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OPTION VALUES FOR RETIREMENT

EFFECTS OF PUBLIC INCENTIVES TO POSTPONE RETIREMENT IN FINLAND, BELGIUM AND GERMANY

HANNU PIEKKOLA
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Hannu Piekkola and Matthias Deschryvere*

Abstract

This paper studies the determinants of the retirement transitions of Europeans and focuses on the impact of social security systems on retirement behaviour. The analysis uses the first eight waves (1994-2001) of the European Community Household Panel. Based on these survey data, option values – which express, for each retirement age, the trade-off between retiring now and keeping the option open for some later retirement date – are constructed for each sampled individual in three countries: Finland, Belgium and Germany. The overall results of the duration and probit models show that the option value, well-being at work and health all have a significant impact on retirement decisions irrespective of gender. The analysis shows that policies to raise marginal incentives and, hence, option values are effective, especially in Finland. The incentives have the highest impact on the early retirement stage. In Germany and Belgium we see spikes in retirement at age 60 or 65, whereas the retirement path in Finland is smooth from age 56 and option values do not significantly decrease with age. Job satisfaction is an important predictor of future withdrawal from work. Poor health also has an important effect on retirement risk, especially in Germany.

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Contents

List of Tables

Option Values for Retirement

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1. Introduction

Sustainability of the European pension systems has been undermined by two main trends. The first one concerns the population structure and the increasing share of older people. The second trend is the declining or low European labour force participation in general and of the elderly in particular. Both trends result in a rise of the dependency ratio as retirees receive pensions for a longer period and there are fewer workers per retiree to finance the pension systems. A third indicator that shows the problematic participation behaviour of the European elderly is the positive gap between the normal retirement age and the average exit age of the labour force. In addition, it can be noticed that based on all the above indicators, sustainability prospects look much brighter in the US.

This paper uses the international variation in pension provisions across Europe to link incentives and labour force exit decisions; the countries studied are Finland, Belgium and Germany. The key variable in this approach is the option value to postpone retirement. The option value to postpone retirement expresses, for each retirement age, the trade-off between retiring now and keeping the option open for some later retirement date. The important policy question is to what degree labour force participation increases from higher marginal incentives to postpone retirement. If the pension system is instead very inflexible, the only alternative is to cut the level of pensions or to raise the pensionable age.

The analysis exploits cross-sectional variation in the social security rules. This paper concentrates on social security and does not take into account pension incentives of the second and third pillars of the pension systems, as those data were lacking. We also exploit the information about job satisfaction. Clark (2001) finds that satisfaction with work and pay are the two most determinant predictors of future exits from jobs.

Since we do not have access to information on retirement through disability pensions, it is also important to have health as one additional control variable. We especially rely on subjective evaluations of health. This includes both measurement error and endogeneity problem biases that may offset each other (Bound, 1991; Bound et al. 1999, Kerkhofs et al., 1999). Börsch-Supan (2000a) stresses that health effects can decrease and financial incentives increase if factors that account for unobserved individual heterogeneity and intertemporal linkages are added to a pooled regression model. There is, however, a concern that the differences in health reports across countries are also owing to differences in reporting behaviour (Lindeboom & Van Doorslaer, 2003).

Our empirical approach can be justified by the fact that early retirement has been a supply-driven phenomenon to a great degree. It can be argued, however, that the evolution of the retirement age and labour force participation of the elderly is a demand-driven reaction to the evolution of unemployment rather than a supply response to early retirement incentives. For Germany in the period 1960-95, Börsch-Supan (2000b) found, however, that the retirement age

and the unemployment rate have a fairly low or positive time-series correlation. Böckerman and Piekkola (2001) show that the adverse employment prospects of the most-experienced employees in the Finnish economy have continued throughout the whole of the 1990s, and has not been a phenomenon only of the great recession of the 1990s.

The structure of this paper is as follows. Section 2 briefly summarises previous results. Section 3 compares age structure and participation trends and age distribution results per country and gender. Section 4 lists different pension incentives. Section 5 describes the data and the empirical strategy. The results are discussed in section 6 before concluding in section 7.

2. Previous literature

The literature on social security and pensions encompasses many studies and methods and mainly uses samples of men. Early studies estimate reduced-form models of the effect of social security wealth on retirement, reduced-form models incorporating the increase in wealth from working one or more years or to a focal age such as 65, and structural models of retirement using a lifetime budget constraint (see Diamond & Gruber, 1999, for a more detailed overview). Coile (2003) notes that the early literature suffers from three major problems. The first problem concerns the fact that those studies are often insufficiently forward-looking, focusing on the one-year accrual in retirement wealth rather than the entire future path of accruals. The second problem is connected to the identification of retirement effects in reduced-form models as social security benefits are a function of past earnings, and lifetime earnings are likely to correlate with retirement. The third concern is the fact that many papers exclude private pensions and rely on outdated data. In Europe the importance of private pension schemes is, however, still small compared with that in the US.

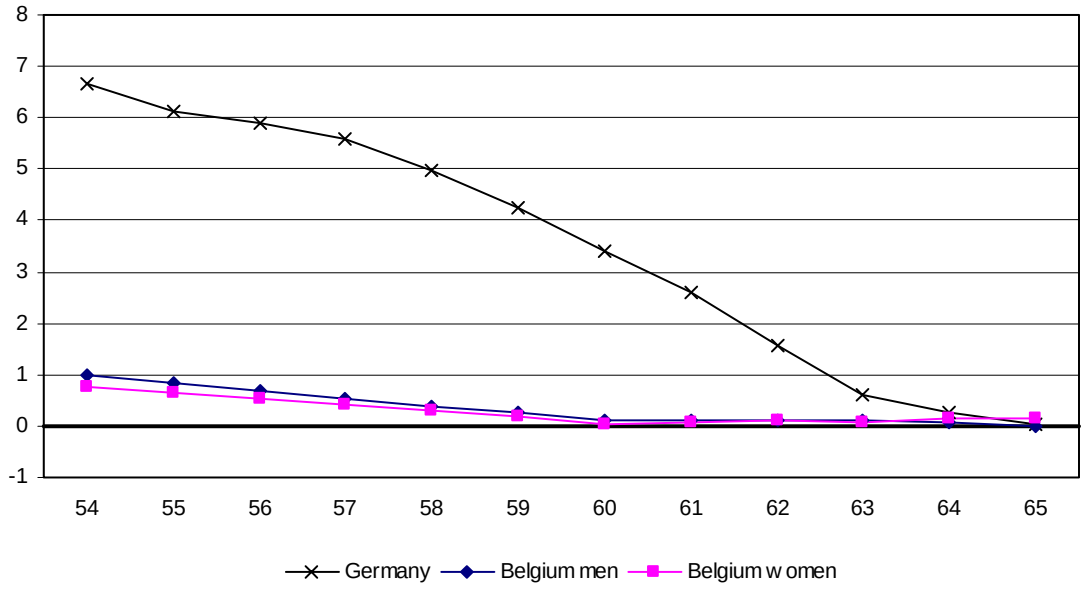
A more recent strain of literature has addressed the above problems. Stock & Wise (1990) develop a structural option-value model that measures the gain in utility from delaying retirement to the optimal age and find that this predicts retirement well in a sample of workers from one firm. Later authors like Gustman & Steinmeier (2002) structurally estimate the option-value model, using survey data from the *Health and Retirement Study*. Coile & Gruber (2000) estimate reduced-form versions of the option-value model and their peak value model. They control for current and lifetime earnings to avoid the identification problem and find that forward-looking incentive measures have a significant explanatory power for retirement, while one-year accruals do not. Coile (2003) uses the option value in a couple approach and finds that women react similarly to incentive measures as men do and that spill-over effects from a wife are a particularly important determinant of the husband's retirement.

In general, empirical results based on European data support earlier results from the US and find that dynamic incentive variables have a strong impact on the labour force decisions of the elderly. This finding supports the view that the pension systems encourage people to retire early, a phenomenon that is not sustainable in the long run. In Europe, the option-value model has first been applied in countries that participated in the "Social security and retirement around the world" project of Gruber & Wise (1999).[1] The first descriptive phase of the project found a striking correlation between labour 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 such as the option value and labour force participation (Gruber & Wise, 2002). For Belgium, Dellis et al. (2001) found that social security accruals were negative for over half of the people as early as age 58

[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 UK and the US (Gruber & Wise, 1999 and 2002).

and for most people aged 60 and above. A similar pattern was found for forward-looking incentive measures. Option values by year are shown in Figure 1 and are close to zero. In Germany, Börsch-Supan et al. (2003) also found that the German pension system provided strong incentives to retire early although in Figure 1 option values are not close to zero before the age of 63. However, the econometric evidence for the strength of incentive effects on old age labour supply is relatively robust. For Finland, the option value approach has been applied by Hakola (2002) and by Laine (2004). Laine concludes that in the Finnish case the economic incentive measure – the option value – has a significant effect on early exit from the labour market.

