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Flexible Pension System: Postponed Retirement and Distributional Fairness

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CONTENTS

Abstract

This paper studies how the pension systems and wellbeing at work can be improved to postpone retirement in European households. The analysis uses the first 8 waves (1994-2001) of the European Community Household Panel (ECHP). Option values for retirement are constructed from a pool of four countries Finland, Belgium, Germany and Spain all relying on public-sector mandated pensions. The pooled estimation strategy diminishes the caveats of using an existing institutional setting to examine the incentives of introducing a new pension system. Pension reforms have to implement higher pension rights accruals than what has been introduced in the pension reforms during 2000s. Actuarial adjustment for reduction of pensions by 5%-point for each year of early retirement and even greater additions to pensions for postponed retirement, would increase retirement age by around 4.4 years on average and even up to 6 years in Belgium and Germany. Pecuniary incentives are not dwarfed by joint retirement. The alternatives of improving wellbeing at work or improving health have minor effects.

Keywords: retirement, pensions, social security, labor force participation, income distribution.

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1. Introduction

Sustainability of the European pension systems has been undermined by the increasing share of older people as a result of low fertility, the rise in life expectancy, the ageing of the baby-boom generations and by the low European labor force participation, in particular of older workers who are 55-64 years of age. In 1999-2003 we have seen some recovery in labor force participation in many European countries, especially in Finland (up 10%-point), Belgium (up 3%-point) and Spain (unemployment of workers 55+ halved in 2002 compared with 1994). Part of this can also be explained by the first big wave of pension reforms across Europe. New measures – like the transitional rise of the early or normal retirement age – may have been effective. We are, anyhow, short of precise estimates of behavioral responses to the changing pension systems. This paper simulates pension reforms and other supply side factors in explaining the retirement transitions of Europeans. The aim is to benefit from cross-country comparisons.

In Europe the option value model was first applied in countries that participated in Gruber and Wise's project called *Social security and retirement around the world* (1999), but distinctively for each country.[1] The first descriptive phase of the project found a striking correlation between labor force participation and social security incentives. The second phase of the project carried out micro-estimations of the impact of social security on retirement and found a causal relationship between social security incentives like the option value and labor force participation (Gruber and Wise, 2002). However, there was no experiment of pension reforms. Some of the spikes in pension wealth at particular ages would indeed be much too tight for *existing institutional factors* in a single country study.

Option values are here constructed that account for household behavior in four countries: Belgium, Finland, Germany and Spain.[2] All these countries rely on defined benefit rules and primarily on first and second pillars of pension system. OECD (2003) finds that the implicit tax rates embedded in the old-

[1] The 12 participating countries in the *Social security and retirement around the world* project are Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, the United Kingdom and the United States (Gruber and Wise, 1999; 2002).

[2] Stock and Wise (1990) develop a structural option value model that measures the gain in utility from delaying retirement until the optimal age and find that this predicts retirement well in a sample of workers from one firm (for structural models, see also Diamond and Gruber, 1999).

age pension and early retirement schemes are particularly high in these countries (as for Finland not examined). For Finland, the option value approach has been found to have significant effects (Hakola, 2002, and Laine, 2004). Dellis *et al.* (2001) found in Belgium that postponed retirement yielded no gain (social security accruals were negative) for over half of the people as early as age 58 and for most people aged 60 and above. In Germany, Börsch-Supan et al. (2003) also found that the German pension system provided strong incentives to retire early and Berkel and Börsch-Supan (2004) find modest changes in retirement paths arising from the 2001/2004 pension reforms. Boldrin et al. (2002) find only modest effects in their study of the Spanish pension system. Spain and Finland have been reforming pension systems in 2000s by extending the earnings period that is used for calculating the pension entitlement. Instead of using the years of highest earnings towards the end of the career, the earnings period is extended to a much longer period in Spain or to the entire career individual's earnings history in Finland (other European countries with similar pension reforms are Austria, Czech Republic, France, Hungary, Portugal, Italy). According to Social Protection Committee (2006), none of the four countries considered are implementing a very drastic leveling down of pensions. The target of abolishing early retirement has also been clear but early retirement is more markedly reformed only in Germany.

Our analysis uses the 8 waves (1994-2001) of the European Community Household Panel (ECHP). The advantage is that we examine financial incentives in pooled data set from four countries. While the option value approach does not miss large spikes in pension wealth at particular ages, some of the spikes would be much too tied up for existing institutional factors in a single country study. It is well know that health and work satisfaction are important for retirement decisions, but are dwarfed by pecuniary incentives. Since much of the analysis in this paper is also on the quantitative change in retirement years it is of interest to measure the relatively influence of health and work satisfaction after pecuniary incentives are appropriately controlled for. Clark (2001) finds that job satisfaction is the most determinant predictor of future quits from jobs besides satisfaction with pay, but the results can also relate to dissatisfaction with salary.

We also analyze whether the spouse's option value to defer retirement influence retirement decision. Here, the age difference between spouses is taken into account. The European evidence provided by Zweimuller et al. (1996) for Austria, Blau and Riphahn (1999) for Germany and Garcia et al. (2005) for the EU countries in the ECHP shows that joint retirement is frequent among married couples. Coile (2004) finds that women and men react similarly to their own incentive measures, but the husband's retirement is sensitive to spillover effects from the wife and not vice versa.

In pension reforms during 2000s actuarial accrual deductions at early retirement and increments thereafter are used in Spain and Germany, and to a more moderate degree in Finland. Our uniform pension reform proposes more drastic incentives. Gustman and Steinmeier (2002), using U.S. survey data from the *Health and Retirement Study*, find that the 3% annual pension accrual is not enough for large percentage of workers, which explains early retirement at age 62. An actuarial neutral pension system at age 60 would have an accrual rate of around 4%. Thus, the pension increase of 4% for one year's postponement of retirement matches the loss from the shorter period left as a result of retiring at age 60. In pooled data we simulate an actuarial adjustment for reduction of pensions by 5%-point for each year of early retirement pension before age 63 and an annual increase in pension rights of up to 7%-points if retirement is postponed beyond the age of 63. This follows the suggested reform for Germany by Berkel and Börsch-Supan (2004) and is comparable to the Spanish early retirement schemes with a deduction of pension rights by 8%-points per year for retirement prior age 65 (but with minimum pensions). The new pension system in Finland effective as of 2005 with actuarial adjustment 4.5% rather leaves the pension expenditures at the same level (for given retirement patterns). In Germany the most important change in 2000s was the abolishment of early retirement since there are no exceptions for unemployed and women. The second reform is the change of age when actuarial adjustment begins from 60 to 65 years of age.

The main findings are that pension reforms have to implement higher pension rights accruals than what has been introduced in the pension reforms during 2000s in order to postpone retirement age many years. It is also shown that health and work satisfaction have relatively little influence on retirement as well as spouse's retirement decision. Finally, even the radical pension reform would be distributionally fair towards poor-income households. The structure of the paper is as follows. Section 2 describes pension incentives and section 3 describes the data and the empirical strategy. The results are discussed in section 4 and pension reform simulations are performed in section 5. Section 6 examines the distributional effect before the conclusion in section 7.

2. The pension incentives

We apply the option value model for the pension systems in Belgium, Finland, Germany and Spain and then use the observed hazard rates to simulate pension reforms. The option value calculates the utility gain from working until some future retirement date A relative to retiring today τ and does not miss

large spikes in pension wealth at particular ages (Stock and Wise, 1990). Each household member decides upon his/her labor supply and consumption path based on the earnings and pension at the current period, $A = \tau$. Indirect utility over work and leisure for the non-retired is as follows:

$$V_\tau(A) = \sum_{t=\tau}^{A-1} \left[Y_t\right]^\gamma (1+\delta)^{-(t-\tau)} + \sum_{t=A}^{T} \left[\alpha (1+\chi_t)^{(t-A)}\ P(A, Y_{A-1})\right]^\gamma (1+\delta)^{-(t-A)}, \qquad (1)$$

where T = the expected age of death at each age t, τ = the current period, A = the period of retirement, δ = the real discount factor, Y_t = the income while working, $P(A, Y_{A-1})$ = the retirement benefits at the time of retirement, χ_t = the index for the pension, γ = the utility curvature parameter or the risk aversion parameter (assuming isoelastic utility function) and $\alpha >=1$ is a parameter to account for the relative utility of the pension benefits to the wages or the marginal utility of leisure. The index for pension χ follows the evolution of the consumer price index in Belgium and Spain and the wage index in Germany. Pension rights before 65 in Finland are indexed at 50% on wages and at 50% on consumer prices and the indices for pensions from 65 onwards are set at 80% on prices and 20% on wages. (See the appendix for details.) Life expectancy is evaluated by age and gender.[3] The utility parameters are α =1.5, γ =0.75 and the discount rate δ is set at 3%, which is half of the 6% used by Coile (2004).

The option value of retirement A, giving the opportunity cost of retiring today τ, is

$$OV(A) = E_\tau\left[V(A)\right] - V_\tau(\tau), \qquad (2)$$

where E = the expectation operator. Optimal retirement should occur at periods (ages) A^* where the option value is (most) negative. We examine pecuniary incentives for the household as a whole. Retired couples spend a considerable time together and therefore pension income can be expected to be shared. (For Finnish evidence of joint time use, see Niemi, 2005.) If a spouse has a high option value from not retiring, say, in five years, the individual may not retire today even if the individual's own option value is negative. An individual with a younger spouse may also have a high option value for continuing to

[3] Life expectancy at age 60 – in the age range when retirement transitions are made – has been rising all over Europe on average by 1.6 years up to 22.1 years during 1991-2002 in the EU area, but men and women in Finland, Belgium and Germany still have a lower life expectancy than the European average.

work, which significantly raises one's own optimal retirement age. Since we have a priori no information on how option values should be added up, the option values of household members are included separately in the estimations. We use the option value both for employed and non-employed spouses, where the latter uses the predicted earnings. As additional explanatory variables we include a spouse's employment status and the age difference between spouses.

We include pension wealth in estimations as one explanatory variable in order to capture how wealth affects retirement behavior. The pension wealth of individuals in period *t* is simply

$$PW_{\tau} = \sum_{t=A}^{T} P(A, Y_{A-1})(1+\delta)^{-(t-A)} \qquad (4)$$

The OV modeling strategy is as follows.

1. Pooled estimation strategy: The OV parameters are taken as given and are set equal across countries. We thus first follow an 'IV strategy' for this variable and interpret the results accordingly.
2. Country-specific estimations: The OV parameters are estimated separately for each country with the rest of the parameters and compared with pooled estimation strategy.
3. Non-pecuniary incentives: Joint retirement decision is evaluated through spouse's employment position, potential option value (irrespective of whether employed or not) and via the age difference between spouses. The estimates are imprecise since we also include in the data single adult households that are 20% of the estimation sample.
4. Job satisfaction and health are examined as alternative non-pecuniary incentives.
5. Uniform pension reform experiments: The OV parameters are used to evaluate the overall change in retirement
6. Fair income distribution: The OV parameters are used to evaluate (i) the change in retirement for individuals in poor and rich families according to household pension wealth and (ii) overall change in the net present value of pension wealth that account for hazard rates of retirement at each age.

The option for retirement is calculated for the age of 54 and beyond. Pension and tax rules are adapted from the pension system and pension rules for the year 2000 (see appendix B). OECD (2000, 2001) is

the main source for pension calculations. We do not take into account the pension incentives of the third pillars of the pension system, as those data were lacking (second pillar is included in Belgium). Appendix describes the complex and differing pension rules in the four countries.

