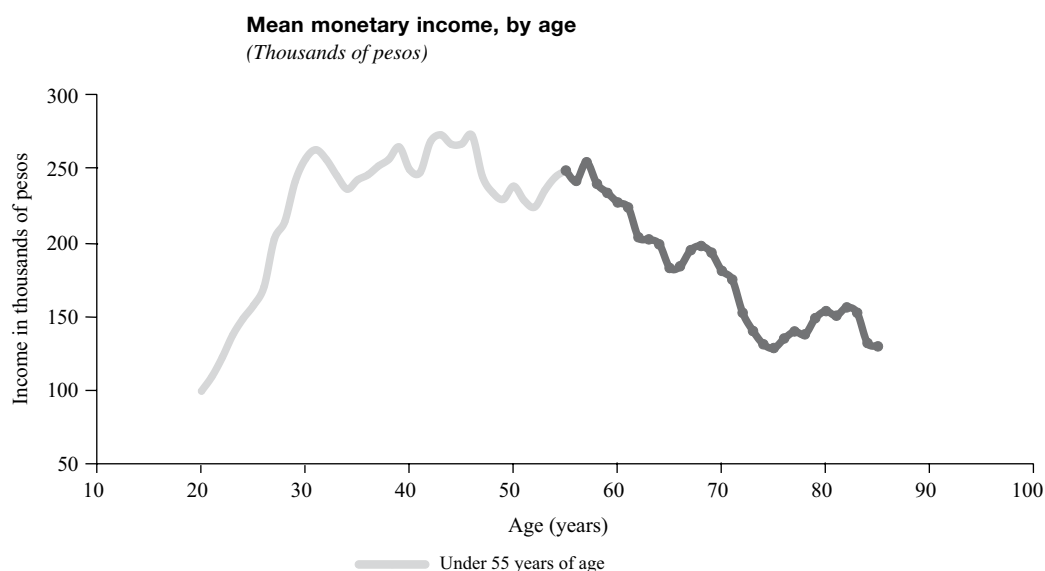
The number of people deciding to take early retirement has fluctuated over time (see figure 4), and there seems to be some correlation between this number and the rate of return on pension funds. When that rate is lower, fewer people would appear to choose to retire early, although this effect is lagged somewhat. The impact of the 2008 financial crisis is clearly reflected in the rate of return on pension funds and in the level of early retirements, which did not rebound to their pre-crisis levels until 2010.

The figures compiled by the National Statistics Institute (INE) indicate that the potential number of retirees is rising sharply and could reach about 20% of the population by 2016.

In 2006, 9.2% of respondents “self-reported” themselves to have retired for a given reason, and slightly over one fifth of those people (20.7%) said that they had done so because of a disability. For this latter group, the decision to retire is exogenous, and they are therefore not taken into consideration in the following analysis.

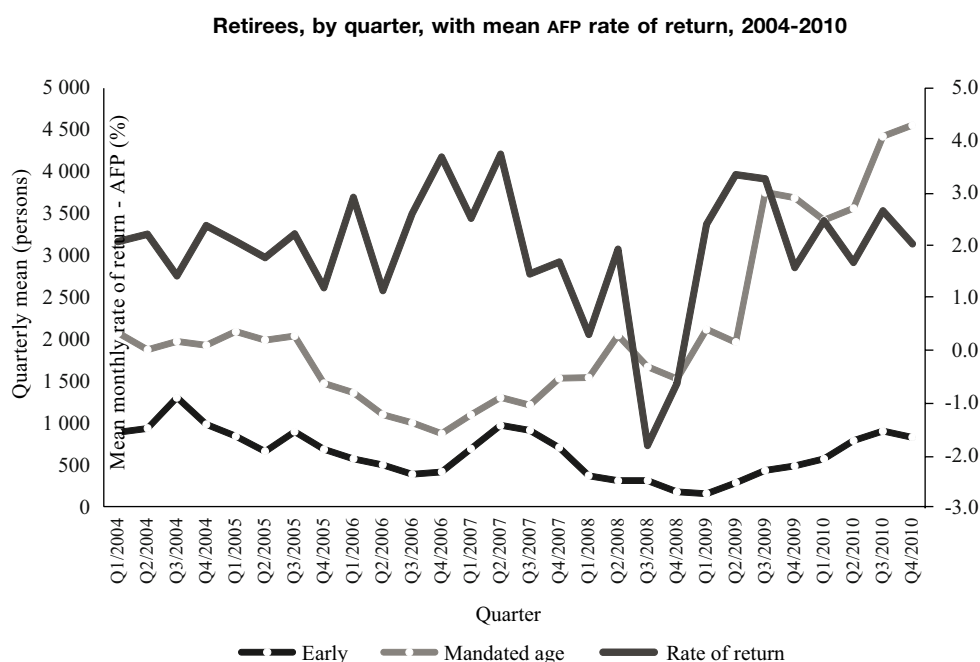
economically inactive by the poll-takers of the other employment surveys. This leads to an overestimation of the unemployment rate and of the labour participation rate, especially in the case of women.

FIGURE 3



Source: Original calculations based on the Social Protection Survey of 2006.

FIGURE 4



Source: Original calculations based on figures from the Pension Superintendency of Chile.

AFP: Pension fund management companies.