Figure 1. Age distribution of pension incentives: Previous option value results for Belgium and Germany (in €10,000)



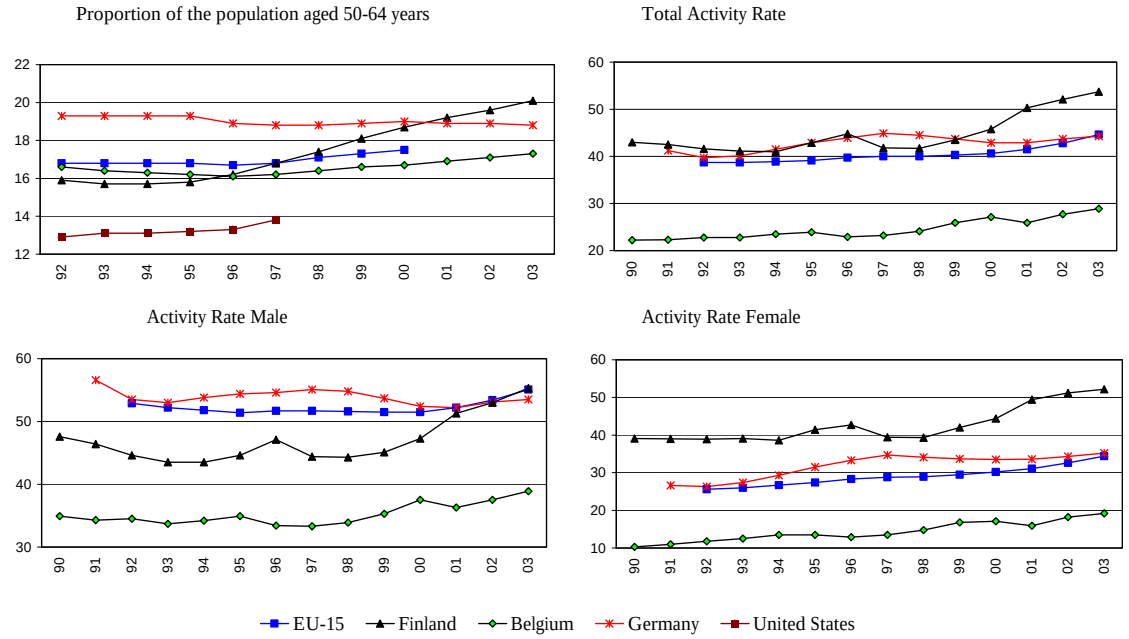
Sources: Börsch-Supan et al. (2003) and Dellis et al. (2001).

3. Labour supply patterns of the elderly

3.1 Trends in age structure and participation

Figure 2 shows that the share of the population aged 50 to 64 has been rising, especially in the last five years. In addition, those shares of the elderly are much higher in Europe than in the US. The level and the rise in the share of people aged 50 to 64 is especially important in Finland (a level of 20% in 2003) and, to a smaller extent, in Belgium. This evolution of the age structure has been caused by low fertility rates in European countries, by the rise in life expectancy (in other words, fewer people are born and they live longer) and by the ageing of the baby-boom generations. Life expectancy at age 60 – in the age range when retirement transitions are made – has been rising by an average by 1.6 years up to 22.1 years during 1991-2002 in EU area; yet men and women in Finland, Belgium and Germany still have a lower life expectancy than the European average, a factor that somehow weakens their pension system sustainability problems.

Figure 2. Recent evolution of age structure and activity rates



Source: Eurostat.

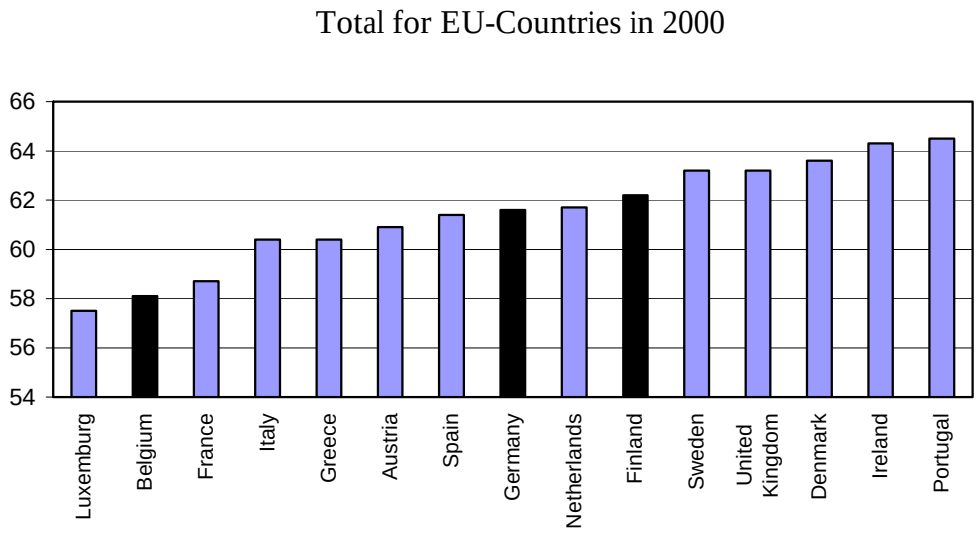
In most European countries, participation of the elderly in working life is very low, and uncertainty about demographic dynamics in the coming decades has a growing influence on the ongoing debate about the sustainability of the pension systems. The activity rates of the elderly (age 55-64) have been around 40% in the EU-15 during the last decade (see Figure 2). During the same period, the increasing participation of European women rose above 30%. During the last 10 years, however, a new trend has emerged, and the labour force participation of elderly men has become, somehow, stable and has even increased since the year 2000. Concerns about the impact of ageing on the population structure and about the declining participation rates of men have already culminated in the first big wave of pension reform measures across Europe. Those new measures – like, for example, the transitional rise of the early or normal retirement age – and the changing entry rates into different age categories contributes to the recent rise in the participation rates of the elderly.

Figure 2 reveals that trends are similar across Europe but that there are still considerable differences in the levels of the participation of the elderly. Men's participation was below the European average for Finland and Belgium and above average for Germany. Finnish male participation, however, started to rise as early as 1995 and reached the European average in 2003. The Belgian male participation rate has increased, especially during the last few years, but it seems to diverge more from the European average than it did 15 years ago. Also, Belgian women perform very weakly. Germany is close to the European average and Finland overall performs above the European average – partly attributable to the fact that since 1998, women's labour force participation in Finland has risen considerably.

Similar information can be obtained by looking at the average exit rate from the labour force in Figure 3. In 2000, all European countries had average exit ages below the normal retirement age. There are, however, country differences up to six years. Belgium has almost the lowest exit age at about 58, Germany (a little below 62) and Finland (a little above 62) perform better. Finland and Germany follow the European average in that average exit ages declined from 2000

to 2002, whereas it increased a little in Belgium. European women retire, on average, about one year earlier than men. In Finland average ages across gender are, however, almost the same.

Figure 3. Average exit age from the labour force



Source: Eurostat.

3.2 Participation patterns from the ECHP

A close look at the European Community Household Panel (ECHP) data provides some useful information about further decisions concerning the model specification. Interestingly, unemployment rises steeply between ages 50 and 60 both in Finland and Germany. This can be explained by the existence of a Finnish and German 'unemployment pipeline' into retirement. For men the profiles of Finland and Germany are similar, although for Finland 53% of the initial sample are inactive (unemployed or out of the labour force) at age 60 compared with 44% in Germany (in Finland increasing from 12% at age 55 to 53% at age 60). Because there is little re-entry into employment (on average 2.8%), retirement or unemployment can be considered as an absorbing state. Compared with employed individuals, unemployed persons have more than twice as much probability of retiring. The broad concept of retirement or non-employment used here includes this unemployment channel.