As a proxy for labor market experience we use the age less education years less 6 years (e.g. in Finland, 12 years deducted for primary, 15 years for secondary and 18 years for tertiary education). This gives an average work experience of around 33 years in all countries. The figure matches well the actual average work experience, which is 29.6 years in Finland and 38 years in Spain according to the Social Protection Committee (2006) and 38 years in Germany in Börsch-Supan et al. (2003). The periods spent in unemployment, inactivity due to sickness and disability and early retirement count as affiliation years in computation of the average wage, as in many of the new pension rules (already in the old system in Belgium).

Unemployment pension applies to an extended unemployment period as of age 58 in Finland and as of age 56 or 57 (since 1997) in Germany (where after the Hartz IV reforms there are no more exceptions for unemployed, part-time employees, and woman as of 2010). The missing years between the person's age at the time of unemployment and age 65 are counted as actual years of service in Finland and to some extent in Germany, but not in Belgium and Spain. In *Finland* the benefit level of unemployment and disability pensions are most generous and close the same and therefore unemployment pension rules are applied for all early retired prior age 60. In *Germany*, we apply the same rules for early retired as for the old-age pension, which includes annual accrual deduction 3.6%. The number of disability pensioneers is also low (below 2%).

In *Belgium* the practice of the unemployment system, in which people aged 50 or more are considered "aged unemployed" and are not required to actively seek work, has been abolished, but not at the time of the study. In disability pensions the normal allowance is 65% of the lost earnings (subject to a ceiling) for individuals with dependants, but is lower otherwise. In Belgium we do not account for disability pension (around 6% of the sample), and person simply looses annual accrual increments when retiring earlier.

In *Spain* an employee is eligible for unemployment benefits as of age 52 in Spain (UB52+ program) when the employee has been unemployed (including the preceding and following years). After age 60, a person cannot claim UB52+. The accrual increments are tied to the age, work experience and includes

8% annual accrual deduction when retiring prior age 65 (with maximum deduction 60% at age 60). All non-employed before 60 years of age are assumed to be on an unemployment benefit pipeline before retiring at age 60 (higher benefit for first 160 days and then receiving 'pensions' taking into account the penalizing factor 60%). The rules changed slightly in pension reform in 1997 (see appendix).

3 Data and Empirical Model

The *European Community Household Panel* (ECHP) is an annual panel study and consists of a household and a personal file. The same individuals and families are interviewed over time. The advantage of these country data is their high comparability. The survey provides a detailed account of income and employment status. We constructed an unbalanced panel of women and men aged 54 to 64 for four countries: Finland, Belgium, Germany and Spain (8 waves from 1994 through 2001 for the countries studied except for 6 waves for Finland). The panel is left-censored, as we include only persons who are working (as defined before). There is right censoring, due to missing interviews and missing transitions. The final sample has been constructed in different stages. In the first stage we dropped individuals who lacked social security incentive variables. In the second stage we excluded the special category of the self-employed, as they may have different pension system rules. 9,350 individuals out of 33,400 observations for age 54-64 are employed (but for many only for one period).

Estimated earnings use OLS estimation for the full-time employed (working week exceeds 20 hours). The earnings of the employed are replaced by estimated earnings if the predicted earnings deviate more than 5 standard deviations from the actual earnings (1,845 out of 33,400 observations; the share of observations is 2.1% in Belgium, 1.2% in Finland, 1.3% in Germany, 15.6% in Spain). Estimation of wages was done separately for each country and by gender, and explanatory variables include age, age squared, log weekly working hours, supervisory job, two-adult household, spouse employed, self-reported health, owner-occupied house, lag unemployment, public-sector job, firm size, and year dummies. (Details are available upon request.) Earnings are further evaluated as an average of the last two years in 2000 prices (or using earnings from last year if the earnings were 50% lower in the previous year). Person is only considered as working when self-reported status is normally working not inactive (pe200a=1 and pe200=3 in ECHP) and not working less than 15 hours (all self-employed are also excluded). 42% of individuals at age group 53-59 and 13% of individuals at age group 60-64 are still working. Employed persons with annual earnings below 5000€ are also considered retired (919 obs.).

All this means that all the unemployed and disabled are considered retired. More complex histories with at least one reverse transition have been excluded from the sample. Reverse transitions accounted for a minor share of a maximum of 2% of the individuals (most common in Germany).

We use the earnings model to assess the individual earnings profile similarly to Boldrin et al. (2002) and above, but this time separately by gender at three education levels. We use the estimated parameters to impute the earnings of the censored observations. We project earnings forward and backward in the following way.

- Forward: here we assume 1% real growth.
- Backward: $\hat{w}_{T-k-l} = w_{T-k} + g(a_{T-k-1})$,

where w_{T-k} is observed wages in year $t = T-k$ (T current period, k lag when last employed) and $\hat{w}_{T-k-l}$ is estimated wages for the lag $l = 1,...,L$. The function $g(.)$ corrects for the growth of log earnings defined as: $g(a_{T-k-l}) = \beta_1 * a_{T-k-l} + \beta_2 * a^2_{T-k-l} - \beta_1 * a_{T-k} - \beta_2 * a^2_{T-k}$ and $\beta = \beta_1, \beta_2$'s are estimated coefficients in a wage regression.

Based on all criteria, the estimation sample includes up to 4871 employed individuals of 54-64 years of age (Finland: 835, Belgium: 492, Germany: 2117, Spain: 1427) with an average spell of 2.4 years (only 1.5 years in Spain whereas over 4 years in Germany and Finland). A close look at the European Household Panel (ECHP) data summary table A.1 in the appendix using the national survey weights and the estimation sample provides some useful information about further decisions concerning the model specification. About 65.3% of our sample persons who are employed are males and the most frequent retirement age is 60 years of age. Health information is a potentially important determinant of retirement. In table A.1 the sample share of people with self-reported bad health (bad or very bad category) varies between countries. In particular, a high share of German women (23.7%) and men (21.1%) report as being in bad health. Belgium has unreliably small shares below 1%, whereas Finland has about 4.5%. Therefore we include stay in hospital (the last 12 months) as an additional explanatory variable.

Figure A.1 in Appendix A shows the share of employed people that withdraw from employment per age and gender. It can be seen that the average share of those who withdraw from work is below 10 per cent before the age of 59 and over 20 per cent after that (see also Table A.1). Data for Belgium shows

very early retirement, as virtually all women beyond the age of 60 are retired, and retirement propensities are low from age 60 onwards. Spikes are more pronounced for females and in general in Germany and Belgium, especially at ages 60 and 65. Finland has steadily increasing transitions, while in Spain retirement is concentrated on an age close to 65 years. The absence of spike at around age 60 in Spain is likely to be explained by sample criterion with very short spells (1.5 years) and less than 30% of individuals being women. The share of older age group 60-64 out of all employed 54 years or over is also relatively high above 30% (see table A.1).

We rely on the duration model approach, where retirement is treated as a dynamic discrete choice.[4] The variable that explains this is the duration of employment, and the failure is defined as retiring in the next period. The variable of interest is the length of duration *T*, which elapses from the beginning of employment until its end into retirement or until the measurement is taken, which may precede termination. Assume *T* is a random variable that has a continuous probability distribution f(t). The probability of the spell length of employment being smaller or equal to a particular value t or the cumulative distribution function is as follows:

$$F(t) = P(T \le t) = \int_0^t f(s)ds\,. \tag{5}$$

The survival function S or the probability that the spell of the working period is of length of at least t is given by:

$$S(t) = P(T > t) = 1 - F(t) = \exp\left(-\int_0^t \lambda(s)ds\right). \tag{6}$$

The hazard rate h is the rate at which spells are completed at time t, given that they have lasted until t. It can be interpreted as the age-specific failure rate and is given by

$$h(t) = \lim_{\Delta t \to 0} \frac{P(t \le T < t + \Delta t \,|\, T \ge t)}{\Delta t} = \frac{f(t)}{S(t)} = \frac{f(t)}{1 - F(t)} \tag{7}$$

[4] The hazard model approach is based on Diamond and Hausman (1984) and Hausman and Wise (1985). The hazard model that treats the retirement decision as a dynamic discrete choice has been used in other empirical studies such as Antolin and Scarpetta (1998) for Germany, Mastrogiacomo et al. (2002) for the Netherlands and Bütler et al. (2004) for Switzerland.

So far, the distribution of the stochastic dependent variable duration has not been specified; thus the duration can follow any known distribution. In this study duration model estimates are based on a parametric Weibull distribution, where the survival function is given by $S(t) = \exp(-\lambda t^{p})$, where $p > 1$ indicates that hazard rates increase with time (as is found to be the case here). The very important advantage of the duration analysis is that censored spells can be taken into account. The probit estimates are likely to be biased downwards due to left censoring. The duration model gives twice as high incentive effects than the probit model (not reported).

4. Estimation results

Duration model results are reported for the pooled estimation strategy in table 1. The results of second strategy of allowing parameters to change by country are reported in table 2. We report the risk ratio e^{β}, where β is the coefficient estimate. Thus, the value $e^{0.39}$=1.37 for initial bad health in column 1 in table 1 below means that the hazard is about 37 per cent higher with self-reported bad health. In all estimates weibull distributional assumptions of the hazard rate are supported by share value p, which varies around 1.5. Hazard rates thus increase with age. The generalized Cox-Snell residuals also indicate that the weibull model is the most appropriate one.

Table 1 Duration Model for Retirement at 54-64 Years of Age

	All	All	Women	Men
Option value	0.88***	0.88***	0.82***	0.91***
	(-9.2)	(-9.5)	(-7.7)	(-6.2)
Option value spouse	0.99		0.98	1.00
	(-0.6)		(-0.4)	(0.1)
Pension wealth	1.01*	1.01*	1.03*	1.02+
	(2.0)	(2.2)	(2.2)	(1.8)
Married	1.27	0.92	2.40	0.82
	(1.0)	(-0.9)	(1.6)	(-0.7)
Employed spouse	0.90		1.16	0.74
	(-0.7)		(0.5)	(-1.5)
Male	1.12	1.16+		
	(1.3)	(1.7)		
Age difference	1.01		1.01	1.00
	(1.2)		(1.6)	(-0.1)
Initial work satisfaction	0.96	0.96	0.92	0.99
	(-1.3)	(-1.1)	(-1.5)	(-0.4)
Initial leisure satisfaction	1.07+	1.06+	1.03	1.08+
	(1.8)	(1.8)	(0.5)	(1.9)
Initial bad health	1.38**	1.39**	1.00	1.73***
	(2.9)	(3.0)	(0.0)	(3.9)
Initial bad health spouse	1.00		1.78	0.75
	(-0.0)		(1.6)	(-0.7)

Inpatient at hospital	1.69***	1.69***	1.46*	1.76***
	(6.2)	(6.2)	(2.5)	(5.5)
Inpatient at hospital spouse	0.86		0.89	0.80
	(-0.5)		(-0.3)	(-0.6)
Tertiary education	0.93	0.92	0.97	0.94
	(-0.8)	(-0.9)	(-0.1)	(-0.5)
Supervisory job status	0.74+	0.72*	0.48+	0.73+
	(-1.9)	(-2.1)	(-1.7)	(-1.7)
Part time	0.91	0.89	0.71+	1.36
	(-0.6)	(-0.8)	(-1.8)	(1.1)
Public employment	0.78**	0.78**	0.71*	0.79*
	(-2.9)	(-3.0)	(-2.5)	(-2.1)
Firm size < 20	0.91	0.92	1.05	0.86
	(-1.1)	(-1.0)	(0.4)	(-1.4)
Owner occupied	0.91	0.92	1.00	0.85
	(-1.2)	(-1.0)	(0.0)	(-1.6)
Observations	4871	4886	1732	3139
No. of subjects	1864	1868	687	1177
No. of failures	832	837	275	557
Log pseudolikelihood	-1486.32	-1495.16	-496.91	-964.57
Degrees of freedom	22	17	21	21
p (Weibul)	1.55	1.55	1.49	1.60

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

In table 1 it can be seen that, as expected, the option value has a negative impact on the propensity to leave employment, as the risk ratio is below unity. The interpretation of the hazard ratio can be done with reference to two persons whose option values are OV and OV+1. Column 1 in table 1 shows that the individual with the higher option value has a hazard that is 12%, so the probability of retirement over a short period of time is considerably high in the pooled data. (That is, the ratio of their respective hazards is 0.88.) Re-estimating the model with other values for lifetime utility function parameters (the marginal utility of leisure parameter α and the discount rate δ) suggests that the effect of the option value on retirement is robust (however, a change in the utility curvature parameter gamma from 1.5 to the assumed 0.75 considerably strengthens the marginal effect).