When the reason for retiring is cross-referenced with the self-reported date of retirement, certain differences appear. Table 1 shows that slightly fewer than half of the people who said that they had started to draw their old-age pensions did so before the legally mandated age. When the reason for retirement is corrected for the self-reported rate of retirement at the legally mandated age, then the percentage of all pensioners who took early retirement falls to 35.1%.

In Chile, 94% of the population belongs to the AFP system, but only 46% of all retirees do so, with the rest being part of the former Pension Standardization Institute (INP) scheme or some other system.¹⁷

The 2006 EPS included a series of questions designed to determine how risk averse the respondents were.¹⁸ This information can be used to classify respondents as belonging to one of four risk-aversion categories, ranging from a low-level of risk aversion (category 1) to a high level (category 4).¹⁹ This risk-aversion variable

is determined after asking respondents the following question: “Suppose that you, as the only breadwinner for your household, had to choose one of the following jobs...”, with the first job being described as guaranteeing a fixed, stable level of income for life and the second as offering an equal chance of earning double that level for life or only one-fourth as much, half as much or three-fourths as much.

This method for determining the level of risk aversion is identical to the one used in the Health and Retirement Study (HRS) in the United States and in the Survey on Household Income and Wealth (SHIW) conducted by the Italian central bank. Like the HRS and SHIW, the EPS sets up a situation of convergence towards risk neutrality, since each question is stochastically dominated by the preceding one; this means that, if an individual prefers the option with the lowest expected value, then that individual will also prefer the options offering the highest expected value. This generates a conditional order of selection. The percentage distribution of the differing degrees of risk aversion found among the population aged 18 and over in the 2006 EPS is shown in table 2.

The risk-aversion distribution is somewhat different for retirees than it is for non-retirees. As shown in table 3, the greatest difference is seen at high risk-aversion levels, which is also where the greatest concentration is found.

¹⁷ Fewer than 3% of respondents did not report their reason for retiring and even fewer said that they had a voluntary pension savings (APV) account.

¹⁸ These questions are found in module J (from j1_1 to j1_3).

¹⁹ The questions in this module are discrete, and the queries do not suffice to cover risk-neutral or risk-seeking individuals.

TABLE 1

Type of pension reported by respondents

| Self-reported date of retirement | Self-reported reason for retiring (Percentages) | | | Total |
|----------------------------------|--|--------------|--------------|--------------|
| | Mandated age | Early | Disability | |
| Mandated age or higher | 56.5 | 3.7 | 8.7 | 35.1 |
| Before mandated age | 43.5 | 96.3 | 91.3 | 64.9 |
| <i>Total</i> | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> |

Source: Original calculations based on the Social Protection Survey of 2006.

Population: 1,129,325; No. of observations: 2,375 (total respondents).

This might be accounted for by the censure of higher levels of risk aversion.

If, however, early retirees are compared with those who retired at the legally mandated age according to their self-reported retirement date, then these differences disappear (see table 3). This would seem to indicate that the decision to take early retirement or not is independent of a person's degree of risk aversion.

On the other hand, a person's state of health does appear to play an important role in retirement decisions.

TABLE 3

Level of risk aversion, by retirement status (early or legally mandated)

| Level of retirees' risk aversion | Early retirement ^a | | Population |
|----------------------------------|-------------------------------|--------------|--------------|
| | No (%) | Yes (%) | |
| 1 (Low) | 15.0 | 13.2 | 13.9 |
| 2 (Lower-intermediate) | 8.0 | 8.8 | 8.5 |
| 3 (Upper-intermediate) | 5.4 | 4.2 | 4.6 |
| 4 (High) | 71.6 | 73.8 | 73.0 |
| <i>Total</i> | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> |

Source: Original calculations based on the Social Protection Survey of 2006.

No. of observations: 1,875 (total respondents).

^a Self-reported date.

TABLE 2

Levels of aversion: retirees and non-retirees

| Level of aversion Persons over 18 | Retired | | Population |
|--------------------------------------|--------------|--------------|--------------|
| | No (%) | Yes (%) | |
| 1 (Low) | 20.3 | 14.0 | 19.8 |
| 2 (Lower-intermediate) | 8.6 | 8.5 | 8.6 |
| 3 (Upper-intermediate) | 6.7 | 4.5 | 6.5 |
| 4 (High) | 64.4 | 73.0 | 65.1 |
| <i>Total</i> | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> |

Source: Original calculations based on the Social Protection Survey of 2006.

Population: 11,492,732. No. of observations: 15,052 (total respondents).

According to the results of the 2006 EPS, health problems were the most main reason for retiring for 21.5% of retirees (see table A.3 in annex A), while 24.3% said that they retired because they had reached the legally mandated age. In addition, in almost 60% of all cases, the main reason cited for not continuing to work was that the respondents' state of health prevented them from doing so.

This shows us that people's perception of their state of health is an important consideration in the decision to retire. This perception is closely correlated with life expectancy, however, since the better a person's perceived state of health is, the greater that person's future life expectancy is, as shown in table 4.

Another important consideration in people's decisions concerning retirement is future life expectancy, which, of course, declines with age. Figure 5 shows the rate at which mean life expectancy, measured as the estimated number of years that a person has left to live, declines as a person ages, with the profile being very similar for men and women.

More specifically, our focus will be on the future life expectancy of people who retire at the legally mandated age and of people who retire early. Figure 6 shows that the trends for these two groups are similar and that, in turn, the trend for these two groups, taken together, is similar to the trend for the rest of the population.

