Do financial incentives affect retirement decisions?

Evidence from European countries

By

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Abstract

This paper investigates the effects of financial incentives on retirement decisions across eleven European countries using data from the Survey of Health, Ageing and Retirement in Europe (SHARE). I estimate a structural model of retirement using simplified version of the option value to postpone retirement approach. I argue about self-selection problem and apply Heckman two-step method to correct for it. The main result is that financial incentives have a large effect on probability of transition into retirement. Respondents of the survey are more responsive to increases in expected pension wealth than to decreases in expected level of earnings. Also, they are more responsive to changes in expected pension benefits compared to increases in legal retirement age. Finally, the effects from financial incentives found to be larger for potential early retirees. My results suggest that financial incentives are effective to use when trying to overcome the early retirement problem in European countries.

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1 Introduction

In recent decades the European Union has faced a number of pension reforms, triggered by dramatic population ageing and inability to sustain financially stable pension systems in many countries. As suggested by report of European Commission (2009), demographic trends across most European countries, characterized by increasing life expectancy and decreasing fertility rates, are not going to reverse in the near future. Such demographic patterns together with low participation rates of the older workers and early exit ages from the labor force impose a large burden on sustainability of pension systems across the European Union. Recent pension reforms have tried to implement different measures to provide people with incentives to work longer either by raising the normal retirement age and applying penalties to early retirees or through reduction of pension benefits. To determine which measures are more effective it is important to understand which forces drive early retirement decisions.

In this paper I examine the strength of financial incentives provided by pension systems and estimate their effect on the probability of making the transition into retirement. I estimate a structural model of retirement using micro-level data from eleven European countries, which participated in the Survey of Health, Ageing and Retirement in Europe (SHARE)[1]. The counties are Austria, Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, and Belgium. I combine a two-year panel dataset constructed from first two waves of the survey, which provide information about economic and socio-demographic factors of respondents' lives, with a third wave of the survey, which contains individuals' extended working histories.

[1] This paper uses data from SHARELIFE release 1, as of November 24th 2010 or SHARE release 2.5.0, as of May 24th 2011. The SHARE data collection has been primarily funded by the European Commission through the 5th framework programme (project QLK6-CT-2001- 00360 in the thematic programme Quality of Life), through the 6th framework programme (projects SHARE-I3, RII-CT- 2006-062193, COMPARE, CIT5-CT-2005-028857, and SHARELIFE, CIT4-CT-2006-028812) and through the 7th framework programme (SHARE-PREP, 211909 and SHARE-LEAP, 227822). Additional funding from the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, Y1-AG-4553-01 and OGHA 04-064, IAG BSR06-11, R21 AG025169) as well as from various national sources is gratefully acknowledged (see www.share-project.org for a full list of funding institutions).

It is important to note that the pension systems in the countries that I study are very diverse. The public sector is an important part of most pension systems; however, the role of private and occupational provisions changes from country to country. I provide a detailed description of pension systems for eleven countries in Table A.1 in the Appendix. As the empirical part of my study is focused on transitions into retirement status which take place between 2005 and 2006 years, only pension system regulations that were valid in 2006 are presented. For more recent regulations, please, refer to OECD (2011). Also, I analyze labor supply patterns for eleven chosen countries in Figures A.1 – A.4 in the Appendix.

The theoretical framework for my research is formed by an "option value to postpone retirement" concept of Stock and Wise (1990), where option value measures a difference between the maximum expected present value of retirement across all possible future years and the expected present value of immediate retirement. Computation of the original option value is quite involved and requires a much longer earnings histories than I have. Therefore, I follow a simplified version of a structural model of retirement which uses only two periods of earnings histories.

Any application of option value model, including a simplified one, involves prediction of earnings in case person retires and prediction of pensions in case individual continues to work. In my analysis I use several measures of financial incentives. I show that simple measures of expected earnings and expected pension cannot capture an important variation in these variables, and, also, suffer from a self-selection problem. Therefore, I estimate income equations by OLS using different sets of explanatory variables. Such estimations also suffer from self-selection bias: individuals with high earnings are probably less likely to retire than low earners as they have to give up more income. Estimates of expected earnings and expected pensions become inconsistent, and estimated effects from such variables on

probability of transition into retirement are overestimated. To correct for selectivity in a structural model I use Heckman two-step procedure.

My study contributes to a wide range of empirical literature on effects of financial incentives in retirement decisions in several ways. It proves the ability of a simplified model to capture the effect of financial incentives on retirement decisions. Simplified model was previously applied only to Hungarian data, but I implement it for data from eleven European countries. Even though estimations on a pooled dataset are not informative about individual behavior in any particular country, important policy implications on the level of European Union can be derived from my estimations. In particular, I find out that individuals are more responsive to changes in financial incentives than to changes in normal retirement ages. Also, I compare the effect from financial incentives to effects from health, household composition and job satisfaction and find out that financial incentives play larger role in retirement decisions. Finally, I show that financial incentives matter more for people below 65 years old than for older individuals, hence, financial incentives may be used to affect retirement decisions of potential early retirees.

The structure of the paper is the following. Chapter 2 briefly describes evolution of option value concept and summarizes previous studies on the effect of financial incentives for retirement transitions in Europe. Chapter 3 gives formal frameworks for an original option value model and for a simplified model with correction for selection. In Chapter 4 I describe the dataset and empirical strategy. Finally, Chapter 5 covers estimation and results; I start with a description of a country-level data and proceed with an estimation of a structural model of retirement on pooled dataset. I conclude with an analysis of estimated effects.

2 Previous literature on retirement

Literature on social security and pensions is very wide and touches different aspects of theory and empirics. In my study I concentrate on analysis of impact of financial incentives on retirement decisions. Much of the recent empirical research on the role of financial factors in driving retirement decisions to some extent relies on a seminal work by Stock and Wise (1990), who analyzed the effects of firm pension plan provisions on the retirement decisions of older employees in the US. Central feature of Stock and Wise model was an "option value to continue to work" concept, which became a baseline framework for many latter studies on retirement, including mine. In my analysis of the literature I try to shed light on the evolution of the option value concept and its place among other measures of financial incentives in retirement literature.

The option value model of Stock and Wise (1990) has unified the previous modeling techniques, in particular the hazard model and the lifetime budget constraint approach: it is a dynamic forward-looking model of retirement. It was very close to a common at those times dynamic programming approach, but was less complex in its practical implementation. A range of literature on comparison of these two approaches and also on comparison of structural models and reduced forms evolved in the early 90s. For example, Lumsdaine, Stock and Wise (1992) found out that both option value and dynamic programming models were much more successful than less complex probit model, and, at the same time, the option value model was not worse in approximating behavior than a complex dynamic programming rule.

The option value model became widely used in studies on retirement decisions and has many modifications and applications. At first, most of them were done for the U.S. For example, Samwick (1998) estimated the combined effect of social security benefits and incentives provided by private pension plans on transition probabilities for individuals close to normal retirement age. Gustman and Steinmeier (2002) used the US Health and Retirement

Study dataset to estimate structural option value model. Coile and Gruber (2000) used same dataset and estimated reduced version of option value model. They found that forward-looking incentives matter for retirement decisions more than one year accrual. In early 90s researchers began to focus on joint retirement models of retirement. Gustman and Steinmeier (2004) studied correlations between spouses' labor statuses and spouses' joint retirement decisions. Coile (2003) explored spillover effects between spouses' financial incentives from social security and private plans.

First implementation of option value model for European countries was done by Gruber and Wise (2004). The model was applied to countries which took part in the Gruber and Wise project "Social security and retirement around the world". The project consists of separate papers by groups of economists who perform analysis for their own countries: Börsch-Supan et al (2004) for Germany, Dellis et al (2004) for Belgium, Bingley et al (2004) for Denmark, Blanchet and Mahieu (2004) for France, Brugiavini and Peracchi (2004) for Italy, De Vos and Kapteyn (2004) for the Netherlands, Boldrin et al (2004) for Spain, and Palme and Svensson (2004) for Sweden. At the first stage of the project, Gruber and Wise compare trends and patterns of labor participation and retirement in these countries. At the second stage of the project, the authors employ a micro-data analysis to study the relationship between retirement and the incentives faced by individual workers. They found large disincentives to work build into social security systems of many countries. Gruber and Wise put forward an important issue of multiple retirement decisions which was not relevant for the U.S. studies. In some countries, a person may face several retirement plans with different pathways to retirement, like in Germany for example. The authors weigh the incentive measures provided by each pathway based on eligibility probabilities. While this issue has some relevance for my analysis as well, because of complexity of the approach proposed by the authors and because of lack of data to construct such probabilities, I am unable to implement it in my study.

More recent research on retirement in Europe was associated with two projects: Research Training Network on Health, Ageing and Retirement (REVISER) and Adequacy and Sustainability of Old-Age Income Maintenance (AIM), undertaken within the framework of European Network of Economic Policy Research Institutes (ENEPRI). The projects study social security and private pension funds across EU countries, as well as pension reforms. Option value approach in particular was implemented by Piekkola and Deschryvere (2005) for Finland, Belgium and Germany and by Piekkola (2008) also for Spain. They use eight waves of the European Community Household Panel (ECHP) and examine financial incentives in a pooled dataset, which hasn't been done before. They find out that financial incentives matter for predicting retirement decisions.

Latter studies use different methods and different data to study various aspects of retirement in Europe. For example, Fischer and Sousa-Poza (2006) use the first wave of Survey of Health, Ageing and Retirement in Europe (SHARE) to explore retirement processes and determinants of early retirement in Western Europe; however, they employ reduced form linear probability and probit models, which don't account for any forward-looking incentive measures. In my study I will also make use of the above mentioned survey, however, in addition to a reduced form model I will estimate structural model of retirement. I am going to use modification of an option value approach proposed by Cseres-Gergely (2009), who applied a simplified option value model that dealt with limited data availability to a post-transition economy of Hungary.

3 Theoretical framework

3.1 Original option value model

The theoretical framework for my research is formed by an option value concept, defined by Stock and Wise (1990) as a forward looking measure of incentives provided by pension system. The option value concept is based on the idea of utility maximization. The intuition for the model, as in Lumsdaine, Stock and Wise (1992), is the following. At any given age, a worker decides whether to make a transition into retirement by comparing the expected present value of retiring at that age with the value of retiring at each age in the future through her expected lifetime. The option value of postponing retirement is a difference between the maximum expected present value of retirement across all possible future years and expected present value of immediate retirement. Positive option value means that it is optimal for a person to continue to work, whereas negative option value implies immediate retirement.

The formal model specification, given in Stock and Wise (1990), is the following. An individual, who continues to work at the beginning of year *t*, expects to receive labor income Y_s in year *s* if she stays employed, and real retirement benefits of B_s if she retires at the beginning of year *s*. The first year of retirement is denoted as *r* and subsequent pension benefits as $B_s(r)$. It is assumed that individuals derive indirect utilities from income earned while working $U_w(Y_s)$ and utility from the pension benefits $U_r(B_s(r))$. These utilities are discounted by factor β at age *t*. It is also assumed that individual is expected to die by year *S* with probability one. Thus, the value of future stream of income if retired at age *r* is given by the following formula:

$$V_t(r) = \sum_{s=t}^{r-1} \beta^{s-t} U_w(Y_s) + \sum_{s=r}^{S} \beta^{s-t} U_r(B_s(r)). \tag{3.1}$$

An individual makes a decision whether to work in year *t* or to retire by comparing the expected value he would receive if retired today with the maximum of expected values from retirements at any dates in the future. The expected gain from postponing retirement can be formulated as following:

$$G_t(r) = E_t V_t(r) - E_t V_t(t). \tag{3.2}$$

Option value is then defined as the difference between utilities of retiring at the best point in the future r^* and at year t. Person chooses to postpone retirement if the option value is positive:

$$G_t(r^*) = E_t V_t(r^*) - E_t V_t(t) > 0. \tag{3.3}$$

Two approaches for estimation of option-value model prevail in the literature. The original approach offered by Stock and Wise (1990) involves maximum likelihood estimation of parameters of indirect utility in the structural model. On the other side, many applications of the Stock and Wise model don't estimate parameters of utility function but calculate option value based on assumed parameter values. In this simplified approach the option value is used as an explanatory variable in reduced form probit-type models of retirement. For example, in the study of retirement transitions in Germany by Börsch-Supan et al (2004) the parameters were partially estimated using grid search and partially assumed. Piekkola and Deschryvere (2005) in their study of the determinants of the retirement transitions of Europeans use the reduced-form version of the option value model with all parameters being assumed.

Each application of the option value model relies on predictions of labor and pension income in case of continuing work or retirement. Depending on available data different studies employ different techniques in determining future pensions and labor income. For example, in the original study of Stock and Wise (1990) future earnings paths as well as provisions of firm pension plan are projected from individual earnings histories on a firm level. Further, Börsch-Supan et al (2004) make use of a detailed "labor market calendar",

which is a part of the German Socio-Economic Panel. Making use of 14 annual waves they manage to precisely estimate future pension wealth from German public retirement insurance by estimating the average relative earnings position and applying pension formula and eligibility rules.

3.2 Simplified model and correction for selection

As the dataset I am using provides information about the same individuals only for two consecutive periods, the implementation of the original option value model is not possible. The available dataset information on individual working histories is not enough to calculate expected pension wealth or future earnings path. A similar problem was faced by Cseres-Gergely (2009), who used a two-year panel dataset constructed from Hungarian HBS Rotating Panel. Trying to overcome a data shortage problem and still wanting to be able to use the option value framework, the author came up with a simplified version of the original model. The main feature of the adapted model is that agents decide whether to transit between mutually exclusive working (0) and retired (1) states at time *t* based on their expectations about income only in the next period *t+1*, whereas in the original model agents decided upon transition based on a stream of expected future earnings or pensions each year up till their death.

The model is formulated as a binary index model. The transition decision is defined through expected utilities from two states, which include conditional expectations about earnings levels if stay at work ($E_t(y_{0it+1}|\Omega)$) and pension benefits if retire ($E_t(y_{1it+1}|\Omega)$), set of additional observable characteristics of two states Z_{0t} and Z_{1t}, and state specific unobservable factors v_{0t} and v_{1t}. The decision is described as the following:

$$I_{it+1} = \begin{cases} 0 & if \quad V_{0t+1} \geq V_{1t+1} \\ 1 & if \quad V_{0t+1} < V_{1t+1} \end{cases}, \tag{3.4}$$

$$V_{jt+1} = E_t(y_{jit+1} \mid \Omega)\alpha_j + Z_{jit}\gamma_j + v_{jit}, \tag{3.5}$$

where expectations are conditioned on information available in period *t*, Ω. Then the probability of transition into retirement can be written as

$$\Pr(I_{it+1} = 1) = \Pr[E_t(y_{0it+1} \mid \Omega)\alpha_0 + Z_{0it}\gamma_0 + v_{0it} < E_t(y_{1it+1} \mid \Omega)\alpha_1 + Z_{1it}\gamma_1 + v_{1it}], \tag{3.6}$$

$$\Pr(I_{it+1} = 1) = \Pr[E_t(y_{0it+1} \mid \Omega)\alpha_0 - E_t(y_{1it+1} \mid \Omega)\alpha_1 + Z_{0it}\gamma_0 - Z_{1it}\gamma_1 < v_{1it} - v_{0it}], \tag{3.7}$$

$$\Pr(I_{it+1} = 1) = \Pr[E_t(y_{0it+1} \mid \Omega)\alpha_0 - E_t(y_{1it+1} \mid \Omega)\alpha_1 + Z_{0it}\gamma_0 - Z_{1it}\gamma_1 < \upsilon_{it}], \tag{3.8}$$

$$\Pr(I_{it+1} = 1) = F[E_t(y_{0it+1} \mid \Omega)\alpha_0 - E_t(y_{1it+1} \mid \Omega)\alpha_1 + Z_{0it}\gamma_0 - Z_{1it}\gamma_1], \tag{3.9}$$

where $\upsilon_{it} = v_{1it} - v_{0it}$ is a compound disturbance term and $F(x)$ is some distribution function.