Gender-specific estimations in columns 3 and 4 show that the pecuniary incentives are somewhat stronger for women than for men. However, table A.1 in the appendix shows that men have higher option values to stay in the market than females on average. (The average option value is around 6 for both genders) Although not directly comparable, the option value effects are significant and in magnitude similar to those in a U.S. probit analysis by Coile (2004). Next, we can see that wealthier individuals (with more pension wealth) retire earlier. Berkel and Börsch-Supan (2004) also find

significant wealth effects from unearned income in general in Germany, but we do not have enough information here on other wealth than pension wealth to examine this.

General finding is that joint retirement decision plays only a minor role. Spouse's employment status or age difference affects fairly little retirement propensity. The spouse's option value is also insignificant in columns 1, 3 and 4 in table 1. Finally, a comparison of columns 1 and 2 reveals that hazard rates for individual option values are also robust whether we take into account the option values for the employed spouse or not. We next analyze the importance of non-pecuniary incentives related to work characteristics, job and leisure satisfaction (not available for Germany and set at zero in pooled estimates) and health. We use initial health and satisfaction measures at the beginning of the spell to lower the endogeneity. Estimates would not change much if current instead of initial values were used (see Clark, 2001, for similar findings). It is seen here that job satisfaction and the profession (supervisory job status) are insignificant. (We also have in the model occupational dummies for managers and professionals, technicians and service workers that are not reported.) Leisure satisfaction increases the hazard rate out of employment and is significant at 10% level. However, job and leisure satisfaction little clean the estimated coefficients of the option values from some non-economic effects as these are robust to their inclusion.

It is seen that good health (whether measured by self-reported health status or as an inpatient at a hospital in the last 12 months) postpones retirement. Women report themselves as having worse health than men (14.9% in contrast to 13.4% of men). However, bad health only influences men's retirement (producing a hazard rate of 73% for men). A fairly large share of all individuals has received hospital care (over 10% with inpatient care at a hospital in the past 12 months) and the hazard rates are again steeper for men (76%) than for women (46%). This is probably the only reliable measure for Belgium, where the self-reported bad health share was very low.

An important final finding is that after all these controls the differences in the opportunity set attributed to the education level (tertiary education) are no longer significant. Civil servants are modeled to be part of the standard social security system, but the higher maximal replacement rates in Finland and Spain have been taken into account. Civil servants in Belgium also have to work longer, with a retirement age of 65, but disability channels are frequent. It is seen from table 1 that working in the public sector in general decreases retirement propensity. It is also seen that workers in small firms who have owner-occupied houses tend to retire later, but the effects are insignificant.

If we turn in greater detail to the country-specific analysis in table 2, we see that the effects of option values vary to some degree but the overall picture is similar.

Table 2. Duration Model by Country at 54-64 Years of Age

	Finland	Belgium	Germany	Spain
Option value	0.71***	0.95	0.88***	0.89***
	(-6.2)	(-0.5)	(-8.1)	(-3.7)
Option value spouse	1.08	1.02	0.98	1.00
	(1.2)	(0.1)	(-1.0)	(-0.1)
Pension wealth	1.03*	1.03	1.02+	1.01
	(2.1)	(0.9)	(1.8)	(0.5)
Married	2.06	0.84	1.02	1.19
	(1.2)	(-0.3)	(0.1)	(0.3)
Employed spouse	0.42+	0.64	1.05	0.85
	(-1.7)	(-0.5)	(0.2)	(-0.3)
Male	1.69*	1.29	0.92	1.87**
	(2.3)	(0.9)	(-0.7)	(2.6)
Age difference	1.01	1.00	1.00	1.01
	(1.0)	(-0.3)	(0.4)	(0.7)
Initial work satisfaction	0.94	0.79*		1.00
	(-0.7)	(-2.2)		(-0.0)
Initial leisure satisfaction	1.14	1.15		0.99
	(1.6)	(1.3)		(-0.2)
Initial bad health	2.05+	2.51	1.29*	1.61
	(1.9)	(1.5)	(2.0)	(1.6)
Initial bad health spouse	2.44	1.31	1.18	0.41
	(1.1)	(0.3)	(0.5)	(-0.9)
Inpatient at hospital	1.87**	0.81	1.65***	1.83***
	(3.0)	(-0.5)	(4.4)	(3.3)
Inpatient at hospital spouse	0.99	2.34	0.70	2.22
	(-0.0)	(1.1)	(-0.9)	(0.7)
Tertiary education	0.99	1.17	1.05	0.71
	(-0.0)	(0.6)	(0.3)	(-1.0)
Supervisory job status	0.53*	0.85		0.80
	(-2.3)	(-0.4)		(-0.8)
Part time	0.69	1.21	0.77	0.78
	(-1.2)	(0.5)	(-1.0)	(-0.6)
Public employment	0.93	1.76*	0.67**	0.82
	(-0.3)	(2.1)	(-3.1)	(-1.1)
Firm size < 20	0.95	0.75	0.98	0.69*
	(-0.2)	(-0.7)	(-0.1)	(-2.3)
Owner occupied	1.24	0.91	0.84+	1.16
	(0.7)	(-0.3)	(-1.7)	(0.6)
Observations	835	492	2117	1427
No. of subjects	399	198	708	559
No. of failures	132	84	387	229
Log pseudolikelihood	-245.79	-135.61	-624.54	-424.08
Degrees of freedom	22	21	19	22
p (Weibul)	1.70	1.99	1.43	1.62

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

It is seen from table 2 that the hazard rates of option values are significant in the range of 11%-29%, except insignificant for Belgium. In Belgium virtually all women retire before they reach 60 years of age, and apparently also for some non-economic reasons. The generous early retirement pensions can hence be expected to enhance early retirement, especially in Finland and in Germany, where the option values to postpone retirement are also highest (see later figure 2). In Spain incentive effects are limited by the large share of receivers of the minimum pension, by restrictions on the maximum pension and by later retirement close to 65 years of age (possibly also due to biased sample). Despite this, we find that the pension system do explain retirement in Spain, which differs from Boldrin et al. (2002), who use another data set for the same period.

For analyzing distributional effects of pension policies it is of interest to examine whether financial incentives differ for poor and rich families. We define household pension wealth as the sum of spouses' pension wealth or that of an individual (if there is no spouse) standardized by the size of the household size using the McClement scales (1978). The family's capital income has practically no correlation (0.08) with it, which is the reason why we exclude reported capital income from the analysis. Table 3 examines retirement behavior. Families in the bottom and top quartiles in household pension wealth in each country are separately pooled together (The households in the top 1% and lowest 1% of family pension wealth are omitted as outliers.)

Table 3. Duration Model, Pooling Individuals with Household Pension Wealth Below 25th or Above 75th Decile in Overall Distribution of Household Pension Wealth in Each Country at 54-64 Years of Age

	Below 25th	Above 75th
Option value	0.83***	0.88***
	(-5.9)	(-3.5)
Option value spouse	1.02	0.97
	(0.3)	(-1.0)
Pension wealth	1.03	1.02*
	(1.2)	(2.2)
Married	1.37	1.94
	(0.8)	(0.6)
Employed spouse	0.58	1.32
	(-0.7)	(0.9)
Male	1.00	0.91
	(0.0)	(-0.4)
Age difference	1.01	1.01
	(1.5)	(0.7)
Initial work satisfaction	0.88+	1.02
	(-1.8)	(0.3)

Initial leisure satisfaction	1.13	1.08
	(1.6)	(0.8)
Initial bad health	1.35	1.72+
	(1.3)	(1.8)
Initial bad health spouse	0.76	2.13
	(-0.3)	(1.5)
Inpatient at hospital	1.90***	1.77*
	(3.9)	(2.4)
Inpatient at hospital spouse	0.00***	1.40
	(-16.8)	(0.9)
Tertiary education	0.89	0.91
	(-0.4)	(-0.4)
Supervisory job status	1.47	0.42**
	(0.7)	(-2.8)
Part time	0.68	0.97
	(-1.3)	(-0.1)
Public employment	0.88	0.59*
	(-0.7)	(-2.4)
Firm size < 20	1.07	0.70
	(0.4)	(-1.4)
Owner occupied	0.84	1.58+
	(-0.9)	(1.8)
Observations	1111	977
No. of subjects	446	418
No. of failures	186	122
Log pseudolikelihood	-335.33	-211.29
Degrees of freedom	22	22
p (Weibul)	1.54	1.80

+ p<0.1, * p<0.05, ** p<0.01, *** p<0.001

It is seen that the pecuniary effects remain the same as before, and do not much differ for low and high household pension wealth families. Option values are also close the same being around 7 for poor and rich families, whereas average household pension wealth is 6.8 for low and 20.1 for high household pension wealth families (in ten thousand euro, year 2000 values). The probability for retirement is around 12% higher for high household pension wealth families merely due to the differences in family pension wealth. The effect is not large enough to give strong support for 'an added worker effect', when pension wealth is too low and worker is forced to stay longer in working life. Health parameters are the same, whereas, obviously, occupational effects differ.

5. Pension Reform

We evaluate retirement patterns after launching a flexible pension system with higher actuarial increments and flexible retirement between 63 and 67 years of age. The actuarial adjustment resembles in structure the new pension system in Finland, which has gradually started to become established since

2005. The estimated hazard rates can also be used to compute the net present value of lifetime pension wealth. The net present value of pension wealth over the current and 10 future periods starting with the current period τ is given by

$$NPVZ_{\tau i} = \sum_{A=\tau}^{\tau+10} \left[h_i(A,X) + h_{Di}(A) \right] P(A_i, Y_{i,A-1}) \ , \tag{8}$$

where $h_i(A,X)$ is the conditional probability of retirement and $h_{Di}(A)$ is the conditional probability of death (by gender) at period A starting from the current period $\tau = 0$. The conditional probabilities in each period vary with time (age) and are given by estimated conditional hazards in weibull distribution. Using the shape value of p=1.55 in the Weibull distribution, the conditional hazard rates are dropped to one-fourth from the initial value in six periods and are close to zero in the maximum of the eleven periods considered. Thus we can safely limit the calculation of the net present value for 11 periods, since expected retirement takes place with almost 100% certainty earlier. The conditional probability of retirement $h_i(A,X)$ can be written using the estimated unconditional hazard rates as

$$h_i(0,X_i) = \hat{h}_i(0,X_i) \quad \text{for A = 0;} \tag{9}$$

$$h_i(A,X) = (1 - h_i(A-1,X))\hat{h}_i(A,X) \quad \text{for } A = 1,\ldots,10 \ ,$$

where $\hat{h}_i(A,X) = EXP(\hat{b}X_i)pA^{p-1}$ and $\hat{b}$ are the estimated coefficients for the explanatory variables X and p is the shape value in the weibull distribution. In simulations we rely on pooled estimation strategy (estimates from column 1 in table 1), but also report results when using country-specific parameters from table 2. We ignore those observations for which our calculations predict optimal retirement at 80 years of age or over (not changing our results). At the second stage, we aggregate the net present value of pension wealth and option values using the national survey weights. In aggregating the results over the four countries, we simply use country sample sizes as weights and not the country's size of population. The estimation sample is three times larger for Germany and twice higher for Spain than on average for Finland or Belgium, so the largest countries are given roughly three times higher weight.