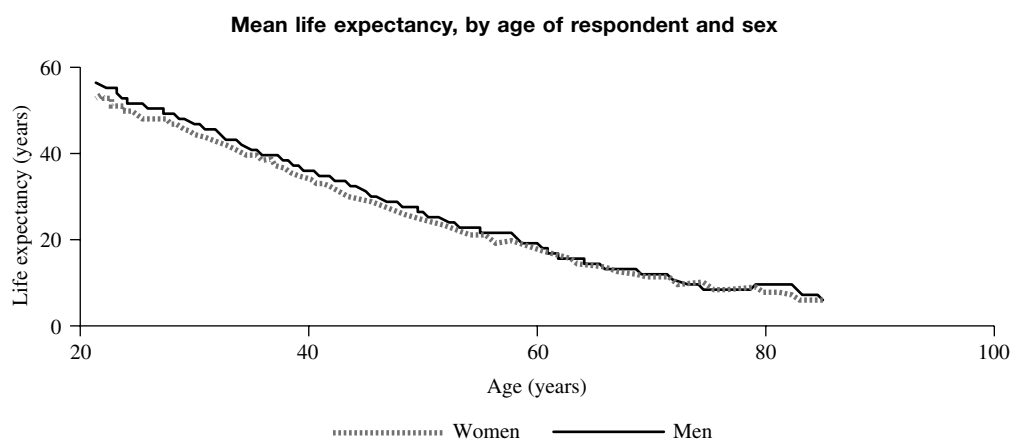
TABLE 4

Mean life expectancy, in years, by perceived state of health

| Perceived state of health | Life expectancy (years) | | | | | |
|---------------------------|-------------------------|-------|---------------|-------|-------------|-------|
| | Population | | Women (51,3%) | | Men (48,7%) | |
| | Percentage | Mean | Percentage | Mean | Percentage | Mean |
| Very poor | 1.0 | 12.05 | 1.5 | 11.53 | 0.5 | 13.69 |
| Poor | 5.8 | 18.25 | 7.3 | 17.80 | 4.2 | 19.09 |
| Average | 22.4 | 26.42 | 25.0 | 26.35 | 19.5 | 26.50 |
| Good | 48.8 | 38.68 | 47.7 | 38.03 | 50.1 | 39.33 |
| Very good | 13.3 | 44.13 | 12.1 | 43.53 | 14.6 | 44.66 |
| Excellent | 8.7 | 45.92 | 6.4 | 44.48 | 11.1 | 46.78 |
| | 100.0 | 35.8 | 100.0 | 34.3 | 100.0 | 37.5 |

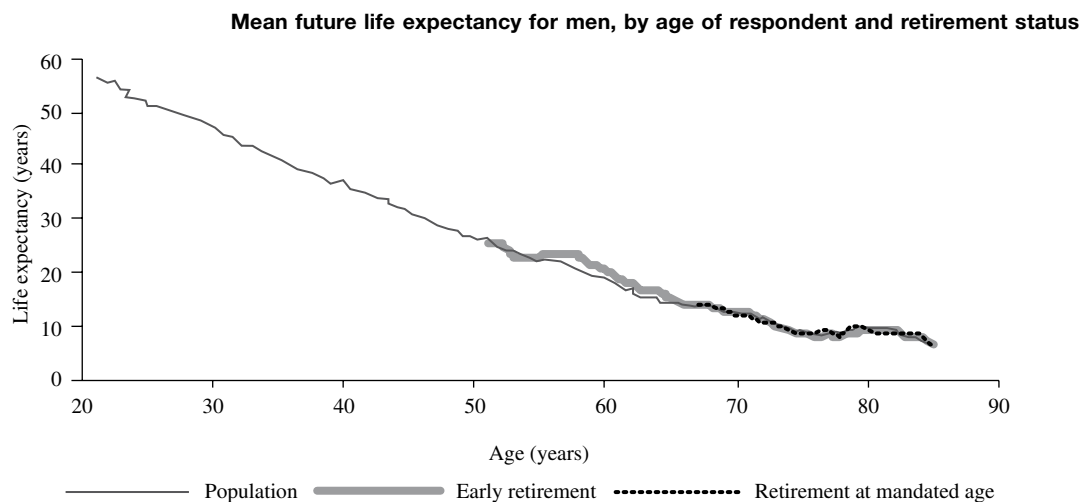
Source: Original calculations based on the Social Protection Survey of 2006.
Population: 9,953,561; No. of observations: 13,086 (total respondents).

FIGURE 5



Source: Original calculations based on the Social Protection Survey of 2006.

FIGURE 6



Source: Original calculations based on the Social Protection Survey of 2006.

2. Estimating the determinants of early retirement

Before examining these estimates, we should first review the features of the sample and the variables to be used. The sample is pared down on the basis of a series of considerations that need to be taken into account in order to arrive at these estimates. First of all, the requirements that must be met under Chilean law in order to be eligible for early retirement,²⁰ the way in which this situation works out in practice, and the fact that respondents have in fact answered the questionnaire are all factors that restrict the number of observations.²¹ In addition, age ranges of 60-65 for women and 65-70 for men were set.