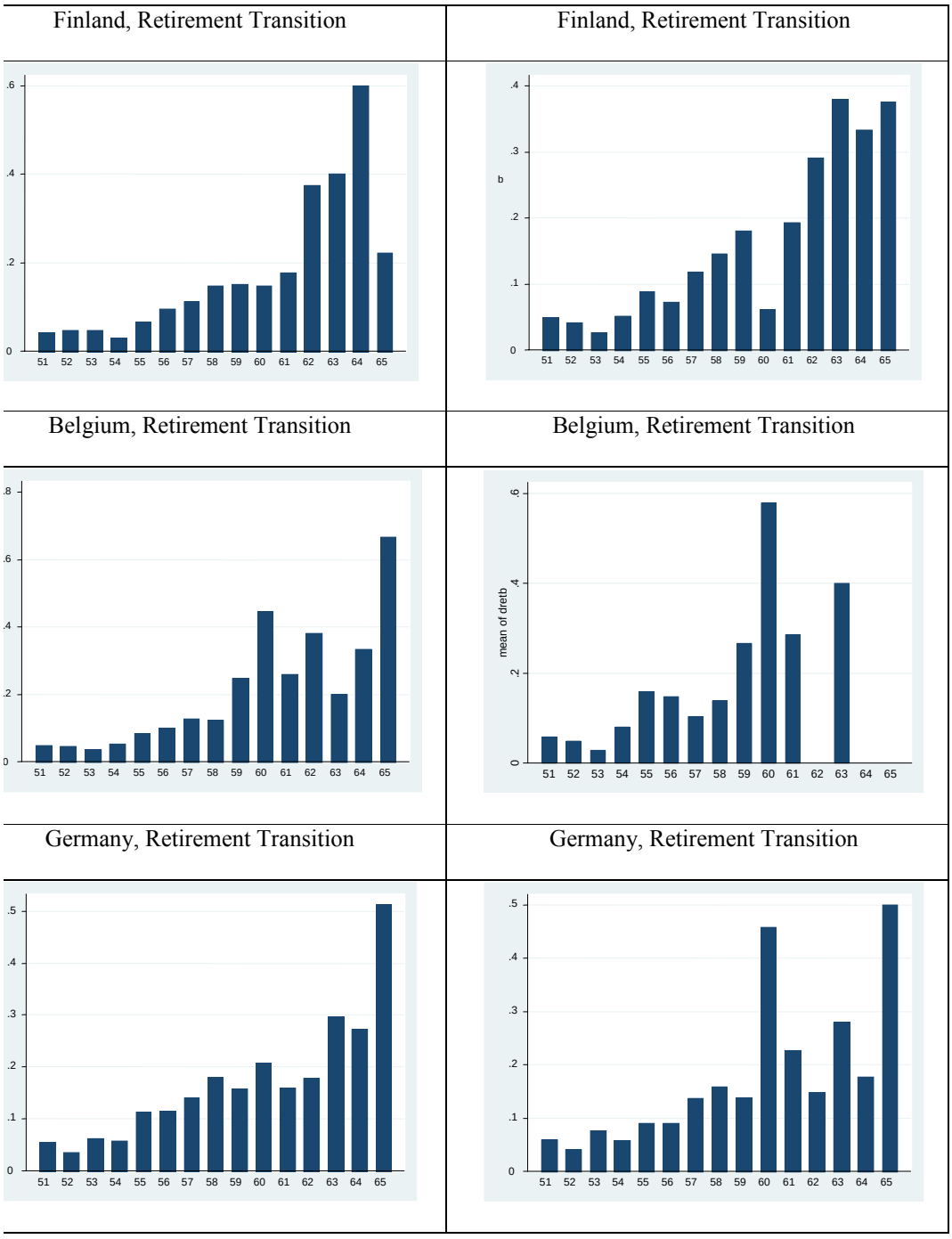
Börsch-Supan (2000b) used their calculated accrual rates and implicit tax profiles to analyze pension incentives and retirement age distributions, and concludes that in several countries there is a close link between kinks and spikes in both functions (Table 1). Figure 4 shows the share of employed people that decide to retire per age.

Table 1. Kinks and spikes in withdrawal out of employment.

	Finland	**Belgium**	**Germany**
Distribution of withdrawal out of employment	Spikes at ages 59, 61 and 64; opposite spike at age 60 (women)	Sharp spikes at ages 60 and 65	Spikes at ages 60, 63 and 65

Source: Authors' calculations.

Figure 4. Age profile of retirement transitions by country and gender



Source: Author calculations based on the ECHP 1994-2001.

The main findings can be summarised as follows: spikes are more pronounced in Germany and Belgium, especially at ages 60 and 65. Exits are more evenly distributed across the ages for Finnish and German men. A significant share (5%) of individuals start leaving the labour force when they are aged 55. For both men and women, exit from the labour force peaks around the ages of 59 and 63-65 (Finland) or at 60 and 65 (Belgium and Germany), revealing the ages of early and normal retirement. In the peak years, around 40% of the workforce retires or becomes unemployed. The evidence suggests that when analysing behaviour associated with exits from the labour force, we need to also look at individuals younger than 60, particularly in Belgium. We therefore select the sample to contain women and men from age 51 to age 64.

4. Pension incentives

Social security and pensions may affect retirement through both the level of pension wealth and the increase in wealth resulting from future work. The *pension wealth* is the present discounted value of retirement wealth, which is the stream of future pension benefits an individual has earned based on his or her work to date, discounted for time preference. Based on Coile (2003) this paper uses a real discount rate of 6%.

The wealth accrual effect can be captured by several incentive measures. A first simple measure is the accrual, the change in pension wealth that results from working one additional year. As the accrual only looks one year ahead it may miss large spikes in pension wealth at particular ages. A second measure – the option value measure – has a more forward-looking nature and will be used in this paper (Stock & Wise, 1990). The option value calculates the utility gain from working to the some future retirement date *A* relative to retiring today. The option-value model is based on the individual's indirect utility over work and leisure:

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

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 is income while working, $P(A, Y_{A-1})$ retirement benefits at the time of retirement, χ_t is the index for pension, γ is the utility curvature parameter or the risk aversion parameter and α >=1 is a parameter to account for the relative utility of the pension benefits to the wages or the marginal utility of leisure. The utility of consumption is represented by an isoelastic utility function, $U(Y)=Y^\gamma$ and $U(P)=[\alpha P]^\gamma$.

This approach uses a reduced-form version of the model and the same parameters as Coile (2003). The utility parameters are α=1.5, γ=0.75 and a discount rate δ of 6%. Re-estimating the model with other lifetime utility function parameters suggests that the effect of the option value on retirement is robust when we use alternative values for the marginal utility of leisure parameter α and the discount rate δ but that a change in the utility curvature parameter gamma from 1.5 to 0.75 considerably strengthens the marginal effect. One explanation is the lower weight given to outliers. Real earnings are projected to grow at about 1%. This is similar to assuming real depreciation at 2% and a discount rate of 3%. The index for pension χ follows the evolution of the consumer price index in Belgium and the wage index in Germany (see appendix for details). In Finland pension rights before age 65 are indexed at 50% on wages and 50% on consumer prices and from age 65 onwards are indexed at 80% on prices and 20% on wages. In the calculation of these wage and price indexes we use the average figures over the last three observations for each individual.

Now we turn to the optimal retirement decision A^*, which the marginal incentives for leisure considered above indicate. The individual's option value for a specific age is defined as the difference between the expected lifetime utility if the individual postpones his or her decisions until the optimal retirement age and the expected value if s/he retires today. If the individual retires immediately, s/he loses some years of income and higher pension benefits. If s/he retires later, s/he will lose the forgone leisure time. A worker is expected to retire if the optimal utility is not larger than the utility obtained if retiring today. Retirement probabilities should, therefore, depend negatively on the option value. The option value at optimal age of retirement A^*, giving the opportunity cost of retiring today, is

$$OV(A^*) = E_\tau\left[V(A^*)\right] - V_\tau(\tau), \tag{2}$$

where E = the expectation operator. Optimal retirement should occur at an age where the option value is negative. Life-time utility is calculated like this also for each possible retirement period A. This approach suggests empirically that we estimate the probability of retirement at a given age by taking the option value as the principle explanatory variable.

5. Data and empirical strategy

5.1 Data

This study uses the ECHP, an annual panel study consisting of a household and a personal file. The same individuals and families are interviewed over time. Currently, eight waves from 1994 through 2001 are available for most EU countries (six waves for Finland). The advantage of these country data is their high comparability level. The survey provides a detailed account of income and employment status. We constructed an unbalanced panel of women and men aged 51 to 64 for three countries: Finland, Belgium and Germany.