The flexible pension system experimented resembles in structure the new one introduced in Finland:

- A unified pension system in all countries with actuarial adjustment: the annual accrual rate to replacement rate is 1.5%-points for the 18-53 year age bracket, 1.9%-points for the 53-60 year age bracket, and 7%-points for the 61-68 year age bracket. [5]
- The pension is based on the entire working career with 80% wage and 20% inflation indexation on past earnings (Finland had 50% wage and 50% inflation indexation for the last ten years of earning, Belgium 100% inflation indexation, Germany 100% wage indexation and Spain a complex combination of both, see appendix for details).
- The pensions are indexed entirely by inflation. (The new Finnish system gives 20% weight on the wage index.).
- No limit for maximal replacement rate and no minimum or maximal pension

The higher accrual increment 1.9%-points as of 53 years of age benefits highly educated workers who have a steep wage profile (as applied in the new pension system in Finland). However, pensions based on earnings over the lifetime and not on last earnings moderate pension level considerably. Pensionable wage (the average earnings for certain years) is 15% lower due to calculations using lifetime earnings and not last ten years at work (which was the rule in the pension system prior to 2005 in Finland and Belgium, and also in Spain before 1997, see appendix for details). The annual accrual rate to replacement rate of 7%-points since 63 years of age is on the extreme side of added incentives. Finally, the new system in Finland also levels down pensions when the life expectancy of the population increases, but this option is not taken into account in this experiment.

In Finland the extended periods for unemployment benefits for older workers may still allow 'early retirement' as of age 57 in the new pension system. The Central Pension Security Institute in Finland has estimated that the new pension system postpones retirement only by one year on average (Central Pension Security Institute, 2002). Most of the new pension reforms in other countries indeed impose a

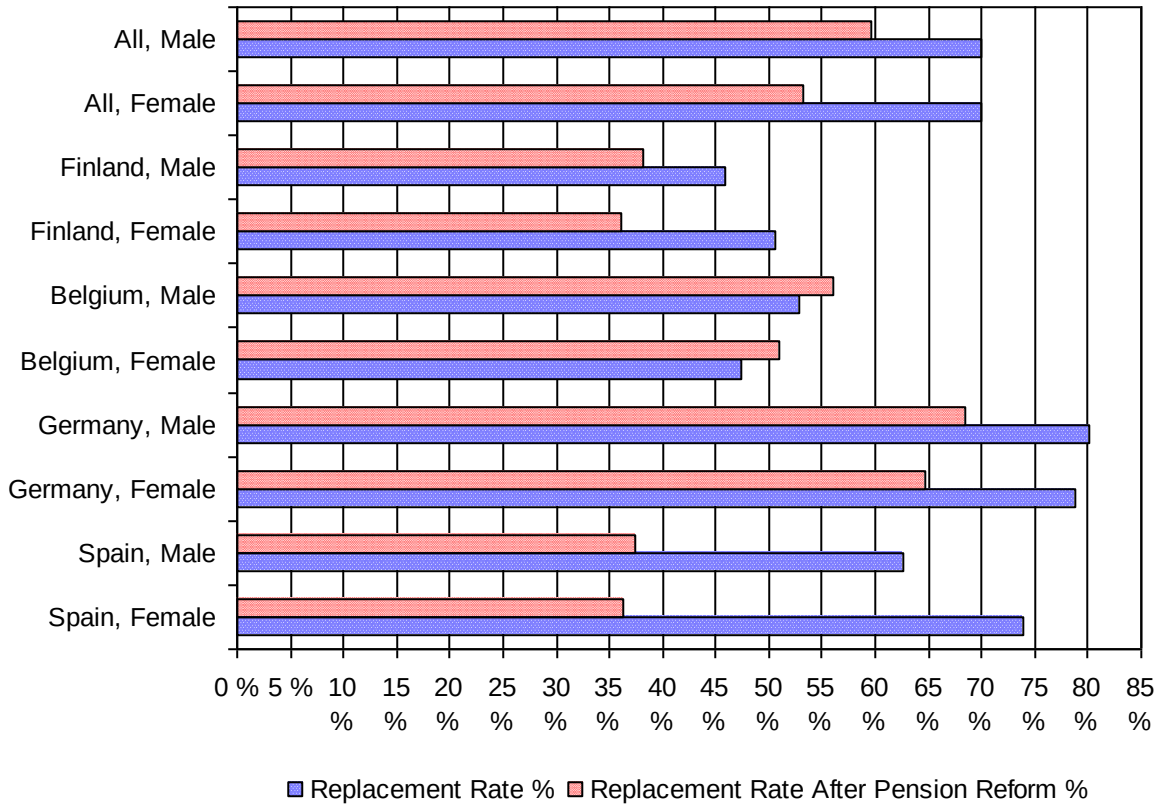
[5] In all calculations for Finland we account for the fact that accruals are halved for income earned prior to 1963.

real cut in pension benefits. In order to have more remarkable postponement in retirement, we use notably higher accrual deductions. We therefore penalize retirement before the age of 63.

- Pension rights decrease annually by 5%-point for early retirement prior to age 63 reaching the maximum deduction of 30% at age 56 or below and there is no other early retirement scheme.

The new Finnish system only yields once and for all an additional cut in pensions by 7% if retirement takes place at age 62 or earlier. Spain has instead an analogous deduction to the proposed one for early retirement prior to age 65 (but minimum pensions cover large share of pensioners). Berkel and Börsch-Supan (2004) similarly argue that the adjustment factors are not high enough in the new German pension system. They propose an actuarial adjustment with a reduction of 7.2% (instead of 3.6%) for each year of early retirement and an increase of 8.1% (instead of 6%) for each year of postponed retirement. Figure 1 first shows the expected replacement rates under the old system and in the new system for 60 years of age and for all those who are 57-60 years of age in the panel (also shown in table A.1).

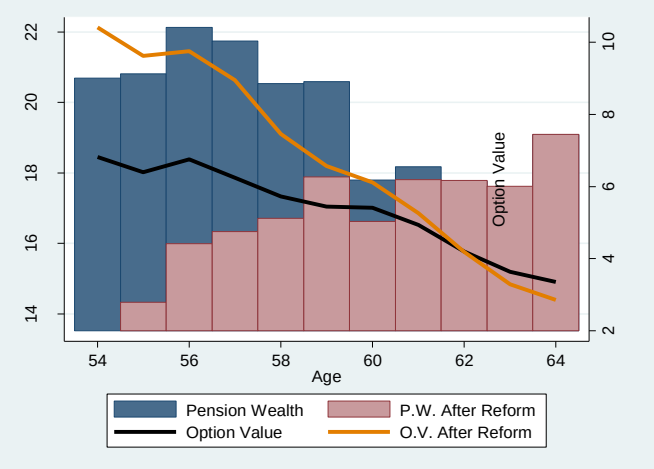
Figure 1. Replacement Rates at Age 60 Before and After Pension Reform

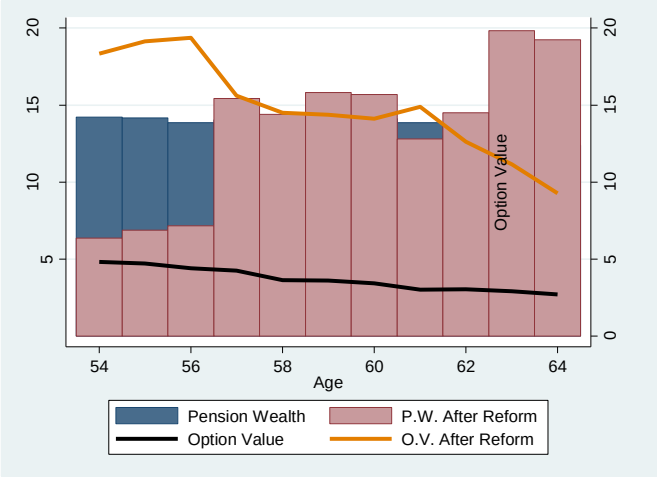


Replacement rates are decreased at age 60 on average by 17.8 points (in figure 1 18.9 points for women and 17.2 points for men). The decrease is greatest in Spain, where minimum pensions are binding for large share of retirees. Replacement rates are close to 35% both in Finland and Spain, whereas the tax exemptions of the pension incomes lead to the replacement rates to stay at relatively high level in Germany. The shifts in replacement rates follow a common trend. In the new legislation in the U.S., average earners retiring at age 62 (considered as early retirees) will see their replacement rate fall from 30 per cent today to 23 per cent in 2030. (These replacement rates are net of Medicare part B reported in Munnell et al., 2004.) Pension wealth and option value before and after reform for employed by age are shown in figure 2.

Figure 2 Age Profile of Pension Wealth (in 10000 Euros) and Option Value (mean).

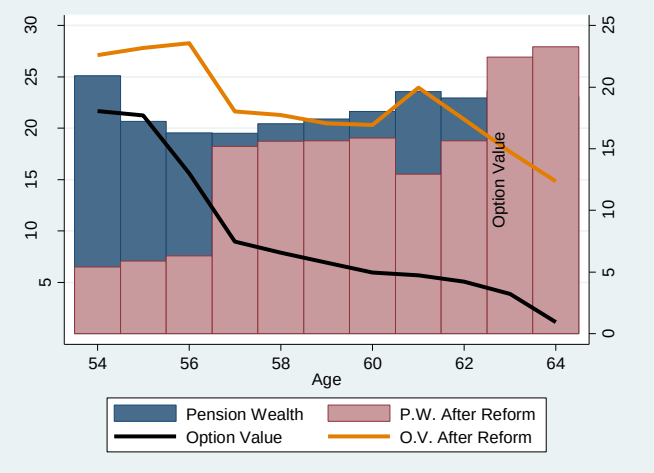
Finland Belgium

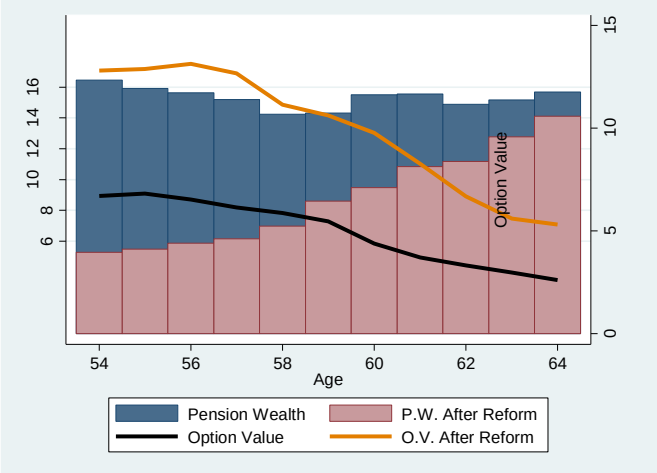




Germany

Spain





Source: Author calculations based on the ECHP 1994-2001

It is first seen that variation in option value between countries is lower before the reform what can be seen from early country-specific studies, see figure A.2 showing respective values in Dellis et al. (2001) and Börsch-Supan, Kohnz and Schnabel (2003) for Belgium and Germany. (In the latter the marginal utility of leisure α is set at 2.8 instead of 1.5 and the curvature parameter γ is 1 instead of 0.75). The purpose of the pension reform is to increase these option values, which are indeed substantially increased after the reform in all the countries. It is seen that after the reform the option values are highest in Germany and Belgium (in these countries the postponement of retirement is also greatest). It is seen that, after the pension reform, pension wealth is increasing by age. The accrual rate around 7% is high enough to compensate the loss from the shorter period left in retirement at age 60. A lower accrual

rate such as 2% accrual for pensioners retiring after 65 years of age would clearly not be enough (as introduced in the Spanish 2002 pension reform).