The variables that were used have to do with the determinants of the utility function. In this case, a vector is defined of variables representing traits of individuals, households and the labour market, along with those having to do with the pension system as such. This set of variables is shown in table 5.

Risk aversion is an intrinsic trait of each individual, and it was therefore defined as a parameter whose influence on early retirement decisions needed to be established. Because the risk-aversion variable exhibits little continuity, it had to be grouped into two categories: a high level of risk aversion (approximately 73% of the sample) and an upper-intermediate, lower-intermediate

and low level of risk aversion (27% of the sample) (see table 3).

The information that can be used to predict the degree of uncertainty surrounding a given event will influence what action a risk-averse person will take. The extent of a person's knowledge about the financial market and pensions schemes was therefore taken into account.

Information on the geographical area in which respondents reside was also included, with the categories being northern zones (regions I-IV), central areas (regions V-VII) and southern areas (regions VIII-XII). The responses from these zones were then compared with those given in the Metropolitan Region.

The descriptive statistic for the variables to be used for the estimates is shown in table 6. When the average age of respondents and their expectation regarding future years of life are examined, it turns out that both the group of people who retired at the legally mandated age and the group of early retirees believe that they will live until nearly 80 years of age.

The descriptive statistic also indicates that a majority of early retirees are men (see table 6). The early retirees have lower monetary incomes, which could have to do with the fact that the percentage of the members of this group who are economically active is also lower, as is their lower average level of education.

The retirees in the sample belong to the AFP pension scheme. Their level of knowledge concerning the AFP system and the relevant pension plan is slightly lower than is the case for those who choose to retire at the legally mandated age. The level of knowledge concerning the financial market is similar in the two groups of retirees, however (see table 6).

²⁰ Act No. 19,943.

²¹ The 2006 EPS covered 12,426,437 individuals based on 16,443 respondents, of whom 8.5% did not respond to the question regarding risk aversion.

TABLE 5

Variables to be taken into consideration

| Individual characteristics | Household characteristics | Other |
|----------------------------|---------------------------|----------------------------------|
| Gender | Head of household | Knowledge about AFP system |
| Age | Marital status | Knowledge about pension system |
| Years of schooling | Number of children | Knowledge about financial market |
| Perceived state of health | Number of grandchildren | Region of residence, by zone |
| Perceived life expectancy | Monetary income | Years in labour market |
| Level of risk aversion | Assets | Age at entry into labour market |
| | Home ownership | Economically active |

Source: Original calculations.

TABLE 6

Characteristics of retirees at mandated age and early retirees in sample
(Percentages)

| Variables | Retirees | | Women [38%] | | Men [62%] | |
|---|--------------------|-------------|--------------------|-------------|--------------------|-------------|
| | Mandated age (34%) | Early (66%) | Mandated age (54%) | Early (46%) | Mandated age (22%) | Early (78%) |
| Population: 134 934; Sample: 314 observations | | | | | | |
| Gender (male = 1) | 0.40 | 0.73 | | | | |
| Years of schooling | 7.1 | 8.1 | 7.9 | 10.9 | 6.0 | 7.1 |
| Age (years) | 65.3 | 66.1 | 63.4 | 62.4 | 68.1 | 67.4 |
| Perceived state of health (poor = 1 to excellent = 6) | 3.4 | 3.4 | 3.3 | 3.4 | 3.5 | 3.4 |
| Perceived life expectancy (years) | 14.7 | 12.4 | 16.5 | 14.9 | 11.9 | 11.5 |
| Level of aversion (high = 1) | 0.7 | 0.8 | 0.8 | 0.8 | 0.7 | 0.8 |
| Head of household (yes = 1) | 0.72 | 0.91 | 0.56 | 0.80 | 0.95 | 0.95 |
| Marital status (partner present = 1) | 0.48 | 0.64 | 0.43 | 0.18 | 0.54 | 0.81 |
| Number of children | 0.22 | 0.36 | 0.32 | 0.42 | 0.08 | 0.34 |
| Number of grandchildren | 2.1 | 2.2 | 2.0 | 1.6 | 2.3 | 2.4 |
| Monetary income (M\$ / 2006) | \$ 287 | \$ 270 | \$ 333 | \$ 238 | \$ 217 | \$ 282 |
| Assets (MM\$ / 2006) | \$ 19.85 | \$ 25.05 | \$ 21.88 | \$ 20.02 | \$ 16.75 | \$ 26.90 |
| Debts (MM\$ / 2006) | \$ 0.54 | \$ 0.86 | \$ 0.84 | \$ 1.87 | \$ 0.08 | \$ 0.49 |
| Home ownership (yes = 1) | 0.87 | 0.88 | 0.88 | 0.81 | 0.87 | 0.91 |
| Knowledge of AFP system (<math>\leq 0\%>) | 0.35 | 0.40 | 0.37 | 0.45 | 0.31 | 0.38 |
| Knowledge of pension system (<math>\leq 0\%>) | 0.29 | 0.40 | 0.29 | 0.36 | 0.28 | 0.42 |
| Knowledge of financial market (yes = 1) | 0.06 | 0.05 | 0.06 | 0.05 | 0.06 | 0.06 |
| Northern zone | 0.11 | 0.12 | 0.15 | 0.11 | 0.05 | 0.13 |
| Central zone | 0.30 | 0.17 | 0.24 | 0.13 | 0.38 | 0.19 |
| Southern zone | 0.19 | 0.17 | 0.13 | 0.10 | 0.29 | 0.20 |
| Years in labour market | 43.3 | 39.4 | 40.1 | 33.9 | 48.1 | 41.5 |
| Age at entry into labour market | 19.0 | 17.4 | 19.9 | 21.2 | 17.5 | 16.1 |
| Economically active (yes = 1) | 0.35 | 0.43 | 0.35 | 0.33 | 0.36 | 0.46 |

Source: Original calculations based on the Social Protection Survey of 2006.

