Individual Risk Aversion and Financial Investments Through the Life-Cycle: An Application To Private Retirement Systems*

Marcela V. Parada-Contzen†

Department of Economics

The University of North Carolina at Chapel Hill

June 29, 2016

Abstract

This paper proposes a dynamic model of individual life-cycle optimization and jointly estimates a derived set of dynamic demand equations representing observed financial investments and other wealth-related behaviors such as employment, occupation, and savings. The paper explores the role of risk aversion and life expectancy using the first 4 waves of the Chilean Survey of Social Protection (EPS). It uses the Discrete Factor Random Effects (DFRE) method to account for estimation bias allowing correlation across equations. The results show that there is a considerable correlation in unobservable characteristics between investment decisions and elicited risk aversion; and that not accounting for individual unobserved heterogeneity generates biased estimates. The model is used to simulate the impact on wealth accumulation of policies associated with investment decisions in private retirement systems.

Keywords: Investment Decisions, Risk Preferences, Elicited Risk Aversion, Retirement Income Policy.

JEL Classification: C30, D91, G11, J26.

*I thank Donna Gilleskie, Jane Cooley Fruehwirth, David Guilkey, Tiago Pires, Helen Tauchen, and the participants at the UNC Applied Microeconomics Seminar for helpful discussions and comments. I also thank the Chilean Bureau of Social Security (Subsecretaría de Previsión Social) for providing the data.

†E-mail: parada@live.unc.edu.

1 Introduction

This paper proposes a dynamic model of individual life-cycle optimization and derives a set of jointly-estimated dynamic demand equations representing observed investment behavior and other wealth-related behaviors such as employment, occupation, and savings. The estimated model also explains observed time-varying health and family characteristics that individuals may value and may influence investment decisions. Importantly, the paper explores the role of risk aversion and life expectancy using unique survey data available from Chile: elicited individual values obtained four times over nine years. The results are used to analyze policies associated with investments in private retirement systems and their impact on wealth accumulation.

As local, state, and national budgets have experienced fiscal stress, private retirement systems have gained importance around the world. These systems rely on the idea that individuals invest their private savings for retirement over their life cycle in financial accounts that better match their willingness to accept financial risks. Theoretically there are economic models that predict the relationship between investment decisions, portfolio composition, individual risk aversion, and wealth accumulation (Chiappori and Paiella, 2011). However, as risk aversion is intrinsically a theoretical concept, it is hard to account for it in empirical models of individual decisionmaking. In this paper I am able to better understand individual financial investments through the life-cycle by using elicited measures of individual risk aversion and life expectancy which may be correlated with the behaviors of interest through permanent and time-varying unobserved heterogeneity.

Measuring and identifying risk aversion empirically is a difficult task. Some measures have been developed to proxy for an individual's risk preferences and they have been used in the economics literature for several purposes. Researchers have used them to understand what drives differences in observed behaviors of individuals, and with respect to theoretical predictions where assumptions about risk preferences are made. Empirical measures of risk aversion have also been used to explain financial and savings decisions, to analyze individual retirement wealth accumulation, and to explain individual behavior and outcomes in the labor market.[1]

Empirical measures of risk aversion are also useful for the design of public policies. Some authors suggest that these measures should be used to test whether theoretical assumptions about risk neutrality made in several welfare analyses of economic policies hold and to test whether such welfare analyses change as individuals do not exhibit risk neutrality (e.g., assumptions about risk preferences are made in various situations such as retirement, employment, healthcare utilization, education) (Harrison et al., 2007). In

[1] Some examples of authors that explore these roles are Johnson and Powell (1994); Schubert et al. (1999); Bernasek and Shwiff (2001); Hartog et al. (2002); Cramer et al. (2002); Eckel and Grossman (2008); Arano et al. (2010); Le et al. (2011); Chakravarty et al. (2011); Nelson (2014).

terms of retirement systems based on individuals investments, accounting for individual risk preferences, understanding how risk aversion varies across individuals, how it evolves with age, what drives this evolution, and how it correlates with investment decisions and other wealth-related behaviors could aid in the design of better policies to improve individual welfare and ameliorate retirement income disparity. Some examples of papers that explore this line are Bernasek and Shwiff (2001) and Arano et al. (2010).

Mainly due to data limitations, there are still challenges in the literature of empirical risk aversion. First, datasets that contain measures of risk aversion for the same individuals over time are scarce. Second, it is not clear how to use experimental measures of risk aversion and how to reconcile them with observed behaviors and decisions in real settings. Third, the evidence on the demographics of risk aversion is weak. Except for gender and age differences, there is little conclusive evidence regarding additional sources of individual heterogeneity in risk aversion. Additionally, there are still many other unmodeled and unobservable factors that likely interact with risk preferences and affect empirical measures of risk aversion that have not been taken into consideration. Studies that focus in individual financial investment decisions or portfolio composition are usually able to focus on one risky behavior, rather than capturing the many risky-wealth-related decisions that individuals made in real life. There are also selection issues as researchers are usually able to observe just individual who participate in financial markets, who are expected to be the least risk averse individuals.

This paper addresses some of these concerns. I use the first four waves of the Chilean Survey of Social Protection (EPS) which includes rich information about individuals characteristics as well as questions about preferences toward lotteries for every individual in every wave starting at 15 years old. This allows for an empirical measure of individuals elicited risk aversion and its evolution as an individual ages, which makes possible to approach unmodeled variables by the previous literature. I frame the analysis in the setting of the Chilean private retirement system and complement the EPS with administrative data from the Chilean Superintendence of Pensions. Under this system, every dependent worker must participate in financial markets for investing her retirement funds, approaching the selection issue of portfolio analysis. Additionally, the paper allows correlation between observed measures of risk aversion from hypothetical settings with wealth-related observed decisions that may proxy for individual's risk preferences (e.g., financial investment, savings decisions, occupation selection). It also allows correlation with other behaviors and outcomes that an individual may value besides wealth (such as health and family characteristics) in an attempt to disentangle differences between individuals, and with individual unobserved characteristics. It uses the Discrete Factor Random Effects (DFRE) method to account for several potential sources of estimation bias: endogeneity, selection, and measurement error.[2]

[2]Endogeneity refers to correlation through unobservables of observed outcomes that explain subsequent outcomes in dynamic equations. Selection bias results from participation behaviors that may be correlated with

Finally, all these elements allows me to analyze wealth accumulation through the life-cycle of an individual under different simulated policies in the context of a private retirement system.

The results show that there is a considerable correlation in unobservable characteristics between individual investment decisions, elicited risk aversion, occupation category, and earnings. The marginal effects when and when not modeling individual unobserved characteristics and elicited risk aversion are statistical different, suggesting that not accounting for these typically omitted variables generate biased estimates. There is a persistence effect in financial investment decisions. Work experience as well as accumulated assets are relevant in making these decisions. Family and health characteristics are also statistically significant in explaining financial investments. The simulation results show that in 7 years, slightly riskier investment strategies may increase asset accumulation by 7 percent. Increasing mandatory contribution rates in 3 and 5 percent generate statistical significant increase in asset accumulation by 9 and 15 percent, respectively, in 7 years.

The paper is organized as follows. The next section presents a overall description of the Chilean retirement system and reviews the literature in empirical risk aversion. Section 3 presents a dynamic model of individual life cycle decisions, derives the set of structural correlated equation to be estimated, and discuss the estimation strategy. Section 4 presents the data and the research sample. Results are presented in Section 5 and Section 6 concludes.

2 Literature Review

2.1 The Chilean Private Retirement System

In this section I describe some characteristics of the Chilean private retirement system relevant for this paper.[3] The system is based on individual private capitalization and it was introduced in 1981 to replace the old pay-as-you-go pension system managed by the state. In the new system, each dependent worker must have an individual account where every period the worker contributes 10% of her income.

Individuals savings are capitalized and managed by private companies known as Pension Fund Administrators (AFPs). Every period, the AFPs invest the workers' savings in the financial market based on investment decisions made by the workers. The worker can choose one of five possible investment funds (accounts A, B, C, D, or E), or a combination of two of these funds (e.g., half in account A and half in account B). These funds differ by the level of financial risk, which is measure as the fraction of investment on equities. Account A is

other modeled behaviors (e.g., savings accounts). Measurement error might be present in the survey measures for subjective assessments as well as reported savings.

[3] For a complete description of the system, see Berstein (2010).

the riskier one while account E is the safest one.[4] These investment accounts are offered by private firms whose sole objective is to manage workers investments for retirement and whose profits are protected from financial risks.

Contributors naturally face a financial risk in their savings accounts. It is expected that riskier accounts will generate a higher financial return, while the fluctuations in returns is also expected to be higher. The system assumes that individuals make financial decisions over their life cycle that match their level of risk aversion.

2.2 Empirical Measures of Risk Aversion

In classic economic theory, individual risk aversion is measured using the absolute and relative measures of risk aversion proposed by Pratt (1964) and Arrow (1965). These measures rely on the curvature of the individual's utility function in a static optimization problem where it is assumed that the utility function captures individual preferences over wealth. Bommier and Rochet (2006) expand the analysis by defining an individual dynamic measure of risk aversion that incorporates the horizon length for any utility function and periods of time. Under this framework an individual's absolute and relative dynamic risk aversion rely on the curvature of the lifetime utility function.

Several empirical papers have attempted to estimate these measures and to test the theoretical predictions. In an extensive survey, Holt and Laury (2014) report that there are generally three approaches for eliciting risk attitudes: the investment portfolio approach, the lottery choice menu approach, and the pricing task approach. The investment portfolio approach asks respondents to choose between alternative financial gambles. One alternative is always less risky than the rest. The lottery choice menu builds the individual's risk attitude based on a structured list of binary choices between safe and risky gambles. The pricing task approach asks respondents to name a certainty equivalent money amount for a gamble. Risk attitude is inferred using this value and the expected value of the gamble. The three approaches are similar since binary choices in a menu list can be thought of as pairs of alternative portfolios and one can be asked to elicit a certainty equivalent instead of a price or a choice.

Empirical measures of elicited risk aversion, or its proxies, have been useful in explaining different wealth-related behaviors. There is evidence on the relationship between risk aversion and the labor market. Cramer et al. (2002); Ekelund et al. (2005); Brown et al. (2011) find evidence that more risk averse individuals are less likely to be self-employed than be a dependent worker. Grazier and Sloane (2008) find that workers seem to have preferences for risky jobs based on family composition and gender, which are assumed to be

[4] Account A invest between a 40-80% in equities; Account B 25-60%; Account C 15-40%; Account D 5-20%; and Account E 0-5%.

proxies for risk aversion. Le et al. (2011) analyze the role of risk aversion in explaining wages received. They find that females are more risk averse than males and that workers with more favorable attitudes towards risk are associated with higher earnings. They suggest that gender differences in risk attitudes can account for a small part of the gender pay gap.

When elicited measures of risk aversion are not available, some authors have use participation in financial markets and risky asset holdings to proxy for individual risk aversion. The main objective has been to test relationship between wealth accumulation and risk aversion. There is evidence that changes in liquid wealth have a significant effect on the probability of entering or exiting the stock mark but little effect on asset allocation for households that already participate in the market. (Brunnermeier and Nagel, 2008). Chiappori and Paiella (2011) find that investment in risky assets does not change as financial wealth changes although this does not hold as they expand the wealth measure to include business equities and housing, where investment in risky assets increases as wealth increases. There is also evidence that past consumption levels explain current risky asset holdings (Lupton, 2003; Ravina, 2005).

This paper follows the lottery choice menu approach to construct an elicited measure of risk aversion. It allows correlation with observed decisions that partially capture individual's risk preferences, such as investments decisions in financial market, labor market participation, and occupation selection. Additionally, it allows correlation with other behaviors and outcomes that an individual may value besides wealth and that have been used as proxies for risk attitudes, (e.g., health and family characteristics) and with permanent and time varying individual unobserved characteristics.

3 Empirical Model

This section presents dynamic model of individual life-cycle optimization and derives a set of jointly-estimated dynamic demand equations representing investment behavior and other wealth-related behaviors such as employment, occupation, and savings. The model incorporates two individual subjective assessments: elicited risk aversion and expected duration of life.

3.1 Timing and Notation

An individual enters each period t with information about her history of past choices and relevant knowledge about current individual and market characteristics, denoted by the vector Ω_t. The choice history is summarized by the individual's accumulated stock of assets from required savings for retirement (A^r_{t-1}), financial investment chosen last period (i_{t-1}), optional savings last period (s_{t-1}), and work experience up to period t (E_t). Her current characteristics are summarized by marital state (M_t), number of children (N_t), health status (H_t), individual exogenous characteristics (X_t), and other exogenous market-level characteristics (Z_t) (e.g., prices). I denote $\tilde{\Omega}_t$ as the set of endogenous variables influencing the individual decisionmaking problem (i.e., Ω_t includes $\tilde{\Omega}_t$, X_t, and Z_t).