Conditional on the state in which decision was made income is defined as a set of equations:

$$y_{0it+1|I_{it}=0} = X_{0it}\beta_0 + y_{0it}\rho_0 + u_{0it+1} \tag{3.10}$$

$$y_{1it+1|I_{it}=0} = X_{1it}\beta_1 + y_{0it}\rho_1 + u_{1it+1} \tag{3.11}$$

Equation (3.10) describes labor income if individual chooses to stay in state 0. Author uses similar to Stock and Wise (1990) approach and defines earnings through a first order autoregressive model. Expected earnings are defined by previous period earnings and by set of individual and labor market characteristics X_{0i}. Equation (3.11) describes income from pension benefits if individual decides to make a transition into retirement state. Due to data availability, only income from the last year before retirement is included. Of course, this doesn't correspond to an official pension formula and is not enough to precisely define future pension, but, together with set of individual factors and institutional characteristics, it gives at least some meaningful estimation of possible retirement benefits.

Next, the assumptions about disturbance terms are made. Conditional on observed variables the distribution of disturbance terms is normal with covariance matrix Σ:

$$\upsilon, u_0, u_1 \sim iidN(0,\Sigma), \qquad \Sigma = \begin{bmatrix} 1 & \sigma_{u_0\upsilon} & \sigma_{u_1\upsilon} \\ & \sigma^2_{u_0} & \sigma_{u_1u_0} \\ & & \sigma^2_{u_1} \end{bmatrix}. \tag{3.12}$$

Equations (3.4), (3.5), (3.10), (3.11), and (3.12) form a structural model, which is very similar to a migration model by Nakosteen and Zimmer (1980), and represents a class of switching regression models with endogenous switching. Our task is to estimate the parameters of decision function and income equations. Consistent estimates from income equations may be used to estimate the parameters of the decision equation. A well known selectivity problem is usually associated with estimation of such kind of models. The source of it will be discussed in the next chapter in more detail; here I simply give a formal description of the model. The problem with the usual procedure is that OLS estimates of income equations appear to be inconsistent, as conditional means of income disturbance terms are non-zero and non-constant for all observations, as stated by Nakosteen and Zimmer (1980):

$$E(u_{0it+1} \mid I_{it+1} = 0) = \sigma_{u_0\upsilon} \cdot [\phi(\omega_{it}) / 1 - \Phi(\omega_{it})] \tag{3.13}$$

$$E(u_{1it+1} \mid I_{it+1} = 1) = \sigma_{u_1\upsilon} \cdot [-\phi(\omega_{it}) / \Phi(\omega_{it})], \tag{3.14}$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ are standard normal density and distribution functions, and the argument ω_{it} is an index from reduced form of the decision equation estimated by maximum likelihood probit method:

$$I_{it+1} = \begin{cases} 0 & if \quad V_{0t+1} \geq V_{1t+1} \\ 1 & if \quad V_{0t+1} < V_{1t+1} \end{cases}, \tag{3.15}$$

$$V_{jt+1} = X_{jit}\beta_j + y_{0it}\rho_j + Z_{jit}\gamma_j + \nu_{jit}, \tag{3.16}$$

$$\Pr(I_{it+1} = 1) = \Phi[X_{0it}\beta_0 + y_{0it}\rho_0 - X_{1it}\beta_1 - y_{0it}\rho_1 + Z_{0it}\gamma_0 - Z_{1it}\gamma_1], \tag{3.17}$$

$$\omega_{it} = X_{it}\beta + y_{0it}\rho + Z_{it}\gamma, \tag{3.18}$$

where X_{it} and Z_{it} consist of all exogenous variables in the model.

It is suggested to employ a two-stage Heckman procedure in order to correct for selectivity. The corrected income equations are the following:

$$y_{0it+1|I_{it}=0} = X_{0it}\beta_0 + y_{0it}\rho_0 + \sigma_{u_0\upsilon} \cdot [\phi(\omega_{it})/1-\Phi(\omega_{it})] + \varepsilon_{0it+1} \qquad (3.19)$$

$$y_{1it+1|I_{it}=0} = X_{1it}\beta_1 + y_{0it}\rho_1 + \sigma_{u_1\upsilon} \cdot [-\phi(\omega_{it})/\Phi(\omega_{it})] + \varepsilon_{1it+1} \qquad (3.20)$$

where $E(\varepsilon_{0it+1} \mid I_{it+1} = 0) = 0$ and $E(\varepsilon_{1it+1} \mid I_{it+1} = 1) = 0$. At stage one the reduced form decision equation (3.15)-(3.16) is estimated as a probit model. Then selectivity terms are constructed by the formula:

$$\lambda_{1it} = [-\phi(\hat{\omega}_{it})/\Phi(\hat{\omega}_{it})] \qquad (3.21)$$

$$\lambda_{0it} = [\phi(\hat{\omega}_{it})/1-\Phi(\hat{\omega}_{it})] \qquad (3.22)$$

At stage two, selectivity terms are used as regressors in income equations (3.10) and (3.11). OLS estimation produces consistent estimates. The empirical strategy and description of available data are presented in the next chapter.

4 Data and empirical strategy

4.1 Structure of SHARE dataset

This study uses the Survey of Health, Ageing and Retirement in Europe (SHARE) dataset, which is a panel database from 15 European countries and for over 30000 individuals aged 50 and over. Four waves of the survey are currently available. The first and the second waves, launched in 2004/2005 and 2006/2007 respectively, contain information about circumstances of people's lives at the time they were interviewed. These surveys provide little information about what happened in earlier lives of respondents. SHARELIFE, which is the third wave of data collection for SHARE launched in 2008/2009, is different from the first two. It tracks the same individuals; however, it focuses on people's life histories. It contains information on different aspects of respondents' lives from their childhood to retirement, including extended work history. The fourth wave of data collection took place in 2010/2011 and is similar to the first two waves; thus, together they form a three year panel. Unfortunately, the fourth wave is not yet available for public use, so for my analysis I used only the first two waves and SHARELIFE.

Out of fifteen countries that took part in at least one wave, eleven countries participated in all surveys and, therefore, constitute the subject of my analysis. The list of countries with years of participation in SHARE surveys is presented in Table 4.1.

Table 4.1 Countries participating in SHARE surveys. *Source: SHARE (2011).*

ID	Country	Wave 1	Wave 2	Wave 3 (Sharelife)
1	Austria	2004	2006/07	2008/09
2	Germany	2004	2006/07	2008/09
3	Sweden	2004	2006/07	2008/09
4	Netherlands	2004	2007	2008/09
5	Spain	2004	2006/07	2008/09
6	Italy	2004	2006/07	2008/09
7	France	2004/05	2006/07	2009
8	Denmark	2004	2006/07	2008/09
9	Greece	2004/05	2007	2008/09
10	Switzerland	2004	2006/07	2008/09
11	Belgium	2004/05	2006/07	2008/09

4.2 Merged dataset, construction of variables and sample size

For the purpose of analysis I constructed a merged dataset, which combines variables from all three waves of SHARE dataset along with computed variables. Individual level economic variables were taken from first two waves. They include information about earnings for employed or self-employed respondents and pensions for those who are already retired. Annual earnings were constructed as a sum of annual gross income from employment and from self-employment in previous year. The pension wealth variable was calculated as a sum of public, private, and occupational pension plan provisions the previous year. The list of items calculated into pension wealth is presented in Table A.2 in the Appendix.

As I used data from two different years and from different countries, I transformed all economic variables into real terms, denominated in prices obtained in Germany in year 2005. I did this by dividing nominal variables with specially designed exchange rates, which adjust for the differences in the purchasing power of money across countries and over the time, as suggested in SHARE (2011).

An important aspect of work with economic variables is a problem of non-response and missing data. SHARE dataset suffers serious problem of non-response, as mentioned by Christelis (2010). The reasons for this are various, including length of the questionnaire, respondents' physical and mental health conditions, unwillingness to respond because of privacy concerns or lack of free time because of work, etc. Unfortunately, economic variables usually suffer the most from non-response problem, and SHARE dataset is not an exception. As earnings and pension benefits are the key variables in my research, I made use of imputed values for these variables. As the methodology used in SHARE imputation procedure produces multiple imputations for each missing observation, I used a method suggested by Christelis (2010) for dealing with SHARE imputed variables; in particular, I computed the average among five imputed values for each missing one.

Besides economic variables, I used sets of socio-demographic and work-related variables. Variables indicating hours worked, sector of employment, job satisfaction and whether a respondent is a civil servant, other employee or self employed were obtained from the first wave of the survey, thus describe the working conditions of respondent before making a decision about transition into retirement. Years of education, self-perceived health, number of children and grandchildren were taken from generated variables.

Years to legal retirement variable was computed as a difference between age and country specific normal retirement age. It happens that during the years 2004-2007 pension reforms were taking place in several countries, for example in Italy. As normal retirement age and other factors may have changed during these years, I treat 2006 year as a reference year. It is so, because SHARE respondents make their decision about retirement between 2005 and 2006, therefore, most probably they take into account the expected normal retirement age for 2006.

The most complicated variable in my dataset is years of experience variable. On the contrary to some previous studies, like Piekkola (2008) and Cseres-Gergely (2009), which use a crude measure of labor market experience that depends on the age and the education level, I use a more realistic measure. I constructed experience variable using full employment histories available in SHARELIFE dataset. Unfortunately, there were many missing observations in the dataset itself, and for many more individuals there was no SHARELIFE entry at all. Where it was possible, I imputed experience using age and education variables and assuming no gaps in employment histories. I also constructed variable which indicates years of contributions to private, public and occupational pension funds, however, it has too any unrealistic or missing values, and thus, I cannot use it for analysis. Finally, I control for the gender and country of residence.

The original dataset contains entries for individuals who were born in 1954 or earlier, and their spouses independent of age. The first wave contains entries on 28517 individuals, excluding observations on Israel. Second wave contains 27984 observations, excluding entries from Czech Republic, Poland and Ireland. SHARELIFE dataset contains 23045 entries, excluding Czech Republic and Poland. I assume random attrition from the program, even though one could find a mechanism through which those who quitted the survey may be different.

To proceed with the data analysis we need to define different states. Literature offers various ways to define retirement status. These can be self-reported status, few hours worked, or the receipt of retirement benefits. For example, Piekkola (2008) combines two definitions by defining retired as either self-reported retired, or working less than 15 hours or having annual earnings below EUR 5000. Cseres-Gergely (2009) defines retirement through receipt of old-age or disability benefit. I follow Börsch-Supan et al (2004) and use only self-assessed status, which is available in SHARE dataset. Thus, the transition is defined as change in a self-assessed status from employed or self-employed to retired between waves 1 and 2. I used such definition because it is the simplest and my dataset provides enough information to implement it. However, it is also problematic, as many individuals who reported to be retired in fact continued to work part-time, which was not accounted for in the study.

There are only 18741 individuals for whom entries in all three waves are available, of these 47.7% were already retired during the first wave, 29.6% were employed or self-employed, 16.3% were homemakers, 3.3% were unemployed, 2.9% were permanently sick or disabled. As I am interested only in those individuals who were employed or self-employed in the first wave, the sample reduces to 5532 individuals. Thus, the data is left-censored. Out of these 4304 persons didn't change their status and stayed employed when data for the second wave was collected, 738 persons transited to retirement, and others became either

unemployed, or homemakers, or became disabled. I am not interested in transitions other than into retirement, thus the sample reduces further to 5042 observations.

As the dataset contains observations on younger spouses as well, I restrict the sample further. I am going to work with two samples: the first one contains 4674 individuals aged from 50 to 82 (the maximum age in the first period); the second sample is designed to capture specifics of early retirement decisions and contains 4484 individuals aged from 50 to 65.

4.3 Empirical strategy

To quantitatively assess the effect of financial incentives on retirement decisions of individuals I estimate probit models of probability of transition into retirement on variables that indicate expected income from retired and working states and on other explanatory variables. The problem with such an estimation is that both earnings for those who retired and possible pension income for those who still work during the second wave are counterfactual. There are various ways of how to deal with this problem and how to project the missing values. In my analysis I use two approaches.

At first, I use a crude measure of financial incentives. I assume that earnings grow with the same rate over several periods and replacement rates also stay constant. Thus, I derive growth rates of earnings and replacement rates between first and second waves and use them to calculate expected earnings and expected pension benefits for the second period:

$$E(Y_{it+1}) = \begin{cases} Y_{it+1}, & \text{if still working} \\ Y_{it} \cdot g, & \text{if retired} \end{cases} \quad \text{and} \quad E(P_{it+1}) = \begin{cases} Y_{it} \cdot r, & \text{if still working} \\ P_{it+1}, & \text{if retired} \end{cases}$$

where Y_t, P_t indicate earnings and pension, g is an average growth rate of earnings, r is an average replacement rate; growth rates and replacement rates vary for different country and gender. I predict earnings and pensions only where these are counterfactual. Otherwise, I use second year values as expected income measures. This means that two groups of people have a different variation in expected earnings and pensions depending on whether they have

retired or not. Those who are retired in the second period are assumed to have perfect foresight on their future pension income and those who continue to work are assumed to perfectly predict their future earnings. On the other hand, counterfactual earnings and pensions have less variation, because they use country and gender specific rates to predict earnings and pensions from the previous period. The amount of variation depends on whether person retires or not, and her decision to retire is affected by expected income in two states. This is a clear selection problem. Therefore, I expect the estimates to be problematic, but it is still interesting to explore them.

In my second approach instead of using crude measures of income variables, I rather estimate income equations (3.10) and (3.11) by OLS and use those in estimation of the decision equation. Similarly to Cseres-Gergely (2009), who also had only two consecutive periods of data on earnings, I assume certain amount of stationarity in income processes: I estimate wage equation on a sample of those who didn't retire and predict wages in second period for both working and retired individuals. Similarly, pension equation is estimated on a sample of retired in second period people, and predictions are made for the whole sample.

My goal is to obtain consistent estimators of the parameters of decision function and income equations. However, the above mentioned procedure also leads to a self-selection problem: individuals who continue to work probably are high-income workers, who would lose more if they retire; on the other hand, those who chose to retire may expect higher replacement rate compared to those who are still at work partly due to low earnings before retirement. This would overestimate expected earnings for those who retired and underestimate expected pension for those who continue to work. Estimated effects of financial incentives on retirement decisions then would be biased upwards. To correct for self-selection I implement the two-step Heckman model. Decision equation serves as selection equation for both earnings and pension equations.

To help identification of parameters, I should include at least one instrument in each equation, i.e. variables that make identification from independent variation possible. Wage equation is identified by self-employment and civil servant dummies, hours worked, sector of employment, years of experience and education. Pension equation is identified by civil servant or self-employed dummies, years of experience and square of years to legal retirement. I also include gender variables and country fixed effects. Decision equation is then identified by job satisfaction and individual socio-demographic factors.

Table 4.2 List of variables and their role in the estimation procedure.

	Decision equation	Earnings equation	Pension equation
Lag earnings		+	+
Expected earnings (empl+self.empl)	+		
Expected pension (public+private+occupational)	+		
Employee, civil servant or self employed		+	+
Hours worked		+	
Public or private sector		+	
Satisfied with job	+		
Years of experience		+	+
Years to legal retirement age	+		+
Years to legal retirement age squared			+
Gender	+	+	+
Household composition (ego alone, couple alone, living with family, living with others)	+		
Health (excellent, very good, good, fair, poor)	+		
Age		+	
Years of education		+	
Number of grandchildren	+		
Number of children	+		
Country fixed effects	+	+	+

In the next chapter I will begin with providing some country-level evidence on retirement patterns and strength of financial incentives, derived from SHARE survey; then I will proceed with estimation of effect of financial incentives on retirement decisions using simple measures of income variables; finally, I will estimate a structural model of transition into retirement with the Heckman two-step procedure.

5 Estimation and results

5.1 Analysis of raw data on a country level

Due to lack of data on income variables and also due to a low number of retirement transitions between waves 1 and 2 of SHARE, I am unable to conduct econometric analysis for each country separately. Instead, I use pooled dataset to study average effect of financial incentives on retirement decisions across eleven European countries. But naturally, each country has specific regulations on pension provisions and different levels of financial incentives provided for working individuals and pensioners. To shed light on what drives retirement decisions in different countries I present country-level evidence that can be derived from the SHARE dataset.