The panel is left-censored, as we include only those persons who are working. There is right censoring due to missing interviews and due to missing transitions. As noted before, the sample includes men and women between age 51 and 64, the age period where early retirement is possible. If people retire at age 65 they use, by definition, the old-age path to retirement. The final sample has been constructed in different stages. In the first stage we dropped persons with unreliable wage observations. In the second stage we dropped individuals lacking social security incentive variables. In the third stage we excluded the special category of the self-employed, as they may have different pension system rules. Finally, the sample excluded persons who are out of the labour force and are missing transitions. Based on these criteria, the panel includes up to 4,201 individual observations (FI: 1315, BE: 681, DE: 2205) with 15,862 (FI: 4414, BE: 2436, DE: 9012). The average observation time is 3.8 years.

Of these individuals, 27.54% (FI: 15.92%, BE: 27.03%, DE: 32.94%) make a transition from employment to retirement. 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). About 56% of our sample persons are men (FI: 43%, BE: 62%, DE: 60%) and the most frequent retirement age is age 60.

A quick glance at the data reveals some interesting characteristics per country and gender. Table 2 depicts summary statistics for employed individuals from age 51 to age 64. The average age is 54.6. If we turn to transition percentages out of employment, we note that numbers vary from 6.37% (FI) to 10.46% (DE) of the total observations. Transitions are slightly more frequent for men than for women. The average pension wealth in the sample amounts to around €280,000 and is highest in Finland and lowest in Belgium. (For age distribution, see Figure 5).

The average income replacement rates are around 55% in Finland, 45% in Belgium and remarkably higher (73%) in Germany. The average option value is about €12,000 and is larger for men than for women.

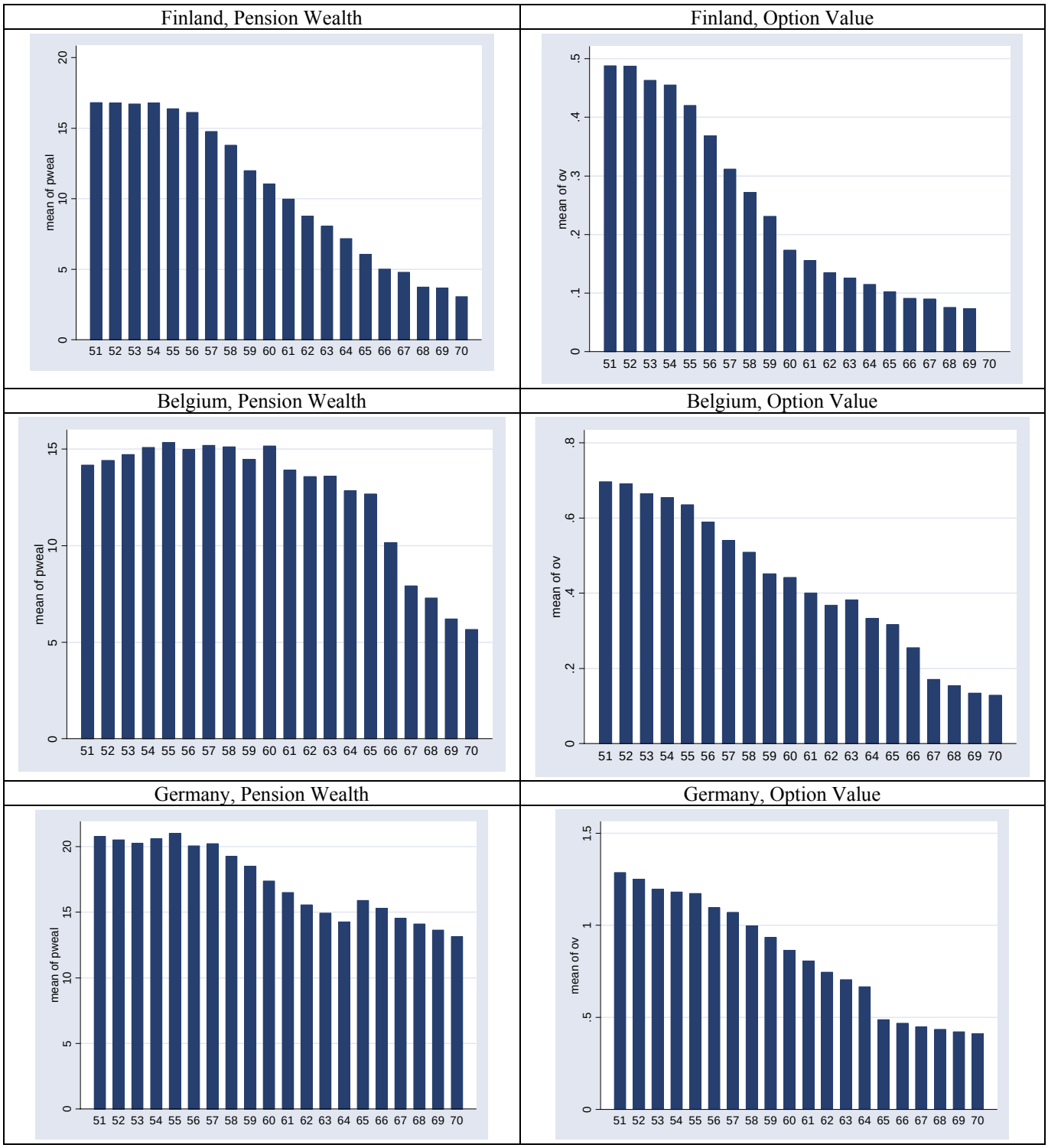
Table 2. Summary statistics by country

total sample (age 50- age 64)	Belgium		Finland		Germany		All countries	
	2700	obs,	3813	obs,	8483	obs,	14996	obs,
	Mean	st-dev,	Mean	st-dev,	Mean	st-dev,	Mean	st-dev,
Transition to retirement	8,88%	0,67%	6,37%	0,47%	10,46%	0,53%	9,10%	0,34%
Option value	0,50	0,00	1,74	0,02	1,18	0,01	1,24	0,01
Peak value	1,50	0,06	1,55	0,08	0,71	0,01	1,17	0,03
Pension wealth	20,96	0,11	38,01	0,28	24,28	0,19	28,46	0,15
Replacement rate	45,55%	0,26%	55,31%	0,19%	72,83%	0,41%	61,44%	0,26%
Replacement rate at age 60	44,64%	0,29%	47,23%	0,23%	68,69%	0,29%	59,00%	0,23%
Replacement rate at age 65	40,38%	0,36%	40,08%	0,28%	64,19%	0,41%	54,53%	0,32%
Age	53,84	0,07	54,16	0,06	55,08	0,06	54,62	0,04
Primary education	27,95%	0,99%	35,79%	0,98%	19,84%	0,63%	25,48%	0,48%
Secondary education	34,44%	1,08%	35,93%	0,96%	56,19%	0,80%	47,00%	0,56%
Tertiary education	33,98%	1,03%	28,21%	0,84%	23,97%	0,68%	26,85%	0,48%
Married	79,19%	0,86%	72,34%	0,94%	78,06%	0,70%	76,75%	0,49%
Cohabitation	82,58%	0,81%	79,33%	0,86%	81,09%	0,68%	80,89%	0,47%
Separation/divorce /widowhood	15,80%	0,78%	19,69%	0,84%	14,69%	0,55%	16,21%	0,41%
Children 0-13	5,44%	0,53%	7,50%	1,31%	7,68%	0,49%	7,24%	0,45%
Children 0-15	10,60%	0,77%	15,55%	1,97%	13,10%	0,64%	13,31%	0,65%
Household size	2,76	0,02	2,27	0,03	2,51	0,02	2,49	0,02
Non-national	4,27%	0,40%	0,87%	0,16%	9,71%	0,44%	6,41%	0,26%
Net annual salary/wage (10000 Euro's)	1,92	0,02	2,33	0,02	1,76	0,02	1,93	0,01
Gross annual salary/wage (10000 Euro's)	3,30	0,03	3,49	0,03	2,87	0,02	3,11	0,02
Capital income (10000 Euro's)	0,12	0,01	0,06	0,01	0,07	0,00	0,08	0,00
Owner occupied	85,51%	0,74%	81,23%	0,80%	52,06%	0,81%	65,67%	0,53%
Satisfaction with work (rising scale: 1 to 6)	4,50	0,03	4,30	0,03				
Satisfaction with leisure (rising scale: 1to 6)	4,12	0,03	4,20	0,03				
Low work status	56,68%	1,10%	68,49%	0,90%				
High work status	14,97%	0,81%	13,89%	0,65%				
Working experience	30,02	0,09	30,67	0,07	31,20	0,07	30,86	0,05
Hours (total, weekly)	38,36	0,24	38,39	0,16	39,19	0,19	38,83	0,12
Hours (main job, weekly)	37,76	0,24	37,67	0,14	38,87	0,18	38,36	0,12
Part time	10,57%	0,66%	7,47%	0,50%	5,83%	0,40%	7,10%	0,29%
Public employment	34,52%	1,02%	48,36%	0,99%	31,14%	0,72%	36,29%	0,52%
Firm size < 20	12,25%	0,74%	36,31%	0,96%	17,26%	0,63%	21,41%	0,46%
Managers, professionals	23,47%	0,91%	20,47%	0,74%	16,38%	0,59%	18,71%	0,41%
Technicians	12,89%	0,74%	19,60%	0,76%	20,61%	0,64%	18,98%	0,43%
Clerks, service workers	20,39%	0,89%	26,69%	0,87%	21,65%	0,71%	22,76%	0,49%
Blue-collar worker	18,80%	0,89%	28,70%	0,97%	35,50%	0,77%	30,76%	0,53%
Health (declining scale: 1 to 5)	1,86	0,04	1,76	0,06	2,75	0,02	2,33	0,02
Bad health	1,46%	0,24%	4,66%	0,41%	18,83%	0,63%	12,03%	0,38%
Good health	77,84%	0,88%	51,71%	1,00%	38,82%	0,80%	49,11%	0,56%
Chronic physical/mental health problem	11,84%	0,69%	40,89%	0,97%	38,90%	0,78%	34,66%	0,53%
Limitation	11,33%	0,67%	26,45%	0,86%	37,02%	0,77%	29,70%	0,51%
Inpatient at a hospital	10,00%	0,63%	11,12%	0,60%	10,24%	0,45%	10,43%	0,32%
Hospital nights	0,58	0,10	0,64	0,08	1,54	0,10	1,13	0,06
1-5 visits to the doctor	49,06%	1,11%	56,38%	0,98%				
6+ visits to the doctor	41,41%	1,08%	34,57%	0,94%				