Next, table 4 shows, in column 3, the postponement in retirement using the pooled estimation strategy (relying on parameters given in table 1, column 1). We also report result using country-specific estimates from table 2 in column 4. Column 5 gives postponement for low and high-household pension wealth families (using pooled data parameters from table 1 rather than from table 3.

Table 4. Retirement and Postponement in Retirement due to the Reform in Alternative Models

Column		1	2	3	4		5
				Postponed Retirement (years)			
	Gender	Retirement Age (Year 2000)	Retirement Age (Model Year 2000)		Estimates by Country	Household Pension Wealth Quartile	
All	Female	58.7	59.1	3.7	2.2	Lowest	3.0
	Male	58.9	58.8	4.9	0.8	Highest	6.9
Finland	Female	59.4	60.0	1.0	3.0	Lowest	0.6
	Male	58.3	60.0	1.3	3.5	Highest	2.5
Belgium	Female	56.6	59.0	6.7	-0.7	Lowest	4.7
	Male	57.9	57.1	6.7	0.5	Highest	7.8
Germany	Female	58.3	57.9	5.2	5.7	Lowest	4.0
	Male	58.9	58.1	6.7	7.3	Highest	7.3
Spain	Female	61.3	60.3	3.2	2.5	Lowest	1.8
	Male	59.6	59.5	3.2	1.6	Highest	7.9

Columns 3 and 5 are based on estimation in column 1 in table 1; column 4 uses estimation by country from table 2.

The exit age in 2000 was at about 58 in Belgium, a little below 62 in Germany and a little above 62 in Finland and 62.5 in Spain, while column 1 shows somewhat earlier retirement age in the ECHP sample. The earlier retirement age is explained by the inclusion of unemployed in the retired pool. It is seen from column 2 that the predicted average retirement age is close to the figures in the sample. Column 3 shows that the postponement in retirement age due to pension reform is around 4 years (3.7 years for women and 4.9 years for men. The pension reform generates its largest effects in Belgium and Germany with, on average, 6.5 years' postponed retirement. In Finland the postponement is less, 1 year. Next column 4 uses the duration model estimated separately in each country (based on table 2). The country-specific duration model now gives more pronounced results for Finland, since Finland had the largest

parameter values for the option values in table 2. Note that the country-specific duration model would instead work poorly for Belgium yielding no role for pension reform to have real effects on retirement.

The last column 4 relates to changing retirement for low- and high-family-pension wealth families using pooled estimation. It is seen that families with a large amount of accrued pension wealth are generally the ones that respond more forcefully to the pension reform. Retirement is postponed by 7 as contrast to 3 years for poor families. The results would be close the same when using the country-specific estimation strategy (not reported) or separate parameters for poor and rich from table 3.

It is of interest to contrast these effects with policies that aim to increase wellbeing at work or to improve health. We assume that wellbeing at work improves considerably. Job satisfaction increases by 20% (by 0.94, the average is 4.5 on the rising scale 1 to 6), and leisure satisfaction decreases by an equal amount (by 0.78, the average is 3.9). Job satisfaction and leisure satisfaction are highly positively correlated (0.84) and have opposite implications on retirement. Therefore, the reform should change both the push and pull factors for early retirement and thus also introduce measures that make leisure less attractive. Lower utility of leisure from not working at all can be achieved with shortened working hours and better wellbeing at work. Taxes on leisure activities such as time-consuming sports (golf, tennis, fishing) can also be introduced. Another reform considered is an ad hoc assumption of a 50% improvement in health. The share of workers experiencing bad health (a combination of bad or very bad health) is halved from the average of 12% and the share of those having had inpatient care at hospital in the past 12 months is halved from 10%. These figures are not entirely unrealistic, since days spent in hospital have halved in many countries in the last 10 years.

Table 5. Postponement in Retirement Due to Greater Job Satisfaction
and Leisure Dissatisfaction or Due to Improved Health.

		Postponed retirement (years)	
	Gender	Greater job satis-faction and leisure dissatisfaction	Improved health
All	Female	0.3	0.1
	Male	0.3	0.1
Finland	Female	0.3	0.1
	Male	0.3	0.1
Belgium	Female	0.2	0.1
	Male	0.2	0.0
Germany	Female	na	0.2
	Male	na	0.2
Spain	Female	0.3	0.1
	Male	0.3	0.1

1) 20% greater reported job satisfaction and lower leisure satisfaction (mean is 4.47 for job satisfaction and 3.93 for leisure satisfaction where scale is from 1 to 6).

2) Share of individuals with self-reported bad health is halved from 12.3%.

It is seen from table 5 that in the basic model improved wellbeing at work (and decreased utility from leisure) would postpone retirement by around 0.3 years. The improvement of health has almost insignificant effects on retirement propensities, too. Health problems are concentrated at the end of the working career, where the employee is likely to retire in any case. Wellbeing at work policies can also be of limited use for the same reason.

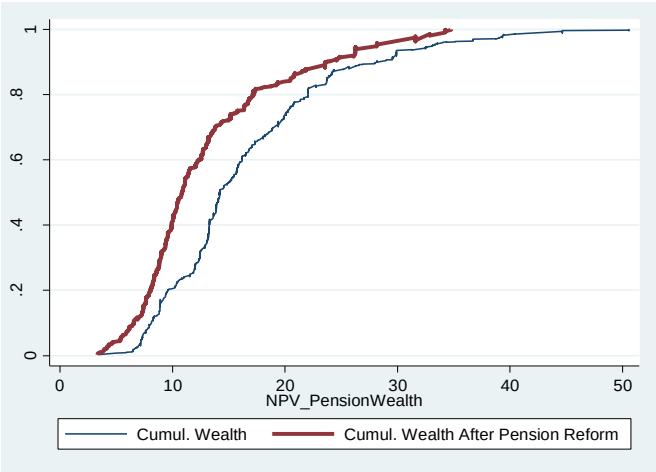
6. Pension Reform and Income Inequality

We have seen that the reform has large and fairly consistent effects in postponing retirement. Since early retirement is punished severely, it is of considerable interest to examine the changes in income inequality. Table A.1 in appendix shows that the average pension wealth is decreased from 19.4 to 14.7 (in 10,000€). Pension wealth is decreased in all countries if the reform had no influence on retirement patterns so that the pool of employed is exactly the same as before. This decrease is what we expected given the popularity of early retirement which is punished. The net present value of pension wealth takes into account the changes in pension wealth at each age and weights these according to hazard rates as described by (8). Using pooled estimation strategy results from table 1 it can be seen that the

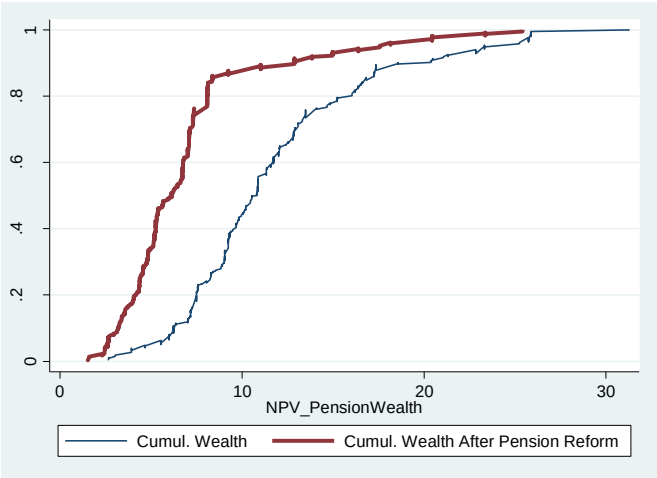
Gini coefficients indicate greater inequality in Belgium, Germany and Spain after the reform.[6] The Spanish increase in inequality is explained by the abolishment of minimum pensions, while in Germany the rich households benefit from low taxation of pension income. Figure 3 further shows the cumulative distribution of the net present value of pension wealth opportunity set before and after the pension reform.

Figure 3 Cumulative Distribution of Net Present Value of Pension Wealth Before and After Pension Reform.