Baseline probabilities of retirement

Men and women appear to be different in their labor market behavior, as follows from Figure A.5 and Figure A.6 in the Appendix. In many countries, the percentage of women who are homemakers is very high. For example, in Spain 59% of women reported to be homemakers and only 15% were employed. In my study I work only with individuals who are either employed or retired, therefore study doesn't describe retirement behavior of a large fraction of women who are not involved in the labor market previously to retirement.

The baseline probabilities of retirement for men and women vary across countries (Figure 5.1). Baseline probability is calculated as proportion of number of transitions into retirement made from wave 1 to wave 2 to the total number of employed in the first period. In some countries baseline probabilities of retirement are quite high, reaching 29% for men in Italy. In Greece probabilities are the lowest: only 7.6% for men. Taking into account such diversity in baseline probabilities, the results which use pooled dataset are not informative about any particular country, but should be regarded as average effects. The average baseline probability of retirement across countries is 14.64%.

Figure 5.1 Baseline probabilities of retirement by gender and country. *Source: SHARE survey.*

Despite the common belief that women are more likely to retire, data shows the opposite for most of the countries. The only country with higher baseline probability of retirement for women is Austria (28.6%). In all other countries women are less likely to retire. These results are valid only for working women and not for homemakers, whose retirement probabilities are, most likely, higher.

Retirement patterns by age and health

Figure 5.2 shows the percentage of retired people for each age group across countries. The first age group contains people from 50 years old up to an early retirement ages. The second age group is from early retirement age to the legal retirement age. For France, Italy, the Netherlands, and Sweden, early retirement ages coincide with normal retirement ages in 2006, thus, there are no people in the second age group for these countries. Finally, the third group of people are those older than legal retirement age, which is 65 for most of the countries. In Denmark and Switzerland there is almost no retirement before early retirement ages. However, in other countries from 6% to 22% of people below early retirement age are already retired. In those countries, where early retirement age exists, different fractions of people use the opportunity to retire earlier. In Austria, for example, 71% of people aged from 62 to 65 (57 to 60 for women) are already retired. Large fraction of early-retirees is in Germany (more than 60%) and in Belgium (50%). Fraction of retirees among those older than

normal retirement age is also different for countries. The highest rates are in Denmark and Germany, where legal retirement age is 65 for both men and women. In France, Sweden and Italy rates are also high, even though official retirement ages in 2006 for these countries were 60, 61 and 57 respectively. Spain has the lowest percent of retired among the elderly. A simple analysis of the graph showed that there is a problem of early retirement in European countries, and people exploit opportunity to retire early where it is possible.

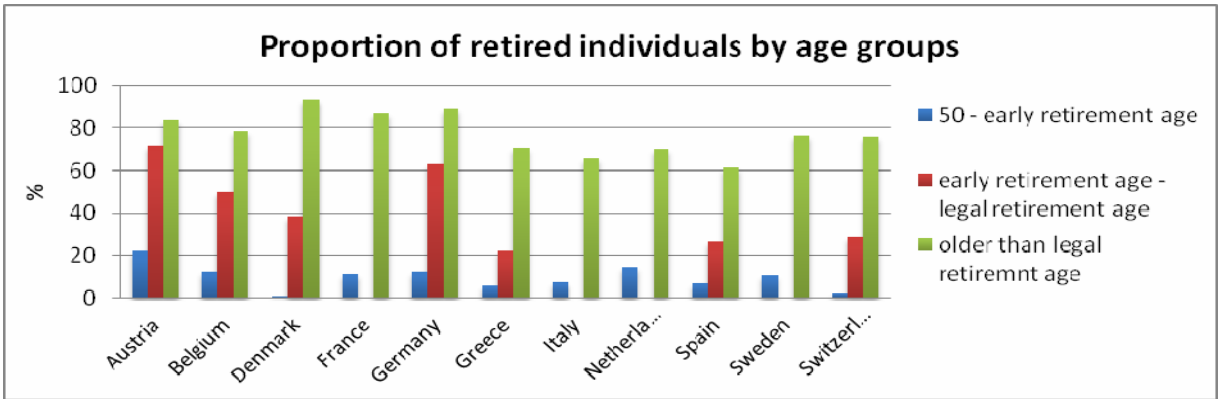

Figure 5.2 Percentage of retired by age groups and country. ***Source: SHARE survey, wave 2.***

Figure 5.3 shows distribution of retired by health across countries. We can see from this graph that health obviously matters for retirement decision, but the effect varies across countries. The highest proportion of retired people among those who have poor health is in Sweden (73%) and in Austria and France (70%). In Spain the fraction is the lowest, due to a low proportion of retired people in the whole sample.

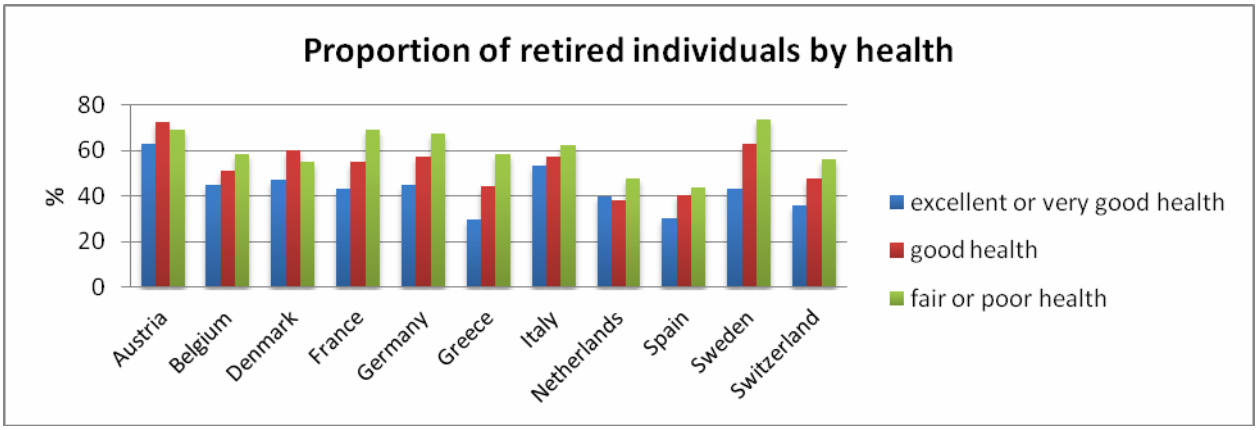

Figure 5.3 Percentage of retired by health and country. ***Source: SHARE survey, wave 2.***

Are financial incentives strong or weak?

Before trying to estimate how financial incentives influence retirement behavior of individuals it is good to analyze the strength of financial incentives in different countries. Figure 5.4 helps us with this by showing median annual earnings and pensions of men across two waves of SHARE survey by age and country. We see that in some countries median earnings are much higher than median pensions, whereas in other countries pensions and earnings overlap. Intuitively, in countries, where the difference is small, financial incentives to stay at work are very weak, as when changing from employment to retirement person doesn't lose much of income, but also obtains leisure associated with retirement status. Thus, in Italy and Greece financial incentives to stay at work are the weakest, because red and blue tickers overlap. Austria, the Netherlands, Spain and France also provide much incentive to retire. Remember, from Figure 5.2, Austria had the highest proportion of low retirees. However, in Germany, Sweden, Belgium and Denmark financial incentives to retire are weak. Median earnings are significantly higher than median pensions, so, with retirement a person is giving up a lot of possible income.

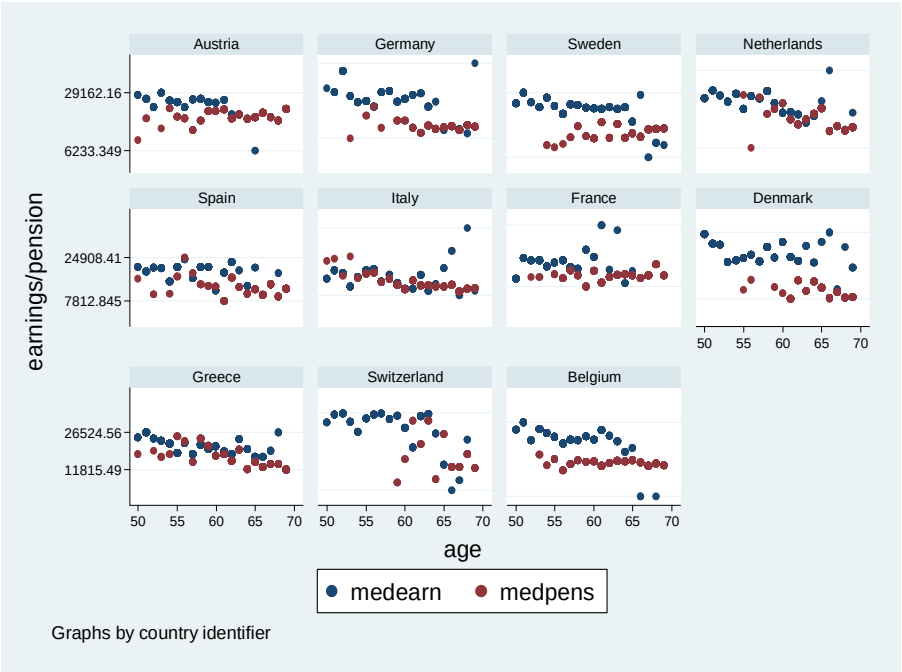

Figure 5.4 Median annual earnings and pensions for men across waves 1, 2 of SHARE by age and country.

The same graph for women is available in Figure 5.5. Only Sweden and Denmark provide strong financial incentives to stay at work for women, whereas other countries provide more incentives to retire. But, even though financial incentives to retire are stronger for women than for men, we remember that baseline probabilities for women were lower. Thus, it is not obvious how these incentives actually affect retirement decisions of women.

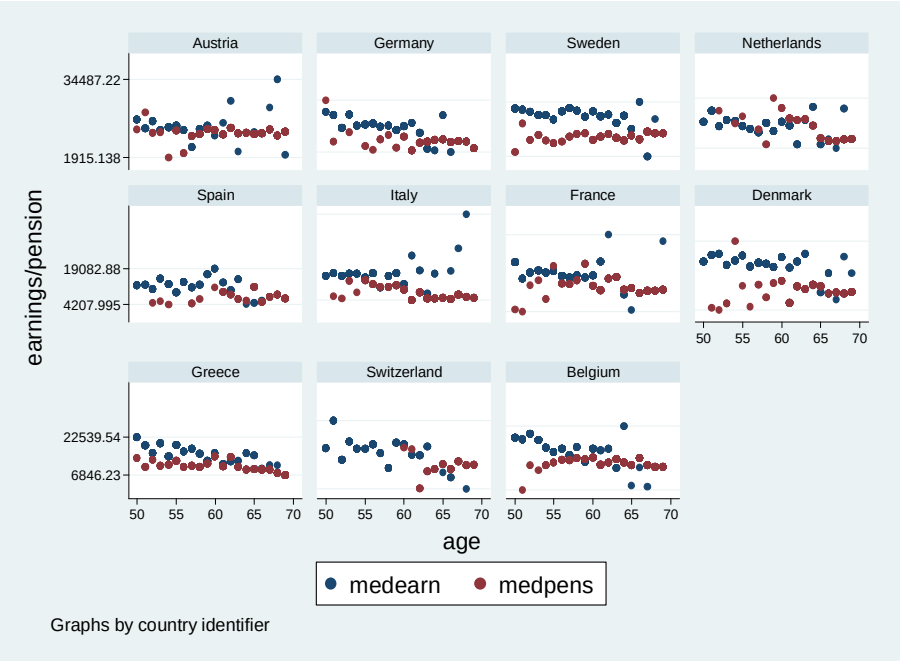

Figure 5.5 Median annual earnings and pensions for women across waves 1, 2 of SHARE by age and country.

Similar graphs can be found in Figure A.7 and Figure A.8 in the Appendix, but they use more complicated measures of financial incentives, which will be derived latter in this chapter. They might be more informative and descriptive, as they depict clear differences between expected earnings and expected pensions, which is exactly what we call “option value” in this paper.

So far, we have seen that in different countries financial incentives are stronger or weaker, but yet we know nothing about whether these incentives influence behavior of individuals concerning retirement. In the next chapter I proceed with an actual estimation of the effect of financial incentives on retirement decision for a pooled dataset. I start with using simple measures of income variables, and continue with a more sophisticated approach.

5.2 Simple measures of financial incentives

To begin with, I would like to try the simplest approach and estimate decision equation with previous year earnings. Previous year earnings are strongly connected to an option value to postpone retirement in my setup, so, it would be interesting to see how this measure affects retirement decisions. I am interested in the transition from employment to retirement, therefore I work only with persons who were employed (or self-employed) in the first period, and either stayed in this status in the second period, or changed their status to "retired".

Table 5.1 shows several estimations. Each specification contains income measure to which I gradually add other factors. To the second specification I add years to legal retirement variable. I choose years to legal retirement variable over the age variable to account for differences in regulations on normal retirement ages across countries. I also include country dummies everywhere to account for institutional factors. The reference is Austrian data, for each other country there is a dummy. I report average marginal effects on the contrary to marginal effects at means following justification presented in Bartus (2005).

Table 5.1 Probit estimates of the probability of transition to pensioner status using previous year income as financial incentive measure, individuals aged 50-65.

	(1) Transition	(2) Transition	(3) Transition	(4) Transition	(5) Transition	(6) Transition
Previous year earnings (in logs)	-0.0150*	-0.00269	-0.0208***	-0.0124*	-0.00625	-0.00397
	(0.00589)	(0.00530)	(0.00610)	(0.00598)	(0.00555)	(0.00562)
Years to legal retirement age		-0.0415***			-0.0413***	-0.0414***
		(0.00117)			(0.00117)	(0.00117)
Woman			-0.0479***		-0.0275*	-0.0270*
			(0.0126)		(0.0120)	(0.0116)
Very good health				0.0208		0.00486
				(0.0190)		(0.0178)
Good health				0.0660**		0.0399*
				(0.0202)		(0.0175)
Fair health				0.0951**		0.0695**
				(0.0291)		(0.0250)
Poor health				0.106		0.0940*
				(0.0656)		(0.0474)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	4491	4491	4491	4491	4491	4491
Pseudo R^2	0.0221	0.2899	0.0270	0.0296	0.2910	0.2946

Average marginal effects
Standard errors clustered by household in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Alone, previous year earnings negatively affect retirement probabilities, as was expected. Inserting gender and health variables changes effect of income and weakly affects its significance. However, if we add years to legal retirement variable, effect of previous year earnings becomes totally insignificant. Pseudo R-squared also suggests that income together with gender and health are weak predictors of retirement, most of variation in retirement probabilities in these models is explained by years to legal retirement variable. So, we cannot argue about effect of financial incentives on retirement decisions from models estimated with previous year earnings. There is a need to use different, more precise, measure of expected income.

Next, I estimate decision equation with another group of income measures. As indicated in the previous chapter, I calculate expected earnings or pensions in the second period using their growth rates or replacement rates respectively. Average growth rates of earnings and replacement rates were derived from SHARE data by country and gender for working individuals and retirees respectively and are presented in Table A.3 and Table A.4 in the Appendix. I predict earnings and pensions only where these are counterfactual and otherwise I use second year values as expected income measures. Such an estimation is by construction contaminated by self-selection. I expect the results to be problematic, but it is hard to say to what extent. As I am still interested in possibility to apply simpler measure of income, let's examine the results.

I estimate decision equation as a probit model in different specifications separately for men and women. I start with the simplest one, and then I add years to legal retirement variable. Third specification includes also dummies for household composition, health, and job satisfaction. The reference category is person living alone with excellent health and perfectly satisfied with job. Table 5.2 shows estimates for a sample of individuals aged 50-65,

i.e. for those, who are actually exposed to early retirement. First three models are estimated for men, the rest – for women.

Expected earnings and pensions have a large effect on retirement probabilities in all specifications; however, the effect has a wrong sign. Other effects are more or less meaningful: years to legal retirement have same negative effect for both men and women; poor health and household composition factors more affect men, whereas job satisfaction is more important for women's decisions. But, reversed signs on income effects show that there is something wrong with all these estimations.

Table 5.2 Probit estimates of the probability of transition to pensioner status using simple measures of income variables, individuals aged 50-65, men [(1)-(3)] and women [(4)-(6)].