Source: Authors' calculations.

Figure 5 also shows that option values decreases steadily with age in Finland and follow a less steep path in Germany.

Figure 5. Age profile of pension wealth and option value (mean, per €10,000)



Source: Author calculations based on the ECHP 1994-2001.

More than 77% of the individuals are married. It should be noted that a larger share of men are married (83%) than women (69%) and therefore 30% of men have children below age 15 as compared with 8% for women. Part-time work (7%) has a typically high share for women (14.2%) compared with the share for men (1.6%). Public-sector workers (36%) contribute at least 30% to the men's sample and as much as 45% to the women's sample.

Health information is an important determinant of retirement and is also used here to control for the disability pension status. The sample share of people with self-reported bad health (bad or very bad divided into five categories) varies between countries. In particular, a high share of German men (17.8%) and women (20.4%) report to be in bad health. Belgium has very small shares, whereas Finland has about 4.6%. The share of people reporting a chronic physical or mental health problem is very high (about 39%) in both Finland and Germany but remarkably low in Belgium (about 12%). It appears that for Belgium an objective health measure such as stay in hospital is more reliable than the surprisingly low share of individuals who report to have poor health (subjective measure). Therefore we include a stay in a hospital (during the last 12 months) or being hampered in daily activities as additional explanatory variables. It should be noted that all results have to be interpreted as conditional on each country's age structure. The age means are, however, very similar and are only about one year higher for Germany.

5.2 Empirical strategy

This approach estimates reduced-form models of retirement by country and gender and aims at capturing effects on retirement of movements in variables. At the first stage the duration model approach is used.[2] Retirement is treated as a dynamic discrete choice. The variable to explain is the duration of employment and the failure is defined as retiring in the next period. This includes, besides self-reported retirement, self-reported unemployment as well, but it excludes individuals who report taking care of the household. The results of the duration model are compared with those of the probit model to check for robustness. Both models weight observations by sample weights.

We use crude measures for labour market experience, which depends on the age and the education level (in Finland, 12 years are deducted for primary, 15 years for secondary and 18 years for tertiary education). This gives an average work experience of around 30 years in Finland at 55-59 years of age and 35 years in other countries. The figure is not far from the actual average work experience of 27 years in Finland in 2000 (Tuomainen, 2001). In Belgium, periods spent in unemployment, inactivity due to sickness and disability and early retirement also count as affiliation years in the computation of the average wage

Pension and tax rules for the rest of the years are adapted from the pension system and pension rules for the year 2000 (see appendix). The replacement rate is assumed to be positive even before the minimum entitlement age, which in this case is the early retirement age minus the period of the relevant years of preceding unemployment. We thus assume that retirement has taken place through a disability pension. Here we describe how we adapted these rules in unemployment pension and disability pensions, when these alternative routes are not directly classified in the ECHP.

[2] 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 and Bütler et al. (2004) for Switzerland.

Unemployment pension

Unemployment of the elderly is in most cases a permanent absorbing state before retirement and can, in that sense, be seen as a channel towards retirement. The eligibility for an unemployment pension is assumed to start at the time when the person can start the unemployment pension pipeline, including the first year(s) in unemployment. In *Finland*, the person is considered to start an unemployment pension if s/he was unemployed last year, this year or next year and is older than 51 years. We do not thus include the age limit of 55 (until 1997) or 57 (since 1997) for the unemployment pension pipeline. In *Belgium*, 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. In addition, the most prevalent way is to pass through the unemployment system in which people aged 51 or more are considered 'aged unemployed' or not being required to actively seek work. We thus consider the person to be entitled to an old-age pension as of age 51, where the normal accrual rates apply as described in the appendix. In *Germany*, all men are considered to be eligible for an unemployment pension when retiring at ages 51 to 63.

Disability pension

We assume retirement with a disability pension if the person is receiving invalidity or sickness benefits this or next year and retired next year. In *Finland* we use the unemployment pension as the closest pension level (see appendix for a description). In *Belgium* the normal allowance is 65% of the lost earnings (subject to a ceiling) for individuals with dependants and is lower otherwise. We do not, however, separate disability pension from other pension recipients. In *Germany*, we apply the same rules as for the old-age pension.

Duration model

The variable of interest is the length of duration *T*, which elapses from the beginning of some event until its end or until the measurement is taken, which may precede termination. In this case *T* is the time span of employment before retirement and the end or 'failure' is defined as being retired in the next period. One advantage of the duration analysis is that censored spells can be taken into account. Assume *T* is a random variable having a continuous probability distribution f(t). The probability of the spell length being smaller or equal to a particular value t or the cumulative distribution function is as follows:

$$F(t) = P(T \le t) = \int_0^t f(s)ds\,. \tag{6}$$

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

$$S(t) = P(T > t) = 1 - F(t) = \exp\left(-\int_0^t \lambda(s)ds\right). \tag{7}$$

The hazard rate *h* is the rate at which spells are completed at time t, given that they have lasted until *t*. In this case the hazard function is the probability of entering retirement at a certain age t, conditional on the fact that the agent has not retired before that age. It can be interpreted as the age-specific failure rate and is given by

$$h(t) = \lim_{\Delta t \to 0} \frac{P(t \le T < t + \Delta t \,|\, T \ge t)}{\Delta t} = \frac{f(t)}{S(t)} = \frac{f(t)}{1 - F(t)} \tag{8}$$

So far, the distribution of the stochastic dependent variable duration has not been specified; thus the duration can follow any known distribution. Based on the underlying assumptions of that distribution, the three groups of duration models are non-parametric, semi-parametric and parametric models. An example of a non-parametric duration model – estimated without covariates – is the Kaplan-Meier or product-limit estimator. This estimator can be applied to subgroups of the population to summarise differences across groups. For the latter purpose, selected Kaplan-Meier estimates are presented.

In this study duration model estimates are, however, based on a semi-parametric distribution. The advantage is that no parametric assumption has to be made. The estimation approach is based on a partial likelihood function. The approach is a way of eliminating the baseline hazard from the equation to be maximised in the estimation procedure. No functional form therefore needs to be specified for the baseline hazard. Here, the Cox proportional hazard model is chosen. Its hazard rate can be written as

$$h(t_i) = h_0(t_i)e^{\beta' x_i} \quad with \; h_0(t_i) > 0, \tag{9}$$

where x_i is a vector of explanatory variables and h_0 is the time-dependent baseline hazard, constant for all individuals. The partial likelihood function *PL* is the likelihood that all n spells in the sample are observed. In t_i, all spells that have not ended previously are at risk of ending, with the risk given by the hazard rate. These spells can be combined into the risk set R_i. L_i is then the probability that out of the risk set R_i spell i is terminated:

$$PL = \prod_{i=1}^{n} L_i = \prod_{i=1}^{n} \frac{h_0(t_i)e^{\beta' x_i}}{\sum_{t_j \in R_i} h_0(t_i)e^{\beta' x_j}} = \prod_{i=1}^{n} \frac{e^{\beta' x_i}}{\sum_{t_j \in R_i} e^{\beta' x_j}}. \tag{10}$$

This is the proportional hazard, in which the quotient depends on time. This partial likelihood, which is independent of a distributional assumption, can now be derived. The disadvantage of this model is that the baseline hazard is identical across individuals at every point in time during the spell. We also report the marginal effects using probit models (see Wooldridge, 2002). The marginal effects are to be interpreted as the change in the probability of flowing out of employment given a unit change in an explanatory variable X_{it}. We allow the covariates to have various impacts on the flow out of employment for the two genders by carrying out the analysis separately for men and women.