Hourly wage rate is denoted by w_t and hours worked by h_t. The retirement system in Chile is based on individual savings and capitalization. It is mandatory that every dependent worker save ten percent of her employment income. Each period the worker chooses one of five possible investment funds, or a combination of two of those funds, in which to invest her mandatory savings. The individual makes 5 investment decisions, $i_t = (i_t^A, i_t^B, i_t^C, i_t^D, i_t^E)$, that consist of whether or not to invest in each of the available accounts. If an individual is not employed in t but was in the past, she does not contribute money to the account (since $w_t = 0$), but she still makes the investment fund decision with the money already in the account.

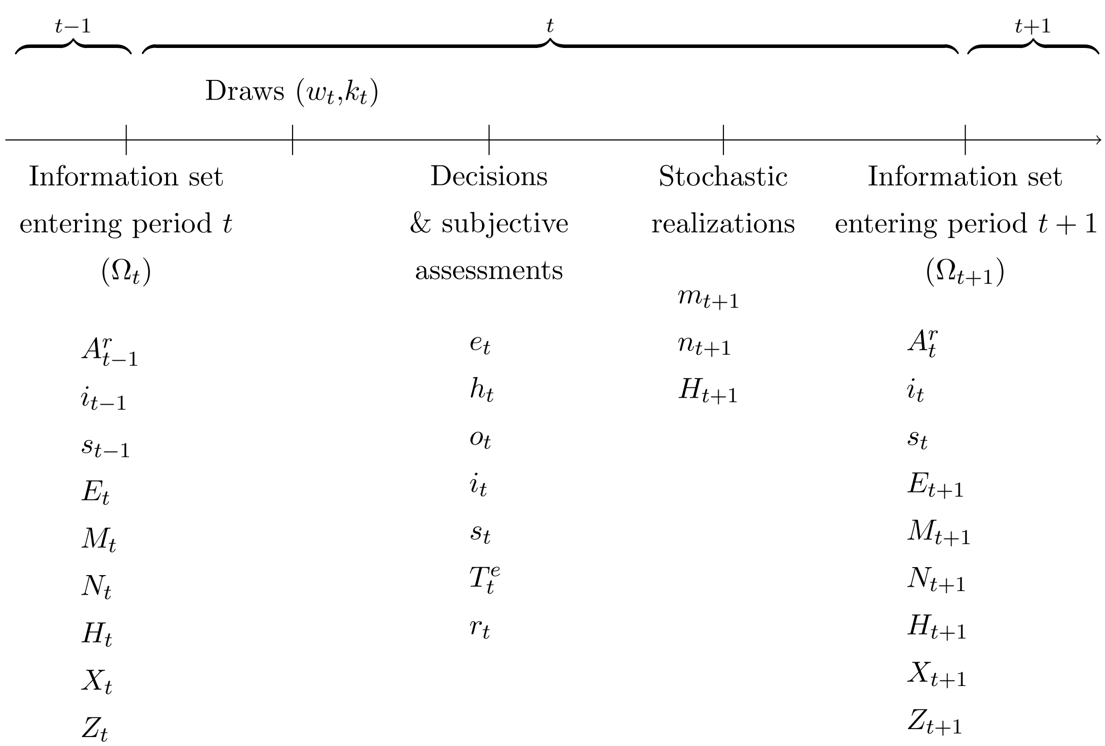
In addition, individuals may choose to hold a voluntary account outside the system and save an amount in it (s_t). These voluntary savings can be cashed at any time, before or after retirement. An individual's wealth level entering the period has two components. The first component is the value of accumulated required savings, $\left[A_{t-1}^r \cdot R_{t-1}^r(i_{t-1})\right]$, and the second component is the value of accumulated optional savings, $\left[s_{t-1} \cdot R_{t-1}^o\right]$. The rates of return are denoted by $R_{t-1}^r(i_{t-1})$ and R_{t-1}^o for the requirement funds and optional savings accounts. R_{t-1}^r is a function of the chosen investment funds last period, i_{t-1}. When an individual is making the investment and savings decision, i_t and s_t, she does not know the rates of return because they depend on the performance of the financial market. I assume that she observes the rates of return from the previous period when entering period t.

At the beginning of each period, the individual receives a wage offer, w_t^*, which is unobserved by the econometrician and drawn from an occupation-specific wage distribution. She also receives a draw, denoted k_t, from the medical care consumption distribution and it represents stochastic necessary consumption within the current period. The individual realizes her elicited level of risk aversion (r_t) and forms her expected duration of life (T_t^e). Simultaneously, the individual decides her employment state (e_t), occupation category (o_t), financial investments (i_t), and optional savings (s_t). It is assumed that elicited risk aversion and expected duration of life are realized at the time of decision making, which is when the individual faces the wealth uncertainty. The per-period alternatives are $e_t = \{0, 1, 2\}$ indicating non employed, working part-time, and working full-time, respectively; $o_t = \{1, 2, ..., 6\}$; $i_t^A = \{0, 1\}$, $i_t^B = \{0, 1\}$, $i_t^C = \{0, 1\}$, $i_t^D = \{0, 1\}$, $i_t^E = \{0, 1\}$, indicating no investment or investment in that fund, and $s_t = \{0, 1\}$ indicating no optional savings or some optional savings. According to the survey answers that the individual provides for the hypothetical lotteries, r_t takes one of three values, $r_t = \{1, 2, 3\}$ where 1 is the most risk averse category and 3 is the least risk averse category. Expected duration of life, T_t^e, is reported in years.

The period t marital status (m_t), changes in family size (n_t), and health status (H_t) are observed entering period t. To focus on the role of wealth-related decisions, it is assume that their future values are stochastic outcomes that are realized at the end of each period, prior to entering the next period. These transitions may depend on behaviors during the period, as well as previous behaviors and outcomes. Past marriage realizations are summarized by the marital history vector M_t. This vector includes the marriage state entering the period, m_t, and number of years married. Past child realizations are summarized by the child history vector N_t which include a birth last period, n_t, and the number of children up to period t.

After making the period t decisions and subjective assessments, and realizing the period $t+1$ stochastic values, the individual updates her information set to Ω_{t+1}. Figure 1 depicts the timing of endogenous decisions, stochastic realizations and subjective assessments.

Figure 1: Timing of Decisions, Subjective Assessments and Stochastic Realizations



3.2 Individual Dynamic Problem

Each period t the individual receives utility (U_t) from consumption (c_t), leisure (l_t), marital status (m_t), number of children (N_t), and health status (H_t). True risk aversion is captured by the curvature of the utility function (r^*_t) and it may vary over the life-cycle of an individual. Equation 1 presents the per-period utility function U.

$$U_t = U\left(c_t, l_t; X_t, m_t, N_t, H_t, \epsilon_t, r_t^*\right) \tag{1}$$

where ϵ_t is an alternative-specific preference error.

The individual faces a time and a budget constraint given in equations 2 and 3. Total time, Γ_t, is distributed between leisure, working hours (h_t), and family time $f(m_t, N_t)$. An employed individual receives earned income equal to $w_t h_t$. She receives non-earned income from her spouse (Y_t), if married (m_t). She also receives interest income on previous savings, with rates of returns R^o_{t-1} for optional savings, and $R^r_{t-1}(i_{t-1})$ for required savings which is a function of the chosen investment funds. The individual distributes her earnings and wealth between consumption, savings, medical care consumption expenditures $K(k_t)$, and family expenditures $g(m_t, N_t)$ each period. Specifically,

$$\Gamma_t = l_t + e_t h_t + f(m_t, N_t) \tag{2}$$

$$c_t + a_t^r + s_t + K(k_t) + g(m_t, N_t) = w_t h_t + A^r_{t-1} R^r_{t-1}(i_{t-1}) + s_{t-1} R^o_{t-1} + m_t Y_t \tag{3}$$

where s_t is optional savings, and a_t^r defines the required savings each period if a person is employed. That is

$$a_t^r = \alpha w_t h_t \tag{4}$$

where α represent the fraction of required savings.

An individual makes decisions each period about e_t, h_t, o_t, i_t, and s_t to maximize remaining lifetime utility given information (Ω_t) entering period t and her current beliefs about future stochastic outcomes. At period t there is uncertainty about elements of the next period recursive value function due to future stochastic outcomes.[5] I assume that the individual knows the stochastic processes.

The value of alternative $eois$ (where $e_t = e$, $o_t = o$, $i_t^A = i^A$, $i_t^B = i^B$, $i_t^C = i^C$, $i_t^D = i^D$, $i_t^E = i^E$, $s_t = s$) and denoted $d_t^{eois} = 1$, is the sum of current period utility and the maximum expected lifetime utility at $t+1$ given the alternative chosen at time t. The instant utility of choice d_t is U_t^{eois}. Let T be the final period for an individual. At period $t = T$ the individual cares about her per-period utility and maximizes equation 5.[6]

$$V_T^{eois}(\Omega_T, \epsilon_T, w_T, k_T) = U_T^{eois} \text{ if } t = T \tag{5}$$

For all $t < T$, the individual's value function (equation 6) has two components: the per-period

[5]That is, the individual does not know her future wage draw, the change in marital status and number of children, health care consumption.

[6]No bequest motive are assumed. An extension of this model could allow for bequest motives as the individual values family characteristics and she is making decisions that affects wealth.

utility and the discounted maximal expected value of utility at time $t+1$. Specifically,

$$
\begin{aligned}
V_t^{eois}(\Omega_t, \epsilon_t, w_t, k_t, R_t^o, R_t^r) = U_t^{eois} + \\
\beta \int_{R_{t+1}^r} \int_{R_{t+1}^o} \int_{w_{t+1}} \int_{k_{t+1}} \int_{\epsilon_{t+1}} \left[\max_{eois'} V_{t+1}^{eois'}(\Omega_{t+1}, \epsilon_{t+1}, w_{t+1}, k_{t+1}, R_t^o, R_t^r | d_t = eois) \right] \\
dF(\epsilon_{t+1}) dF(k_{t+1}) dF(w_{t+1}) dF(R_{t+1}^o) dF(R_{t+1}^r), \\
\forall t = 1, 2, ..., T-1
\end{aligned}
\tag{6}
$$

where β is an exogenous discount factor, $dF(\epsilon_{t+1})$, $dF(k_{t+1})$, $dF(w_{t+1})$, $dF(R_{t+1}^o)$, and $dF(R_{t+1}^r)$ are the probability density functions over the alternative-specific preference error, medical consumption, wages, return on optional savings, and returns on required savings, respectively.

3.3 Demand Equations and Subjective Assessments

Individuals optimize with respect to e_t, o_t, i_t, and s_t. These first order conditions plus the restrictions yield eight equations that are functions of individual observed and unobserved (by the econometrician) information. These demand functions are approximated by a Taylor series expansion of its arguments and jointly estimated with the subjective assessments, which are assumed to be made with the same set of information. I decompose the unobserved heterogeneity into three components. These components are: 1) permanent individual unobserved heterogeneity (μ), 2) time-varying individual unobserved heterogeneity (ν_t), and 3) idiosyncratic unobserved heterogeneity (ε_t).

$$
\ln \left[\frac{p(e_t=j)}{p(e_t=0)} \right] = e^j(E_t, i_{t-1}, A_{t-1}^r, s_{t-1}, M_t, N_t, H_t, X_t, Z_t, \mu, \nu_t) \quad j = \{1, 2\} \tag{7}
$$

$$
\ln \left[\frac{p(o_t=j)}{p(o_t=1)} \right] = o^j(E_t, i_{t-1}, A_{t-1}^r, s_{t-1}, M_t, N_t, H_t, X_t, Z_t, \mu, \nu_t) \quad j = \{2, ..., 6\} \tag{8}
$$

$$
\ln \left[\frac{p(i_t^f=1)}{p(i_t^f=0)} \right] = i^f(E_t, i_{t-1}, A_{t-1}^r, s_{t-1}, M_t, N_t, H_t, X_t, Z_t, \mu, \nu_t) \quad f = \{A, B, C, D, E\} \tag{9}
$$

$$
\ln \left[\frac{p(s_t=1)}{p(s_t=0)} \right] = s(E_t, i_{t-1}, A_{t-1}^r, s_{t-1}, M_t, N_t, H_t, X_t, Z_t, \mu, \nu_t) \tag{10}
$$

$$
T_t^e = T^e(E_t, i_{t-1}, A_{t-1}^r, s_{t-1}, M_t, N_t, H_t, X_t, Z_t, \epsilon_t^T, \mu, \nu_t) \tag{11}
$$

$$
ln \left[\frac{p(r_t=j)}{p(r_t=1)} \right] = r^j(E_t, i_{t-1}, A_{t-1}^r, s_{t-1}, M_t, N_t, H_t, X_t, Z_t, \mu, \nu_t) \quad j = \{2, 3\} \tag{12}
$$

3.4 Stochastic Realizations

The density of wages is a function of work experience, occupation category, health status, and other individual's exogenous individual characteristics, such as age, gender and education. It also depends on a vector of employment demand side shifters, Z_t^E such as unemployment rates.

$$w_t = w(E_t, o_t, H_t, X_t, Z_t^E, \epsilon_t^w) \tag{13}$$

where ϵ_t^w is an uncorrelated error term. The probability of being not married in period $t+1$ ($m_{t+1} = 0$) relative to being married ($m_{t+1} = 1$) is defined in equation 14. The probabilistic dichotomous event depends on endogenous and exogenous individual characteristics. While not modeled explicitly, I assume that there is a marriage market such that supply side factors, Z_t^M, also impact marriage probability. Supply side factors may include the number of marriages in the population of each gender or by other characteristics.