	(1) Transition (men)	(2) Transition (men)	(3) Transition (men)	(4) Transition (women)	(5) Transition (women)	(6) Transition (women)
Log(Expected earnings)	0.116***	0.0709***	0.0735***	0.112***	0.0885***	0.0880***
	(0.00523)	(0.00344)	(0.00353)	(0.00670)	(0.00495)	(0.00501)
Log(Expected pension)	-0.138***	-0.0826***	-0.0806***	-0.118***	-0.0791***	-0.0781***
	(0.00476)	(0.00330)	(0.00332)	(0.00424)	(0.00330)	(0.00331)
Years to legal retirement age		-0.0285***	-0.0277***		-0.0252***	-0.0245***
		(0.000582)	(0.000604)		(0.000657)	(0.000703)
Somehow satisfied with job			0.0253***			0.00177
			(0.00700)			(0.00510)
Unsatisfied with job			0.0480***			0.0139
			(0.0129)			(0.0101)
Strongly unsatisfied with job			-0.0471+			0.102***
			(0.0261)			(0.0249)
Very good health			-0.0127			-0.0105+
			(0.00890)			(0.00620)
Good health			0.00413			0.0245***
			(0.00898)			(0.00699)
Fair health			0.0128			0.0287**
			(0.0125)			(0.0103)
Poor health			0.0660*			0.0576***
			(0.0295)			(0.0165)
Couple living alone			0.0935***			0.0347***
			(0.0123)			(0.00853)
Living with family			0.0890***			0.0233*
			(0.0146)			(0.0102)
Living with others			0.132***			-0.0583**
			(0.0389)			(0.0216)
Number of children			-0.0133***			-0.00857***
			(0.00195)			(0.00212)
Number of grandchildren			0.00810***			0.00561***
			(0.00118)			(0.00122)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	2274	2274	2262	1846	1846	1843
Pseudo R^2	0.2127	0.4803	0.4952	0.1701	0.4124	0.4323

Average marginal effects
Standard errors clustered by household in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

For other specifications, and also for a joint sample (Table A.6 in the Appendix), estimation results are very similar and all show reversed signs. As it was expected, such measures of expected earnings and pensions do not capture the desired effect. Apparently, there is much more variation in expected pensions of non-retired individuals than it was captured by replacement rates estimated on a sample of only 727 retirees. Thus, we need different measure of financial incentives.

5.3 Advanced measures of financial incentives and Heckman two-step procedure

The simple measures of expected income and pension didn't help in quantifying the effect of financial incentives on retirement decisions. Therefore, I proceed with a more sophisticated method for estimation of income variables, which will give us consistent estimates that can be used in decision equation.

Reduced form probit

Following a two-step Heckman procedure, I start with estimation of a reduced form probit model in several specifications. I present estimations on two samples: respondents aged from 50 to 82 and from 50 to 65. By default I cluster standard errors by households; however as a part of robustness checks I produce estimations with clustering by country.

In the first specification, probability of transition to retirement status is described by years remaining to legal retirement age and country dummies. The average marginal effects and standard errors are presented in column (1) of Table 5.3. We see that coefficient on years to legal retirement variable is negative and highly significant, which is not a surprise. I expect that the further person is from the normal retirement age, the lower is probability of her transition to retirement. Second specification includes also square of years to legal retirement variable, which appears to be highly significant.

Table 5.3 Reduced-form probit estimates of the probability of transition to pensioner status, individuals aged 50-82 [(1) – (4)] and 50-65 [(5)].

	(1) Transition	(2) Transition	(3) Transition	(4) Transition	(5) Transition
Years to legal retirement age	-0.0371***	-0.0310***	-0.00427	-0.00495	-0.0188***
	(0.00145)	(0.00190)	(0.00345)	(0.00335)	(0.00364)
Years to legal retirement age squared		-0.000862***	-0.000710***	-0.000618***	0.000393***
		(0.000202)	(0.0000829)	(0.0000845)	(0.000110)
Woman			-0.00637	-0.0104	-0.00862
			(0.00581)	(0.00679)	(0.00662)
Couple living alone			0.0783***	0.0696***	0.0724***
			(0.0102)	(0.01000)	(0.0103)
Living with family			0.0356**	0.0271*	0.0297*
			(0.0114)	(0.0114)	(0.0115)
Living with others			0.0520	0.0658	0.0676
			(0.0417)	(0.0407)	(0.0415)
Very good health			0.0110	0.0201*	0.00738
			(0.00867)	(0.00888)	(0.00852)
Good health			0.0379***	0.0401***	0.0328***
			(0.00872)	(0.00884)	(0.00854)
Fair health			0.0659***	0.0492***	0.0499***
			(0.0127)	(0.0126)	(0.0124)
Poor health			0.0967***	0.0784***	0.0694**
			(0.0255)	(0.0235)	(0.0227)
Number of grandchildren			0.0122***	0.0102***	0.00957***
			(0.00123)	(0.00119)	(0.00114)
Number of children			-0.0160***	-0.0128***	-0.0106***
			(0.00215)	(0.00210)	(0.00205)
Age			0.0201***	0.0188***	0.0172***
			(0.00338)	(0.00326)	(0.00328)
Previous year earnings (in logs)				-0.00314	0.00116
				(0.00281)	(0.00282)
Years of education				-0.00338***	-0.00242***
				(0.000611)	(0.000618)
Somehow satisfied with job				-0.01000+	-0.00604
				(0.00590)	(0.00580)
Unsatisfied with job				0.0510***	0.0616***
				(0.0128)	(0.0128)
Strongly unsatisfied with job				0.0515*	0.0714**
				(0.0251)	(0.0247)
Civil servant				0.0249*	0.0161
				(0.0103)	(0.00984)
Self employed				-0.0867***	-0.0773***
				(0.00665)	(0.00660)
Private sector of employment				-0.00735	-0.00552
				(0.00750)	(0.00725)
Hours worked				-0.000529**	-0.000536**
				(0.000170)	(0.000171)
Years of experience				0.00226***	0.00307***
				(0.000308)	(0.000322)
Country fixed effects	Yes	Yes	Yes	Yes	Yes
N	4674	4674	4674	4484	4404
Pseudo R^2	0.2749	0.2768	0.2945	0.3218	0.3354

Average marginal effects
Standard errors clustered by household in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The third equation is estimated with a set of socio-demographical explanatory variables, which include gender, household composition, number of children and number of grandchildren, age, and self-perceived health variable. I also constructed a dummy variable for whether a spouse is retired; however, there was a serious lack of data, and, I could not use this variable for estimation. Coefficient on woman is not significant here, thus on average women have the same probability of transition into retirement as men, which is not what we saw in the data. Years to legal retirement became insignificant and half of its previous effect is now captured by age variable.

Fourth and fifth specifications are estimated using set of employment related variables: education, job satisfaction, whether person is employee, civil servant or self-employed, sector of employment, hours worked, years of experience, and previous year annual earnings from employment or self-employment. In columns (4) and (5) of Table 5.3 I present estimation outputs for samples “50-82” and “50-65” respectively. For both samples most estimates are similar in terms of significance and magnitude. It appears that each additional year of education decreases transition probabilities. Non-satisfaction with job positively affects retirement probability. As we would expect, self-employed people are less likely to retire: the coefficient on self-employment is negative, large in absolute value, and highly significant. Hours worked per week have a small negative impact on retirement probabilities. Years of experience has positive effect on probability of retirement; however this effect is very low. I also added square of years to legal retirement variable, which appears to be highly significant.

Earnings variable is insignificant for both samples. I also tried to estimate the same equations using clustering of standard errors by country; the results are presented in columns (1) and (2) of Table A.7 in the Appendix. Usage of such a kind of standard errors even increases significance of results. Other robustness checks, presented in Table A.7, show that most of the coefficients are quite stable, except coefficients on years to legal retirement.

Income equations

The next step is estimation of non-pensioner and pensioner income equations. Firstly, I estimate earnings equation on a sample of those who didn't retire in second period, which has 3663 individuals. Table 5.4 contains estimates from different specifications, with and without correction for selectivity and for large and small samples. All models are estimated by OLS with standard errors clustered by households. Columns (1) and (4) show results from the simplest specification for samples "50-82" and "50-65" respectively. Logarithm of non-pensioner income in second period is defined by autoregressive term, years of experience, education, age, gender, and a set of country dummies. For both samples the coefficient on previous year income is large positive and highly significant. Years of experience have positive effect on earnings, but this effect is less significant than we would expect. Effect of years of education is very strong across all specifications. Older people tend to earn less, and women tend to earn significantly less than men.

In specifications (2) and (5) I add more covariates that help in identification. Income for civil servants tends to be higher than for employees, whereas for self-employed it tends to be lower on average. Sector of employment doesn't have a strong predictive power for income, whereas hours worked affect income positively, which is not surprising.

In equations (3) and (6) I added selectivity term to all previous variables. I perform estimations for a sample "50-82" using equation (4) from Table 5.3 as selection equation and for a "50-65" sample using equation (5) from Table 5.3 for selection. The selection terms have statistically significant coefficient only in a smaller sample. The magnitude is large, but significance is weak. This suggests that the expected future income of those who decide to retire and those who don't somehow differ. In this case implementation of Heckman two-step procedure is partly justified. Table A.8 in the Appendix contains same estimations with standard errors clustered by country; results don't differ from the above ones.

Table 5.4 OLS estimations of earnings equation, individuals aged 50-82 [(1)-(3)] and 50-65 [(4)-(6)]. Equations (3) and (6) estimated with selection terms.

	(1) Earnings	(2) Earnings	(3) Earnings	(4) Earnings	(5) Earnings	(6) Earnings
$Log(earnings)_{t-1}$	0.474***	0.447***	0.444***	0.469***	0.442***	0.439***
	(0.0251)	(0.0252)	(0.0252)	(0.0254)	(0.0255)	(0.0255)
Years of experience	0.00625***	0.00524**	0.00586**	0.00625***	0.00519**	0.00682***
	(0.00184)	(0.00181)	(0.00190)	(0.00185)	(0.00182)	(0.00202)
Woman	-0.133***	-0.140***	-0.139***	-0.136***	-0.144***	-0.143***
	(0.0240)	(0.0244)	(0.0244)	(0.0242)	(0.0246)	(0.0245)
Age	-0.0164***	-0.0118**	-0.00327	-0.0171***	-0.0133***	0.00294
	(0.00377)	(0.00366)	(0.00838)	(0.00408)	(0.00395)	(0.00863)
Years of education	0.0241***	0.0220***	0.0207***	0.0244***	0.0221***	0.0200***
	(0.00336)	(0.00338)	(0.00353)	(0.00339)	(0.00341)	(0.00353)
Civil servant		0.0791*	0.0863**		0.0802**	0.0896**
		(0.0308)	(0.0314)		(0.0308)	(0.0311)
Self employed		-0.291***	-0.321***		-0.296***	-0.344***
		(0.0468)	(0.0528)		(0.0478)	(0.0541)
Private sector of employment		-0.0280	-0.0288		-0.0282	-0.0295
		(0.0249)	(0.0248)		(0.0250)	(0.0249)
Hours worked		0.00476***	0.00467***		0.00461***	0.00439***
		(0.000911)	(0.000916)		(0.000930)	(0.000943)
lambda			-0.331			-0.668*
			(0.282)			(0.328)
_cons	5.510***	5.449***	5.507***	5.591***	5.589***	5.684***
	(0.306)	(0.300)	(0.301)	(0.321)	(0.314)	(0.317)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	3663	3613	3608	3627	3578	3573
R^2	0.333	0.356	0.356	0.329	0.352	0.353
adj. R^2	0.330	0.353	0.353	0.326	0.349	0.349
F	73.57	70.23	66.64	72.14	68.76	65.22

Standard errors clustered by household in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Logarithm of pensioner income in second period is defined by logarithm of earnings from employment or self-employment in the first period, years of experience, self-employment and civil servant dummies, years to legal retirement age and its square, woman dummy, and set of country specific dummies. Equations (1)-(6) in Table 5.5 were estimated using OLS with clustered standard errors on a sample of those only, who were working in first period but retired in second, as only for these individuals pension income is observable. Full sample contains 536 observations, sample "50-65" contains at most 493 observations. Equations (1) and (4) are estimated without civil servant or self-employed dummies, equations (2) and (5) contain these dummies, and equations (3) and (6) contain also selectivity

terms. Previous period earnings remain weakly significant in all specifications. For civil servants pension is significantly higher on average than for employees or self-employed. Women receive on average significantly lower pensions than men. However, neither years to legal retirement variable nor its square help in predicting future pension. Years of experience, the variable for which I had the most hope in predicting pensioner income, also appears to be insignificant. All the variables are significant jointly, as suggested by an F-test. Fit is very low, but it increases with adding civil servant dummies and decreasing sample size. Adding a selection term into equations does not improve estimates, and coefficients on selection terms are insignificant. This suggests that expected pension for those who decided to retire, and those who do not doesn't differ significantly. Table A.9 in the Appendix shows estimates with standard errors clustered by country; results don't differ substantially.

Table 5.5 OLS estimations of pensioner income equation, individuals aged 50-82 [(1)-(3)] and 50-65 [(4)-(6)]. Equations (3) and (6) estimated with selection terms.

	(1) Pension	(2) Pension	(3) Pension	(4) Pension	(5) Pension	(6) Pension
Log(earnings) $_{t-1}$	0.119*	0.107*	0.1000*	0.143**	0.129*	0.126*
	(0.0462)	(0.0465)	(0.0465)	(0.0534)	(0.0535)	(0.0536)
Years of experience	0.00126	0.00137	-0.00000228	0.00605	0.00598	0.00437
	(0.00579)	(0.00580)	(0.00546)	(0.00600)	(0.00605)	(0.00569)
Years to legal retirement age	0.00465	0.000240	-0.0172	-0.00405	-0.00813	-0.0340
	(0.00910)	(0.00976)	(0.0218)	(0.0141)	(0.0143)	(0.0315)
Years to legal retirement age squared	0.00112^{+}	0.00124^{+}	0.000648	0.00167	0.00190	0.00198
	(0.000602)	(0.000632)	(0.000904)	(0.00123)	(0.00124)	(0.00125)
Woman	-0.241**	-0.261**	-0.278***	-0.210*	-0.225**	-0.241**
	(0.0802)	(0.0817)	(0.0823)	(0.0832)	(0.0841)	(0.0848)
Civil servant		0.281**	0.278**		0.309**	0.308**
		(0.0929)	(0.0925)		(0.0954)	(0.0943)
Self employed		-0.122	-0.150		-0.0698	-0.133
		(0.0965)	(0.124)		(0.104)	(0.141)
lambda			-1.591			-3.025
			(4.852)			(4.353)
_cons	7.958***	8.062***	8.097***	7.627***	7.724***	7.588***
	(0.535)	(0.541)	(0.663)	(0.601)	(0.602)	(0.736)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	536	528	518	493	486	478
R^2	0.106	0.128	0.130	0.117	0.140	0.141
adj. R^2	0.080	0.099	0.099	0.089	0.109	0.108
F	4.432	4.987	4.684	4.698	5.273	5.141

Standard errors clustered by household in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.10 in the Appendix contains results from other specifications. In particular, I tried to replace years to legal retirement and its square variables with two dummies: “close to legal retirement” and “passed legal retirement”. Close to legal retirement was defined as 1 if respondent has less than two years until legal retirement age. In another specification I replaced previous variables by “passed early retirement” dummy. Neither of specifications worked on both full and reduced samples.

Figure A.7 and Figure A.8 in the Appendix depict median expected earnings and pensions predicted from model (2) in Table 5.4 and model (2) in table Table 5.5 respectively, separately for men and women by age and country. We can learn about strength of financial incentives in different countries, and also we can compare these graphs to the ones with raw data. Our measures capture similar patterns to raw earnings and pension data in Figure 5.4 and Figure 5.5, which is good.

Decision equation

Finally, I turn to a structural estimation of probability of transition into retirement. The variables that predict retirement decision are first of all the expected earnings and expected pensioner income, which absorb also lagged labor income variable. Börsch-Supan et al (2004) suggest to add experience, education variables and self-employed and civil servant dummies to the decision equation along with expected labor income, however I believe that these variables affect retirement decision through expected labor income only, which is already included into equation. Years to legal retirement is one of the main predictors for retirement decision apart from its indirect effect through expected pensioner income. Other variables that may predict probability of transition into retirement are job satisfaction dummies, health dummies, gender and household composition dummies, age, number of children and grandchildren, and country dummies.