6. Estimation results

Both probit- and duration-model results are reported for the total sample (see Table 3) and then the country-specific duration model results are discussed (see Table 4 for men and Table 5 for women). The duration model estimates the hazard out of employment and reports the hazard ratios, whereas the probit model estimates the probability of leaving employment and reports the marginal effects. To interpret the coefficient estimates it is simpler to calculate the so-called 'risk ratio', which is e^{β}. In Table 3 – for example – $e^{0.592}$=1.807 means that the hazard is about 80% higher for men with self-reported bad health, so their probability of retiring is indeed considerably higher.

Table 3. Duration vs. probit models, for the total BE-FI-DE sample

	Men		Women	
	Duration	Probit	Duration	Probit
Option value	0.3734***	-0.1016***	0.4806***	-0.0779***
	[5.635]	[4.18]	[3.617]	[2.93]
Pension wealth	1.0164*	-0.0005	0.9909	-0.0019
	[1.863]	[0.45]	[0.964]	[1.38]
Capital income	1.0657***	0.0077**	0.9891	-0.0011
	[5.145]	[2.28]	[0.202]	[0.15]
Owner occupied	0.9698	0.0018	1.0445	0.0319**
	[0.417]	[0.14]	[0.486]	[1.99]
Bad health	1.8070***	0.0887***	1.6050***	0.1013***
	[7.235]	[3.67]	[4.920]	[4.68]
Inpatient at hospital	1.2788***	0.0510***	1.3462***	0.0509**
	[2.848]	[3.00]	[3.052]	[2.42]
Married	0.9166	-0.0252*	0.8704	-0.0255
	[0.918]	[1.76]	[1.469]	[1.58]
Third level education	0.9528	0.004	1.0375	-0.019
	[0.521]	[0.26]	[0.295]	[1.04]
Number of children 0-14	0.7098**	-0.0355*	0.9433	-0.0247
	[2.473]	[1.82]	[0.349]	[0.64]
Work satisfaction	0.8214***	-0.0278***	0.8472***	-0.0199***
	[5.121]	[5.16]	[3.804]	[3.00]
Leisure satisfaction	1.1620***	0.0186***	1.0885*	0.0079
	[4.009]	[3.50]	[1.927]	[1.16]
Supervisory job status	0.7243**	-0.0444***	0.8382	-0.0318
	[2.183]	[2.81]	[0.712]	[1.10]
Part time	1.3656*	0.0571	0.7712**	-0.0375**
	[1.910]	[1.61]	[2.255]	[2.13]
Public employment	0.933	-0.0135	1.0345	0.0035
	[0.838]	[1.05]	[0.398]	[0.24]
Firm size < 20	1.01	0.0008	1.0203	-0.0101
	[0.113]	[0.05]	[0.217]	[0.57]
Managers, professionals	0.7643**	-0.0332*	0.8564	0.018
	[2.324]	[1.88]	[0.937]	[0.63]
Technicians	0.8287*	-0.014	0.9898	0.0097
	[1.709]	[0.91]	[0.083]	[0.44]
Clerks, service workers	0.9071	-0.0065	0.9865	0.0084
	[0.892]	[0.38]	[0.142]	[0.43]
Observations	5510	5604	4001	4066
Log pseudo-likelihood	-4721.8	-1908.4	-3588.8	-1438.9
Wald chi2	579.9	438.1	536.6	247.1
Pseudo R-squared	0.046	0.157	0.049	0.129

Robust z statistics in brackets * significant at 10%; ** significant at 5%; *** significant at 1%
Specification includes age 50 to age 64 dummies and year dummies.

Source: Authors' calculations.

Table 3 above shows that as expected, the option value has a negative impact on the propensity to leave employment. The duration model gives more pronounced results than the probit model. The specification includes pension wealth and not permanent income, as the panel comprises only average information on incomes from three years. Further, the table reveals that pension wealth does not have very strong effects, although wealthy men tend to retire earlier. Option values are measured in utility units. The marginal effect for the option value shows that a €10,000 increase in the option value lowers retirement propensity by around 10 percentage points (option values are expressed in €10,000). The marginal effects of the option value are also somewhat higher for men than for women. These effects are about twice of those based on a US model with the same utility parameters in Coile (2003). The interpretation of the hazard ratio can be done with reference to two persons whose option values are OV and OV+10,000. The person with the higher option value has a hazard that is 63% (52%) lower, so the probability of retirement over a short period of time is considerably high (that is, the ratio of their respective hazards is 0.37 (0.48)). This ratio differs significantly from 1.

Age dummies show that older workers have a higher probability to retire than younger ones. The omission of the age dummies raises the estimated absolute coefficient of the option value up to two times (not reported). Besides non-reported age dummies, job satisfaction, status and pension wealth measures also clean the estimated coefficient of the option value from some non-economic effects (discussed in greater detail in relation to Tables 4 and 5). Option values are a non-linear function of the income level that, in itself, affects the valuation of leisure/work. High-income earners may exhibit greater job satisfaction. Thus the option value would otherwise partly capture the job satisfaction effects of higher incomes. Exclusion of job and leisure satisfaction variables, however, raises the hazard rates of option values only by up to 1 percentage point.

It can be concluded that option values capture an essential part of the spikes in early retirement. Tables 4 and 5 below report the results of the option-value hazard rates of separate country samples. We can observe that hazard rates for men vary from 0.009 in Finland to 1.08 in Germany (the average was 0.37 in Table 2). For women they vary from 0.0034 in Finland to 0.937 in Belgium (the average was 0.48). Finland delivers significant and consistent negative effects. It is notable that option values have predicted effects in Finland overall and in Belgian for men. In these countries and gender groups, Figure 5 illustrates that pension wealth and option values are also most clearly decreasing with age. The income data for Belgium is partly unreliable, which can explain the relatively mild effects for Belgian women.

Note that all the option curves are roughly in line for those obtained in earlier studies (see Figure 1 and Laine (2004) for Finland). The mild effects for German men appear to contrast with those for a sample of both genders obtained in an earlier paper (see Börsch-Supan, Kohnz and Schnabel, 2003). One reason for this is the different choice of utility function parameters with a high emphasis on pension wealth and peaks in it (parameters in connection to option value equation (1) are marginal utility of leisure α =2.8, curvature parameter γ=1 discount rate δ of 3%) and by the exclusion of flows from non-employment back to employment. In the option value calculations a higher value to pension wealth as compared to foregone earnings would have brought our option values and estimates close to those obtained by Börsch-Supan, Kohnz and Schnabel (2003) for Germany (their higher option values are shown in Table 1).

The hazard rate of pension wealth is greater than 1 only for Finland, so that the wealthier have a tendency to retire earlier. The expected results in Finland are likely related to the fact that pension wealth decreases most steeply with age (see Figure 5). It is noteworthy that Berkel and Börsch-Supan (2004) find that in Germany a significant wealth effect only derives from home-ownership and financial securities and not from pension wealth.