$$\ln\left[\frac{p(m_{t+1} = 1)}{p(m_{t+1} = 0)}\right] = m(d_t, \tilde{\Omega}_t, X_t, Z_t^M) \tag{14}$$

The probability of decreasing or increasing the number of children in period $t+1$ ($n_{t+1} = \{-1, 1\}$) relative to not ($n_{t+1} = 0$) is defined in equation 15 and depends on endogenous and exogenous individual characteristics, and exogenous supply side factors.

$$\ln\left[\frac{p(n_{t+1} = j)}{p(n_{t+1} = 0)}\right] = n^j(d_t, \tilde{\Omega}_t, X_t, Z_t^N), \qquad j = \{-1, 1\} \tag{15}$$

The density function at period $t+1$ of health consumption, measured by the number of medical visits, is a function of endogenous and exogenous individual characteristics, and supply side factors such as medical care prices and insurance coverage, Z_t^K.

$$k_{t+1} = k(d_t, \tilde{\Omega}_t, X_t, Z_t^K, \epsilon_t^k) \tag{16}$$

where ϵ_t^k is an uncorrelated error term. The probability of being in health status j in period $t+1$ ($H_{t+1} = j$ where $j = \{2, 3, 4\}$ represent categories good, regular, and poor respectively)relative to being in a very good health status ($H_{t+1} = 1$) is

$$\ln\left[\frac{p(H_{t+1} = j)}{p(H_{t+1} = 1)}\right] = H^j(H_t, k_t, e_t, o_t, X_t, Z_t^H), \qquad j = \{2, 3, 4\} \tag{17}$$

and depends on current health and medical care consumption which represents medical care inputs. The period t employment and occupation choice, as well as other individual exogenous characteristics, also impact health transitions. Employment behavior may directly affect health or may proxy for omitted non-medical care inputs such as nutrition and exercise.

Returns on required, R_t^r, and optional, R_t^o, savings are stochastic and exogenous to the individual as they depend on financial markets. These distributions are not estimated inside the model. Required savings evolve according to equation 18.

$$A_t^r = [1 + R_{t-1}^r(i_{t-1})]A_{t-1}^r + a_t^r. \tag{18}$$

3.5 Initial Conditions

Because individuals are aged 25 to 59 years old when they are first observed in 2002, some of the state variables that explain endogenous behavior are non zero. The dynamic equations cannot be used to estimate this initially-observed variation as they depend on past values. Thus, I model the initial conditions as static equations and as a function of exogenous individual and market characteristics. These are: initial employment status, initial work experience, initial occupation category, initial savings decision, initial marital status, initial number of children, and initial health status. I also allow these initial conditions to be correlated through individual permanent unobserved heterogeneity.

3.6 Estimation Strategy and Likelihood Function

The system estimated consists of 22 equations: 8 demand behaviors, 2 subjective assessments, 5 stochastic outcomes, and 7 initial conditions. They are correlated through the unobserved heterogeneity which represents an individual's characteristics and attitudes that are unobserved by the econometrician and that affect an individual's behaviors and observed outcomes.

These equations are estimated using the Discrete Factor Random Effects (DFRE) method. The DFRE method does not impose distributional assumptions over the correlated error terms across equations. Rather, the support of the unobserved heterogeneity distribution is discretized and the mass point locations as well as their probabilities are estimated jointly with parameters on the observed heterogeneity in each equation (Mroz and Guilkey, 1992; Mroz, 1999).

I assume that the error in each demand, subjective assessment, or stochastic outcome equation has the form:

$$\epsilon_t^z = \mu^z + \nu_t^z + \varepsilon_t^z,\ z = \{1, ..., 15\} \tag{19}$$

and that the error in each initial condition equations has the form:

$$\epsilon_t^{z_i} = \mu^{z_i} + \varepsilon_t^{z_i},\ z_i = \{1, ..., 7\} \tag{20}$$

where z represents the per-period equation, z_i the initial conditions equation, μ captures permanent unobserved heterogeneity, ν_t captures time-varying unobserved heterogeneity, and ε_t is an independently and identically distributed component.

The advantage of the DFRE method in this setting is that it allows us to estimate the decisions and observed outcomes derived from the individual's optimization problem without assuming specific functional forms for the utility function, constraints, and expectation processes, and without assuming any specific distributional form for the correlated error terms. Additionally, it enables to allow for both the permanent and time-varying unobserved components flexibly and thus better understand the contribution of subjective assessments. Moreover, this method allows us to account for, among other unobserved factors, measurement error in survey responses.

Likelihood function

The likelihood function conditional and unconditional to the unobserved heterogeneity is given by equations 21 and 22, respectively.

$$L_{ct}(\mu,\nu_t) = f_w(\epsilon_t^W|\mu,\nu_t) f_k(\epsilon_t^K|\mu,\nu_t) \prod_j^J \left\{ Pr\left(I(d_t^j = d^j)|\mu,\nu_t \right) f_j(\epsilon_t^j|\mu,\nu_t) \right\}^{I(d_t^j=d^j)} \quad (21)$$

where d_t^j represents a choice, $j = \{E, O, I^A, I^B, I^C, I^D, I^E, S, T^e, R, M, N, H\}$, $f(\cdot)$ represents the density function of the error term of each equation, $Pr(\cdot)$ is the cumulative distribution function for each choice, and $I(d_t^j = d^j)$ is an indicator of a particular choice.

$$L_t = \sum_{q=1}^{Q} PW_{\mu q} \sum_{r=1}^{R} PW_{\nu r} \prod_{t=1}^{T} L_{ct}(\mu,\nu_t) \quad (22)$$

where $PW_{\mu q}$ is the probability of observing q mass points for the permanent component μ and $PW_{\mu r}$ is the probability of observing r mass points for the time-varying component ν_t. These approximate the true distributions of μ and ν_t.

4 Data and Research Sample

The main source of data are the first 4 waves of the EPS. This survey is an individual longitudinal dataset for the years 2002, 2004, 2006, and 2009. It is administered by the Ministry of Labor and Social Security in Chile jointly with the University of Chile and the Institute for Social Research from the University of Michigan. I complement the EPS with administrative data from the Chilean Superintendence of Pensions.

The EPS 2002 was designed to obtain a representative sample of individuals who are affiliated with the Chilean retirement system. Beginning in 2004, the EPS is a representative sample of the entire adult population as in 2004 this sample was extended to include those individuals who are not affiliated with the retirement program (i.e., any individual who has not worked as a dependent worker for at least one month).

An important feature of EPS is that it provides information about individual preferences over hypothetical gambles. A measure of risk aversion for every individual aged 15 years-old and above can be created from this information, and it is measured every wave.

4.1 Elicited Measure of Risk Aversion

Individual risk attitude can be derived from the EPS dataset based on a set of questions that involve hypothetical gambles over lifetime income. Respondents are separated into three distinct risk preference categories. Depending on the option that the individual accepts, she is more or less risk averse than another individual. The three categories are label "most risk averse", "intermediate risk aversion", and "least risk averse."

Table 1 presents the distribution of the index of risk aversion for the whole sample. A majority (78%) of individuals belong to the most risk averse category. Appendix A presents the survey questions that allow to obtain the measures for elicited risk aversion and discusses in detail how the measure is constructed.

Table 1: Distribution of Elicited Risk Aversion for the whole sample

Elicited Risk Aversion	2002	2004	2006	2009	Total
1	14,604	12,099	11,258	9,545	47,506
	(90.25%)	(74.42%)	(74.22%)	(74.02%)	(78.52%)
2	377	1,142	1,194	1,073	3,786
	(2.33%)	(7.02%)	(7.87%)	(8.32%)	(6.26%)
3	1,201	3,016	2,716	2,278	9,211
	(7.42%)	(18.55%)	(17.91%)	(17.66%)	(15.22%)
Mean	2.828	2.559	2.563	2.564	2.633
St.Dev	0.539	0.786	0.777	0.774	0.733
Observations	16,182	16,257	15,168	12,896	60,503

Note: (a) Elicited Risk Aversion goes from 1 to 3, being 1 the highest level of risk aversion. This measure was constructed using two questions about preferences over hypothetical lotteries in the four waves of EPS. (b) The whole sample is used. (c) In this paper, elicited risk aversion from the first wave does not enter the estimation.

4.2 Description of Research Sample

The research sample used in the estimation consists of all individuals aged between 25 and 59 years old (limits included) in 2002 who are observed in all four waves of EPS (no attrition nor deaths) and who have no missing information for the variables: health status, optional savings, work experience, marital status, and region of residence. The research sample contains 7,168 individuals observed four times (28,672 person-year observations). Table 2 details determination of research sample.

Table 3 describes the dependent variables of the 15 equation system. The number of observations differ per equations as individuals may have missing information in dependent variable(s). I assume that this missing information is random. I create a missing indicator when the variable is an endogenous explanatory variable. Table 4 describes the explanatory variable used in estimation, entering period t.

Table 2: Construction of Research Sample

Sample	# Individuals
Reference sample	
Age between 25 and 59 years old in 2002*	13,178
And observed in 3 consecutive periods	
First three waves	8,545
Last three waves	8,869
And no attrition no death	
Observed in all four waves**	7,238
And Information available in key variables	
Research Sample***	7,168

Note: (a) * Individuals who show up more than one period. ** Death rates are small for individuals aged between 25 and 59 years old in 2002. *** No missing information in the following variables: health status, optional savings decisions, work experience, marital status, and region of residence. (b) The variables are defined in detail in Section B.

Table 3: Summary Statistics of Dependent Variables for Research Sample

Variable	Estimator	Mean	Std. Dev.	Min.	Max.	N
Employment (e_t)	mlogit					21,504
Full-time employed		0.690	0.462	0	1	
Part-time employed		0.031	0.174	0	1	
Not working		0.278	0.448	0	1	
Occupation (o_t) (if working)	mlogit					15,327
Elementary occupations		0.219	0.414	0	1	
Legis., Prof., Tech., other		0.185	0.388	0	1	
Clerical support workers		0.107	0.309	0	1	
Service and sales workers		0.147	0.354	0	1	
Agricultural, craft and trade		0.057	0.231	0	1	
Operators and assemblers.		0.286	0.452	0	1	
Investment (i_t)	logit					21,504
Account A (Riskier)		0.104	0.305	0	1	
Account B		0.231	0.422	0	1	
Account C		0.495	0.500	0	1	
Account D		0.215	0.411	0	1	
Account E (Safest)		0.037	0.189	0	1	
Savings outcomes (s_t)	logit					21,490
Any Optional Savings		0.263	0.441	0	1	
Expected Duration of Life (T_t^e)	OLS	75.780	10.091	30	110	17,287
Elicited Risk Aversion (r_t)	mlogit					20,557
Most Risk Averse		0.747	0.435	0	1	
Intermediate Risk Averse		0.076	0.265	0	1	
Least Risk Averse		0.177	0.381	0	1	
Log of wage (w_t)	OLS	0.657	1.440	-10.219	5.255	14,705
Marital status (m_{t+1})	logit					21,504
Married		0.571	0.495	0	1	
Variation in number of children (n_{t+1})	mlogit					21,060
No change		0.788	0.408	0	1	
Decrease		0.184	0.387	0	1	
Increase		0.028	0.165	0	1	
Medical consumption (k_{t+1})	OLS					21,438
Number of Medical Visits		6.697	12.639	0	240	
Health status (H_{t+1})	mlogit					14,336
Very good		0.147	0.354	0	1	
Good		0.519	0.500	0	1	
Regular		0.266	0.442	0	1	
Poor		0.068	0.252	0	1	

Table 4: Summary Statistics of Explanatory Variables Entering Period t for Research Sample

Variable	Mean	Std. Dev.	Min.	Max.
Work experience (years)	15.646	8.111	0	30
Employment Status at period t				
Full-time Worker	0.691	0.462	0	1
Part-time Worker	0.032	0.177	0	1
Not employed	0.277	0.447	0	1
Occupation Category in period t				
Elementary occupations	0.117	0.322	0	1
Legis., Prof., Tech., other	0.099	0.298	0	1
Clerical support workers	0.057	0.232	0	1
Service and sales workers	0.078	0.269	0	1
Agricultural, craft and trade, other	0.030	0.172	0	1
Operators and assemblers	0.153	0.360	0	1
Lagged Investment Decision				
Account A (Riskier)	0.059	0.235	0	1
Account B	0.135	0.341	0	1
Account C	0.495	0.500	0	1
Account D	0.095	0.293	0	1
Account E (Safest)	0.021	0.144	0	1
Value of Assets	5.906	12.487	0	241.337
Any Optional Savings	0.218	0.413	0	1
Married	0.569	0.495	0	1
Duration of marriage (years)	11.444	12.626	0	56
Number of Children	1.009	1.083	0	8
Number of Medical Visits in period t	5.007	11.31	0	240
Health Status				
Very Good	0.139	0.346	0	1
Good	0.536	0.499	0	1
Fair	0.266	0.442	0	1
Poor	0.059	0.236	0	1
Age	43.965	9.628	25	66
Female	0.462	0.499	0	1
Education Category				
Less than High School	0.536	0.499	0	1
High School	0.334	0.472	0	1
Technical College	0.097	0.296	0	1
College and Post-Graduate	0.025	0.156	0	1
Exclusion Restrictions				
Unemployment rate	9.226	2.261	4.200	15.000
Number of hospital beds (# per 1,000 population)	2.345	0.373	1.300	3.900
Number of doctors (# per 1,000 population)	0.978	0.220	0.580	1.870
Number of marriages (# year per 1,000 population)	3.486	0.437	2.500	5.100
Inches of rainfall (thousand inches per year)	17.501	13.705	0.000	65.450
College tuition (thousand dollars)	3.240	0.641	0.000	4.300
Missing Indicators				
Missing: Number of Children	0.021	0.142	0	1
Missing: Education	0.007	0.082	0	1
Missing: Occupation	0.261	0.439	0	1
Missing: Marriage Duration	0.005	0.069	0	1
Missing: Number of Medical Visits	0.252	0.434	0	1

5 Results

5.1 Estimation Results

Empirical Specification

Table 5 presents the empirical specification for the 22 jointly estimated dynamic correlated equations and for the model without unobserved heterogeneity. The model estimated without unobserved heterogeneity estimates each equation separately and does not include column (3).