I estimated equations (1) and (2) in Table 5.6 on a sample of 4484 individuals aged from 50 to 82. Equations (3) and (4) are estimated for "50-65" sample of 4404 individuals. Equations (2) and (4) are estimated using expected labor and pensioner income with correction for selection. Estimates of coefficients for most variables are very similar to those estimated for a reduced form probit in Table 5.3.

Coefficients on years to legal retirement age variable are highly significant and have same magnitude over different specifications. Being 1 year closer to legal retirement age for an average person means increase in probability of retirement by around 0.03% in each specification.

The most important for us is the role of financial incentives in predicting retirement probabilities. Coefficients on expected pension are highly significant throughout all specifications presented in Table 5.6. The effect varies from 0.065% to 0.17% increase in probability of retirement if expected pension is 1% higher than average. Effects, estimated on a sample of people aged from 50 to 65, are much larger. This could mean that for people who retire early financial incentives are more important than for older individuals. Heckman selection approach reduces coefficients on expected pensions by 0.04% for each sample, which a large difference. As I expected, without correction for selectivity the effects are overestimated.

The role of expected earnings is less significant for retirement decisions. Coefficients are significant only for a smaller sample and magnitude varies a lot. Expecting 1% higher earnings than average decreases probability of retirement by 0.042%, which reduces to 0.027% if I use the Heckman selection approach for estimation.

Table 5.6 Structural probit estimates of probability of transition into pensioner status, individuals aged 50-82 [(1)-(2)] and 50-65 [(3)-(4)]. Equations (2) and (4) estimated with correction for selectivity.

	(1) Transition	(2) Transition	(3) Transition	(4) Transition
Expected earnings (in Logs)	-0.0240**	-0.0105	-0.0419***	-0.0268***
	(0.00803)	(0.00802)	(0.00743)	(0.00791)
Expected pension (in Logs)	0.110***	0.0648**	0.170***	0.130***
	(0.0222)	(0.0230)	(0.0172)	(0.0197)
Years to legal retirement age	-0.0299***	-0.0295***	-0.0340***	-0.0338***
	(0.000699)	(0.000691)	(0.000554)	(0.000557)
Woman	0.0130	0.00129	0.0181**	0.00847
	(0.00791)	(0.00765)	(0.00670)	(0.00673)
Somehow satisfied with job	0.00322	0.00281	0.00180	0.00159
	(0.00559)	(0.00558)	(0.00522)	(0.00522)
Unsatisfied with job	0.0594***	0.0631***	0.0562***	0.0634***
	(0.0123)	(0.0124)	(0.0115)	(0.0118)
Strongly unsatisfied with job	0.0686**	0.0697**	0.0729**	0.0784***
	(0.0236)	(0.0238)	(0.0229)	(0.0235)
Very good health	0.0142+	0.0153+	0.00351	0.00437
	(0.00808)	(0.00808)	(0.00741)	(0.00744)
Good health	0.0399***	0.0427***	0.0305***	0.0347***
	(0.00837)	(0.00846)	(0.00761)	(0.00773)
Fair health	0.0513***	0.0560***	0.0491***	0.0566***
	(0.0121)	(0.0123)	(0.0110)	(0.0113)
Poor health	0.0922***	0.0985***	0.0765***	0.0867***
	(0.0230)	(0.0235)	(0.0211)	(0.0218)
Couple living alone	0.0720***	0.0764***	0.0691***	0.0777***
	(0.00997)	(0.0101)	(0.00934)	(0.00953)
Living with family	0.0236*	0.0249*	0.0278**	0.0310**
	(0.0103)	(0.0104)	(0.0101)	(0.0102)
Living with others	0.0728+	0.0784*	0.0729+	0.0842*
	(0.0376)	(0.0380)	(0.0392)	(0.0402)
Number of grandchildren	0.0126***	0.0131***	0.0116***	0.0127***
	(0.00118)	(0.00118)	(0.00113)	(0.00113)
Number of children	-0.0143***	-0.0150***	-0.0127***	-0.0140***
	(0.00206)	(0.00206)	(0.00202)	(0.00202)
Country fixed effects	Yes	Yes	Yes	Yes
N	4484	4484	4404	4404
Pseudo R^2	0.2942	0.2933	0.3181	0.3152

Average marginal effects
Standard errors clustered by household in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.11 in the Appendix presents same estimations with standard errors clustered by country, and the significance doesn't change dramatically even though standard errors become larger. In addition, I perform a series of robustness checks in Table A.12 in the Appendix using different sets of covariates for identification purposes. Across all specifications effects of expected pension on retirement decisions is significant and more or less of the same magnitude. Effects corrected for selectivity are usually smaller.

How large is the effect of financial incentives compared to effects from other factors?

So far, I have found that increase in expected pension substantially increases probability of retirement and increase in expected earnings somehow decreases this probability. To assess the magnitude of these effects I compare them to results from previous studies and also to effects from other factors that might matter for retirement decisions.

Results obtained in this paper are in line with the previous studies on the same countries. For example, Piekkola and Deschryvere (2005) estimated structural model with an option value term on a pooled data for Belgium, Finland and Denmark and found out that one percent increase in option value to postpone retirement decreases probability of retirement by 0.10% for men and 0.08% for women. Dellis et al (2004) give similar results for Belgium, which are 0.04% for men and 0.08% for women. Blanchet and Mahieu (2004) report effects from option values for France, which are 0.02% for men and 0.04% for women. Of course, all these results are different from mine, because I estimated effects from expected earnings and expected income separately instead of estimating effect of an option value. But because these two measures are conceptually very close, I expected the results to be of a similar magnitude and sign. The fact that it is true adds confidence to my results.

Also, I compare my results to results from Cseres-Gergely (2009), which conceptually are the closest to what I estimated. The effect of expected pension on retirement decisions is only a bit higher than estimated in his work. However, my study underestimates the effect of expected earnings more than twice compared to the previous study. The ratio of effect of two income sources may indicate how much individuals value leisure or dislike work. In my case the ratio is almost 5, whereas in Cseres-Gergely (2009) it is 1.5 and in Stock and Wise (1990) it is 1.6. This could mean that people who took part in SHARE survey highly value leisure associated with retirement, which might be a feature of developed European countries.

Further, I compare effects from financial incentives to effects from other factors. In this study I used several groups of additional explanatory variables, which helped in identification during estimation of decision equation by Heckman selection approach. In the meanwhile, it is itself interesting to analyze the impact of health, household composition, or satisfaction with job on retirement decisions. The effects almost don't differ across specifications in reduced and structural models; therefore I will refer to Table 5.6.

I would expect that the most important impact on retirement decision has health. Indeed, having good, fair or poor health gradually increases probability of retirement compared to having excellent or very good health. Persons with poor health are 0.092% more likely to retire than those who have excellent health.

Strong non-satisfaction with a job increases the probability of retirement by 0.068%, which is also a large impact. This could be evidence of the low ability of older workers to adapt to new workplaces and their unwillingness to undertake new job. Also, workers close to retirement age are usually less likely to be offered a vacancy. While younger people still can change their job in case they are unsatisfied with the previous one, for older people it might be much easier to retire than to start another job.

Compared to person living alone, a person living with a partner is 0.072% more likely to retire. I also tried to include marital status variable instead of household composition variable, and it appears that married people have higher probability to retire than never married or divorced people. Results are not presented here. It seems that living with someone increases probability of retirement. It may be explained either by possibility to rely on spouse's income or by possibility to spend leisure time together if both spouses retire together, as suggested by Coile (2003). Another interesting result is that number of children reduces probability of retirement, whereas number of grandchildren increases this probability. People who have children may have to support them financially, thus, have more incentives to

continue to work. On the other hand, people who have grandchildren most probably have mature and financially independent children, who could provide financing for their parents, while the latter take care of grandchildren, hence, increase in probability of retirement.

In addition to all the estimations which involved income variables, Table A.13 in the Appendix presents estimations of decision equation without including income measures. Job satisfaction doesn't matter anymore, whereas effect of health and household composition increases almost twice and woman variable becomes significant.

Now, I am ready to compare effects of financial incentives to effects from other factors that matter for retirement decision. The role of expected pension in determining probability of transition to retirement is the highest among all explanatory variables, even though the effect differs from one specification to another. Effect form increase in expected pension wealth only by 1 % reaches 0.13% in last specifications, which is twice as large as effect from having poor health, and more than three times larger than effect from being 1 year closer to normal retirement age. Expected income is less important for SHARE respondents in their decisions about retirement. Individuals are more responsive to changes in expected pension wealth than to changes in expected earnings. Finally, decisions of potential early retirees are stronger affected by financial incentives than of older individuals. These findings may lead to an important policy implication: while trying to reduce early retirement rates among Europeans it is effective to change level of pension wealth, and it can be even more effective than increasing official retirement age.

6 Conclusions

In this paper I addressed the effect of financial incentives on retirement decisions of the older workers across eleven European countries using pooled data from the Survey of Health, Ageing and Retirement in Europe (SHARE). Analysis of raw data showed that problem of early retirement exists in all mentioned in my study countries. I showed that patterns of early retirement in some countries are connected to strength of financial incentives provided by the pension systems. To quantitatively assess the effect of expected income measures on decisions to retire, I estimated a structural model of retirement.

The results showed that one percent increase in expected pension level increases probability of retirement by 0.13% on the top of the baseline probability of retirement, which is 14.56% on average for analyzed countries. Expected income is less important in retirement decisions: one percent increase in expected earnings decreases probability of retirement by 0.03%. I corrected for self-selection problem using Heckman two-step procedure and showed that estimates without correction are overestimated over all model specifications.

To evaluate the results I compared the effects from financial incentives to effects from other factors that, I believe, affect retirement decisions. Poor health appeared to be weaker predictor of transition to retirement than one percent increase in expected pension benefits. Other factors like household composition, number of children and grandchildren, and job satisfaction are even less important for retirement decisions. I also compared the effect from expected pension to the effect from being one year closer to normal retirement age. The effect on probability of retirement from expecting 1% higher pensions than average is equivalent to being 3.8 years closer to legal retirement age than average. Obviously, increase in years to legal retirement is closely related to increases in official retirement age. Taking this into account, my results suggest that SHARE respondents are more responsive to changes in pension benefits than to increases in official retirement ages. Another interesting result is that

financial incentives are more important for people below 65 years old, i.e. for potential early retirees, whereas poor health stronger affects decisions of older people.

Due to data limitations encountered in my study, the results should be taken carefully. Firstly, the effects should be regarded as average across eleven countries. Lack of data didn't give me opportunity to perform country-level econometric analysis, which is a possible direction for future research. Further, the study covers three types of pension provisions: public, occupational and private. The nature of financial incentives provided by these pension plans might be different and, therefore, their impact on retirement decisions may vary. The study doesn't consider such provisions as unemployment benefits, disability benefits and survivor pension from partner, as incentives provided by such plans are of a completely different nature. Another interesting direction for further development of the study would be to account for spillover effects from financial incentives of the spouses, which failed to be implemented in my study because of insufficient number of spouses in the dataset.

Despite the above mentioned limitations, my study proved the ability of simple model to capture effects from financial incentives on probability of transition into retirement. Such model gives sufficient results under very little data requirements, whereas original option value model needs extended earnings histories and involves computations of a high complexity. Relatively simple but fruitful analysis enables me to derive a policy implication valid on the level of the European Union. To overcome the problem of early retirement and low participation in the labor force of the older workers both financial incentives and changes in official retirement ages are effective; however, based on a sample of SHARE respondents, potential early retirees are more responsive to changes in pension wealth than to increases in official retirement ages. Thus, based on the analysis, regulation of financial incentives can be more effective in keeping people at work then raising normal retirement ages in European countries.

Appendix

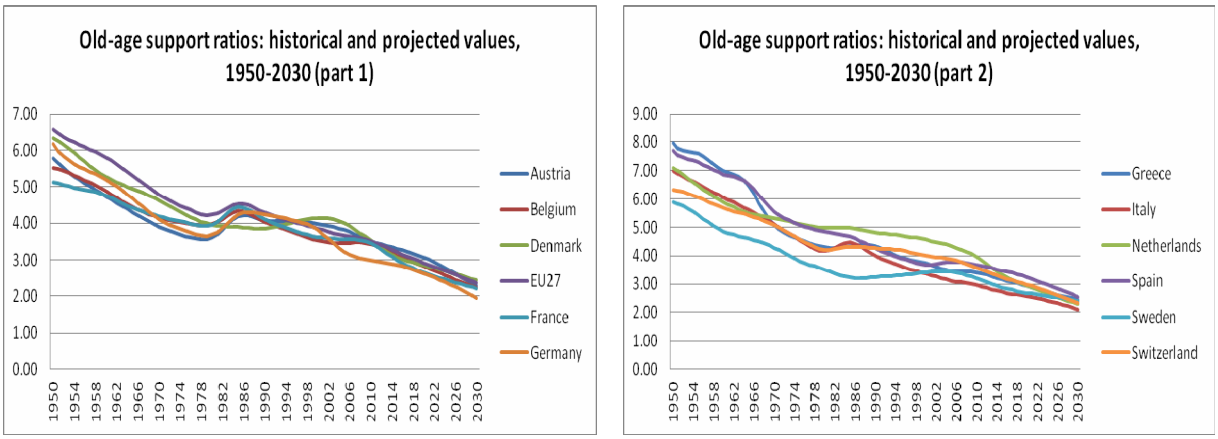

Figure A.1 Old-age support ratios: historical and projected values, 1950-2030. ***Source: OECD statistics.***

Comments:

Old-age support ratio is a reciprocal of dependency ratio and is equal to the number of people of working age (20-64) relative to the number of people of retirement age (65+). Figures show evolution of old-age support ratios for selected eleven European countries. The old-age support ratio has been falling rapidly since the middle of last century from 6.57 in 1950 to 3.5 in 2010 on average in EU. It is also projected to decrease even further and to fall below 2 in several decades, which means that in 20 years, instead of having 3.5 working-age individuals for every dependent person, there will be only 2.

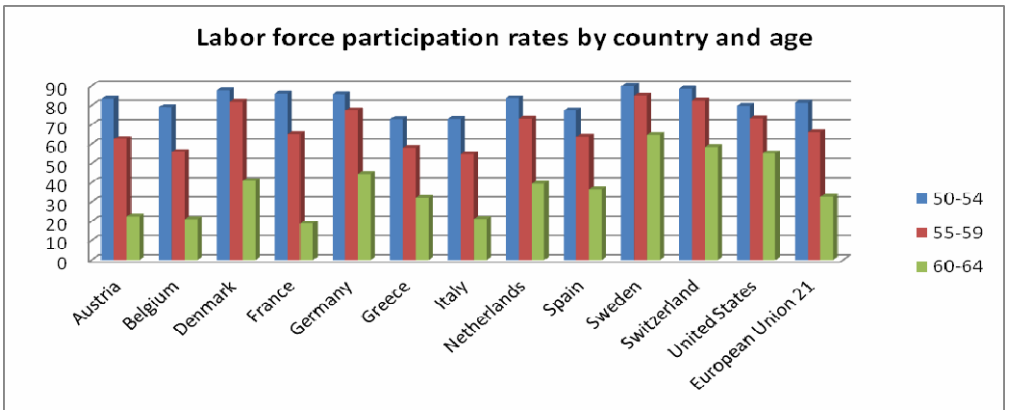

Figure A.2. Labor force participation rates by country and age, 2010. ***Source: OECD statistics.***

Comments:

On average in European Union 81% of people aged 50-54 engage in working activities. This proportion decreases to 66% for people aged 55-59 and falls to only 32% for those aged 60-64. Austria, Belgium, France and Italy have the lowest proportion of workers aged 60-64 (around 20%), whereas Sweden and Switzerland have the highest (64% and 58% respectively).