Table 4. Duration model for the employment of men

	Finland	Belgium	Germany
Option value	0.0094***	0.5014	1.083
	[6.774]	[0.903]	[0.207]
Pension wealth	1.0541***	0.9596	0.9553**
	[5.099]	[1.200]	[2.237]
Capital income	1.1823***	1.0891	1.0488***
	[6.139]	[1.384]	[3.933]
Owner occupied	0.9369	1.1929	0.91
	[0.372]	[0.775]	[1.106]
Bad health	1.3534	0.9405	1.8399***
	[1.301]	[0.084]	[6.923]
Inpatient at hospital	1.3034	1.0933	1.2120*
	[1.391]	[0.384]	[1.807]
Married	0.7966	0.6922	0.9978
	[1.364]	[1.558]	[0.018]
Third level education	1.4057	0.8132	0.7443***
	[1.496]	[0.819]	[2.661]
Number of children 0-14	0.9561	0.6153	0.5479***
	[0.276]	[1.295]	[3.151]
Work satisfaction	0.8318***	0.8271***	
	[2.922]	[3.259]	
Leisure satisfaction	1.2881***	1.1541**	
	[4.121]	[2.382]	
Supervisory job status	0.4685***	0.9954	
	[3.325]	[0.019]	
Part time	0.8684	1.6147	
	[0.513]	[1.440]	
Public employment	1.2493	0.6337**	0.909
	[1.410]	[2.103]	[0.924]
Firm size < 20	1.3568*	0.4902**	0.9804
	[1.921]	[2.213]	[0.171]
Managers, professionals	1.2942	0.5228**	
	[0.937]	[2.274]	
Technicians	1.301	0.5416**	
	[1.278]	[2.157]	
Clerks, service workers	1.1738	0.4735**	
	[0.779]	[2.530]	
Observations	1587	1464	3119
Log pseudo-likelihood	-797.7	-655.6	-2750.9
Wald chi2	280.5	307.4	354.4
Pseudo R-squared	0.136	0.224	0.139

Robust z statistics in brackets * significant at 10%; ** significant at 5%; *** significant at 1%
Specification includes age 50 to age 64 dummies and year dummies.

Source: Authors' calculations.

Table 5. Duration model of the employment of women

	Finland	Belgium	Germany
Option value	0.0034***	0.937	0.7693
	[7.125]	[0.094]	[0.638]
Pension wealth	1.0284**	0.9901	0.9642*
	[2.092]	[0.365]	[1.803]
Capital income	0.4965	1.0531	1.1782*
	[1.415]	[0.637]	[1.759]
Owner occupied	1.266	0.9261	1.0469
	[1.233]	[0.247]	[0.449]
Bad health	1.4232*	1.5274	1.5489***
	[1.776]	[0.917]	[4.020]
Inpatient at hospital	0.926	1.6038	1.3751**
	[0.409]	[1.583]	[2.544]
Married	0.9613	0.8828	0.8548
	[0.228]	[0.502]	[1.246]
Third level education	0.9114	1.7862*	1.0036
	[0.386]	[1.904]	[0.022]
Number of children 0-14	0.8849		1.0506
	[0.530]		[0.218]
Work satisfaction	0.9612	0.8327**	
	[0.622]	[2.302]	
Leisure satisfaction	1.0507	1.1729*	
	[0.814]	[1.772]	
Supervisory job status	0.8557	1.0367	
	[0.487]	[0.070]	
Part time	0.7622	1.089	0.5124***
	[1.583]	[0.323]	[3.895]
Public employment	1.3216**	0.7554	1.1013
	[2.039]	[1.046]	[0.860]
Firm size < 20	1.225	1.2176	0.8705
	[1.570]	[0.562]	[1.003]
Managers, professionals	1.8451**	0.7184	
	[2.051]	[0.835]	
Technicians	1.338	0.4423	
	[1.409]	[1.458]	
Clerks, service workers	1.0062	0.873	
	[0.038]	[0.452]	
Observations	1866	820	1833
Log pseudo-likelihood	-973.5	-344.8	-1582.8
Wald chi2	246.2	213.8	368.7
Pseudo R-squared	0.121	0.103	0.055

Robust z statistics in brackets * significant at 10%; ** significant at 5%; *** significant at 1%
Specification includes age 50 to age 64 dummies and year dummies.

Source: Authors' calculations.

As discussed in the introduction, controls for satisfaction are important and are available for Belgium and Finland. Job and leisure satisfaction capture aspects of happiness and well-being here with on increasing scale from 1 to 6. Work satisfaction indeed has a negative effect on the hazard rate of coming out of employment, and leisure satisfaction has the opposite effect and is significant for men. Satisfaction measures are almost equally crucial to men and women. In Belgium work satisfaction hazard rates are 0.82 for men and 0.83 for women, and leisure satisfaction hazard rates are 1.15 for men and 1.17 for women. The effects are fairly sizeable as they have to be interpreted on a scale from 1 to 6. They are also very robust to alternative specifications such as setting job satisfaction at the value in the first observation year. Clark (2001) similarly finds that satisfaction with pay is an important predictor of future quits from jobs.

Health variables can be found to play a significant role in the pooled data for the countries in Table 3. The health effects for men are stronger than those for women. Having bad health produces a hazard rate of about 1.83 for men and 1.69 for women. The in-patient care at a hospital variable is introduced in the specification and can be the only reliable measure for Belgium, where the self-reported bad health share was very low. The significance is less than that of the bad health variable. One reason is that a fairly large share (10%) has received hospital care. This may also show the importance of mental health problems in retirement decisions, which are better measured by subjective health assessment.

Focusing now on the hazard rates of the country samples reveals that the results for health variables are mixed. Both bad health and in-patient treatment at a hospital have a robust positive effect on the propensity to flow out of employment in the case of Germany. Overall average health in Germany is also reported to be much worse than in Belgium (see Table 2). In Finland the self-reported health status explains the retirement behaviour of women, and hospital care explains the retirement behaviour of men. The factor of having been an inpatient at a hospital appears to have fairly equal effects in Belgium and in Germany for women. Besides the possible underreporting of bad health, the weak influence of the health variable may also show true difference, since disability pensioners in Belgium form a low although growing share of all the retired. As noted before, individuals there also withdraw from work at a younger age, which can have a positive effect on health.

Most other socio-demographical variables are not significant. Tables 3 through 6 show that being married or in a consensual union has a negative effect on flowing out of employment (except for Finnish women). We find that the education dummy of third-level education does not explain retirement transitions. This may be due to the mixed-country effects. The highly educated in Finland and Belgium tend to retire earlier but the opposite is true for German men. Third-level education has a large, significant negative effect for German men and shows a hazard rate of 0.74. Another explanation may be that different education levels result in different incentives to retire and that the overall distribution of incentives is evenly spread. The more highly educated may, for example, leave because of burn-out, whereas the less well-educated may leave employment because of physical health problems or unemployment.

We can observe that part-time work plays an important role in the total sample. Women working part-time are less likely to retire by roughly 30 percentage points. In the country sample we see that part time work is especially important for women in Germany. Germany introduced the option of reducing work to half of the regular weekly hours at the age of 58 in 1998 and at the age of 55 in 1996 (but this will be rescinded by 2010). The ‘blocked’ model of partial retirement included a higher income for older workers than in the case of pre-retirement and more generous reimbursements from the Federal Employment Office to the company, provided the vacancy has been filled by a formerly unemployed person. Part-time work encourages retirement in Belgium but turns out to be insignificant.

Civil servants are modelled to be part of the standard social security system, although the higher maximal replacement rates in Finland are accounted for in the model. Civil servants in Belgium have to work longer, with a retirement age of 65, but use of the disability channel out of employment is frequent. Working in the public sector is insignificant in the total sample, partly because half of the observations come from Germany where this has no effect. Excluding the civil servants also insignificantly increases the estimated effect of the option value. For Belgian men public employment has a negative effect on the propensity to retire. The negative impact for Belgian men signals that Belgian civil servants have more job security and do not use (collectively or individually) the unemployment channel as often as private-sector workers.

From the total sample it is notable that the withdrawal from jobs in small firms is not significantly different to that from jobs in other firms. Looking at the country samples we see that the size of the firm does, however, seem to matter for Belgian and Finnish men. Large firms have often provided additional support for those who retire early. In the large firms a relatively lower share of persons withdraws and directly starts receiving a pension and a relatively greater share of those who do withdraw passes through the unemployment pipeline. Finally, looking at occupational information in Finland, retirement propensity effects turn out to be higher for managers, professionals and technicians in comparison with the reference category of blue-collar workers. The opposite is true in Belgium. Both the highly educated and those individuals in good professions seem to be more encouraged to retire in Finland.

7. Conclusions

Modelling the pension system for different countries is a difficult task, as each country has its very many rules and exceptions. A robust modelling of the system per country has, however, been possible although further fine-tuning is appropriate. Our model is concerned with dynamics in that it explains transitions out of employment; it thereby focuses on the early retirement decisions in a sample of persons aged between 51 and 65.

The analysis shows that forward-looking measures that capture the institutional characteristics of the pension system are important determinants of individual retirement transitions. As it represents the opportunity cost of retirement, the option value turned out to have a significant negative impact on the exit from employment. This is most evident in a duration model that coherently captures the pension wealth accumulation. The forward-looking incentive effects are roughly similar for men and women. Option values have the strongest effects in Finland, where pension wealth and option values are most clearly decreasing with age. The mild effects for German men appear to contrast with those for a sample of both genders obtained in an earlier paper (see Börsch-Supan, Kohnz and Schnabel, 2003). One reason for this is the different choice of utility function parameters with a lower valuation of leisure.