Table 5: Empirical Specification

Outcome	Estimator	Explanatory Variables		
		(1) Endogenous	(2) Exogenous	(3) Un.Het.
Employment (e_t)	mlogit	E_t, i_{t-1}, s_{t-1}, A^r_{t-1}, M_t, N_t, H_t	X_t, Z_t	μ^E, ν_t^E
Occupation (o_t)	mlogit	E_t, i_{t-1}, s_{t-1}, A^r_{t-1}, M_t, N_t, H_t	X_t, Z_t	μ^O, ν_t^O
Savings (s_t)	logit	E_t, i_{t-1}, s_{t-1}, A^r_{t-1}, M_t, N_t, H_t	X_t, Z_t	μ^S, ν_t^S
Investment in A (i_t^A)	logit	E_t, i_{t-1}, s_{t-1}, A^r_{t-1}, M_t, N_t, H_t	X_t, Z_t	μ^{I^A}, $\nu_t^{I^A}$
Investment in B (i_t^B)	logit	E_t, i_{t-1}, s_{t-1}, A^r_{t-1}, M_t, N_t, H_t	X_t, Z_t	μ^{I^B}, $\nu_t^{I^B}$
Investment in C (i_t^C)	logit	E_t, i_{t-1}, s_{t-1}, A^r_{t-1}, M_t, N_t, H_t	X_t, Z_t	μ^{I^C}, $\nu_t^{I^C}$
Investment in D (i_t^D)	logit	E_t, i_{t-1}, s_{t-1}, A^r_{t-1}, M_t, N_t, H_t	X_t, Z_t	μ^{I^D}, $\nu_t^{I^D}$
Investment in E (i_t^E)	logit	E_t, i_{t-1}, s_{t-1}, A^r_{t-1}, M_t, N_t, H_t	X_t, Z_t	μ^{I^E}, $\nu_t^{I^E}$
Expected Duration (T_t^E)	ols	E_t, i_{t-1}, s_{t-1}, A^r_{t-1}, M_t, N_t, H_t	X_t, Z_t	μ^{T^e}, $\nu_t^{T^e}$
Elicited Risk Aversion (r_t)	mlogit	E_t, i_{t-1}, s_{t-1}, A^r_{t-1}, M_t, N_t, H_t	X_t, Z_t	μ^R, ν_t^R
Wage (w_t)	ols	E_t, ot, H_t	X_t, Z_t^E	μ^W, ν_t^W
Marital status (m_{t+1})	logit	e_t, M_t, N_t	X_t, Z_t^M	μ^M, ν_t^M
Change in # children (n_{t+1})	mlogit	e_t, M_t, N_t	X_t, Z_t^N	μ^N, ν_t^N
Medical consumption (k_t)	ols	H_t	X_t, Z_t^K	μ^K, ν_t^K
Health status (H_{t+1})	mlogit	e_t, E_t, o_t, k_t, H_t	X_t, Z_t^H	μ^H, ν_t^H
Initial conditions				
Employment	mlogit		X_1, Z_1	μ^{E_i}
Work experience	ols		X_1, Z_1	μ^{EX_i}
Occupation	mlogit		X_1, Z_1	μ^{O_i}
Savings	logit		X_1, Z_1	μ^{S_i}
Marital status	logit		X_1, Z_1^M	μ^{M_i}
Number of children	ols		X_1, Z_1^N	μ^{N_i}
Health status	mlogit		X_1, Z_1^K, Z_1^H	μ^{H_i}

Note: (a) Explanatory variables in columns (1), (2), and (3) enter in the estimation of the model with unobserved heterogeneity. Explanatory variables in column (3) do not enter in the estimation of the model without unobserved heterogeneity.

Parameter Estimates

Tables C1-C7 in Appendix C present the results for the joint estimation following the DFRE method, with permanent (4 mass points) and time-varying unobserved heterogeneity (4 mass points). Estimates for the initial conditions equations and the model without unobserved heterogeneity are available from the author.

Table C3 presents the estimation results for investment decisions of required retirement savings. Work experience and its squared have a statistical significant effect on some of the investment decisions, specially for safest accounts. For most of the investment decisions the value of accumulated assets at the time of making and investment decisions in the previous period are statistically significant, particularly when the individual invested in that same fund. This suggests that there is a persistence effect. Health status and family characteristics are also statistical significant.

Fit of the Model

Table 6 presents the summary statistics of the observed and simulated behavior. The simulated values are obtained using observed values of explanatory variables, with no updating of current endogenous behaviors in response to past behaviors and outcomes, and with 100 replications for the types probabilities. The standard errors are calculated using predictions based on 100 draws of the estimated coefficients from the estimated variance-covariance matrix.

Contemporaneous Marginal Effects on Investment Decisions

In this section I compare the marginal effects for the jointly estimated model and the model without individual unobserved heterogeneity. Table 7 presents the contemporaneous marginal effects (model with no updating of current endogenous behaviors in response to past behaviors and outcomes) computed at the observed values for an additional year of experience and for lagged decisions in holding optional savings and investment in the 5 alternatives of financial accounts. Standard errors are calculated using predictions based on 100 draws of the estimated coefficients from the estimated variance-covariance matrix.

The significance of the marginal effects changes when estimating the model with and without unobserved heterogeneity. Additionally, most of the marginal effects between the two models are statistical different suggesting that models that do not account for unobserved characteristics generate biased marginal effects. This corresponds to the additional information that we can get from jointly estimating this system of equations. Importantly, allowing correlation with important but typically omitted variables, such as elicited risk aversion and expected duration of life, allow us to recover neater marginal effects by helping us to better estimate the joint distribution of unobservable. For accounts B, C, and D, lagged investment in the accounts have an statistical significant effect in explaining this period investment decision. The same is observed for optional savings.

Table 6: Summary of Fit of the Model

Outcome	Observed		Simulated	
	Mean	St. Error	Mean	St. Error
Employment				
Full-time employed	0.690	0.462	0.695	0.159
Part-time employed	0.031	0.174	0.033	0.191
Not working	0.278	0.448	0.272	0.128
Occupation				
Elementary occupations	0.219	0.414	0.248	0.093
Legis., Prof., Tech., other	0.185	0.388	0.174	0.131
Clerical support workers	0.107	0.309	0.096	0.126
Service and sales workers	0.147	0.354	0.144	0.193
Agricultural, craft and trade	0.057	0.231	0.069	0.128
Operators and assemblers.	0.286	0.452	0.270	0.209
Investment				
Account A (Riskier)	0.104	0.305	0.104	0.070
Account B	0.231	0.422	0.223	0.083
Account C	0.495	0.500	0.512	0.064
Account D	0.215	0.411	0.207	0.065
Account E (Safest)	0.037	0.189	0.038	0.050
Savings outcomes				
Optional Saving	0.263	0.440	0.262	0.121
Expected Duration of Life	75.780	10.091	75.775	2.347
Elicited Risk Aversion				
Most Risk Averse	0.747	0.435	0.747	0.175
Intermediate Risk Averse	0.076	0.265	0.076	0.141
Least Risk Averse	0.177	0.381	0.176	0.155
Log of Wage	0.657	1.440	0.534	0.154
Marital status				
Married	0.571	0.495	0.575	0.028
Variation in number of children				
No change	0.788	0.408	0.784	0.052
Decrease	0.184	0.387	0.184	0.043
Increase	0.028	0.165	0.032	0.035
Medical consumption	6.697	12.639	6.681	1.564
Health status				
Very good	0.147	0.354	0.145	0.046
Good	0.519	0.500	0.521	0.157
Regular	0.266	0.442	0.268	0.179
Poor	0.068	0.252	0.066	0.141

Note: (a) Simulated values are obtained using observed values of explanatory variables, with no updating of current endogenous behaviors in response to past behaviors and outcomes, and with 100 replications for the types probabilities. (b) Bootstrapped standard errors are calculated using 100 repetitions.

Table 7: Contemporaneous Marginal Effects on Financial Investment and Savings Outcomes (%)

Variable	Current Period Decisions											
	Investment in A		Investment in B		Investment in C		Investment in D		Investment in E		Savings	
	UH	No UH	UH	No UH	With UH	No UH	UH	No UH	UH	No UH	UH	No UH
Experience	-0.312[a]	-0.463	0.099[a]	0.210	1.436***[a]	1.315***	-0.862***[a]	-0.475**	-0.016	-0.014	0.407[a]	0.441
(s.e.)	(0.373)	(0.827)	(0.152)	(0.337)	(0.119)	(0.268)	(0.172)	(0.223)	(0.137)	(0.261)	(0.375)	(0.321)
Lagged												
Investment A	13.821[a]	19.404*	0.204[a]	0.029	-3.071***[a]	-6.848***	-0.385[a]	-1.032	-1.382[a]	-1.183	3.787**[a]	4.221
(s.e.)	(8.577)	(11.008)	(1.785)	(1.835)	(0.208)	(2.230)	(1.506)	(2.062)	(1.589)	(1.442)	(1.645)	(5.082)
Investment B	0.759[a]	1.508	15.839***[a]	14.277*	-7.980***[a]	-4.747**	0.716[a]	-0.373	0.047[a]	0.096	2.120[a]	2.332
(s.e.)	(1.254)	(2.445)	(3.315)	(7.329)	(0.675)	(2.137)	(1.239)	(1.945)	(1.348)	(1.611)	(1.337)	(4.669)
Investment C	1.768[a]	2.936	3.590**[a]	2.110	6.623***[a]	7.366***	-1.127[a]	-1.945	0.136[a]	0.181	3.278**	3.281
(s.e.)	(2.437)	(3.490)	(2.170)	(2.860)	(0.804)	(2.793)	(1.685)	(2.557)	(1.491)	(1.203)	(1.582)	(4.417)
Investment D	-0.193[a]	0.814	3.972[a]	1.903	-11.844***[a]	-7.052***	10.057***[a]	5.749*	-0.339[a]	-0.539	2.555[a]	2.506
(s.e.)	(2.117)	(3.025)	(2.499)	(3.848)	(1.297)	(2.620)	(3.328)	(3.271)	(1.492)	(4.779)	(2.106)	(5.543)
Investment E	2.368[a]	4.419	6.347**[a]	5.017	-0.800[a]	1.022	-1.972[a]	-3.503	7.145[a]	7.332	2.246[a]	1.869
(s.e.)	(3.053)	(10.362)	(3.383)	(8.809)	(1.415)	(7.344)	(2.152)	(3.924)	(5.654)	(7.690)	(2.512)	(10.884)
Savings	1.094[a]	1.442	0.218[a]	0.360	-0.763***[a]	-0.478	-0.805*[a]	-0.857	-0.163[a]	-0.236	16.237***[a]	16.793***
(s.e.)	(1.272)	(1.739)	(0.477)	(0.773)	(0.243)	(0.392)	(0.429)	(0.822)	(0.622)	(0.692)	(3.787)	(4.546)

Note: (a) Marginal effects computed at the observed values. (b) Model with no updating of current endogenous behaviors in response to past behaviors and outcomes. (c) Simulated with 100 repetitions. (d) Bootstrapped standard errors are in parentheses using with 100 draws.

* Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.

[a,b,c] Difference in means test between model with and without unobserved heterogeneity significant at the 1, 5, and 10 percent level, respectively.

Correlation between Investment Decisions and Unobservable Characteristics

This section explores the cross-equation correlation in unobservable characteristics between financial investment decisions and other individual outcomes in order to further study investments. The correlation is computed for both types of unoserved heterogeneity using the estimated mass points and probability weights from the joint distribution of unobservable characteristics. There is a considerable correlation between investment decisions and the other outcomes of the model, particularly important across the permanent components.