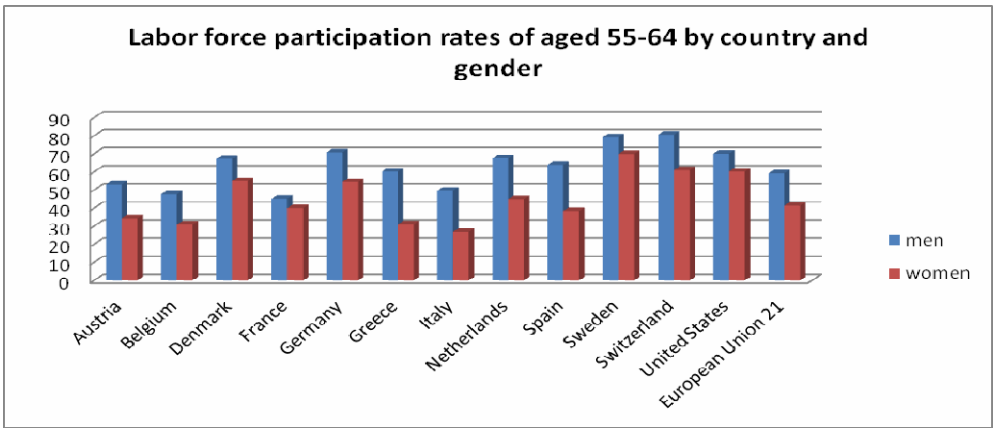

Figure A.3 Labor force participation rates of aged 55-64 by country and gender as of 2010. *Source: OECD statistics.*

Comments:

As shown in Figure 1.9, women of this age are much less active than men, whose participation rates reach 80% in Sweden and Switzerland. The most active women are also in Sweden, whose participation rate reaches 70%. The lowest participation rate for men is in France (40%) and for women is in Italy (28%). As noted by European Commission (2009) participation rates for women have steadily increased over the last 25 years.

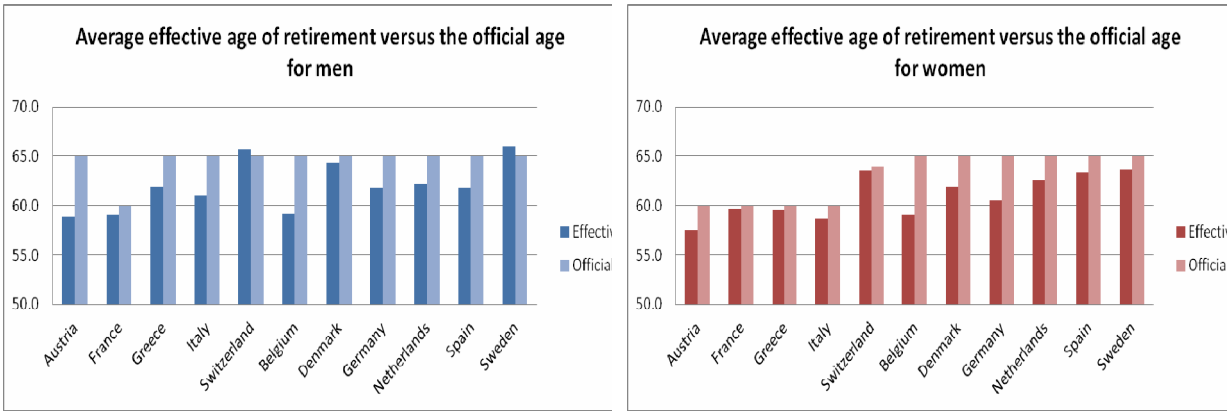

Figure A.4 Average effective age of retirement versus the official age for men and women. *Source:* OECD estimates derived from the European and national labor force surveys.

Comments:

All countries, except Sweden and Switzerland, had average exit rates below the normal retirement age for men. Austria, France and Belgium have the lowest effective retirement age of 59. For Sweden and Switzerland exit age is around 66, which is one year above the normal retirement age. Effective retirement ages for women are lower than normal retirement ages in all countries without exceptions. The lowest age is in Austria (57.5) and the highest is in Spain, Switzerland and Sweden (around 63.5).

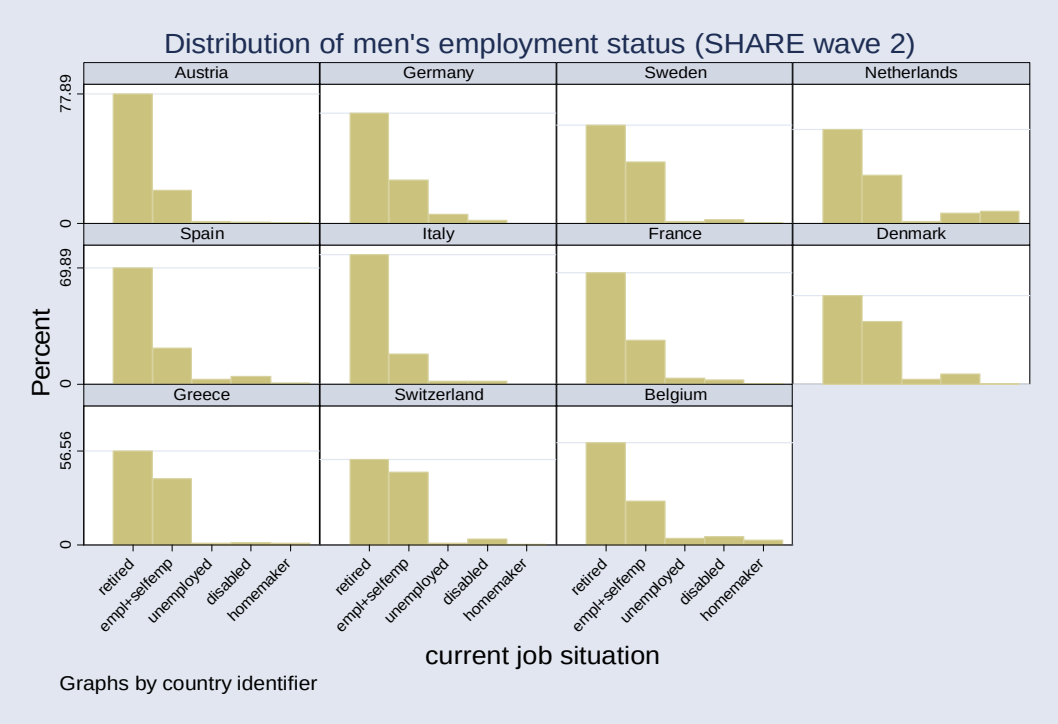

Figure A.5 Distribution of men's employment status by country. ***Source: SHARE dataset.***

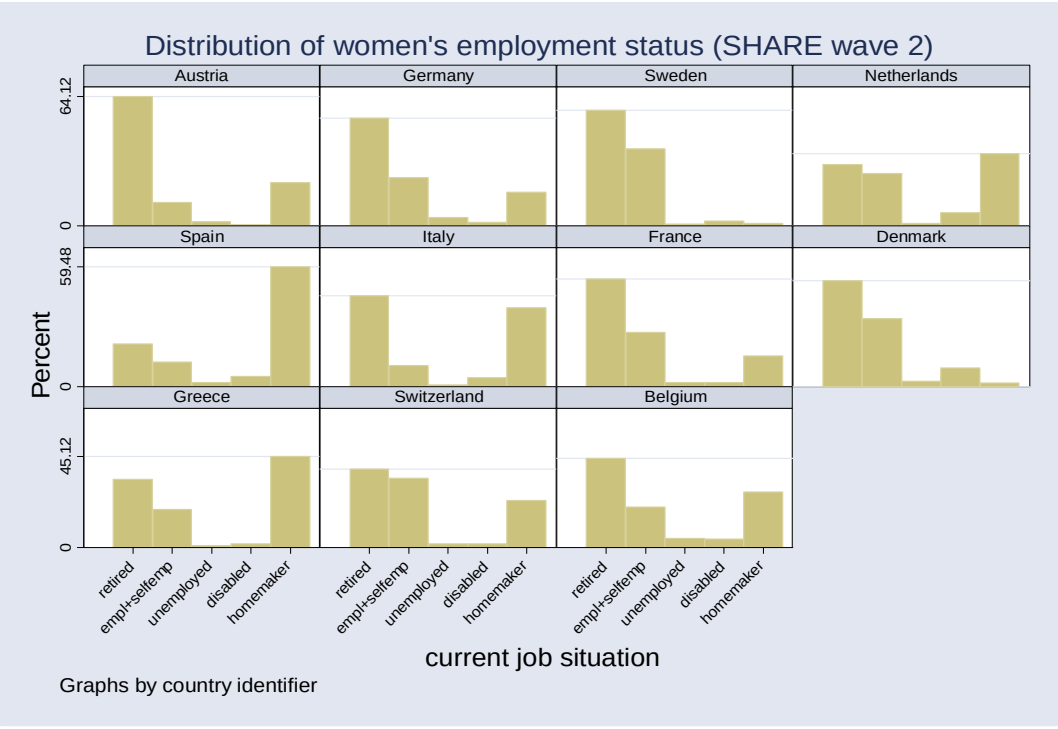

Figure A.6 Distribution of women's employment status by country. ***Source: SHARE dataset.***

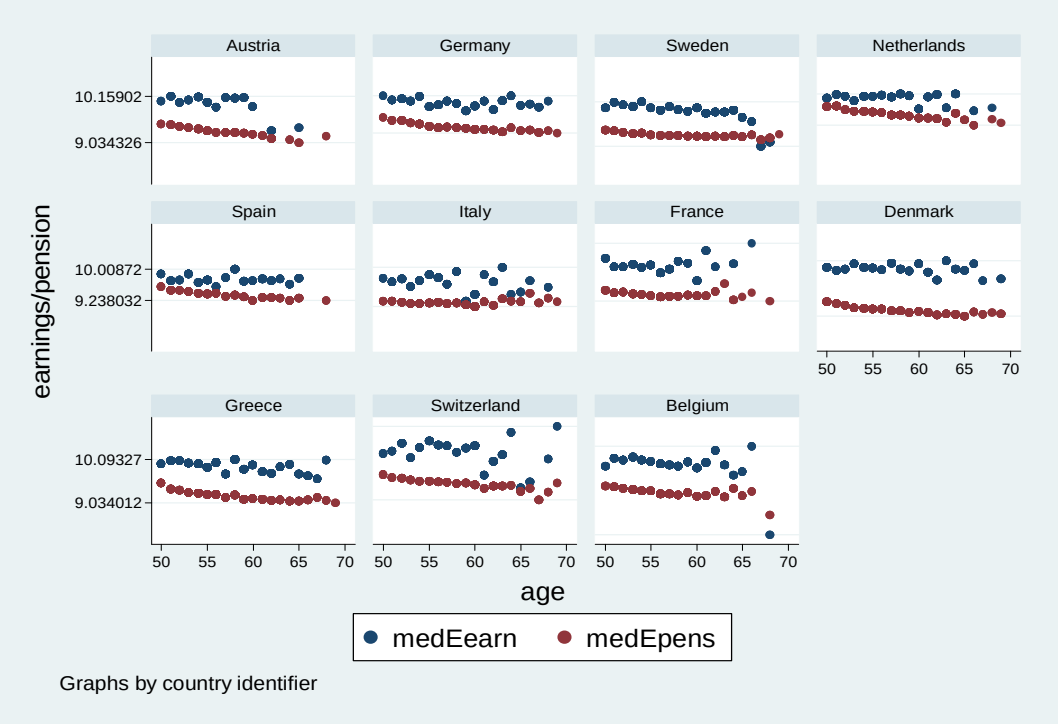

Figure A.7 Median expected earnings and pensions for men by age and country. *Source: SHARE dataset.*

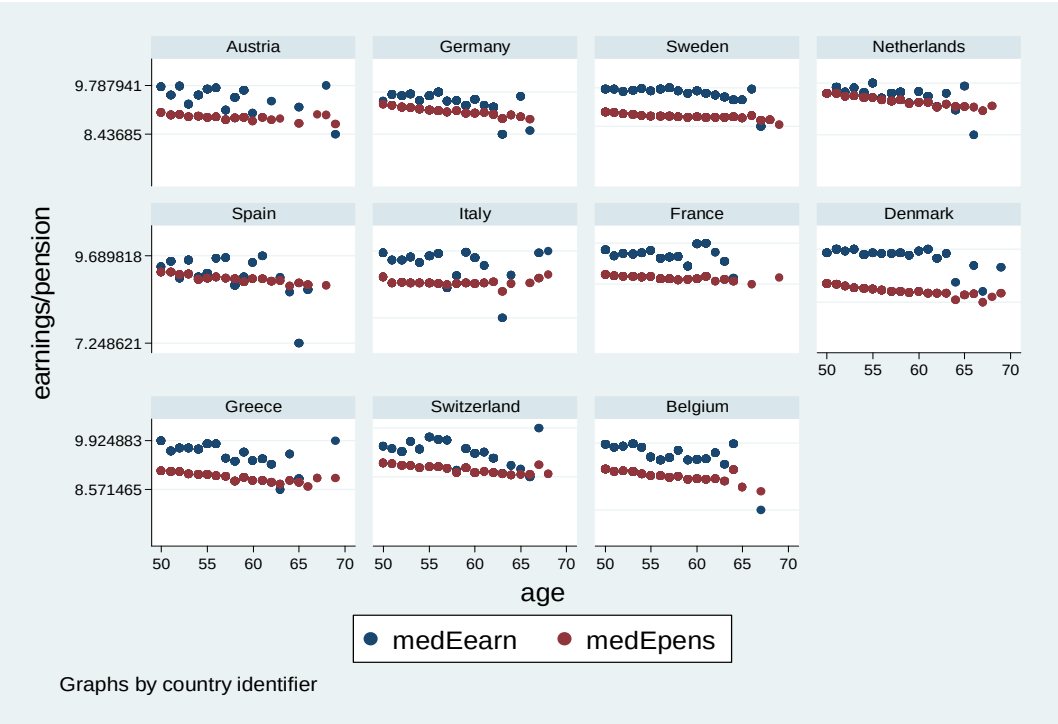

Figure A.8 Median expected earnings and pensions for men by age and country. *Source: SHARE dataset.*

Note: Expected earnings are predicted from model (2) in Table 6.4, expected pensions from model (2) in Table 6.5.

Table A.1 Comparison of pension systems in EU. *Source: OECD (2011).*[2]

	Short description	Normal retirement age	Coverage condition	Early retirement	Late retirement	Childcare	Unemployment
Austria	The pension system consists of a defined benefit public scheme with an income-tested top up for low-income pensioners.	65/60	7 years the last 30 years	Possible from 62 for men and from 57 for women, subject to 37.5 years of contributions. Otherwise, subject to reductions. Combining work and pensions is possible within earnings limit.	For retirement between the ages of 65 and 68 the pension is increased by 4.2% per year and there is no such increment after 68. Combining work and pensions is possible but there is an earnings limit.	Only 2 years per child are covered years and count towards the qualifying period for pension entitlement	Periods of receiving unemployment insurance benefits and unemployment assistance (at 70% of the assessment basis) count as contribution years
Belgium	The pension system has two components: an earnings-related public scheme with a minimum pension and a means-tested safety net.	65/64	A full career requires 45 years for men and 44 years for women. For shorter contribution histories, the pension will be provided, but calculated on the lower number of career years.	Possible from age 60, subject to 35 years contributions. No actuarial reduction in the pension calculation in the scheme of wage-earners. Combining work and pensions is possible but there is an earnings limit.	Possible. Also, possible to combine pensions and earnings (after normal pension age) within limits.	A maximum of three years in total caring for children may count as gainful employment.	unemployment years count in the numerator of the benefit formula
Denmark	There is a public basic scheme. A means-tested supplementary pension benefit is paid to the financially most disadvantaged pensioners. There is also a scheme based on individuals' contribution records - the ATP. Compulsory occupational schemes negotiated as part of collective agreements cover about 90% of full-time employees.	65/65	A full public old-age pension requires 40 years' residence. Shorter periods qualify for a pro-rated benefit. A full entitlement under the labor-market supplementary pension (ATP) requires a full career of contributions	There is a partial early retirement pension for workers aged between 60 and 65 who continue to work for 12 to 30 hours a week.	It is possible to defer the public old age pension for up to 10 years with pension being incremented for each additional year.	Maternity/paternity/parental benefits can be paid for up to 52 weeks in total with double the amount of contributions is paid for ATP.	During unemployment, the unemployment insurance take over the payment obligation of the employer, and ATP contributions are paid at the double rate

[2] Adapted from reports on different countries. Only regulations valid in 2006 year are presented.