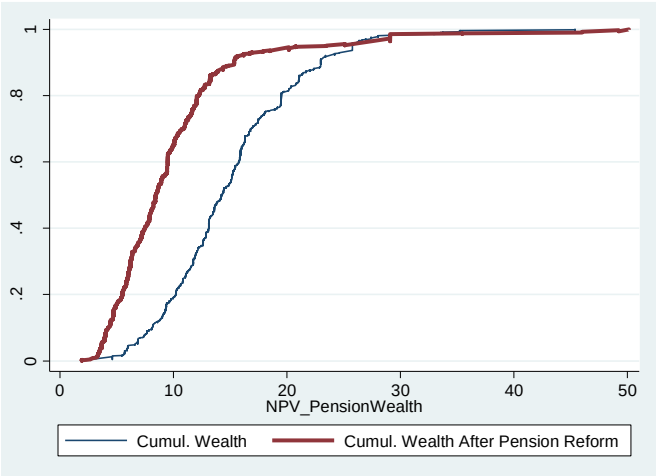
Finland



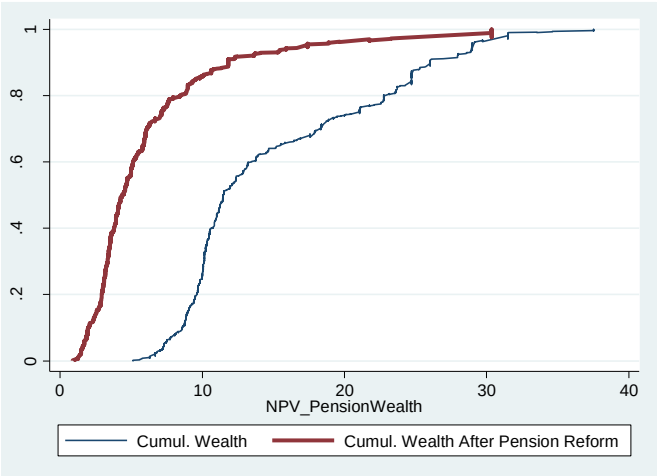
Belgium



Germany



Spain

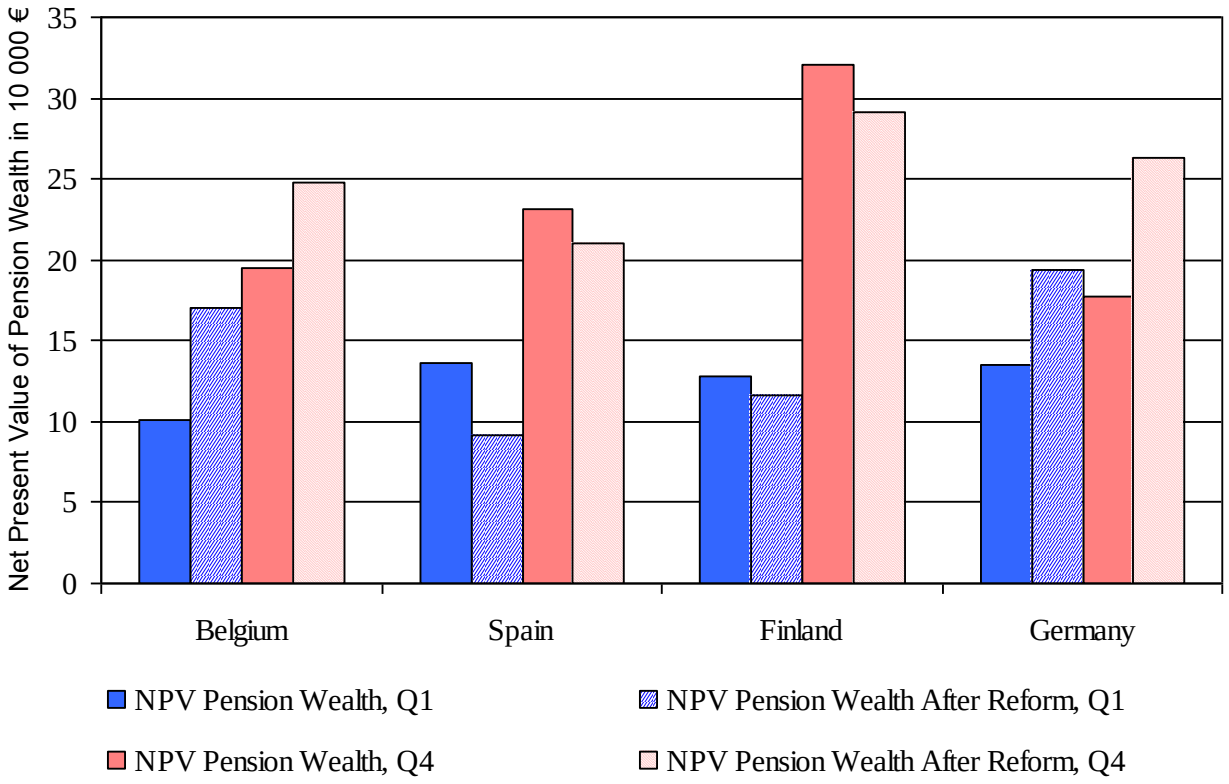


[6] Gini coefficients are before and after pension reform experiments 0.25 and 0.27 for Finland, 0.24 and 0.29 for Belgium, 0.21 and 0.30 for Germany and 0.26 and 0.40 for Spain.

Source: Author calculations based on the ECHP 1994-2001

It is seen that the curve for the net present value of pension wealth shifts left in all countries, least so in Finland and to the greatest amount in Germany and Spain. Figure 4 examines the distributional effects on net present value of individual's pension wealth that belong either in the lowest or highest quartile of household pension wealth.

Figure 4. Net Present Value of Pension Wealth Before and After Pension Reform in Lowest (Q1) and Highest Quartile (Q4) in the Countries.



It is seen that due to postponed retirement the net present value of pension wealth is increased both for poor and rich in Belgium and Germany, since the average retirement age increases over 6.5 years with higher pensions. In Spain the opposite trend is explained by the abolishment of minimum pensions. Note that in Finland the net present value of household pension wealth decreases, since unemployment pension system is relatively generous. The estimated postponement in retirement is only one year. However, country-specific estimation strategy yields postponement by three years and the net present

value of pension wealth would remain the same as before the reform (the results not shown). Overall, we can conclude that the distributional consequences of the pension reform are not adverse for the poor families although Gini coefficients indicate this. Individuals at the bottom quarter of household pension wealth gain from the reform, too.

7. Conclusions

Modeling the pension system for different countries is a difficult task, as each country has its very many rules and exceptions. It is noteworthy that possibly also due the pension rules the spikes in retirement at the ages of 60 or 65 are remarkable in Germany and Belgium, whereas in Finland retirement is smooth as of age 56. A robust modeling of the system for pooled data covering four countries has, however, been possible and is more reliable than the use of country-specific estimates that can overly depend on the characteristics of the existing pension system as for Belgium. Thereby the forward-looking measures do not only capture the institutional characteristics of the pension system. Analysis was, indeed, sensitive to whether countries are analyzed separately although, at the same time, also indicate robustness of the model as the OV parameters were much alike in country-specific estimates.

We show that pension reforms have to implement higher pension rights accruals than what has been introduced in the pension reforms during 2000s. Actuarial reform requires higher accruals for older ages e.g. beyond 63 years of age, and also a common reform of the abolishment of early retirement and a decrease in pensions by 5% for each year before age 63 (with a maximum deduction of 30%). The new ones introduced in Finland with a 4.5% accrual rate between the ages of 63 and 68 are too low.

The considered pension reform would exert the greatest effect in Belgium and Germany and would postpone retirement by around 6 years. In Finland the postponement of retirement would also be 3 years if the higher country-specific estimates were used. In Spain retirement is postponed less but this may be partly due to the estimation sample. In Belgium and Spain, the significance of financial incentives differs from Dellis *et al.* (2001) and Boldrin *et al.* (2002), while results for Germany follow Börsch-Supan, Kohnz and Schnabel (2003).

The pecuniary incentives are also the primary ones to rely on in making pension reforms compared with the fine-tuning of family and work life or work satisfaction. The 20% improvement in wellbeing at work

that had been experimented with an equal decrease in satisfaction from leisure did not largely affect retirement patterns. The same is true for health capital that can be rather considered as long-term investment. The subjective assessment of health deteriorates only at the end of the working career. It is clearly too late to influence health-related habits when one's health has already deteriorated. Joint retirement decisions of spouses did not also largely affect the individual's retirement: singles and spouse are largely on equal foot in retirement decisions.

Finally, the proposed pension reform would postpone more retirement of rich as compared with poor families. The pension reform can still be claimed distributionally fair. The distributional consequences of the pension reform are not adverse for the poor families although generally inequality in wealth increases. Individuals at the bottom quarter of household pension wealth also gain from the reform when retirement is postponed. An additional factor that would force poor families to postpone retirement is the liquidity constraints faced by low-income earners, but we find surprisingly little behavioral differences in retirement patterns between low- and high-household pension wealth households. It is clear, however, that additional demand side policies may be needed.

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Appendix A: Age Distribution of Pension Incentives, Age Profiles and Pension Rules and Tax Treatments

Figure A.1 Age Profile of Retirement Transitions by Country.

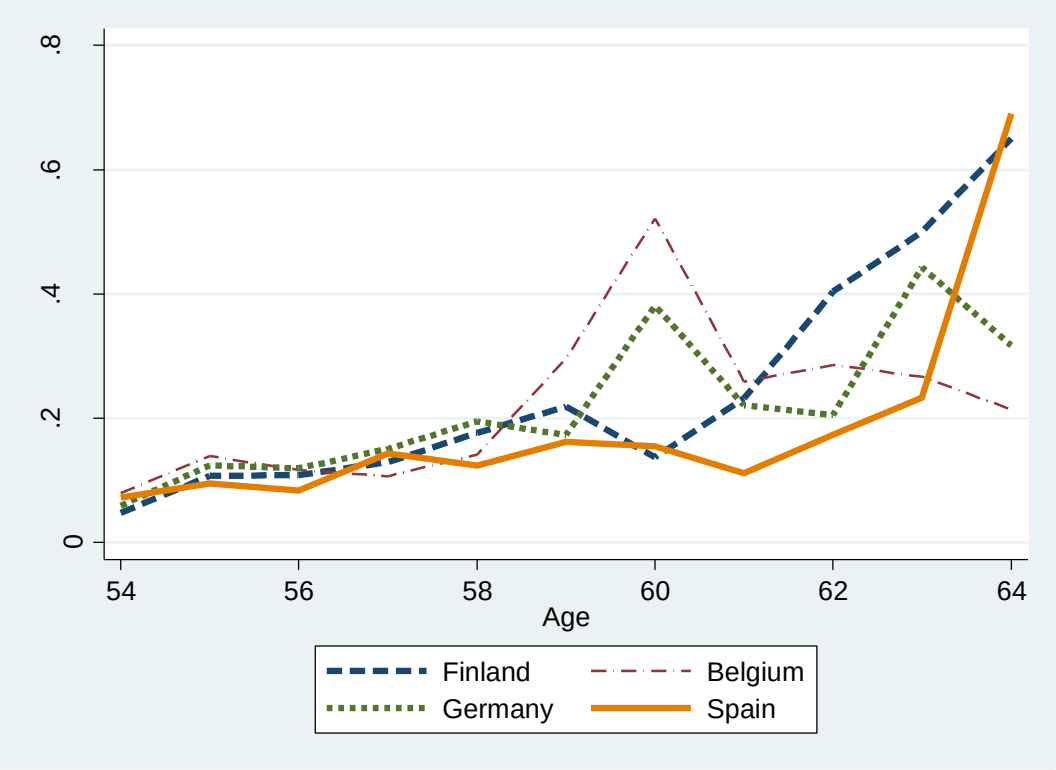
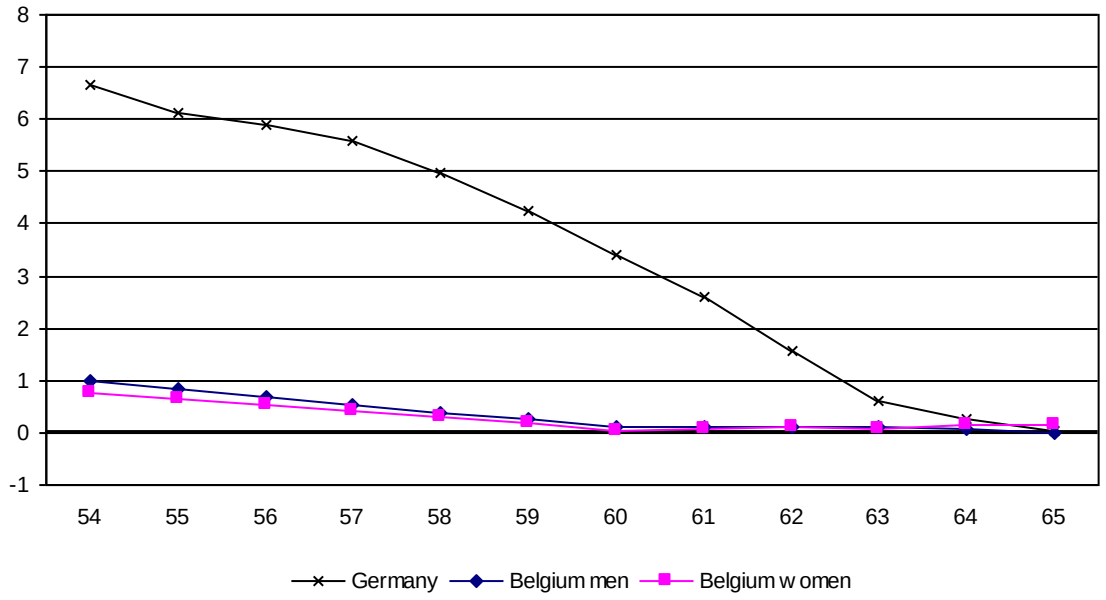