Unobservables characteristics for individuals in the least risk averse category are positive correlated with unobservables in investments in accounts A, and B (just permanent); and negatively correlated with accounts B (time-variant), C, D, E. There is an important correlation of permanent unobservable between investment decisions in the riskier and safest funds, occupation category, and earnings. Legislators, professionals, technicians, clerical support workers, service and sales workers, and operators and assemblers are positively (negatively) correlated with investment in the riskier (safest) account, while skilled agricultural, craft and trade workers are negatively (positively) correlated with investments in the riskier (safest) account. Individuals who earn more are also more likely to investment in the riskier account and less likely to invest in the safest one. With respect to other characteristics, there is an important correlation in permanent unobservable heterogeneity between investment decisions, variations in the number of children, and health status. The correlation matrices are available from the author.

5.2 Wealth Accumulation Under Different Policy Simulations in the Chilean Private Retirement System

I this section I analyze asset accumulation under several simulated scenarios in the context of a private retirement system. I use the model as the data-generating process and simulate behaviors for 7 years. The simulated outcomes are use to update next period's endogenous explanatory variables. I replicate each individual 100 times allowing draws from the unobserved heterogeneity distribution. Every individual enters the first period with their initial observed characteristics, except when other specified. As a baseline for comparison, I use the simulated behaviors and outcomes of 100 replications of each individual, where the updating goes according to the estimated model or following the default investment path suggested by the Chilean retirement system. The baseline comparison specified in each simulation. I use a yearly model, assuming that individuals save a 10% of their annual wage (except when other specified), and accumulating assets at the annualized mean-real rate of return of investment funds for the periods October of 2002 to December of 2009. For each simulation, I compute the percentage change in accumulated assets with respect to the baseline simulation at the end of the 7th period.

Different Investment Paths

Table 8 presents the percent change in accumulated assets at the end of the 7th year under different investment paths with respect to the default. Five investment strategies are evaluated: (1) the one predicted by the model, (2) the *Riskier Default* adds one level of financial risk to the system default following the same trajectory (e.g., if the default suggest B, the riskier default uses A); (3) the *Riskier Gender-Equated* is financially more aggressive for young individuals than the current system's default and equates conditions between men and women; (4) the *All* C in which every individual invests in account C every period (no multi-accounts); and (5) the *All* E in which every individual invests in account E every period (i.e., risk-free return). Table D1 in Appendix D presents in detail the investment strategy for each simulation.

Table 8 shows the results from these simulations. Individuals are getting statistically the same asset accumulation than if they were all following the system's default investment path. The riskier default and the riskier gender-equated strategies generate statistically significant increases in asset accumulation, with means of 7.00 and 7.34 percent respectively. This is the effect of holding riskier financial positions through the life-cycle. When simulating the option with no multi-accounts, at the mean, individuals would get an statistical significant increase in asset accumulation of 0.83 percent. The percent loss of asset accumulation if everyone receives the risk-free return is significant and substantial (11.29 percent at the mean). The effect is bigger as one move forward in the asset distribution.

Policy Intervention: An Increase In Required Contributions

Currently every worker is required to contribute a 10 percent of her salary into their retirement account. I simulate four different scenarios in which individuals are required to contribute 11, 13, 15, and 20 percent of their wages. Table 9 presents the change in accumulated assets under these schedules. These are relevant results for policy makers. Even small increases in the contribution rate generate important differences in asset accumulation. An increase of the contribution rate in 1 percent generates significant increases of 2.93 percent at the mean, with bigger effects in the first quartile. An increasing the mandatory contributions of 3and 5 percent generate a statistical significant increase of 8.79 and 14.66 percent at the mean.

Fixing Not-employed Women With Children To Be Part-time Workers

In this scenario every women with children who is not working, is simulated to hold a part-time job. At the mean there is a statistical significant increase of 3.04 percent in asset

Table 8: Effect of Investment Path Through the Life-Cycle: Percentage Change in Accumulated Assets at the End of Seven Years under Simulated Life-cycle Investment Paths.

	Investment Paths				
	Predicted by Model	Riskier Default	Riskier Gender-Equated	All C	All E
	(1)	(2)	(3)	(4)	(5)
Mean	0.23	7.00***	7.34***	0.83***	-11.29***
	(2.09)	(0.45)	(0.49)	(0.25)	(1.20)
Percentile					
1%	0.02	7.09	8.28	3.53	-5.02
	(3.15)	(6.47)	(5.20)	(5.35)	(13.40)
5%	-0.57	6.60*	7.80**	2.28	-7.70
	(2.39)	(3.66)	(3.12)	(3.11)	(7.38)
10%	-0.88	5.87**	7.07***	1.29	-8.45
	(2.04)	(2.79)	(2.38)	(2.06)	(5.57)
25%	-0.92	5.44***	6.13***	-0.04	-9.58***
	(1.70)	(1.53)	(1.28)	(0.95)	(3.56)
50%	-0.84	6.54***	7.11***	-0.78*	-11.51***
	(1.86)	(0.78)	(0.73)	(0.47)	(2.24)
75%	-0.12	7.16***	8.08***	-0.10	-11.78***
	(2.12)	(0.47)	(0.61)	(0.21)	(1.36)
90%	0.36	7.33***	7.78***	1.14***	-11.62***
	(2.18)	(0.32)	(0.45)	(0.15)	(0.78)
95%	0.63	7.06***	7.46***	1.83***	-11.28***
	(2.27)	(0.30)	(0.41)	(0.16)	(0.62)
99%	1.29	7.17***	6.26***	2.64***	-10.76***
	(2.32)	(0.33)	(0.39)	(0.31)	(0.51)

Note: (a) Percentage change in accumulated assets with respect to default investment path. (b) Bootstrapped standard errors are in parentheses using with 100 draws.

* Significant at the 10 percent level; ** 5 percent level; *** 1 percent level.

Table 9: Effect of Contribution Rate: Percentage Change in Accumulated Assets at the End of Seven Years under Different Mandatory Contribution Schedules.

	Mandatory Contribution Schedule			
	$\alpha = 11\%$	$\alpha = 13\%$	$\alpha = 15\%$	$\alpha = 20\%$
	(1)	(2)	(3)	(4)
Mean	2.93***	8.79***	14.66***	29.39***
	(0.43)	(1.29)	(2.15)	(4.31)
Percentile				
1%	7.02***	21.63***	34.73**	65.71**
	(2.56)	(7.97)	(13.56)	(27.74)
5%	7.53***	22.11***	35.80***	68.88***
	(0.99)	(3.12)	(5.52)	(11.96)
10%	7.71***	22.88***	37.48***	72.34***
	(0.81)	(2.55)	(4.43)	(9.59)
25%	7.44***	22.04***	36.17***	70.18***
	(0.48)	(1.50)	(2.60)	(5.65)
50%	5.19***	15.40***	25.58***	50.36***
	(0.47)	(1.41)	(2.32)	(4.63)
75%	3.34***	10.01***	16.74***	33.56***
	(0.50)	(1.50)	(2.48)	(4.84)
90%	1.85***	5.68***	9.66***	20.27***
	(0.37)	(1.15)	(1.96)	(4.15)
95%	1.45***	4.42***	7.40***	15.29***
	(0.30)	(0.92)	(1.57)	(3.34)
99%	0.92***	2.96***	5.05***	10.48***
	(0.22)	(0.68)	(1.15)	(2.35)

Note: (a) Percentage change in accumulated assets with respect to the baseline simulation ($\alpha = 10\%$). (b) Bootstrapped standard errors are in parentheses using with 100 draws.
* Significant at the 10 percent level; ** 5 percent level; *** 1 percent level.

accumulation for women. This simulation does not affect men. The total effect at the mean (considering women and men in the system) is an statistical significant increase of 0.92 percent. Table D2 in Appendix D presents the results.

Effect of Family and Health Characteristics On Asset Accumulation

In this set of simulations I compare asset accumulation under different scenarios in family and health characteristics. For family characteristics I compare asset accumulation under three alternative scenarios: (1) every individual is married in the first period, with respect to observed initial values; (2) every individual is permanently married starting at period 2, with respect with being permanently single; and (3) every individual is first observed with an additional children, with respect to observed initial values. For health characteristics, 2 scenarios are compared: (1) an initial improvement in the individual health status and (2) a permanent improvement in health status during the 7 years starting the first period.

Asset accumulation increases by 0.65 and 2.41 percent when the individual is initially or permanently married, respectively. An additional child at period 1 has a significant negative effect on asset accumulation for the lowest percentile of the asset distribution. Asset accumulation increases by 0.59 and 2.40 percent under an initial and permanent improvement in health status, respectively.

Table D3 and D4 in Appendix D presents the results for the family and health characteristics simulation.

6 Conclusions

Theoretically there are models that predict the relationship between investment decisions, portfolio composition, individual risk aversion, and wealth accumulation. However, it is hard to account for it in empirical models of individual decisionmaking. This paper proposes a dynamic model of individual life-cycle optimization and derives a set of jointly-estimated dynamic demand equations, representing investment behavior and other wealth-related decisions; and explores the role of individual risk aversion on investment decisions. The model also incorporates observed time-varying health and family characteristics that individuals may value and may influence investment decisions. The results are used to analyze policies associated with investments in private retirement systems and wealth accumulation.

Two models are estimated: accounting and not accounting for individual unobserved heterogeneity, allowing correlation among other variables, with elicited risk aversion. There is a considerable correlation in unobservable characteristics between investment decisions and other outcomes of the model, such as risk aversion, occupation category, and earnings. The marginal effects between these two models are statistical different, suggesting that models that do not account for these typically omitted variables generate biased marginal effects. The results show that there is a persistence effect in financial investment decisions and that work experience and accumulated assets are relevant in making these decisions. Family and health characteristics are also statistically significant in explaining investment decisions.

The paper analyzes asset accumulation under several simulated scenarios in the context of a private retirement system. The simulation results show that in 7 years, slightly riskier investment strategies may increase asset accumulation by 7 percent. The paper also finds that increasing mandatory contribution rates have big impacts on asset accumulation (an increase of 3 and 5 percent generate statistical significant increase by 9 and 15 percent, respectively). Finally, allowing women with children who are currently not employed to hold a part-time job, generate a mean significant increase by 3 percent in women's asset accumulation.

This paper allows for extensions in order to analyze, in greater detail, investment decisions through an individual's life cycle. One extension consist on incorporating empirical measures that capture individual knowledge about the retirement system, information available in EPS. Another possible extension is to incorporate objective measures of expected duration of life from insurance markets and compare how close they are to the individuals' subjective measures. The objective measures are the ones being used for computing pensions and retirement incomes after an individual retires. With this extension, it is possible to understand how instruments use by policy makers affect individuals' investment decisions.

References

Arano, Kathleen, Carl Parker, and Rory Terry (2010) "Gender-based risk aversion and retirement asset allocation," *Economic Inquiry*, Vol. 48, No. 1, pp. 147–155.

Arrow, Kenneth Joseph (1965) *Aspects of the theory of risk-bearing*: Yrjö Jahnssonin Säätiö.

Bernasek, Alexandra and Stephanie Shwiff (2001) "Gender, risk, and retirement," *Journal of Economic Issues*, pp. 345–356.

Berstein, Solange (Ed.) (2010) *The Chilean Pension System*: Superintendence of Pensions, Chile.

Bommier, Antoine and Jean-Charles Rochet (2006) "Risk aversion and planning horizons," *Journal of the European Economic Association*, Vol. 4, No. 4, pp. 708–734.

Brown, Sarah, Michael Dietrich, Aurora Ortiz-Nuñez, and Karl Taylor (2011) "Self-employment and attitudes towards risk: Timing and unobserved heterogeneity," *Journal of Economic Psychology*, Vol. 32, No. 3, pp. 425–433.

Brunnermeier, Markus K and Stefan Nagel (2008) "Do Wealth Fluctuations Generate Time-Varying Risk Aversion? Micro-Evidence on Individuals Asset Allocation (Digest Summary)," *American Economic Review*, Vol. 98, No. 3, pp. 713–736.

Chakravarty, Sujoy, Glenn W Harrison, Ernan E Haruvy, and E Elisabet Rutström (2011) "Are you risk averse over other people's money?" *Southern Economic Journal*, Vol. 77, No. 4, pp. 901–913.

Chiappori, Pierre-André and Monica Paiella (2011) "Relative risk aversion is constant: Evidence from panel data," *Journal of the European Economic Association*, Vol. 9, No. 6, pp. 1021–1052.

Cramer, Jan S, Joop Hartog, Nicole Jonker, and C Mirjam Van Praag (2002) "Low risk aversion encourages the choice for entrepreneurship: an empirical test of altruism," *Journal of economic behavior & organization*, Vol. 48, No. 1, pp. 29–36.

Eckel, Catherine C and Philip J Grossman (2008) "Forecasting risk attitudes: An experimental study using actual and forecast gamble choices," *Journal of Economic Behavior & Organization*, Vol. 68, No. 1, pp. 1–17.

Ekelund, Jesper, Edvard Johansson, Marjo-Riitta Järvelin, and Dirk Lichtermann (2005) "Self-employment and risk aversionevidence from psychological test data," *Labour Economics*, Vol. 12, No. 5, pp. 649–659.

Grazier, Suzanne and Peter J Sloane (2008) "Accident risk, gender, family status and occupational choice in the UK," *Labour Economics*, Vol. 15, No. 5, pp. 938–957.