France	In the private sector, the pension system has two tiers: an earnings-related public pension and mandatory occupational schemes, based on a points system. The public scheme also has a without means test minimum contributory pension ("*minimum contributif*"). In addition there is a targeted minimum income for the elderly ("*minimum vieillesse*").	60/60	A full first-stage public pension requires 40 years' contributions	Under the occupational pension, early retirement is possible subject to reductions. Retirement is possible at age 60 with 40 years' coverage without a reduction.	After age 60 and having reached 41 years' coverage, each additional year of work increases the benefit under the public scheme by 5%. Work and pension receipt can be combined subject to some limits, provided people leave their usual job.	A mother raising a child for at least nine years is credited with two years' coverage per child in the public scheme	Periods of involuntary unemployment are fully credited towards the state pension when unemployment benefits are received.
Germany	The statutory public pension system has a single tier and is an earnings related PAYG system. Calculation of pensions is based on pension points. There is a social-assistance safety net for low-income pensioners.	65/65	At least five years' contributions. Fewer than five years' contributions earn no benefit.	Early retirement is possible from 63 with 35 years' contributions with reductions.	Deferring the pension after 65 earns a 6% increment for each year of additional work.	one parent is credited for a period of three years with one pension point per year	The unemployment insurance contributes to the pension scheme on behalf of the unemployed.
Greece	Pensions are provided through an earnings-related public scheme with two components plus a series of minimum pensions/social safety nets.	65/65	A minimum of 4 500 days of contributions (equivalent to 15 years). Workers with a contribution record of 11 100 working days (37 years) can retire on a full benefit regardless of age.	Early retirement is possible subject to reductions. The adjustment is 6% per year of early retirement. It is possible to combine work and pension receipt after 55 years of age.	Possible, with an increased accrual rate of 3.3% applied in the main component up to 68 years of age and for a maximum of 3 extra years	Credit towards the pension qualifying conditions of one year for the first child and two years for each subsequent child to a maximum of three children.	Periods of unemployment can be credited up to 200 days during the lifetime.

Italy	The new Italian pension system is based on notional accounts. Contributions earn a rate of return related to GDP growth. At retirement, the accumulated notional capital is converted into an annuity taking account of average life expectancy at retirement. It applies in full to labor-market entrants from 1996 onwards.	57/57	5 years of contributions	Workers could retire at age 57 if they had contributed to the system for 35 years.	Retirement is not compulsory but employers have the right to dismiss employees reaching normal retirement age.	The pension is increased for mothers by giving them a more generous transformation coefficient.	All the unemployment insurance schemes give rise to credited contributions for the time the benefit is received.
Netherlands	The pension system has two main tiers, consisting of a flat-rate public scheme and earnings-related occupational plans. Although there is no statutory obligation for employers to offer a pension scheme to their employees, industrial-relations agreements mean that 91% of employees are covered. These schemes are therefore best thought of as quasi-mandatory.	65/65	All residents are eligible for this benefit	The basic pension is not payable before age 65.	It is not possible to defer the basic old age pension scheme after 65. It is possible to combine the basic pension receipt with work.	In the basic old age pension scheme, periods out of paid work are automatically covered. In the occupational schemes, there are no credits for childcare periods during which people are out of paid work but the accrual of pension rights continues over remaining working years.	There are no credits in the occupational plans for periods of unemployment. The basic old age scheme covers such periods automatically.
Spain	The Spanish public pension system consists of a single, earnings-related benefit in the contribution level, with a means-tested minimum pension. There is also a non-contribution means-tested level, which replaces the previous special social assistance scheme.	65/65	15 years of contributions are necessary to qualify for a pension benefit.	Possible from age 61 if unemployed, with at least 30 years of contribution. Reduction applies. Between 61 and 64, it is possible to combine partial pension receipt and a part-time job.	Possible after 65 with increase in benefit by 2% of the base of calculation per additional year. Possibility of combining partial pension and part-time job.	Two years out of the labor market looking after children count towards eligibility for a pension benefit.	During periods of unemployment-benefit receipt, the government pays all of the employers' contribution and 35% of the employee's contribution to the pension insurance scheme.

Sweden	The earnings-related part is based on notional accounts and there is a small mandatory contribution to individual, defined-contribution funded pensions. There is also a pension-income-tested top-up. Occupational pension plans – with defined-benefit and defined-contribution elements – have broad coverage.	61/61 (guarantee pension from 65)	Maximum guarantee pension is earned with 40 years' residency and is reduced proportionally for shorter periods.	Retirement is possible from age 61 in the public pension scheme. The income-tested guarantee pension cannot be claimed before 65.	It is possible to defer the notional accounts and premium pension with no upper age limit, again with automatic actuarial adjustments. It is also possible to combine work and pension receipt.	Years are credited under the public pension scheme for any period when you have and live with children aged four or under. The government makes the total contributions to the pension system	Unemployment benefits are pensionable income, with the government making the "employer" contribution.
Switzerland	The Swiss pension system has three main parts. The public scheme is earnings-related, but has a progressive formula. There is also a system of mandatory occupational pensions and an income-tested supplementary benefit.	65/64	A full pension requires contributions for 44 years for men and 43 for women.	Early retirement in the public scheme is possible from 63 for men and 62 for women with deductions. Early retirement is permitted in occupational schemes.	The pension can be deferred for up to five years after the normal pension age. It is also possible to claim the public pension at 65 and continue working.	Years of childcare are credited in the public scheme as if earnings had amounted to 3 times the minimum pension of the year in which the caring parent retires.	Unemployment benefits count towards the public pension just as if they were earnings. There are no credits for unemployment periods in occupational schemes.

Table A.2 Variables included in calculation of pension benefits. *Source: SHARE (2011).*

annpen1v	Annual public old age pension, previous year
annpen2v	Annual public early or pre-retirement pension, previous year. In Sweden, it refers to invalidity and disability pension
annpen7v	Annual war pension, previous year. In Sweden, it refers to occupational pension for workers in municipalities, in counties or in the government
annpen8v	Annual private (occupational) old age pension, previous year
annpen9v	Annual private (occupational) early retirement pension, previous year. In Sweden, it refers to unemployment insurance benefits
annpen12v	Annual public old age supplementary pension or public old age second pension, previous year
annpen15v	Annual occupational old age pension from a second job, previous year
annpen16v	Annual occupational old age pension from a third job, previous year
annreg2v	Annual private annuity or private personal pension, previous year

Table A.3 Average growth rates of earnings from wave 1 to wave 2 of SHARE by country and gender. *Source: own calculations.*

Country	Growth rate of earnings (men)	Growth rate of earnings (women)
Austria	0.9529	1.0582
Belgium	1.1039	1.3081
Denmark	0.7382	0.6930
France	0.9244	1.0108
Germany	0.7760	0.8318
Greece	0.9337	1.0783
Italy	2.1909	1.1079
Netherlands	1.1034	1.3618
Spain	1.0223	1.7657
Sweden	0.9885	0.9449
Switzerland	1.3523	1.4750

Table A.4 Average replacement rates from wave 1 to 2 of SHARE by country and gender. *Source: own calculations.*

Country	Replacement rate (men)	Replacement rate (women)
Austria	1.0746	0.6025
Belgium	0.8869	0.8223
Denmark	0.3325	0.9678
France	0.6352	0.5046
Germany	0.6444	1.0605
Greece	1.2212	0.6284
Italy	0.7215	0.6062
Netherlands	0.6562	0.9444
Spain	0.8372	0.7712
Sweden	0.7511	0.6083
Switzerland	0.5514	1.5371

Table A.5 Gross pension replacement rates for a median earner. *Source: OECD (2011).*

Country	Replacement rate (men)	Replacement rate (women)
Austria	0.7660	0.7660
Belgium	0.4260	0.4260
Denmark	0.8470	0.8470
France	0.4910	0.4910
Germany	0.4200	0.4200
Greece	0.9570	0.9570
Italy	0.6450	0.5060
Netherlands	0.8910	0.8910
Spain	0.8120	0.8120
Sweden	0.5380	0.5380
Switzerland	0.5930	0.5850

Table A.6 Probit estimates of the probability of transition to pensioner status using simple measures of income variables, men and women aged 50-65.

	(1) Transition	(2) Transition	(3) Transition	(4) Transition	(5) Transition	(6) Transition
Log(Expected earnings)	0.107***	0.0755***	0.0775***	0.0762***	0.0746***	0.0770***
	(0.00394)	(0.00276)	(0.00280)	(0.00277)	(0.00277)	(0.00283)
Log(Expected pension)	-0.120***	-0.0764***	-0.0761***	-0.0758***	-0.0756***	-0.0747***
	(0.00291)	(0.00214)	(0.00213)	(0.00213)	(0.00214)	(0.00213)
Woman	-0.0279***	-0.00877+	-0.00503	-0.00964+	-0.00811+	-0.00591
	(0.00599)	(0.00517)	(0.00489)	(0.00506)	(0.00452)	(0.00418)
Years to legal retirement age		-0.0264***	-0.0264***	-0.0263***	-0.0258***	-0.0256***
		(0.000431)	(0.000435)	(0.000433)	(0.000448)	(0.000451)
Somehow satisfied with job			0.0215***			0.0171***
			(0.00516)			(0.00457)
Unsatisfied with job			0.0454***			0.0338***
			(0.0100)			(0.00882)
Strongly unsatisfied with job			0.0664**			0.0523**
			(0.0225)			(0.0194)
Very good health				-0.0140*		-0.0118*
				(0.00680)		(0.00562)
Good health				0.0188**		0.0133*
				(0.00703)		(0.00585)
Fair health				0.0315**		0.0215*
				(0.0104)		(0.00850)
Poor health				0.0736***		0.0654***
				(0.0180)		(0.0159)
Couple living alone					0.0598***	0.0584***
					(0.00815)	(0.00766)
Living with family					0.0532***	0.0463***
					(0.00968)	(0.00892)
Living with others					-0.0238	-0.0254
					(0.0293)	(0.0264)
Number of children					-0.0115***	-0.0109***
					(0.00145)	(0.00144)
Number of grandchildren					0.00692***	0.00700***
					(0.000845)	(0.000831)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	4120	4120	4105	4120	4120	4105
Pseudo R^2	0.1932	0.4365	0.4427	0.4395	0.4441	0.4530

Average marginal effects

Standard errors clustered by household in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.7 Reduced-form probit estimates of the probability of transition to pensioner status, individuals aged 50-82 [(1)] and 50-65 [(2)-(6)]. SE clustered by country in (1)-(2), by household in (3)-(6).

	(1) Transition	(2) Transition	(3) Transition	(4) Transition	(5) Transition	(6) Transition
Years to legal retirement age	-0.00495***	-0.0188***	-0.0184***	-0.0186***	-0.0181***	-0.0188***
	(0.00148)	(0.00249)	(0.00366)	(0.00367)	(0.00371)	(0.00359)
Years to legal retirement age squared	-0.000618***	0.000393+	0.000343**	0.000372***	0.000355**	0.000357**
	(0.000127)	(0.000208)	(0.000110)	(0.000109)	(0.000111)	(0.000109)
Woman	-0.0104*	-0.00862	-0.00338	-0.00421	-0.00276	-0.00856
	(0.00500)	(0.00532)	(0.00765)	(0.00759)	(0.00735)	(0.00702)
Couple living alone	0.0696***	0.0724***				0.0748***
	(0.00707)	(0.00793)				(0.0108)
Living with family	0.0271***	0.0297***				0.0310*
	(0.00797)	(0.00762)				(0.0122)
Living with others	0.0658	0.0676				0.0725+
	(0.0530)	(0.0548)				(0.0417)
Very good health	0.0201*	0.00738			0.00743	
	(0.0102)	(0.0101)			(0.00928)	
Good health	0.0401***	0.0328***			0.0389***	
	(0.00731)	(0.00709)			(0.00922)	
Fair health	0.0492**	0.0499***			0.0567***	
	(0.0151)	(0.0146)			(0.0134)	
Poor health	0.0784*	0.0694*			0.0723**	
	(0.0321)	(0.0317)			(0.0241)	
Number of grandchildren	0.0102***	0.00957***				0.00917***
	(0.00170)	(0.00164)				(0.00115)
Number of children	-0.0128***	-0.0106***				-0.0109***
	(0.00247)	(0.00225)				(0.00206)
Age	0.0188***	0.0172***	0.0185***	0.0186***	0.0190***	0.0168***
	(0.00125)	(0.00137)	(0.00329)	(0.00329)	(0.00333)	(0.00325)
Years of education	-0.00338***	-0.00242***	-0.00358***	-0.00347***	-0.00306***	-0.00304***
	(0.000333)	(0.000441)	(0.000612)	(0.000612)	(0.000614)	(0.000615)
Somehow satisfied with job	-0.01000+	-0.00604		-0.00288		
	(0.00566)	(0.00554)		(0.00667)		
Unsatisfied with job	0.0510**	0.0616***		0.0751***		
	(0.0158)	(0.0140)		(0.0141)		
Strongly unsatisfied with job	0.0515	0.0714*		0.0914***		
	(0.0360)	(0.0331)		(0.0275)		
Log(earnings)	-0.00314	0.00116	-0.00123	-0.000111	-0.000249	-0.000651
	(0.00291)	(0.00301)	(0.00280)	(0.00281)	(0.00282)	(0.00280)
Civil servant	0.0249*	0.0161+	0.0199+	0.0188+	0.0180+	0.0187+
	(0.0101)	(0.00859)	(0.0113)	(0.0112)	(0.0109)	(0.0105)
Self employed	-0.0867***	-0.0773***	-0.0959***	-0.0931***	-0.0904***	-0.0844***
	(0.00614)	(0.00739)	(0.00803)	(0.00801)	(0.00753)	(0.00710)
Private sector of employment	-0.00735	-0.00552	-0.00624	-0.00582	-0.00551	-0.00684
	(0.00828)	(0.00873)	(0.00840)	(0.00830)	(0.00807)	(0.00767)
Hours worked	-0.000529**	-0.000536*	-0.000558**	-0.000596***	-0.000514**	-0.000540**
	(0.000187)	(0.000220)	(0.000171)	(0.000172)	(0.000169)	(0.000172)
Years of experience	0.00226***	0.00307***	0.00323***	0.00326***	0.00323***	0.00304***
	(0.000242)	(0.000244)	(0.000333)	(0.000331)	(0.000329)	(0.000329)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
N	4484	4404	4412	4404	4412	4412
Pseudo R^2	0.3218	0.3354	0.3202	0.3230	0.3233	0.3298

Average marginal effects
Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.8 OLS estimations of earnings equation, individuals aged 50-82 [(1)-(3)] and 50-65 [(4)-(6)]. Equations (3) and (6) estimated with selection terms. SE clustered by country.

	(1) Earnings	(2) Earnings	(3) Earnings	(4) Earnings
Log(earnings) $_{t-1}$	0.447***	0.444***	0.442***	0.439***
	(0.0632)	(0.0634)	(0.0648)	(0.0649)
Civil servant	0.0791+	0.0863+	0.0802+	0.0896+
	(0.0374)	(0.0394)	(0.0376)	(0.0403)
Self employed	-0.291*	-0.321*	-0.296*	-0.344*
	(0.114)	(0.120)	(0.116)	(0.127)
Private sector of employment	-0.0280	-0.0288	-0.0282	-0.0295
	(0.0234)	(0.0236)	(0.0236)	(0.0233)
Hours worked	0.00476*	0.00467*	0.00461*	0.00439*
	(0.00180)	(0.00179)	(0.00177)	(0.00172)
Years of experience	0.00524**	0.00586**	0.00519*	0.00682*
	(0.00160)	(0.00179)	(0.00164)	(0.00232)
Woman	-0.140**	-0.139**	-0.144**	-0.143**
	(0.0374)	(0.0371)	(0.0361)	(0.0360)
Age	-0.0118**	-0.00327	-0.0133**	0.00294
	(0.00351)	(0.00446)	(0.00347)	(0.00763)
Years of education	0.0220**	0.0207**	0.0221**	0.0200**
	(0.00601)	(0.00581)	(0.00625)	(0.00621)
lambda		-0.331		-0.668+
		(0.194)		(0.335)
_cons	5.449***	5.507***	5.589***	5.684***
	(0.592)	(0.601)	(0.617)	(0.617)
Country fixed effects	Yes	Yes	Yes	Yes
N	3613	3608	3578	3573
R^2	0.356	0.356	0.352	0.353
adj. R^2	0.353	0.353	0.349	0.349

Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.9 OLS estimations of pensioner income equation, individuals aged 50-82 [(1)-(3)] and 50-65 [(4)-(6)]. Equations (3) and (6) estimated with selection terms. SE clustered by country.