Men: 65 - 70 years; women: 60 - 65 years.

Note: M\$ = Thousands of pesos; MM\$ = Millions of pesos.

(a) *The estimates*

In order to arrive at an estimate for the model proposed in equation (13), it will be assumed that the errors follow a normal distribution based on a normal equivalent deviation (probit). The results, with different specifications, are shown in table 7.

The estimates of the marginal effects for the model given in table 7 are shown in table 8.

The estimates indicate that the effect of future life expectancy on the probability of taking early retirement (parameter Ω_i) is negative and significant, with a stable value for all the models (values of between -0.38 and -0.46). The effect of the combined component of life expectancy and risk aversion (parameter Λ_i) is positive, but its significance changes if the life expectancy variable is not included. This may be because the proxy is unsatisfactory or because risk aversion is also affected by other factors, such as financial exposure.

Other variables, such as years of schooling completed, gender (male) and being economically active, increase the utility of early retirement and have a positive influence on the probability of taking early retirement

(see table 7). Similar results are reported by Gustman and Steinmeier (2005).²² As people grow older, however, they become less likely to take early retirement. This finding is corroborated by the estimates arrived at here and by other studies (Mitchell and Phillips, 2000).

If people place greater value on their present quality of life than on their future quality of life, and if this translates into spending more time with their loved ones, then having children and being married should increase the probability of taking early retirement. The estimates corroborate this hypothesis, since the variables of marital status (being in a conjugal union) and of having children²³ are positive and significant, as shown in tables 7 and 8. This finding is also reported by Mitchell and Phillips (2000).

²² Their estimates are focused on how the social security system and other factors influence retirement decisions, rather than early retirement decisions, but their findings also support the estimates calculated in this study.

²³ When the presence of children (regardless of origin) is the variable that is used, the level of significance is greater than when it is restricted to children within the household.

TABLE 7

Probit^a estimation of life expectancy

| Variables | Probability to taking early retirement | | | | | | |
|--|--|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| | (i) | (ii) | (iii) | (iv) | (v) | (vi) | (vii) |
| Gender (male = 1) | 1.8244*** (0.0131) | 1.8066*** (0.0129) | 1.8456*** (0.0131) | 1.6959*** (0.0143) | 1.9142*** (0.0156) | 1.8077*** (0.0155) | 1.7927*** (0.0155) |
| Years of schooling | 0.1058*** (0.0029) | 0.1027*** (0.0028) | 0.1077*** (0.0029) | 0.1027*** (0.003) | 0.052*** (0.003) | 0.0422*** (0.0011) | 0.0525*** (0.001) |
| Years of schooling 2 | -0.0022*** (0.0002) | -0.0023*** (0.0002) | -0.0023*** (0.0002) | -0.0017*** (0.0002) | 0.0002 (0.0002) | | |
| Age | -0.8566*** (0.0507) | -0.9842*** (0.0509) | -0.9371*** (0.0515) | -1.0081*** (0.0533) | -0.2661*** (0.0566) | -0.1644*** (0.0023) | -0.1653*** (0.0023) |
| Age 2 | 0.0052*** (0.0004) | 0.0063*** (0.0004) | 0.0057*** (0.0004) | 0.0061*** (0.0004) | 0.0008* (0.0004) | | |
| Natural logarithm of life expectancy, Ω_i | -0.3787*** (0.0068) | | -0.4308*** (0.0073) | -0.4637*** (0.0074) | -0.4032*** (0.008) | -0.3801*** (0.0081) | -0.4471*** (0.0077) |
| Aversion * natural logarithm of life expectancy, Λ_i | | -0.0008 (0.0034) | 0.0684*** (0.0035) | 0.0847*** (0.0036) | 0.0394*** (0.0036) | 0.0833*** (0.0036) | 0.0437*** (0.0035) |
| Head of household (yes = 1) | | | | 0.8334*** (0.0126) | 0.9946*** (0.0134) | 0.8594*** (0.013) | 1.0269*** (0.0131) |
| Marital status (partner present = 1) | | | | 0.2619*** (0.0102) | 0.2639*** (0.0106) | 0.2011*** (0.0103) | 0.2283*** (0.0102) |
| Number of children | | | | 0.2199*** (0.0035) | 0.1914*** (0.0043) | | 0.1807*** (0.0039) |
| Number of grandchildren | | | | -0.0099** (0.0049) | 0.0183*** (0.0053) | 0.005 (0.0049) | |
| Monetary income (M\$ / 2006) | | | | -0.0002*** (0.0000) | -0.0002*** (0.0000) | -0.0002*** (0.0000) | -0.0002*** (0.0000) |
| Assets (MM\$ / 2006) | | | | 0.0009*** (0.0001) | -0.0022*** (0.0001) | -0.0009*** (0.0001) | |
| Debts (MM\$ / 2006) | | | | -0.0972*** (0.0127) | -0.1063*** (0.0128) | 0.0389*** (0.0018) | 0.0233*** (0.0013) |
| Home ownership (yes = 1) | | | | -0.0972*** (0.0127) | -0.1063*** (0.0128) | | |
| Knowledge of AFP system (<math>\leq 10\%>) | | | | | 0.4999*** (0.0261) | 0.5655*** (0.0252) | 0.3602*** (0.0240) |
| Knowledge of pension system [<math>\leq 10\%>] | | | | | 0.0489*** (0.0072) | 0.0488*** (0.0068) | 0.0932*** (0.0069) |
| Knowledge of financial market (yes = 1) | | | | | 0.2242*** (0.0186) | | |
| Northern zone | | | | | -0.4605*** (0.0155) | | |
| Central zone | | | | | -0.7562*** (0.0102) | -0.4898*** (0.009) | -0.5773*** (0.0097) |
| Southern zone | | | | | -0.4322*** (0.0125) | | |
| Years in labour market | | | | | -0.0854*** (0.0018) | -0.0425*** (0.0007) | -0.0804*** (0.0019) |
| Age at entry into labour market | | | | | -0.0689*** (0.0021) | | -0.072*** (0.0021) |
| Economically active (yes = 1) | | | | | -0.0062 (0.0086) | -0.0583*** (0.0083) | 0.0204** (0.0082) |
| Constant | 33.609*** (1.6652) | 25.9327 (34.4529) | 36.3342*** (1.6891) | 38.6975*** (1.7492) | 17.8588*** (1.8671) | 11.488*** (0.1582) | 14.4897*** (0.1790) |
| Number of observations | 134 934 | 134 934 | 134 934 | 134 934 | 134 934 | 134 934 | 134 934 |
| Log Likelihood | -72 055.38 | -73 440.3 | -71 864.87 | -68 111.67 | -57 350.75 | -63 692.79 | -58 319.54 |
| Pseudo - R2 | 0.1668 | 0.1508 | 0.169 | 0.2124 | 0.3368 | 0.2635 | 0.3256 |
| AIC | 144 124.8 | 146 894.6 | 143 745.7 | 136 255.3 | 114 751.5 | 127 419.6 | 116 673.1 |
| BIC | 144 193.4 | 146 963.3 | 143 824.2 | 136 412.3 | 114 996.8 | 127 586.4 | 116 839.9 |