Harrison, Glenn W, Morten I Lau, and E Elisabet Rutström (2007) "Estimating risk attitudes in denmark: A field experiment*," *The Scandinavian Journal of Economics*, Vol. 109, No. 2, pp. 341–368.

Hartog, Joop, Ada Ferrer-i Carbonell, and Nicole Jonker (2002) "Linking measured risk aversion to individual characteristics," *Kyklos*, Vol. 55, No. 1, pp. 3–26.

Holt, Charles A and Susan K Laury (2014) "Assessment and estimation of risk preferences," *Handbook of the economics of risk and uncertainty*, Vol. 1, pp. 135–201.

Johnson, Johnnie EV and Philip L Powell (1994) "Decision making, risk and gender: Are managers different?" *British Journal of Management*, Vol. 5, No. 2, pp. 123–138.

Le, Anh T, Paul W Miller, Wendy S Slutske, and Nicholas G Martin (2011) "Attitudes towards economic risk and the gender pay gap," *Labour economics*, Vol. 18, No. 4, pp. 555–561.

Lupton, Joseph P (2003) "Household portfolio choice and habit liability: evidence from panel data," *Unpublished. AQ–Is there a Federal Reserve Working Paper number.*

Mroz, Thomas A (1999) "Discrete factor approximations in simultaneous equation models: Estimating the impact of a dummy endogenous variable on a continuous outcome," *Journal of Econometrics*, Vol. 92, No. 2, pp. 233–274.

Mroz, Thomas Alvin and David K Guilkey (1992) "Discrete factor approximation for use in simultaneous equation models with both continuous and discrete endogenous variables.."

Nelson, Julie A (2014) "Are Women Really More Risk-Averse than Men? A Re-Analysis of the Literature Using Expanded Methods," *Journal of Economic Surveys*.

Pratt, John W (1964) "Risk aversion in the small and in the large," *Econometrica: Journal of the Econometric Society*, pp. 122–136.

Ravina, Enrichetta (2005) "Habit persistence and keeping up with the Joneses: evidence from micro data."

Schubert, Renate, Martin Brown, Matthias Gysler, and Hans Wolfgang Brachinger (1999) "Financial decision-making: are women really more risk-averse?" *American Economic Review*, pp. 381–385.

Appendix

A Construction of the Measure of Elicited Risk Aversion

This paper uses an individual index of risk aversion that ranks individuals according to their risk attitudes. Individual risk attitude can be derived from the EPS dataset based on a set of questions that involve hypothetical gambles over lifetime income. It follows the lottery choice menu approach. The set of questions is slightly different in the first wave, but the same in waves 2, 3, and 4. However, since some hypothetical scenarios are the same for all waves, it is possible to construct a comparable risk attitude measure at each wave.

The first question asks:

> *Suppose that you are the only income earner in the household. You need to choose between two jobs. Which option do you prefer? (Option A) a job with a lifetime-stable and certain salary or (Option B) a job where you have the same chances of doubling your lifetime income or earning only* 1/4 *of your lifetime income.*[7]

In the first wave, instead of "earning only 1/4 of your lifetime income" the survey proposes "decreasing up to 75%" These two are mathematically equivalent. However some argue that there could be a bias in the answer when using the two settings since individuals could have different aversions to loss (Kahneman and Tversky, 1979). This does not present an issue in this paper since the first wave is only used to set the initial conditions and elicited risk aversion from the first wave does not enter the model.

[7]The questions presented in this section where translated from their original wording in Spanish.

If the answer to the question is "option A", the interviewer continues.

> *Now what do you prefer? (Option A) a job with a lifetime-stable and certain salary or (Option B) a job where you have the same chances of doubling your lifetime income or earning only half of your lifetime income.*

In the first wave, this question is asked to every individual regardless of the previous answer. For constructing the risk attitude index, this category is created only for those individuals who answered "option A" in the first question.

B Definition of variables

Employment category (e_t): 0 = non-employed, 1 = working part-time, and 2 = working full-time. Full-and part-time categories depend on the reported weekly hours typically worked in period t. More than 20 hours a week is considered full-time.

Occupation category (o_t): $\{1, 2, ..., 6\}$ based on a regrouping of the 1-digit ISCO classification in period t. 1 = Elementary occupations, 2 = Legislators, senior officials and managers, professionals, technicians and associate professionals. 3 = Clerical support workers. 4 = Service and sales workers. 5 = Skilled agricultural, forestry and fishery workers, craft and related trade workers. 6 = Plant and machine operators and assemblers.

Investment category (i_t): This is a set of five variables: $(i_t^A, i_t^B, i_t^C, i_t^D, i_t^E)$. Each of these variables take 1 of 2 values, $\{0, 1\}$, where 0 represents no investment in that account and 1 represents investment in that account. It is based on all the investment options that an individual affiliated with the retirement system in Chile has. Each variable reflects participation in each of the available accounts. Participation in account A is represented by i_t^A and it is the riskier account. participation in account B is represented by i_t^C, in C by i_t^C, in D by i_t^D, and in E, the safest investment, by i_t^E. The retirement system offers five accounts (A, B, C, D, E). An individual may chose to invest in one or in two accounts. The 5 different accounts where introduced in August of 2002. Before that there where 2 accounts (Account C, and Account E). Account E was introduced in May of 2000 and Account C was the only account since December of 1980 until the introduction of the new ones. When the individual did not report a fund, the legal default account, according to the individual's gender and age, was assigned.

Optional savings (s_t): Dichotomous variable that takes the value 1 if an individual reports to have any optional savings in period t and 0 otherwise.

Accumulated required assets (A_t^r): Amount of private savings accumulated in the retirement system. Computed from Administrative data from the Superintendence of Pensions, based on investing 10% of individual's wage every month, in the account of choice reported in EPS from 2002 onwards. When the individual did not report a fund, the legal default account, according to the individual's gender and age, was assigned. Between May of 2000 and August of 2002, when two accounts are available, investments are accumulated using the mean return of the two accounts. In thousand of dollars of 2009.

Work experience (E_t): Years of labor experience since 1980.

Wage (w_t): Hourly wage, measured by the reported after taxes (and legal deductions) monthly wage divided by 4 times the reported weekly hours typically worked. In 2009 dollars.

Marital status (m_t): Takes 1 if the individual reports to be married in period t and 0 otherwise.

Marital history (M_t): May include lagged marital state, number of marriages and cohabitations, and duration of most recent marriage state.

Changes in number of children (n_t): Takes 1 of 3 values which represent changes in the total number of children of 18 years-old or younger in period t (total number refers to children in and outside the household). 0 = no change in the number of children, -1 = decrease in the number of children, 1 = increase in the number of children.

Children history (N_t): May include birth last period, total number of children and ages of each child.

Number of medical visits (k_t): Reported number of medical visits of the individual in period t.

Health status (H_t): Takes 1 of 4 values, $\{1, ..., 4\}$ where 1 = very good, 2 = good, 3 = fair, 4 = poor.

Expected Duration of Life (T_t^e): Reported expected duration of life in years (reported expected age of death) at the beginning of period t.

Elicited Risk Aversion (r_t): Takes 1 of 3 values based on the answers to hypothetical gambles. 1 being the most risk averse category and 3 the least risk averse category. At the beginning of period t.

Other characteristics (X_t):

Age: Reported age.

Gender: Reported gender.

Education: Education category. It takes four categories: Less than High School, High School, Technical College, and College and Some Post College.

Region of residence: Set of dummy variables based on the reported region of residence. Using the old Chilean administrative division which labels regions from 1 to 13 for 2002, 2004, and 2006. Using the new Chilean administrative division which labels region from 1 to 15 for 2009. Used for geographical classification for exclusion restrictions. When region of residence is missing, region of place of work if working is used.

Other variables:

Market characteristics (Z_t):

Z_t^E**:** It includes: Unemployment rate by region of residence.

Z_t^M**:** It includes: Number of marriages in a year per 1,000 people by region of residence, Mean college tuition in 2009 dollars by region of residence.

Z_t^N**:** It includes: Number of marriages in a year per 1,000 people by region of residence, Mean college tuition in 2009 dollars by region of residence.

Z_t^K**:** It includes: Number of beds available per 1,000 people of residence, Number of medical doctors available per 1,000 people by region of residence.

Z_t^H**:** It includes: Inches of rainfall in a year by region of residence.

Time trend: 0 in 2002, 2 in 2004, 4 in 2006, and 7 in 2009.

C Estimation Results: Parameter Estimates for the Model with Individual Unobserved Heterogeneity

Table C1: Estimation Results: Multinomial Logit on Employment Status (relative to work full-time) with Unobserved Heterogeneity

Variable	Part-Time			Not Working		
	Coeff.	St.Er.		Coeff.	St.Er.	
Work Experience	-0.065	0.021	***	-0.078	0.011	***
Experience Squared	0.001	0.001		-0.001	0.000	***
Lagged Investment in A	-0.164	0.340		-0.077	0.098	
Lagged Investment in B	-0.089	0.293		-0.100	0.081	
Lagged Investment in C	-0.093	0.311		-0.100	0.079	
Lagged Investment in D	-0.043	0.325		0.051	0.094	
Lagged Investment in E	0.265	0.483		-0.047	0.139	
Lagged Assets	-0.042	0.006	***	-0.002	0.002	
Lagged Optional Savings	-0.148	0.097		-0.143	0.049	***
Lagged Marital Status	-0.399	0.138	***	-0.249	0.069	***
Number of Children	-0.052	0.075		-0.078	0.035	**
Interaction Female-Married	0.519	0.174	***	0.698	0.092	***
Interaction Female-Children	0.140	0.085	*	0.233	0.043	***
Health: Very good	-0.007	0.126		0.003	0.066	
Health: Fair	0.083	0.099		0.328	0.050	***
Health: Poor	0.455	0.172	***	1.005	0.088	***
Age	0.126	0.064	**	0.162	0.029	***
Age Squared	-0.044	0.033		-0.072	0.015	***
Age Cubic	0.006	0.005		0.014	0.002	***
Female	0.619	0.147	***	0.602	0.077	***
High School	-0.276	0.107	***	-0.486	0.052	***
Technical College	-0.221	0.168		-1.031	0.093	***
College	-0.106	0.849		-1.581	0.347	***
Unemployment rate	-0.017	0.025		0.033	0.012	***
Number of hospital beds	0.201	0.201		-0.087	0.092	
Number of doctors	1.174	0.512	**	0.191	0.213	
Number of marriages	0.166	0.212		0.272	0.082	***
Inches of rainfall	0.010	0.004	**	0.006	0.002	***
College tuition	0.093	0.091		-0.063	0.045	
Missing: Number of Children	0.189	0.871		-0.317	0.194	
Missing: Education	-0.261	0.785		-0.176	0.317	
Time trend	0.086	0.066		0.065	0.019	***
Constant	-6.321	0.916	***	-2.654	0.406	***
Permanent Unob. Het.	-0.543	0.258	**	-1.229	0.124	***
Permanent Unob. Het.	0.395	0.154	**	0.883	0.091	***
Permanent Unob. Het.	-0.499	0.176	***	-1.399	0.120	***
Time-varying Unob. Het.	0.297	0.140	**	0.028	0.064	
Time-varying Unob. Het.	0.678	0.310	**	1.637	0.409	***
Time-varying Unob. Het.	0.312	0.177	*	-0.146	0.095	

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

Table C2: Estimation Results: Multinomial Logit on Occupation Category (relative to Elementary occupation) with Unobserved Heterogeneity