	(1) Pension	(2) Pension	(3) Pension	(4) Pension
Log(earnings) $_{t-1}$	0.107*	0.1000*	0.129*	0.126*
	(0.0404)	(0.0418)	(0.0518)	(0.0532)
Years of experience	0.00137	-0.00000228	0.00598	0.00437
	(0.00496)	(0.00577)	(0.00523)	(0.00551)
Civil servant	0.281**	0.289**	0.309***	0.311***
	(0.0681)	(0.0701)	(0.0665)	(0.0633)
Self employed	-0.122^{+}	-0.181^{+}	-0.0698	-0.123
	(0.0629)	(0.0942)	(0.0850)	(0.109)
Years to legal retirement age	0.000240	-0.0172	-0.00813	-0.0340
	(0.0102)	(0.0208)	(0.0138)	(0.0289)
Years to legal retirement age squared	0.00124^{+}	0.000648	0.00190	0.00198
	(0.000650)	(0.000435)	(0.00152)	(0.00152)
Woman	-0.261**	-0.278**	-0.225*	-0.241*
	(0.0822)	(0.0808)	(0.0886)	(0.0900)
lambda		-1.591		-3.025
		(5.005)		(3.573)
_cons	8.062***	8.097***	7.724***	7.588***
	(0.598)	(0.866)	(0.627)	(0.830)
Country fixed effects	Yes	Yes	Yes	Yes
N	528	518	486	478
R^2	0.128	0.130	0.140	0.141
adj. R^2	0.099	0.099	0.109	0.108

Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.10 OLS estimations of pensioner income equation using different ways to control for legal retirement age, individuals aged 50-82 [(1)-(3)] and 50-65 [(4)-(6)].

	(1) Pension	(2) Pension	(3) Pension	(4) Pension
Log(earnings) $_{t-1}$	0.102*	0.108*	0.127*	0.132*
	(0.0466)	(0.0458)	(0.0533)	(0.0532)
Years of experience	0.000694	0.000284	0.00489	0.00466
	(0.00557)	(0.00548)	(0.00585)	(0.00580)
Civil servant	0.270**	0.274**	0.298**	0.303**
	(0.0926)	(0.0929)	(0.0952)	(0.0954)
Self employed	-0.123	-0.131	-0.0761	-0.0755
	(0.0959)	(0.0968)	(0.104)	(0.103)
Woman	-0.256**	-0.260**	-0.221**	-0.224**
	(0.0821)	(0.0820)	(0.0844)	(0.0842)
Passed legal retirement age	-0.0345		-0.0346	
	(0.0904)		(0.101)	
Close to legal retirement age	0.0806		0.0810	
	(0.0769)		(0.0806)	
Passed early retirement age		0.0242		0.0289
		(0.0879)		(0.0894)
_cons	8.179***	8.135***	7.805***	7.773***
	(0.537)	(0.532)	(0.587)	(0.584)
Country fixed effects	Yes	Yes	Yes	Yes
N	528	528	486	486
R^2	0.127	0.125	0.139	0.137
adj. R^2	0.098	0.097	0.108	0.108
F	5.067	5.198	5.302	5.521

Standard errors in parentheses

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.11 Structural probit estimates of probability of transition into pensioner status, individuals aged 50-82 [(1)-(2)] and 50-65 [(3)-(4)]. Equations (2) and (4) estimated with correction for selectivity. SE clustered by country.

	(1) Transition	(2) Transition	(3) Transition	(4) Transition
E(Log(earnings))	-0.0240^{+}	-0.0105	-0.0419**	-0.0268^{+}
	(0.0123)	(0.0112)	(0.0129)	(0.0137)
E(Log(pension))	0.110***	0.0648*	0.170***	0.130***
	(0.0335)	(0.0291)	(0.0298)	(0.0322)
Years to legal retirement age	-0.0299***	-0.0295***	-0.0340***	-0.0338***
	(0.00100)	(0.000983)	(0.000911)	(0.000926)
Woman	0.0130	0.00129	0.0181*	0.00847
	(0.00974)	(0.00845)	(0.00803)	(0.00834)
Somehow satisfied with job	0.00322	0.00281	0.00180	0.00159
	(0.00623)	(0.00632)	(0.00597)	(0.00600)
Unsatisfied with job	0.0594***	0.0631***	0.0562***	0.0634***
	(0.0168)	(0.0164)	(0.0150)	(0.0149)
Strongly unsatisfied with job	0.0686*	0.0697*	0.0729*	0.0784*
	(0.0342)	(0.0342)	(0.0308)	(0.0312)
Very good health	0.0142	0.0153^{+}	0.00351	0.00437
	(0.00905)	(0.00900)	(0.00882)	(0.00880)
Good health	0.0399***	0.0427***	0.0305***	0.0347***
	(0.00664)	(0.00719)	(0.00671)	(0.00683)
Fair health	0.0513***	0.0560***	0.0491***	0.0566***
	(0.0142)	(0.0151)	(0.0125)	(0.0132)
Poor health	0.0922**	0.0985**	0.0765**	0.0867**
	(0.0327)	(0.0341)	(0.0294)	(0.0307)
Couple living alone	0.0720***	0.0764***	0.0691***	0.0777***
	(0.00806)	(0.00851)	(0.00758)	(0.00804)
Living with family	0.0236**	0.0249**	0.0278***	0.0310***
	(0.00784)	(0.00830)	(0.00747)	(0.00805)
Living with others	0.0728	0.0784	0.0729	0.0842
	(0.0505)	(0.0514)	(0.0511)	(0.0526)
Number of grandchildren	0.0126***	0.0131***	0.0116***	0.0127***
	(0.00149)	(0.00152)	(0.00152)	(0.00153)
Number of children	-0.0143***	-0.0150***	-0.0127***	-0.0140***
	(0.00233)	(0.00226)	(0.00229)	(0.00224)
Country fixed effects	Yes	Yes	Yes	Yes
N	4484	4484	4404	4404
Pseudo R^2	0.2942	0.2933	0.3181	0.3152

Average marginal effects
Standard errors in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.12 Structural probit estimates of probability of transition to pensioner status, individuals aged 50-65. Equations (2), (4), (6) and (8) estimated with correction for selectivity.

	(1) Transition	(2) Transition	(3) Transition	(4) Transition	(5) Transition	(6) Transition	(7) Transition	(8) Transition
E(Log(earnings))	-0.0510***	-0.0240**	-0.0480***	-0.0161*	-0.0446***	-0.0275***	-0.0461***	-0.0396***
	(0.00730)	(0.00783)	(0.00728)	(0.00791)	(0.00734)	(0.00781)	(0.00733)	(0.00766)
E(Log(pension))	0.189***	0.0871***	0.186***	0.0716***	0.181***	0.115***	0.185***	0.150***
	(0.0192)	(0.0199)	(0.0192)	(0.0202)	(0.0192)	(0.0196)	(0.0193)	(0.0189)
Years to legal retirement age	-0.0370***	-0.0356***	-0.0372***	-0.0360***	-0.0370***	-0.0356***	-0.0351***	-0.0336***
	(0.000552)	(0.000540)	(0.000557)	(0.000555)	(0.000551)	(0.000535)	(0.000574)	(0.000549)
Woman	0.0326***	0.00176	0.0315***	-0.00217	0.0301***	0.00923	0.0265***	0.0135+
	(0.00864)	(0.00826)	(0.00850)	(0.00792)	(0.00829)	(0.00781)	(0.00796)	(0.00732)
Somehow satisfied with job			0.00627	0.00727				
			(0.00624)	(0.00624)				
Unsatisfied with job			0.0710***	0.0941***				
			(0.0130)	(0.0147)				
Strongly unsatisfied with job			0.0971***	0.118***				
			(0.0262)	(0.0282)				
Very good health					0.00398	0.00545		
					(0.00856)	(0.00846)		
Good health					0.0399***	0.0472***		
					(0.00861)	(0.00875)		
Fair health					0.0606***	0.0736***		
					(0.0124)	(0.0129)		
Poor health					0.0873***	0.103***		
					(0.0229)	(0.0240)		
Couple living alone							0.0740***	0.0724***
							(0.00996)	(0.00995)
Living with family							0.0318**	0.0301**
							(0.0111)	(0.0110)
Living with others							0.0822*	0.0812*
							(0.0408)	(0.0402)
Number of grandchildren							0.0116***	0.0115***
							(0.00113)	(0.00113)
Number of children							-0.0136***	-0.0135***
							(0.00203)	(0.00203)
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	4412	4412	4404	4404	4412	4412	4412	4412
Pseudo R^2	0.2983	0.2963	0.3014	0.2984	0.3021	0.3003	0.3106	0.3091

Average marginal effects
Standard errors clustered by household in parentheses
$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A.13 Probit estimates of the probability of transition to pensioner status using health, household composition and job satisfaction variables, individuals aged 50-65.

	(1) Transition	(2) Transition	(3) Transition
Very good health	0.0186		
	(0.0214)		
Good health	0.0699**		
	(0.0228)		
Fair health	0.109***		
	(0.0330)		
Poor health	0.114		
	(0.0744)		
Couple living alone		0.0855***	
		(0.0141)	
Living with family		-0.0633***	
		(0.0105)	
Living with others		-0.0801+	
		(0.0437)	
Number of grandchildren		-0.0133***	
		(0.00248)	
Number of children		0.0302***	
		(0.00151)	
Somehow satisfied with job			-0.0272***
			(0.00737)
Unsatisfied with job			0.0304+
			(0.0168)
Strongly unsatisfied with job			0.0566+
			(0.0329)
Woman	-0.0314**	-0.0534***	-0.0325***
	(0.0120)	(0.00635)	(0.00693)
Country fixed effects	Yes	Yes	Yes
N	4586	4586	4557
R^2	0.0289	0.0875	0.0258

Average marginal effects
Standard errors clustered by household in parentheses
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

References

Bartus, Tamás. 2005. "Estimation of marginal effects using margeff". *The Stata Journal,* 5(3), pp. 309-329

Bingley, Paul, Nabanita Datta Gupta, and Peder J. Pedersen. 2004. "The Impact of Incentives on Retirement in Denmark". *NBER Chapters.* In: Gruber, Jonathan and David A. Wise. 2004. "Social Security Programs and Retirement around the World: Micro-Estimation", pp. 153-254.

Blanchet, Didier and Ronan Mahieu. 2004. "Estimating Models of Retirement Behavior on French Data". *NBER Chapters.* In: Gruber, Jonathan and David A. Wise. 2004. "Social Security Programs and Retirement around the World: Micro-Estimation", pp. 235-284

Boldrin, Michele, Sergi Jiménez-Martín, and Franco Peracchi. 2004. "Micro-Modeling of Retirement Behavior in Spain". *NBER Chapters.* In: Gruber, Jonathan and David A. Wise. 2004. "Social Security Programs and Retirement around the World: Micro-Estimation", pp. 499-578

Börsch-Supan, Axel, Reinhold Schnabel, Simone Kohnz, and Giovanni Mastrobuoni. 2004. "Micro-Modeling of Retirement Decisions in Germany". *NBER Chapters.* In: Gruber, Jonathan and David A. Wise. 2004. "Social Security Programs and Retirement around the World: Micro-Estimation", pp. 285-344

Brugiavini, Agar and Franco Peracchi. 2004. "Micro-Modeling of Retirement Behavior in Italy". *NBER Chapters.* In: Gruber, Jonathan and David A. Wise. 2004. "Social Security Programs and Retirement around the World: Micro-Estimation", pp. 345-398

Christelis, Dimitrios. 2011. "Imputation of Missing Data in Waves 1 and 2 of SHARE". *CSEF Working Papers 278,* Centre for Studies in Economics and Finance (CSEF), University of Naples, Italy

Coile, Courtney and Jonathan Gruber. 2000. "Social Security Incentives for Retirement". *NBER Working Papers 7651*

Coile, Courtney. 2003. "Retirement Incentives and Couples' Retirement Decisions". *NBER Working Papers 9496*

Cseres-Gergely, Zsombor. 2009. "Essays on labour market behaviour at the beginning and end of the active life-cycle". PhD diss. Central European University, Department of Economics

De Vos, Klaas and Arie Kapteyn. 2004. "Incentives and Exit Routes to Retirement in the Netherlands". *NBER Chapters.* In: Gruber, Jonathan and David A. Wise. 2004. "Social Security Programs and Retirement around the World: Micro-Estimation", pp. 461-498

Dellis, Arnaud, Raphaël Desmet, Alain Jousten, and Sergio Perelman. 2004. "Micro-Modeling of Retirement in Belgium". *NBER Chapters.* In: Gruber, Jonathan and David A. Wise. 2004. "Social Security Programs and Retirement around the World: Micro-Estimation", pp. 41-98

European Commission. 2009. "The 2009 Ageing Report: Economic and budgetary projections for the EU-27 Member States (2008-2060)". *European Economy,* No. 2/2009

Fischer, Justina A.V. and Alfonso Sousa-Poza. 2006. "The Institutional Determinants of Early Retirement in Europe". University of St. Gallen Department of Economics working paper series

Gruber, Jonathan and David A. Wise. 2004. "Social Security Programs and Retirement around the World: Micro-Estimation". *NBER Books*, number grub04-1.

Gruber, Jonathan and David Wise. 1998. "Social Security and Retirement: An International Comparison". *The American Economic Review*, Vol. 88, No. 2, pp. 158-163

Gustman , Alan L. and Thomas L. Steinmeier. 2002. "The Social Security Early Entitlement Age in a Structural Model of Retirement and Wealth". *NBER Working Papers 9183*

Gustman , Alan L. and Thomas L. Steinmeier. 2004. "Social security, pensions and retirement behaviour within the family". *Journal of Applied Econometrics*, John Wiley & Sons, Ltd., vol. 19(6), pp. 723-737.

Lumsdaine, Robin L., Stock, James H. and Wise, David A. 1992. "Three Models of Retirement: Computational Complexity Versus Predictive Validity". *NBER Working Paper No. w3558*

Nakosteen, Robert A. and Michael Zimmer. 1980. "Migration and Income: The Question of Self-Selection". *Southern Economic Journal*, Vol. 46, No. 3, pp. 840-851

OECD statistics. Labor force and population statistics, http://stats.oecd.org/ (accessed April 1, 2012)

OECD. 2011. "Pensions at a Glance 2011: Retirement-Income Systems in OECD and G20 Countries". Available at: www.oecd.org/els/social/pensions/PAG

Palme, Mårten and Ingemar Svensson. 2004. "Income Security Programs and Retirement in Sweden". *NBER Chapters.* In: Gruber, Jonathan and David A. Wise. 2004. "Social Security Programs and Retirement around the World: Micro-Estimation", pp. 579 - 642

Piekkola, Hannu and Matthias K.S. Deschryvere. 2005. "Option Values for Retirement: Effects of Public Incentives to Postpone Retirement in Finland, Belgium and Germany". *ENEPRI Research Reports*, No. 14

Piekkola, Hannu. 2008. "Flexible Pension Systems – Postponed Retirement and Distributional Fairness". *ENEPRI Research Reports*, No. 61

Samwick, Andrew A. 1998. "New evidence on pensions, social security, and the timing of retirement". *Journal of Public Economics*, Elsevier, vol. 70(2), pp. 207-236

SHARE. 2011. "SHARE Release Guide 2.5.0 Waves 1 & 2". Mannheim Research Institute for the Economics of Aging

Stock, James H. and David A. Wise. 1990. "Pensions, the Option Value of Work, and Retirement". *Econometrica*, Vol. 58, No. 5, pp. 1151-1180

The Survey of Health, Ageing and Retirement in Europe (SHARE), http://www.share-project.org/ (accessed March 1, 2012)