Source: Original calculations based on the Social Protection Survey of 2006.

Note: M\$ = Thousands of pesos; MM\$ = Millions of pesos; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria.

^a Normal equivalent deviation.

Significant at *10%; ** Significant at 5%; *** Significant at 1% (standard sample deviation).

TABLE 8

Estimation of marginal effects in different models

| Marginal effects on the likelihood of early retirement | | | | | | | |
|--|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|------------------------|
| Variables | (i) | (ii) | (iii) | (iv) | (v) | (vi) | (vii) |
| Gender (male = 1) | 0.6213*** (0.0036) | 0.6176*** (0.0036) | 0.6269*** (0.0036) | 0.5815*** (0.0041) | 0.6181*** (0.0041) | 0.608*** (0.0042) | 0.5878*** (0.0042) |
| Years of schooling | 0.0376*** (0.001) | 0.0367*** (0.001) | 0.0382*** (0.001) | 0.036*** (0.001) | 0.0167*** (0.001) | 0.0145*** (0.0004) | 0.0171*** (0.0003) |
| Years of schooling 2 | -0.0008*** (0.0001) | -0.0008*** (0.0001) | -0.0008*** (0.0001) | -0.0006*** (0.0001) | 0.0001 (0.0001) | | |
| Age | -0.3043*** (0.0181) | -0.3513*** (0.0182) | -0.3326*** (0.0183) | -0.3538*** (0.0188) | -0.0857*** (0.0182) | -0.0566*** (0.0008) | -0.0539*** (0.0008) |
| Age 2 | 0.0018*** (0.0001) | 0.0023*** (0.0001) | 0.002*** (0.0001) | 0.0022*** (0.0001) | 0.0003* (0.0001) | | |
| Natural logarithm of life expectancy, Ω_i | -0.1345*** (0.0024) | | -0.1529*** (0.0026) | -0.1627*** (0.0026) | -0.1298*** (0.0026) | -0.1308*** (0.0028) | -0.1457*** (0.0026) |
| Aversion * natural logarithm of life expectancy, Λ_i | | -0.0003 (0.0012) | 0.0243*** (0.0012) | 0.0297*** (0.0013) | 0.0127*** (0.0012) | 0.0286*** (0.0012) | 0.0142*** (0.0011) |
| Head of household (yes = 1) | | | | 0.3159*** (0.0048) | 0.3643*** (0.0051) | 0.3231*** (0.0049) | 0.3782*** (0.005) |
| Marital status (partner present = 1) | | | | 0.0927*** (0.0036) | 0.086*** (0.0035) | 0.0698*** (0.0036) | 0.0752*** (0.0034) |
| Number of children | | | | 0.0772*** (0.0012) | 0.0616*** (0.0014) | | 0.0589*** (0.0013) |
| Number of grandchildren | | | | -0.0035** (0.0017) | 0.0059*** (0.0017) | 0.0017 (0.0017) | |
| Monetary income (M\$ / 2006) | | | | -0.0001*** (0.0000) | -0.0001*** (0.0000) | -0.0001*** (0.0000) | -0.0001*** (0.0000) |
| Assets (MMS\$ / 2006) | | | | 0.0003*** (0.0000) | -0.0007*** (0.0000) | -0.0003*** (0.0000) | |
| Debts (MMS\$ / 2006) | | | | -0.0334*** (0.0043) | -0.0333*** (0.0039) | 0.0134*** (0.0006) | 0.0076*** (0.0004) |
| Home ownership (yes = 1) | | | | -0.0334*** (0.0043) | -0.0333*** (0.0039) | | |
| Knowledge of AFP system (<=>) | | | | | 0.1609*** (0.0085) | 0.1946*** (0.0087) | 0.1173*** (0.0079) |
| Knowledge of pension system (<=>) | | | | | 0.0157*** (0.0023) | 0.0168*** (0.0024) | 0.0304*** (0.0023) |
| Knowledge of financial market (yes = 1) | | | | | 0.0672*** (0.0051) | | |
| Northern zone | | | | | -0.1626*** (0.0059) | | |
| Central zone | | | | | -0.2687*** (0.0038) | -0.1786*** (0.0034) | -0.2038*** (0.0036) |
| Southern zone | | | | | -0.15*** (0.0047) | | |
| Years in labour market | | | | | -0.0275*** (0.0005) | -0.0146*** (0.0002) | -0.0262*** (0.0006) |
| Age at entry into labour market | | | | | -0.0222*** (0.0006) | | -0.0234*** (0.0006) |
| Economically active (yes = 1) | | | | | -0.0020 (0.0028) | -0.0201*** (0.0029) | 0.0066** (0.0027) |
| Number of observations | 134 934 | 134 934 | 134 934 | 134 934 | 134 934 | 134 934 | 134 934 |
| Log Likelihood | -72 055.38 | -73 440.3 | -71864.87 | -68111.67 | -57350.75 | -63 692.79 | -58 319.54 |
| Pseudo - R2 | 0.1668 | 0.1508 | 0.169 | 0.2124 | 0.3368 | 0.2635 | 0.3256 |
| Obs. P | 0.6602 | 0.6602 | 0.6602 | 0.6602 | 0.6602 | 0.6602 | 0.6602 |
| Pred. P | 0.6850 | 0.6814 | 0.6857 | 0.6938 | 0.7438 | 0.7067 | 0.7378 |