Variable	Prof and Tech			Clerical Support			Service and Sales			Agricultural and Craft			Plant and Machine		
	Coeff.	St.Er.		Coeff.	St.Er.		Coeff.	St.Er.		Coeff.	St.Er.		Coeff.	St.Er.	
xexperience	-0.072	0.029	**	-0.013	0.031		-0.058	0.024	**	-0.003	0.029		-0.014	0.029	
Experience Squared	0.001	0.001		0.000	0.001		0.001	0.001	*	0.002	0.001	**	0.000	0.001	
Lagged Investment in A	-0.108	0.205		-0.078	0.200		0.000	0.209		-0.134	0.251		-0.161	0.191	
Lagged Investment in B	-0.118	0.157		0.174	0.155		0.334	0.156	**	-0.001	0.204		-0.083	0.150	
Lagged Investment in C	-0.401	0.160	**	-0.016	0.157		0.063	0.158		-0.347	0.206	*	-0.245	0.147	*
Lagged Investment in D	-0.241	0.220		-0.124	0.218		-0.149	0.215		-0.026	0.232		-0.196	0.196	
Lagged Investment in E	-0.568	0.373		-0.310	0.386		0.348	0.316		-0.404	0.379		-0.237	0.275	
Lagged Assets	0.051	0.004	***	0.054	0.004	***	0.041	0.004	***	-0.004	0.006		0.028	0.004	***
Lagged Optional Savings	0.317	0.085	***	0.135	0.089		-0.007	0.089		0.118	0.104		-0.191	0.085	**
Lagged Marital Status	0.401	0.174	**	0.591	0.171	***	0.137	0.177		0.068	0.120		0.192	0.133	
Number of Children	-0.077	0.063		-0.162	0.068	**	0.012	0.065		-0.111	0.053	**	0.104	0.049	**
Interaction Female-Married	0.134	0.259		-0.390	0.245		0.098	0.258		0.471	0.249	*	-0.210	0.243	
Interaction Female-Children	-0.030	0.086		0.083	0.089		-0.133	0.088		0.226	0.102	**	-0.239	0.089	***
Health: Very good	0.236	0.115	**	0.042	0.119		0.121	0.119		0.077	0.135		-0.092	0.111	
Health: Fair	-0.265	0.115	**	-0.072	0.114		-0.078	0.110		0.079	0.102		-0.067	0.098	
Health: Poor	-0.151	0.446		0.042	0.406		0.121	0.372		0.076	0.227		-0.171	0.305	
Age	0.010	0.025		-0.080	0.026	***	-0.054	0.023	**	-0.046	0.026	*	0.013	0.025	
Age Squared	0.002	0.006		0.010	0.006		0.011	0.005	**	0.006	0.006		-0.003	0.006	
Female	-0.227	0.180		0.324	0.174	*	0.752	0.184	***	-1.039	0.202	***	-2.275	0.175	***
High School	2.656	0.115	***	2.778	0.118	***	1.558	0.109	***	-0.503	0.121	***	1.075	0.105	***
Technical College	6.471	0.275	***	4.494	0.291	***	2.771	0.269	***	-0.271	0.477		1.523	0.285	***
College	8.027	0.602	***	5.560	0.710	***	3.578	0.732	***	1.209	1.048		1.302	0.867	
Unemployment rate	0.027	0.025		0.021	0.027		-0.025	0.024		0.018	0.026		0.061	0.025	**
Number of hospital beds	-0.136	0.206		-0.199	0.223		-0.275	0.202		-0.217	0.212		-0.058	0.195	
Number of doctors	0.743	0.392	*	0.446	0.467		1.156	0.412	***	-1.558	0.536	***	0.418	0.417	
Number of marriages	0.063	0.173		0.423	0.183	**	0.323	0.164	**	-0.620	0.195	***	0.253	0.161	
Inches of rainfall	0.001	0.005		0.004	0.005		-0.003	0.004		0.027	0.005	***	0.005	0.004	
College tuition	0.204	0.089	**	0.439	0.094	***	0.006	0.089		-0.765	0.102	***	0.164	0.090	*
Missing: Number of Children	-0.084	0.308		-0.235	0.356		-0.586	0.356	*	0.081	0.523		0.181	0.332	
Missing: Education	4.686	0.538	***	3.454	0.633	***	2.151	0.613	***	-11.427	1.186	***	1.692	0.642	***
Time trend	0.023	0.038		-0.041	0.038		-0.026	0.037		-0.006	0.048		0.038	0.035	
Constant	-2.650	0.696	***	-5.162	0.770	***	-2.541	0.696	***	4.692	0.814	***	0.597	0.660	
Permanent Unob. Het.	-1.440	0.193	***	1.370	0.232	***	-1.106	0.222	***	-1.406	0.339	***	-4.461	0.168	***
Permanent Unob. Het.	-3.777	0.259	***	-1.824	0.269	***	-0.729	0.209	***	0.755	0.248	***	-4.240	0.144	***
Permanent Unob. Het.	1.585	0.228	***	1.103	0.307	***	3.710	0.217	***	-1.595	0.547	***	-3.281	0.253	***
Time-varying Unob. Het.	0.005	0.117		-0.037	0.118		-0.034	0.117		-0.004	0.131		-0.163	0.109	
Time-varying Unob. Het.	1.171	0.330	***	0.358	0.361		0.887	0.344	***	0.453	0.501		0.311	0.327	
Time-varying Unob. Het.	0.709	0.176	***	0.477	0.180	***	0.211	0.183		-0.294	0.227		-0.068	0.175	

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

Table C3: Estimation Results: Logit on Investment and Savings Decisions (relative to not invest in that account or relative to not hold optional savings) with Unobserved Heterogeneity

Variable	Logit 1		Logit 2		Logit 3		Logit 5		Logit 5		Logit 6	
	Account A		Account B		Account C		Account D		Account E		Savings	
	Coeff.	St.Er.	Coeff.	St.Er.	Coeff.	St.Er.	Coeff.	St.Er.	Coeff.	St.Er.	Coeff.	St.Er.
Work Experience	0.053	0.024**	0.001	0.012	-0.115	0.017***	0.068	0.014***	0.033	0.020*	-0.007	0.009
Experience Squared	-0.002	0.001***	0.000	0.000	0.004	0.001***	-0.003	0.000***	-0.001	0.001	0.000	0.000
Lagged Investment in A	2.507	0.177***	0.020	0.104	-0.424	0.230**	-0.058	0.141	-0.465	0.202**	0.203	0.068***
Lagged Investment in B	0.246	0.176	1.325	0.088***	-1.123	0.190***	0.103	0.117	0.013	0.150	0.116	0.056**
Lagged Investment in C	0.559	0.194***	0.344	0.088***	0.889	0.175***	-0.168	0.111	0.039	0.137	0.180	0.055***
Lagged Investment in D	-0.067	0.342	0.369	0.114***	-1.739	0.264***	1.210	0.130***	-0.100	0.162	0.138	0.071*
Lagged Investment in E	0.672	0.481	0.570	0.158***	-0.110	0.354	-0.305	0.201	1.255	0.179***	0.121	0.103
Lagged Assets	0.015	0.003***	0.013	0.002***	0.002	0.002	-0.009	0.002***	0.007	0.003***	0.006	0.001***
Lagged Optional Savings	0.365	0.112***	0.021	0.053	-0.106	0.092	-0.119	0.069*	-0.047	0.087	0.825	0.034***
Lagged Marital Status	0.338	0.189*	0.068	0.074	-0.173	0.122	0.016	0.097	0.226	0.120*	0.074	0.050
Number of Children	-0.049	0.067	0.013	0.034	-0.275	0.054***	0.210	0.046***	-0.102	0.058*	0.001	0.023
Interaction Female-Married	-0.289	0.288	-0.139	0.102	0.165	0.174	0.040	0.130	-0.146	0.164	-0.061	0.070
Interaction Female-Children	0.048	0.103	-0.002	0.046	0.655	0.078***	-0.426	0.063***	0.134	0.075*	-0.042	0.032
Health: Very good	0.146	0.138	-0.168	0.066**	0.228	0.115*	-0.022	0.092	0.121	0.109	0.001	0.046
Health: Fair	-0.116	0.155	-0.074	0.062	-0.004	0.101	0.046	0.073	0.060	0.093	-0.077	0.041*
Health: Poor	0.239	0.312	-0.394	0.131***	-0.030	0.184	0.221	0.125*	-0.106	0.171	-0.201	0.081**
Age	0.311	0.033***	-0.347	0.013***	1.207	0.041***	-0.208	0.018	0.035	0.021*	-0.061	0.009***
Age Squared	-0.095	0.007***	0.053	0.003***	-0.318	0.010***	0.104	0.004	-0.006	0.005	0.008	0.002***
Female	-0.314	0.238	0.062	0.084	-1.257	0.152***	1.085	0.110	0.167	0.139	0.131	0.057**
High School	0.705	0.155***	0.261	0.057***	-0.239	0.096**	-0.104	0.072	0.139	0.094	0.294	0.038***
Technical College	1.391	0.199***	0.562	0.086***	-0.798	0.170***	-0.402	0.116	-0.032	0.149	0.529	0.057***
College	1.911	0.427***	0.717	0.210***	-1.079	0.642*	-0.647	0.362	-0.076	0.719	0.893	0.135***
Unemployment rate	0.079	0.027***	0.015	0.014	0.023	0.023	0.013	0.017	0.006	0.022	-0.016	0.010*
Number of hospital beds	-0.135	0.233	-0.004	0.110	0.278	0.197	-0.001	0.137	0.380	0.166**	0.049	0.069
Number of doctors	-0.052	0.496	-0.442	0.326	0.223	0.510	-0.562	0.347	-1.065	0.382***	0.152	0.150
Number of marriages	0.433	0.196**	-0.108	0.134	-0.427	0.162***	-0.111	0.133	-0.107	0.151	0.037	0.062
Inches of rainfall	0.015	0.004***	0.005	0.003*	-0.009	0.004***	-0.005	0.003	-0.002	0.004	0.005	0.002***
College tuition	-0.517	0.107***	-0.107	0.054**	0.257	0.081***	-0.121	0.064	-0.421	0.078***	0.043	0.034
Missing: Number of Children	0.424	0.357	-0.132	0.155	-0.490	0.378	-0.053	0.261	-0.278	0.385	-0.071	0.112
Missing: Education	0.892	0.815	-0.369	0.650	0.018	0.715	-0.872	0.538	0.354	0.711	0.665	0.197***
Time trend	-0.268	0.041***	-0.217	0.023***	-0.024	0.038	-0.056	0.026	-0.116	0.034***	0.008	0.014
Constant	-7.674	0.924***	1.951	0.769**	-2.374	0.724***	-4.353	0.690	-4.342	0.703***	-1.297	0.283***
Permanent Unob. Het.	0.176	0.191	0.195	0.086**	-0.425	0.163***	-0.027	0.117	0.048	0.150	-0.057	0.059
Permanent Unob. Het.	-0.500	0.198**	-0.258	0.081***	0.096	0.143	0.157	0.103	0.399	0.124***	-0.356	0.052***
Permanent Unob. Het.	0.111	0.181	-0.146	0.090	-0.198	0.162	0.126	0.114	0.068	0.151	-0.091	0.056
Time-varying Unob. Het.	2.051	0.210***	2.987	0.087***	-7.760	0.290***	3.405	0.124	2.794	0.267***	0.042	0.047
Time-varying Unob. Het.	2.438	0.308***	1.872	0.175***	-5.302	0.357***	2.142	0.213	1.399	0.521***	-0.142	0.113
Time-varying Unob. Het.	9.663	0.337***	1.132	0.198***	-21.710	27.740	-4.549	0.462	2.718	0.310***	0.172	0.066***

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

Table C4: Estimation Results: Subjective Assessments as Endogenous Valuations with Unobserved Heterogeneity

Variable	Elicited Risk Aversion (relative to Most)						Expected Duration of Life		
	Intermediate			Least					
	Coeff.	St.Er.		Coeff.	St.Er.		Coeff.	St.Er.	
Work Experience	0.024	0.015	*	-0.019	0.011	*	0.018	0.013	
Experience Squared	-0.001	0.001		0.001	0.000				
Lagged Investment in A	0.098	0.117		0.123	0.084		-0.158	0.503	
Lagged Investment in B	-0.021	0.098		0.002	0.071		0.402	0.357	
Lagged Investment in C	0.072	0.094		-0.028	0.072		0.338	0.361	
Lagged Investment in D	0.052	0.117		-0.044	0.089		0.435	0.539	
Lagged Investment in E	-0.390	0.200	*	-0.026	0.124		0.284	0.685	
Lagged Assets	0.001	0.002		-0.001	0.002		0.005	0.006	
Lagged Optional Savings	0.029	0.060		-0.002	0.042		0.526	0.172	***
Lagged Marital Status	0.058	0.080		-0.006	0.055		0.785	0.310	**
Number of Children	0.001	0.038		0.016	0.026		0.145	0.108	
Interaction Female-Married	0.046	0.114		0.062	0.081		-0.766	0.467	
Interaction Female-Children	-0.036	0.054		-0.032	0.037		-0.195	0.151	
Health: Very good	0.115	0.076		0.186	0.052	***	1.253	0.220	***
Health: Fair	0.024	0.067		0.046	0.048		-2.485	0.192	***
Health: Poor	-0.176	0.129		-0.075	0.091		-5.987	0.402	***
Age	-0.006	0.005		-0.010	0.003	***	-0.120	0.042	***
Age Squared							0.055	0.010	***
Female	-0.090	0.096		-0.370	0.067	***	-0.657	0.350	*
High School	0.011	0.068		0.109	0.045	**	0.513	0.191	***
Technical College	0.175	0.102	*	0.283	0.067	***	1.662	0.353	***
College	-0.111	0.613		0.267	0.185		1.735	0.693	**
Unemployment rate	-0.022	0.016		-0.020	0.011	*	-0.182	0.047	***
Number of hospital beds	0.346	0.118	***	0.202	0.091	**	0.164	0.431	
Number of doctors	0.519	0.295	*	0.078	0.302		0.942	0.677	
Number of marriages	-0.281	0.123	**	-0.212	0.126	*	-0.867	0.335	***
Inches of rainfall	-0.015	0.003	***	-0.007	0.002	***	-0.030	0.009	***
College tuition	0.077	0.057		0.104	0.045	**	0.328	0.157	**
Missing: Number of Children	-0.295	0.214		0.106	0.125		0.968	0.556	*
Missing: Education	0.720	0.595		0.423	0.334		0.102	1.000	
Time trend	0.045	0.024	*	0.012	0.020		0.084	0.082	
Constant	-2.805	0.626	***	-0.895	0.741		52.038	1.014	***
Permanent Unob. Het.	-0.152	0.100		-0.200	0.070	***	1.337	0.437	***
Permanent Unob. Het.	-0.059	0.085		-0.275	0.062	***	0.060	0.367	
Permanent Unob. Het.	0.081	0.096		0.154	0.064	**	0.222	0.421	
Time-varying Unob. Het.	0.135	0.079	*	-0.049	0.054		0.135	0.223	
Time-varying Unob. Het.	0.000	0.170		0.065	0.115		1.281	0.788	
Time-varying Unob. Het.	0.321	0.108	***	0.169	0.074	**	0.276	0.474	

* Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.