Table A.1 Summary Statistics for Employed Individuals 54-64 Years of Age in the Estimation Sample

	All		All Female	All Male	Finland Female	Finland Male	Belgium Female	Belgium Male	Germany Female	Germany Male	Spain Female	Spain Male
Observations	4871	st-dev.	1732	3139	480	355	150	342	761	1356	341	1086
Transition to retirement	0.17	0.008	0.17	0.17	0.14	0.19	0.14	0.19	0.23	0.16	0.11	0.18
Option value	6.48	0.090	6.16	6.66	5.52	5.89	3.52	4.29	7.19	8.18	5.54	5.49
Option value spouse	1.11	0.056	1.16	1.08	1.13	2.04	1.08	0.46	1.31	1.51	0.85	0.36
Option value after reform	15.44	0.186	13.07	16.69	7.34	8.24	15.82	16.82	16.83	21.90	11.55	11.63
Pension wealth (10,000€ year 2000)	19.41	0.174	17.64	20.35	18.88	21.22	12.40	14.32	17.95	24.52	16.84	15.99
Pension wealth after reform (10,000€)	14.72	0.245	12.96	15.65	15.25	16.44	9.67	12.70	13.80	20.61	8.39	8.98
Replacement rate	64.3 %	0.003	63.1 %	65.0 %	49.9 %	48.6 %	45.4 %	49.0 %	73.0 %	75.3 %	69.2 %	62.5 %
Replacement rate after reform	46.5 %	0.005	44.2 %	47.8 %	29.3 %	28.0 %	37.1 %	42.6 %	60.9 %	64.7 %	33.3 %	33.4 %
Replacement rate at age 60	69.7 %	0.005	69.5 %	69.8 %	50.7 %	45.8 %	47.3 %	52.8 %	78.8 %	80.2 %	73.9 %	62.6 %
Replacement rate at age 60 after reform	55.6 %	0.005	53.2 %	57.0 %	36.2 %	38.2 %	50.9 %	56.1 %	64.6 %	68.4 %	36.2 %	37.4 %
Cohabiting	79.1 %	0.008	63.8 %	87.2 %	58.2 %	77.5 %	59.6 %	90.4 %	71.7 %	84.2 %	53.7 %	93.8 %
Employment, spouse	15.1 %	0.006	18.0 %	13.5 %	17.9 %	33.6 %	24.4 %	11.2 %	17.2 %	14.1 %	17.6 %	6.7 %
Male	65.3 %	0.010										
McClements scale	1.90	0.00	1.87	1.92	1.86	1.91	1.80	1.93	1.87	1.91	1.92	1.91
Owner occupied	73.4 %	0.009	67.8 %	76.4 %	83.3 %	78.8 %	82.5 %	86.6 %	49.3 %	63.4 %	85.0 %	91.5 %
Age difference (years)	12.2	0.5	17.9	9.2	19.5	12.7	21.4	7.1	13.7	10.7	24.6	6.5
Satisfaction with work (rising scale 1 to 6)	4.47	0.480	4.46	4.48	4.6	4.5	4.8	4.8			4.8	4.5
Satisfaction with leisure (rising scale 1to 6)	3.93	0.051	3.95	3.91	4.2	4.4	4.1	4.3			3.4	3.8
Initial bad health	12.3 %	0.009	13.4 %	11.7 %	4.9 %	4.3 %	0.0 %	0.4 %	23.7 %	21.1 %	5.8 %	4.3 %
Initial bad health spouse	10.6 %	0.003	10.4 %	10.7 %	2.4 %	2.3 %	5.5 %	4.5 %	18.4 %	18.2 %	4.5 %	4.6 %
Inpatient at hospital last 12 months	10.2 %	0.006	10.2 %	10.2 %	9.9 %	12.1 %	10.6 %	8.4 %	12.1 %	10.8 %	5.4 %	9.4 %
Inpatient at hospital spouse	1.8 %	0.002	2.2 %	1.6 %	2.3 %	4.8 %	5.0 %	1.0 %	1.8 %	1.9 %	1.8 %	0.2 %
Tertiary education	28.6 %	0.009	21.8 %	32.2 %	32.5 %	31.1 %	29.8 %	37.1 %	10.7 %	35.7 %	30.3 %	25.6 %
Supervisory job	7.8 %	0.005	4.5 %	9.6 %	10.7 %	30.8 %	8.1 %	23.4 %	0.0 %	0.0 %	4.9 %	11.8 %
Part time	6.4 %	0.005	15.3 %	1.6 %	14.0 %	6.2 %	22.9 %	2.0 %	15.8 %	0.1 %	13.3 %	2.2 %
Public employment	35.7 %	0.009	44.6 %	31.0 %	62.2 %	42.3 %	34.4 %	26.5 %	34.5 %	29.9 %	46.1 %	30.6 %
Firm size < 20	23.0 %	0.008	27.1 %	20.9 %	35.1 %	34.2 %	10.5 %	12.2 %	21.8 %	12.1 %	34.2 %	32.9 %
Age 55-59	71.9 %	0.010	74.5 %	70.6 %	75.4 %	83.2 %	88.3 %	86.6 %	74.8 %	65.3 %	67.1 %	68.3 %
Age 60-64	28.1 %	0.010	25.5 %	29.4 %	24.6 %	16.8 %	11.7 %	13.4 %	25.2 %	34.7 %	32.9 %	31.7 %

Source: Author calculations based on the ECHP 1994-2001

Figure A.2 Age Distribution of Pension Incentives: Previous Option Value Results for Belgium and Germany in 10,000€ (Börsch-Supan *et al.* 2003, Dellis *et al.* 2001).



Pension Rules and Tax Treatments

The focus is on regulations during the sample period years 1994 to 2001. The reference year for figures is 2000 unless otherwise stated. Pension income is taxable income in all countries and work-related expenses may not be deducted.

Finland

The earnings-related pension depends on accrued pension rights during employment and on earnings in the last 10 years. The pension accruals start accumulating from the age of 23. Accruals in the calculation of the replacement rate vary over years. For the years before 1.7.1962 an employee acquires a pension rate of 0.5% per year. For the years following 1.7.1962 the pension rate is 1.5% per year. From the age of 60 onwards an employee acquires a pension rate of 2.5%. The maximum pension is 60% of the highest wage $W_{\max}$.

$$P = \min [rW, 0.6 * W_{\max}] \qquad \text{(a.1)}$$

The pensionable salary W is the gross income net of the employee's pension contributions and corresponds to the average salary over the last 10 years of occupation. The pension index gives 0.5 weight on the wage index (0.2 from age 65 on) and 0.5 weight on the consumer price index (0.8 from age 65 onwards). The income earned after age 65 increases the accrual rate by 0.6% per month (but income is not taken into account in the calculation of pensionable salary). It is possible to retire from the age of 60 onwards. This reduces the level of pension payments by 0.4% for every month below age 65. But we assume that the employee always has access to a more favorable unemployment pension pipeline or a disability pension (where the pension level is approximately the same as in the unemployment pension).

The government pension is 428€ a month and 327€ for a married person, depending on the municipality of residence. This is reduced by one-half of the amount exceeding 35€ a month of other earnings-related pension income. It is not paid if the other pension described above exceeds 764-856€ a month, depending on municipality. A married person receives no pension if his earnings-related pension exceeds 754-785€ a month (1998 figures). The pension income is taxable. Additional sickness insurance for pensioners is 2.7 (in addition to 1.5).

The unemployment pension depends on the following components:

$$P_{unemp} = \min\ [(a+b+c)*(1+\sup)*W,\ 0.6*W_{\max}] \qquad \text{(a.2)}$$

where

a = replacement rate at the time of unemployment at age 57 or after with a yearly accrual of 12/800=0.015 and 0.025 as of age 60

b = upcoming pension accrual until age 60: months of unemployment until age 60 with a yearly accrual of 12/1000=0.012

c = upcoming pension since age 60: unemployment pension months until age 65 (60 or less) * W/ 1500 (yearly accrual 12/1500=0.008)

sup = pension supplement after 500 days of unemployment if retired before age 60

$$\sup = 0.8\ u/22\ /\ (504-u/22)$$

where u = days of unemployment until age 60 and 504 shows months between age 23 and 65.

Those born later than 1945 (younger than age 58 in 2002) are entitled to the pension supplement only as of age 65. For those born before 1945 the pension supplement is also earned during a period of unemployment.

Disability pension consists of

$$P_{disability} = \min\ [(a+b+c+d)*W,\ 0.6*W_{\max}] \qquad \text{(a.3)}$$

where

a = replacement rate at the time of disability

b = upcoming pension accrual until age 50: Disability months until age 50 /800

c = upcoming pension accrual at age 50-59: Disability months at age 50-59 (120 or less)/1000

d = upcoming pension at age 60-65: Disability months at age 60-64 (60 or less)/1500.

As of age 60 the disability pension is equal to the unemployment pension.

Belgium

For men the conditions for obtaining a full pension is a minimum age of 65 and having a working career of at least 45 years. Women can obtain a full pension after a career of 42 years from the age of 62. Men and women can go on pension from age 60 if their career reached a minimum of 20 working years in 1997. The calculation of the pension P is based on the following formula:

$$P = rW \min[d/(42 \text{ or } 45), 1], \qquad \text{(a.4)}$$

where the replacement rate r is 0.6 for singles and 0.75 for a one-earner couple, pensionable salary W depends on years at work, and the share of years d completed of the full career is 42 years for women and 45 years for men. The formula corresponds to an annual accrual rate of 2.38 for women and 2.22 for men. The wage base is the average of the price-indexed wages over the period of affiliation. An important characteristic of this scheme is that periods spent in unemployment, inactivity due to sickness and disability and early retirement also count as affiliation years. Social Protection Committee (2006) argues that while the actual exit age from the labour market is lower than 60, the average age of take up of pensions for salaried workers is 64, after a career (including the assimilated periods) of 42 years. Therefore non-employment works poorly as measure for retirement and hence retirement is used as the proxy instead. All benefits in this scheme are consumer-price indexed.

Pension benefits are limited at both ends: for a complete career the minimum annual pension was 11 794 euros for a one-earner couple or 9 438 euros for individuals in 2002 (about 56% of the average net wages). The earnings entering the above pension formula had a ceiling of 38 678 euros (120% of the average gross wage) in 2001. If the ceiling is adapted for the whole career, the maximum annual pension amounted to 20 894 Euros for a one-earner couple and 16 715 Euros for an individual in 2001.

Calculations include a funded 2nd pillar scheme in line with Social Protection Committee (2006). For the building up of this second pillar, it has been assumed that the contribution period is 12 years yielding an additional actuarial accrual increment of 4.25% for pensionable wage above first quarter in overall distribution and 1% for others (low-income earners). For average earners this represents less than one tenth of the gross pension. The lower contribution rate reflects the fact that contribution rates to second pillar pensions vary depending on the level of wages.

Men may retire at the age of 60 if replaced by unemployed persons. Women may retire if unemployed or disabled between the ages of 61 and 65. People can retire at the age of 60 with a 26-year career for retirement in 2000. (A 20-year career in 1998, a 22-year career in 1998, a 24-year career in 1999, a 30-year career in 2002, a 32-year career in 2003, a 34-year career in 2004, and a 35-year career in 2005). We assume entitlement to retirement for all as of age 60. Wage-earners and self-employed pensions follow the evolution of the consumer price index, that is, the health consumer price index, corrected for cigarettes, etc. These pensions are also irregularly adapted to the living standards.