Source: Original calculations based on the Social Protection Survey of 2006.

Note: M\$ = Thousands of pesos; MMS\$ = Millions of pesos; AIC = Akaike Information Criteria; BIC = Bayesian Information Criteria. Log Likelihood = Logarithm of the probability function; Obs. P = Observed probability; Pred. P = Predicted probability.

Significant at *10%; ** Significant at 5%; *** Significant at 1% (standard sample deviation).

Income, level of assets, indebtedness and home ownership are factors that might be taken into account when a person decides whether or not to take early retirement. This may explain why, when one of these variables is removed from the equation, the others change sign but not significance. They should therefore be taken into consideration (see tables 7 and 8).

(b) *Principal findings*

As people age, the value that they place on the years of life remaining to them may change, and this will be influenced by their individual preferences and the quality of life that they expect to have in the years to come. Because of the uncertainty surrounding these future years of life, their degree of risk aversion will play a part in their consumption decisions. What is posited in this article, specifically, is that people use different intertemporal discount rates depending on how they gauge their future life expectancy and their level of risk aversion, and that this will influence their decision as to whether or not to take early retirement. Our findings indicate that people who discount the future more heavily because they expect to have fewer years left to live or because they are more risk averse, or both, are more likely to retire early.

The importance of having quality time to enjoy in the present, especially as retirement age looms, is not entirely ignored by the pension market either. When people

express a desire to retire, the counsellors employed by the different pension institutions in the market urge them to think about the possibility of spending more time with their families now and thus make them more aware of the possibility of applying a higher future discount rate. Accordingly, hard economic times, declining health, having a family, and little or no knowledge about the pension market could all lead people to take a more pessimistic view of the future and thereby place greater value on the use of the time that they have now and, therefore, to apply a high discount rate or, at the least, a high enough one to make them think that it is best to take early retirement.

While Guiso and Paiella (2006) find empirical evidence that risk aversion helps to explain a series of individual decisions, such as entrepreneurship, portfolio management, demand for insurance, investment in education, migration, job changes and state of health, there is no previous evidence of its effect on early retirement decisions. The findings of this study show that risk aversion alone is not a decisive factor in decisions to retire early, but that it is indeed decisive when combined with individuals' perceptions of their futures (see table 7, models ii and iii). In addition, the marginal impact that risk aversion has on the probability of taking early retirement is substantially greater than the effect of age, years of schooling, the presence of a partner in the home or the number of children (see table 7, models vi and vii).

V Conclusions

We have presented evidence that people who retire early are applying a higher intertemporal discount rate because they place a greater present value on the years that are left to them and because of the way that their level of risk aversion causes them to react to the uncertainty surrounding those additional years of life. While risk aversion has been linked to various individual decisions in the literature, this is the first study to establish that link with the decision to take early retirement.

The average age of the respondents and their perceived life expectancy were considered. Both the group of persons who had waited until the legally mandated age to retire and the group of early retirees believe that their mean life expectancy is approximately 80 years.