Table C5: Estimation Results: Wage equation with Unobserved Heterogeneity

Variable	Log of Wage		
	Coeff.	St.Er.	
Work Experience	0.006	0.003	*
Experience Squared	0.000	0.000	
Legislators	0.561	0.022	***
Clerical	0.339	0.022	***
Service and Sales	0.118	0.023	***
Agricultural	-0.079	0.023	***
Plant Operators	-0.042	0.021	**
Health: Very good	0.060	0.013	***
Health: Fair	-0.107	0.013	***
Health: Poor	-0.196	0.026	***
Number of Children	0.003	0.007	
Lagged Marital Status	0.092	0.011	***
Age	0.001	0.001	
Female	-0.196	0.013	***
High School	0.257	0.012	***
Technical College	0.686	0.021	***
College	0.875	0.040	***
Missing: Occupation	0.139	0.044	***
Unemployment rate	-0.003	0.003	
Missing: Education	0.365	0.059	***
Missing: Number of Children	0.000	0.031	
Constant	0.572	0.039	***
Permanent Unob. Het.	-0.263	0.028	***
Permanent Unob. Het.	-0.411	0.024	***
Permanent Unob. Het.	-0.314	0.029	***
Time-varying Unob. Het.	0.039	0.014	***
Time-varying Unob. Het.	-10.294	0.039	**
Time-varying Unob. Het.	0.180	0.019	***

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

Table C6: Estimation Results: Marital Status, and Variation in number of Children with Unobserved Heterogeneity

Variable	Marital Status (relative to married)			Children variation (relative to no change)					
				Decrease			Increase		
	Coeff.	St.Er.		Coeff.	St.Er.		Coeff.	St.Er.	
Duration of marriage	-0.025	0.004	***	0.066	0.004	***	-0.098	0.014 -6.858	***
Lagged Marital Status	-4.382	0.106	***	-1.133	0.115	***	0.798	0.195 4.099	***
Number of Children	-0.258	0.035	***	1.161	0.032	***	0.691	0.065 10.559	***
Interaction Female-Married	-0.097	0.106		-0.316	0.095	***	-0.076	0.213 -0.357	
Interaction Female-Children	0.100	0.048	**	0.177	0.041	***	-0.035	0.098 -0.359	
Full-Time employed	-0.047	0.071		0.297	0.060	***	0.554	0.194 2.861	***
Part-Time employed	-0.029	0.153		0.254	0.127	**	0.148	0.463 0.319	
Age	0.063	0.028	**	0.515	0.017	***	-0.153	0.025 -6.263	***
Age Squared	-0.037	0.017	**	-0.113	0.004	***	0.006	0.009 0.681	
Age Cubic	0.006	0.003	**						
Female	0.357	0.090	***	0.263	0.098	***	0.005	0.211 0.022	
High School	0.016	0.060		-0.078	0.049		0.202	0.118 1.711	*
Technical College	-0.079	0.092		-0.131	0.080	*	0.068	0.187 0.365	
College	-0.452	0.159	***	-0.075	0.127		0.037	0.583 0.064	
Number of marriages	-0.317	0.085	***						
College tuition				-0.001	0.039		-0.217	0.087 -2.484	***
Missing: Marriage Duration	-0.082	0.441		1.595	0.443	***	-0.026	0.988 -0.026	
Missing: Number of Children	-0.641	0.158	***						
Missing: Education	-0.374	0.553		0.114	0.426		0.941	0.893 1.054	
Constant	3.257	0.388	***	-8.618	0.261	***	-2.371	0.463 -5.117	***
Permanent Unob. Het.	0.184	0.093	**	-0.107	0.079		-0.053	0.200 -0.265	
Permanent Unob. Het.	0.016	0.078		0.041	0.064		-0.112	0.206 -0.546	
Permanent Unob. Het.	0.045	0.093		-0.099	0.076		-0.183	0.198 -0.923	
Time-varying Unob. Het.	0.015	0.089		-0.011	0.079		-0.199	0.212 -0.936	
Time-varying Unob. Het.	-1.795	0.352	***	0.866	0.319	***	3.972	0.439 9.044	***
Time-varying Unob. Het.	-0.043	0.130		0.254	0.105	**	-0.072	0.271 -0.266	

* Significant at the 10 percent level.

** Significant at the 5 percent level.

*** Significant at the 1 percent level.

Table C7: Estimation Results: Medical Consumption and Health status with Unobserved Heterogeneity

Variable	Medical Consumption			Health Status (relative to very good)								
				Good			Regular			Poor		
	Coeff.	St.Er.		Coeff.	St.Er.		Coeff.	St.Er.		Coeff.	St.Er.	
Health: Very good	-1.047	0.246	***	-0.528	0.060	***	-0.789	0.084	***	-0.889	0.203	***
Health: Fair	4.887	0.207	***	0.289	0.081	***	1.526	0.084	***	1.845	0.122	***
Health: Poor	15.679	0.424	***	0.678	0.329	**	2.353	0.322	***	4.108	0.333	***
Number of Medical Visits				0.010	0.003	***	0.022	0.004	***	0.027	0.004	***
Work Experience				0.003	0.005		-0.004	0.006		-0.005	0.008	
Legislators				-0.296	0.142	**	-0.442	0.175	**	-0.288	0.330	
Clerical				-0.025	0.143		0.007	0.172		0.282	0.352	
Service and Sales				0.011	0.156		-0.090	0.187		0.084	0.322	
Agricultural				-0.165	0.178		-0.244	0.204		-0.191	0.342	
Plant Operators				0.062	0.141		-0.018	0.163		0.208	0.264	
Age	-0.048	0.040		0.034	0.014	**	0.084	0.017	***	0.163	0.032	***
Age Squared	0.019	0.009	**	-0.004	0.003		-0.009	0.004	**	-0.021	0.007	***
Female	4.149	0.177	***	0.170	0.064	***	0.379	0.075	***	0.618	0.115	***
High School	1.370	0.198	***	-0.098	0.066		-0.537	0.077	***	-0.693	0.121	***
Technical College	2.881	0.378	***	-0.214	0.105	**	-0.924	0.139	***	-1.301	0.274	***
College	3.974	0.943	***	-0.489	0.253	*	-1.445	0.520	***	-1.873	0.826	**
Number of hospital beds	-0.038	0.299										
Number of doctors	0.550	0.671										
Inches of rainfall				0.001	0.002		0.006	0.002	**	0.003	0.004	
Missing: Occupation				-0.096	0.327		-0.341	0.438		-0.405	0.691	
Missing: Education	2.248	1.000	**	-0.201	0.492		-0.657	0.712		-0.766	0.922	
Not employed				0.123	0.333		0.254	0.448		0.713	0.686	
Constant	1.537	0.882	*	0.869	0.200	***	-0.946	0.244	***	-4.435	0.508	***
Permanent Unob. Het.	-0.302	0.413		-0.079	0.139		-0.130	0.168		-0.220	0.294	
Permanent Unob. Het.	-0.201	0.480		0.072	0.118		0.409	0.136	***	0.749	0.206	***
Permanent Unob. Het.	-0.657	0.434		0.075	0.137		0.093	0.169		0.296	0.288	
Time-varying Unob. Het.	0.215	0.340		-0.068	0.075		-0.055	0.090		0.009	0.150	
Time-varying Unob. Het.	-1.633	0.699	***	1.084	1.442		1.105	1.442		1.624	1.670	
Time-varying Unob. Het.	0.947	0.598		-0.095	0.103		-0.273	0.126	**	-0.325	0.210	

* Significant at the 10 percent level. ** Significant at the 5 percent level. *** Significant at the 1 percent level.

D Additional Tables

Table D1: Investments Paths For Retirement Asset Accumulation Simulations

Investment Path	Portfolio Composition		
	Investment	Men	Women
System's Default	Account A	—	—
	Account B	age$\leq$ 35	age$\leq$ 35
	Account C	$36 \leq$ age ≤ 55	$36 \leq$ age ≤ 50
	Account D	age$\geq$ 56	age$\geq$ 51
	Account E	—	—
Riskier Default	Account A	age$\leq$ 35	age$\leq$ 35
	Account B	$36 \leq$ age ≤ 55	$36 \leq$ age ≤ 50
	Account C	age$\geq$ 56	age$\geq$ 51
	Account D	—	—
	Account E	—	—
Riskier Gender-Equated	Account A	age$\leq$ 45	age$\leq$ 45
	Account B	$46 \leq$ age ≤ 55	$46 \leq$ age ≤ 55
	Account C	$56 \leq$ age ≤ 60	$56 \leq$ age ≤ 60
	Account D	age$\geq$ 61	age$\geq$ 61
	Account E	—	—
All C	Account A	—	—
(no multi-accounts)	Account B	—	—
	Account C	all ages	all ages
	Account D	—	—
	Account E	—	—
All E	Account A	—	—
(risk-free return)	Account B	—	—
	Account C	—	—
	Account D	—	—
	Account E	all ages	all ages

Table D2: Percentage change in accumulated assets at the end of seven years fixing not-employed women with children to be part-time workers, with respect to the updated evolution of the model with no policy changes

	Fixing Mothers to Work Part-Time when Not-employed		
	Total	Women	Men
Mean	0.92*	3.04*	–
	(0.47)	(1.77)	
Percentile			
1%	58.23	71.36	–
	(43.35)	(79.49)	
5%	31.61	58.66	–
	(22.22)	(45.10)	
10%	16.10	38.11	–
	(13.08)	(30.07)	
25%	5.17	15.51	–
	(3.75)	(12.49)	
50%	1.32*	6.26	–
	(0.79)	(4.25)	
75%	0.34*	2.19	–
	(0.18)	(1.46)	
90%	0.12	0.73	–
	(0.08)	(0.47)	
95%	0.00	0.37	–
	(0.06)	(0.26)	
99%	-0.07	0.03	–
	(0.07)	(0.12)	

Note: (a) Percentage change in accumulated assets with respect to the baseline simulation. (b) Bootstrapped standard errors are in parentheses using with 100 draws.

* Significant at the 10 percent level; ** 5 percent level; *** 1 percent level.

Table D3: Effect of Family Characteristics: Percentage Change in Accumulated Assets at the End of Seven Years

	Marital Status		Number of Children
	Married at $t = 1$	Permanently Married	Additional Children at $t = 1$
	(1)	(2)	(3)
Mean	0.65***	2.41***	-0.11
	(0.15)	(0.53)	(0.15)
Percentile			
1%	-5.29**	-14.73**	-6.31***
	(2.35)	(7.08)	(2.39)
5%	-2.31	-5.93	-3.27**
	(1.54)	(4.42)	(1.28)
10%	-0.15	-0.36	-1.93**
	(1.11)	(3.24)	(0.88)
25%	1.47***	4.55***	-0.60
	(0.52)	(1.55)	(0.47)
50%	1.44***	4.31***	-0.21
	(0.30)	(0.85)	(0.30)
75%	0.84***	3.03***	-0.03
	(0.16)	(0.62)	(0.17)
90%	0.34***	1.75***	-0.02
	(0.08)	(0.43)	(0.10)
95%	0.27***	1.50***	0.03
	(0.08)	(0.36)	(0.07)
99%	0.10	1.25***	0.01
	(0.07)	(0.30)	(0.07)

Note: (a) For column 1 and 3 percentage change in accumulated assets with respect to the baseline simulation. For column 2 percentage change in accumulated assets of being permanently married versus being permanently single. (b) Permanently married starting at year 2. (c) Bootstrapped standard errors are in parentheses using with 100 draws.

* Significant at the 10 percent level; ** 5 percent level; *** 1 percent level.

Table D4: Effect of Health Characteristics: Percentage Change in Accumulated Assets at the End of Seven Years

	Initial Improvement in Health Status (1)	Permanent Improvement in Health Status (2)
Mean	0.59***	2.40***
	(0.13)	(0.70)
Percentile		
1%	3.25***	4.26
	(0.86)	(3.64)
5%	2.97***	6.05*
	(0.48)	(3.25)
10%	2.69***	7.01**
	(0.41)	(2.84)
25%	1.87***	6.61***
	(0.30)	(1.88)
50%	1.01***	4.05***
	(0.20)	(1.14)
75%	0.58***	2.61***
	(0.14)	(0.76)
90%	0.36***	1.60***
	(0.10)	(0.49)
95%	0.29***	1.25***
	(0.09)	(0.42)
99%	0.12*	0.70**
	(0.07)	(0.31)

Note: (a) Percentage change in accumulated assets with respect to the baseline simulation. (b) Bootstrapped standard errors are in parentheses using with 100 draws.

* Significant at the 10 percent level; ** 5 percent level; *** 1 percent level.