Retirement through unemployment: The most prevalent individual early retirement is to pass through the unemployment system in which people aged 50 or more are considered "aged unemployed", not being required to actively seek work. We have assumed that those retired under age 60 have used this channel if the person has been unemployed in the past year, this year or in the two consecutive yearw. It is noteworthy that the accumulation of pension rights stops there.

Disability pension: The normal allowance is 65% of the lost earnings (subject to a ceiling) for individuals with dependants, 45% for singles without dependants, and 40% for cohabiting individuals without dependants. The recipient, isolated or co-habitant without dependants, is entitled to a rate of 65% when it is acknowledged that he or she requires the assistance of a third party in order to perform the basic activities of daily living.

Germany

In 1972 Germany underwent a major pension reform that created different incentives to retire earlier than 65. This had an effect on the cross-sectional distribution of retirement ages. Instead of a single retirement spike at age 65 the reform resulted in different spikes at ages 60, 63 and 65 (Börsch-Supan, 2000). Individuals are entitled to the old-age pension at 63 with 35 years of contributions, at 65 with an additional 5 years. The retirement age has been 60 for women, but is being gradually shifted to 65 (assumed for both genders). The maximum of pensions is 75% of the mean earnings of all the insured. *Old-age pension* benefits are defined as

$$P = EP * Pension\ factor * Pension\ value\,. \qquad \text{(a.5)}$$

EP = earnings points is the annual or reference earnings divided by the average earnings of all contributors. *EP* is computed by averaging her or his annual relative contribution positions over the

entire earnings history. Here we evaluate earnings points using the last year earnings, which leads somewhat to an overestimation of the figures for the highly educated. In each year, *EP* is expressed as a multiple (minimum 75%) of the average annual contribution (roughly speaking, the relative income position). The reference earnings are insured employment income (up to the contribution ceiling) during the entire duration of the insurance period. The monthly contribution ceiling is EUR 4,397 (West) and EUR 3,630 (East). For contributions before 1973 the multiple cannot fall below 75%. For contributions between 1973 and 1992, multiples below 75% are multiplied up to a maximum of 75%, effectively reducing the distribution of pension for workers with income positions below 50%.

The *Pension factor* is usually 1 but increases if retirement is postponed. For delayed retirement after age 65, an added factor of 1.0 plus 0.5% for each month is used.

The *Pension value* is a monthly benefit amount for one year's average covered earnings. This determines the income distribution between workers and pensioners. The average gross earnings of all contributors was 53508€ in 1999 and net earnings 33517€ in 1999, and 34143€ in 2000. Contributions are levied on earnings between a floor of 1% and a ceiling of 170% of the average net earnings, thus equaling about 341€ for the floor and 58043€ for the top in 2000. Benefits are adjusted annually for changes in the real value of pensions compared with changes in earnings.

Occupational pension income and civil service income are, in principle, taxed as wage income as assumed here (and thus are eligible for the allowance for work-related expenses, even though such expenses are not usually incurred). In addition, 40% of the benefit is exempt from tax up to a ceiling of DEM 6 000. This rule is applied here for all pensions.

The pension scheme for civil servants granted up to 75% of the last labor income for persons who retired before 2003. In the following years, the maximal replacement rate of 75% gradually decreases in eight equal steps to 71.75% and will presumably be constant from the year 2010 onwards. Retired civil servants are granted tax exemption with 40% of the taxable pension benefits up to a maximum of 3.072 Euros per year (not included in the alternative tax reforms and also gradually eroded as of 2005 in the current tax system).

Unemployment pension: Unemployment compensation has been used as pre-retirement income in an unofficial scheme that induced very early retirement from age 56 onwards, as unemployment

compensation is paid up to three years for elderly workers and is followed by the lower unemployment benefit before an unemployment pension could start at age 60. (Before 1997 the unemployment pipeline started at age 54.) In addition, early retirement at age 58 was made possible in an official (less popular) pre-retirement scheme, in which the employer received a subsidy if a younger employee was hired. According to the "59 rules" and "57 rules" companies which release older workers in a "socially acceptable manner", meaning, in a way, that they can bridge the gap to the take-up of an old-age pension with unemployment benefit, are allowed to shift part of the expenses onto the Federal Employment Office. The Act of the Consolidation of Job Promotion from 1982 obliged companies to pay the earnings-related unemployment benefit plus related social security contributions for up to one year when firing an older worker who had been employed at the company for at least 10 years. Here we assume early retirement as of age 56 before 1997 and as of age 57 since 1997 (the pension level depending on the work experience gained) and apply yearly deductions of pensions of 3.6% for retired males before age 65 and for retired females before age 63. The additional accrual for retirement since age 65 is 6%. After the year 2011, the specific regulations for the retirement age for the unemployed will be abolished completely.

Disability pension: Disability pension benefits can be received if one passes a strict earnings test (full benefits) or a weaker earnings test (before age 60: 60% of the applicable old-age pension). Survivor pensions are 60% of the husband's applicable pension for spouses that are 45 and over or if children are in the household, otherwise 25%. Survivor benefits are a large part of the public pension budget and of the total pension wealth. In addition to the above benefits, transfer payments enable one to have what is referred to as "pre-retirement". We apply disability pension if the person is receiving sickness or invalidity benefits this or next year. There is no age limit and yearly deductions of pensions 3.6% for early retirement do not apply.

Taxation of wage earners and pensioners

There is no special tax relief for older people. Income up to a statutory line is exempt from tax. This was around DEM 13 000 per person in 1999. This provision applies equally to citizens of pensionable age and those of working age. The proportion of the income subject to tax varies with the age at which the individual retired. For retirement at age 62, only 27% of the pension is taxable. The share at other illustrative retirement ages is as follows: 38% at age 55, 32% at age 60 and 21% at age 70. There is an additional deduction of DEM 200. Social security contributions are levied on retirement benefits for health insurance at a rate of about 7% (rates differ between health insurance

companies) and for long-term care insurance at a rate of 0.85% before April 2004 and 1.7% since April 2004.

Social security contributions are paid based on the total amount of the pension, but are not the same as for employed people. Retired wage earners pay 3.55% in social security contributions for sickness and invalidity, provided that (in 2001) this contribution does not mean that the pension paid to single people is less than 1117 €, or 1396 € for married people. On top of that, another contribution ranging between 0.5% and 2% is paid for pension financing, according to the pension level and only for people receiving pensions higher than 1975 € (single) or 2257 € (married). This is called the 'solidarity contribution'. Civil servants pay the same contributions + 0.5% to finance funeral benefits. Wage-earner pensions follow the evolution of the consumer price index, that is, the health consumer price index, corrected for cigarettes, etc. These pensions are also irregularly adapted to the living standards.

Spain

The retirement program we label official (or regular) offers two options: early retirement and normal retirement. Early retirement is possible from age 60 but it only applies to workers who started their contributive career before 1967. The normal retirement age is 65, although some professional groups have lower normal retirement ages that are ignored here. (Miners, military personnel, policemen and fishermen are the main ones.) Collective wage settlements often impose mandatory retirement at age 65, facilitate retirement at 64 with full benefits, or encourage retirement between 60 and 63 through lump sum payments.

As described by Boldrin and Jiménez-Martín (2002) a retiring worker receives an initial monthly pension $P_t = rW_t$, where the pensionable salary (*base reguladora*) W_t is a weighted average of monthly earnings over the last 8 years before retirement

$$W_t = \frac{1}{112}\left(\sum_{j=1}^{24} W_{t-j} + \sum_{j=25}^{96} W_{t-j}\frac{I_{t-25}}{I_{t-j}}\right) \quad , \qquad \text{(a.6)}$$

where W_{t-j} is wage indexed wage and I_{t-j} the consumer price index in month *j* before retirement. Pensions are paid in fourteen annual installments, hence the division by 112 in the previous formula. Beginning in 1997, the number of reference years has been increased from the initial 8 years by one every year until 2003, to reach a total of 15 years. In our calculations we use the wage index to evaluate nominal wage growth to the wage level given by an average of the last two periods. These wages are deflated by the consumer price index according to the formula given by (a.2). The replacement rate r depends on the age of the retirees and on the number of years of contribution. For age equal or larger than 65, this is equal to

$$r = \begin{cases} 0 & if\ n < 15 \\ 0.6 + 0.02(n-15) & if\ 15 \le n < 35 \\ 1 & if\ n \le 35 \end{cases} \qquad \text{(a.7)}$$

In early retirement for ages between 60 and 65, r is determined by the previous formula multiplied by a penalization factor. This is equal to 0.6 at 60, and increases 0.08 each year, until reaching the value of 1 at age 65. When the age is below 60, $r = 0$, while workers receive unemployment benefits. Since 1997 the formula for computing r has been changed to the following

$$r = \begin{cases} 0 & if\ n < 15 \\ 0.5 + 0.03(n-15) & if\ 15 \le n < 2 \\ 0.8 + 0.02(n-25) & if\ 25 \le n < 35 \\ 1 & if\ n \le 35 \end{cases} \qquad \text{(a.8)}$$

The penalization factor is the same, with an exception made for workers with 40 or more years of contributions. The replacement rate of a public servant is proxied following Boldring et al. (2002) by $r = \min(1, 1 - 0.366(35-n))$. Wage-earner pensions follow the evolution of the consumer price index.

Maximum and minimum pension

Pensions are subject to a ceiling, legislated annually and roughly equal to the ceiling on covered earnings. The 2000 ceiling corresponds to about 4.3 times the minimum wage (*salario m´inimo interprofesional*, or SMI) and about 1.6 times the average monthly earnings in the manufacturing and service sectors. If the initial old-age pension, computed as above, is below a minimum, then the minimum pension is paid. The latter is also legislated annually. Other things being equal, minimum

pensions are higher for those who are older than 65 or have a dependent spouse. In the last decade, minimum pensions grew at about the same rate as nominal wages, whereas maximum pensions grew at the rate of inflation. The ratio between the minimum old-age pension and the minimum wage has been increasing steadily since the late 1970s (it was 75 percent in 1975) until it reached almost 100 percent in the early 1990s. The earnings related pensions are topped up to the minimum levels for pensions. The share of pensioners receiving the minimum pension is declining and was 28.3% in 2005. (The proportion of new pensioners receiving minimum pension decreased from 30.1% in 1995 to 18.4% in 2004.)

The normal retirement age is 65 but early retirement at age 60 is permitted as a general rule for those who became affiliated to the Social Security system (*Mutualidades Laborales*) before 1967. The replacement rate for early retirees is reduced by 8 percentage points for each year below age 65. Starting from 1997, workers who retire after the age of 60 with 40 or more contributive years are charged a penalty of only 7 percent for each year under age 65.

Unemployment benefits are 70% of reference earnings for the first 180 days; and 60% afterwards. The maximum is 170%, 195% or 220% of the minimum wage (Salario Mínimo Interprofesional) according to the number of dependant children. The minimum is 100% of the minimum wage with dependant children and 75% of the minimum wage without dependant children. The maximum duration of benefit is 720 days with 2,160 days or more of contributions.

The *Disability pension* is ignored in Spain (because of strict rules). Unemployment benefits are generally conditional on previous spells of contributions and are available only for workers in the General Regime (RGSS) of the Spanish Social Security (S3) system.1 There are two continuation programs for those who have exhausted their entitlement to contributory unemployment benefits: one for those aged 45+ (UB45+ program) and the other for those aged 52+ (UB52+ program). The latter is a special subsidy for unemployed people that are older than 52, lack other income sources, have contributed to unemployment insurance for at least 6 years in their life and, except for age, satisfy all the requirements for an old-age pension.