The estimation procedures that were used showed that being a head of household and having a greater number

of children have a positive and significant influence on the probability of early retirement. This could be due to an urgent need for household funds in the present that causes the present value of such funds to outweigh their future value to such an extent that the possibility of a better future pension is foregone.

Robust evidence was found that the two groups' valuation of the years of life left to them differs, with those who place a greater value on their remaining years in the present than in the future therefore applying a lower intertemporal discount rate and consequently moving their retirement date forward.

Evidence was also found which indicates that the higher the level of risk aversion, the greater the degree of impatience to take early retirement. This could be due to uncertainty as to the possibility of enjoying a better

quality of life in the future. It would therefore be more beneficial to discount future utility more heavily and to prefer to enjoy a better present quality of life. These effects overshadow other variables such as age, years of schooling and household structure.

This analysis thus offers evidence that supports the hypothesis of heterogeneity in intertemporal discount rates

linked to future life expectancy, which is heightened by uncertainty about future quality of life. As an extrapolation from these conclusions, it can be posited that situations such as economic crises, increased uncertainty as to the possibility of enjoying quality time in the future and small monetary shocks can increase the probability of early retirement as well.

(Original: Spanish)

ANNEX A

Supplementary tables

Module J of the 2006 Social Protection Survey (EPS) contains three questions (j1_1 - j1_3) that are used to place the respondents at one of four different levels of risk aversion, ranging from the lowest (1) to the highest level of aversion (4).

TABLE A.1

Population distribution, by sex, economic activity status and level of risk aversion

| Level of aversion | Population distribution | Sex | | Working | | Retired | |
|------------------------|-------------------------|------------------|------------------|------------------|------------------|-------------------|----------------|
| | | Women | Men | No | Yes | No | Yes |
| 1 (Low) | 2 278 115 | 964 894 | 1 313 221 | 871 829 | 1 406 286 | 2 146 101 | 132 014 |
| 2 (Lower-intermediate) | 985 508 | 464 222 | 521 286 | 398 050 | 587 458 | 905 571 | 79 937 |
| 3 (Upper-intermediate) | 750 826 | 361 057 | 389 769 | 327 635 | 423 191 | 708 212 | 42 614 |
| 4 (Alto) | 7 478 283 | 3 975 611 | 3 502 672 | 3 360 807 | 4 117 476 | 6 789 315 | 688 968 |
| <i>Total</i> | <i>11 492 732</i> | <i>5 765 784</i> | <i>5 726 948</i> | <i>4 958 321</i> | <i>6 534 411</i> | <i>10 549 199</i> | <i>943 533</i> |

Source: Original calculations based on the Social Protection Survey (EPS) of 2006.

TABLE A.2

Membership in pension systems

| System | Pension System | | | |
|--------------|------------------|--------------|----------------|--------------|
| | Population | | Retirees | |
| | No. | Percentage | No. | Percentage |
| AFP | 7 550 278 | 88.5 | 338 274 | 41.3 |
| INP | 849 219 | 10.0 | 421 799 | 51.5 |
| CAPREDENA | 25 260 | 0.3 | 9 123 | 1.1 |
| DIPRECA | 26 228 | 0.3 | 5 173 | 0.6 |
| Other | 81 157 | 1.0 | 44 543 | 5.4 |
| <i>Total</i> | <i>8 532 142</i> | <i>100.0</i> | <i>818 912</i> | <i>100.0</i> |

Source: Original calculations based on the Social Protection Survey (EPS) of 2006. Respondents self-reported their pension system membership.

AFP: Pension fund management companies.

INP: Pension Standardization Institute.

CAPREDENA: National Defence Pension Fund.

DIPRECA: Carabineros Pension Administration.

TABLE A.3

Retirees in the AFP system: retirees at the legally mandated age and early retirees

| Reasons for retiring | Retired population (Percentages) | | |
|--|----------------------------------|--------------------------------|-------------------------|
| | Total | Mandated age [No. = 34,929] | Early [No. = 51,556] |
| To increase income by undertaking new income-generating activities | 24.9 | 8.5 | 36.0 |
| To use disposable funds or surpluses | 4.8 | 3.1 | 6.0 |
| Convinced to do so by a sales agent | 1.1 | 0.0 | 1.8 |
| Health problems | 21.5 | 24.3 | 19.5 |
| To devote time to other, non-occupational activities | 6.0 | 3.6 | 7.6 |
| Completed years of service (INP, DIPRECA or CAPREDENA) | 8.7 | 15.4 | 4.2 |
| The company offered a buy-out | 3.8 | 3.7 | 3.9 |
| Because was performing heavy labour | 0.5 | 0.0 | 0.7 |
| Became unemployed and little time remained until retirement age | 5.9 | 0.2 | 9.3 |
| Received a gift or money from a sales agent | 0.0 | 0.0 | 0.0 |
| Reached legally mandated retirement age | 20.0 | 40.4 | 6.2 |
| Other | 2.9 | 0.0 | 4.9 |
| <i>Total</i> | <i>100.0</i> | <i>100.0</i> | <i>100.0</i> |

Source: Original calculations based on the Social Protection Survey (EPS) of 2006.

INP: Pension Standardization Institute.

CAPREDENA: National Defence Pension Fund.

DIPRECA: Carabineros Pension Administration.

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