Our initial policy question was to what degree the labour force participation increases from higher marginal incentives to postpone retirement. The analysis shows that policies to raise marginal incentives, and hence, option values, are effective in Finland and for men in Belgium and women in Germany. The incentives hold especially for the early retirement stage. The new ones introduced in Finland with a 4.5% accrual rate between the ages of 63 and 68 can be viewed as taking place too late, given that the average retirement age is 62 (see Figure 3). It is noteworthy that in Germany and Belgium the spikes in retirement at the ages of 60 or 65 are remarkable, whereas in Finland retirement is smooth as of age 56. This brings additional evidence that raising the pensionable age is relatively more effective in Germany and Belgium than raising marginal incentives. Thus, the current economic incentives in Germany around the age of 65, well beyond the pensionable age, may continue to be ineffective. This also raises some doubts about the effectiveness of raising marginal incentives – without large structural

changes in the pension system – in favour of suggestions to raise relevant age limits, e.g. by two years (following German Social Security Reform Commission in 2002).

The satisfaction measures have also turned about to be significant. These measures are particularly important in Finland and to an even greater degree in Belgium. Thus well-being at work remains a crucial factor in all the countries, for both men and women. Well-being at work and the fine-tuning of combining family and work life remain very important issues. We find some country variation, especially in the health effects. Poor health has an important effect on the retirement risk, especially for Germany. Bad health and hospitalisation also play a key role in the early retirement decision. We also show some weak evidence for the average early retirement in Belgium being associated with better health. The postponement of retirement to a later age is thus more clearly linked with deteriorating health.

Our data covers only eight waves of labour force participation information. The construction of option values could be made optimal by incorporating administrative data into the analysis. Future retirement research could use dynamic programming modelling to study specific issues. Although the latter models can turn out to be rather complex, they have the advantage that the estimates of structural parameters can be used for simulating the effect of policy measures.

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Appendix. Pension Rules and Tax Treatments

This appendix describes pension rules within the first pillar. The focus is on regulations during the sample period years of 1994 to 2001. The CPI deflated data have the reference year 2000.

Belgium

The conditions for obtaining a full pension for men is being a minimum of 65 years of age 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 years in 1997. It may be informative to know that the gross replacement rate of the average worker in the private sector amounted to 29.9% in 2000.

The calculation of the pension benefits is based on the following formula:

$$\text{Benefit} = r^{*}\text{average wage}^{*}\min[d/(42 \text{ or } 45),1].$$

This consequently depends on 1) replacement rate r depending on the reported type of household: 0.6 for singles and 0.75 for a one-earner couple; 2) average earnings based on periods of affiliation; and 3) the share of years *d* completed of the full career (42 years for women and 45 years for men). This corresponds to an annual accrual rate of 2.38 for women and 2.22 for men. The average wage corresponds to the price-indexed average 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 in the computation of the average wage and hence of the pension benefit. All benefits in this scheme are consumer-price indexed.

In this system, pension benefits are limited at both ends: for a complete career the minimum annual pension was €11,794 for a one-earner couple or €9,438 for individuals in February 2002 (about 56% of the average net wages). The earnings entering the above pension formula had a ceiling of €38,678 (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.

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 as of 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).

Wage-earner 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.

Unemployment pension. Next to the official wage-earner scheme, several forms of early retirement programmes have recently developed, some being official early retirement schemes, others (unemployment, disability, sickness) being unofficial. Those schemes can be broadly divided into two groups, mandatory collective retirement and individual retirement. Individual early retirement differentiates itself from its collective counterpart by the fact that it is based on an individual's decisions to retire from work. The most prevalent way 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.

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

Finland

The earnings-related pension depends on accrued pension rights during (self) employment: benefits are based on 1) the number of years in employment, and 2) the accrual rate: the pension starts growing from the age of 23.

Benefit= pensionable salary*years of employment*accrual rate

For the years prior to 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. 3) The pensionable salary is the gross income net of the employee's pension contributions and corresponds to the average salary of the last 10 years of occupation. Although the maximum pension is 60% of the highest income during the career, there is no upper limit for the amount of pension received. Pension rights are indexed-based on the evolution of wages (50% before age 65, 80% from age 65 onwards) and prices (50% before age 65, 20% from age 65 onwards). No pension rights can be accrued on the income earned after age 65 but this does increase the pension entitlements by 0.6% per month. It is however possible to retire from the age of 60. This actuarially reduces the level of pension payments by 0.4% for every month below age 65.

The government pension, in 1998 figures, was FIM 2,547 a month, FIM 2,272 for a married person, depending on the municipality of residence. This was reduced by one-half of the amount exceeding FIM 245 a month of the pension based on employment contracts. It was not paid if the earnings-related pension exceeds FIM 5,090-5,311 a month, depending on municipality. A married person receives no pension if his/her earnings-related pension exceeded FIM 4,484-4,672 a month. The pension income is taxable. Additional sickness insurance for pensioners is 2.7 (in addition to 1.5).

Unemployment pension. This benefit is equal to the disability pension at the time the person is entitled to a disability pension (if disabled). Those born later than 1945 (younger than age 58 in 2002) are not entitled to the pension supplement until age 65. For those born before 1945 the pension supplement is also earned during a period of unemployment. This is equal to 0.8 times the number of months of unemployment times the pension divided by the remaining months until age 65.

Unemployment pension consists of (a) pension entitlement at the time of unemployment, (b) upcoming pension until age 60 = unemployment months until age 60 * pension wage / 1000 after 500 days of unemployment (approx. two years), (c) upcoming pension since age 60 = unemployment pension months until age 65 (60 or less) * pension wage / 1500 after 500 days of unemployment (approx. two years), and (d) pension supplement after 500 days of unemployment: coefficient = 0.8 * unemployment months / (504 – unemployment months) where unemployment months = unemployment days until age 60 / 22 and 504 shows months between age 23 and 65. Unemployment pension can than be defined as:

Unemployment pension = min [(a+b+c)*(1+coefficient), 0.6*pension wage]

Disability pension. This benefit consists of (a) pension entitlement at the time of disability, (b) upcoming pension until age 50 = disability months until age 50 * pension wage / 800, (c) upcoming pension at age 50-59 = disability months at age 50-59 (120 or less) * pension wage /

1,000, and (d) upcoming pension at age 60-65 = disability months at age 60-64 (60 or less) / 1500 where unemployment period = unemployment days / 22. The disability pension can then be defined as:

$$\text{Disability pension} = \min [(a+b+c+d), 0.6*\text{pension wage}]$$

Germany

In 1972 Germany underwent a major pension reform that created different incentives to retire earlier than age 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 or at 65 with five 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 average earnings of all the insured. *Old-age pension* benefits are defined as:

$$\text{Pension}=\text{earnings points}*\text{pension factor}*\text{pension value}.$$

Earnings points are annual or reference earnings divided by the average earnings of all contributors. The employee's relative contribution position (EP) is computed by averaging her or his annual relative contribution positions over the entire earnings history. In each year, the relative contribution position 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 for 2000 is €4,397 (West Germany) and €3,630 (East Germany). 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 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 to increase the benefit (pension factor). The pension value refers to the 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 €53,508 in 1999. The average net earnings of all contributors was €33,517 in 1999, and €34,143 in 2000. Contributions were levied on earnings between a floor of 1% and a ceiling of 170% of average earnings, thus equalling about DM 272.58 for the floor and DM 46,338.6 for the top in 1999. Benefits are adjusted annually for changes in the real value of pensions compared with changes in earnings.

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 aid 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.

Thus, according to the '59 rules' and '57 rules' companies that 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.

There is no special tax relief for older people. Income up to a statutory line is exempt from tax. This was around DM 13,000 per person in 1999. This provision applies equally to citizens of pensionable age and those of working age. A part of the income reflecting the (notional) repayment of capital is not taxable, while a part relating to the (notional) interest on capital is taxable. This covers the public pension, privately purchased annuities and two particular types of occupational pension plan. 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 was an additional deduction of DM 200 (1999).

Two other forms of 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 DM 6,000. This rule is applied here for all pensions.

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% 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 €1,117 or €1,396 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 persons receiving pensions higher than €1,975 (single) or €2,257 (married). This is called the 'solidarity contribution'. Civil servants pay the same contributions + 0.5% to finance funeral benefits.

Self-employed persons do not pay contributions from their pensions. Their pensions are financed by the contributions paid during their career and an annual federal amount. As for taxes, the normal tax rates apply to pensions. Since pensions are replacement income, a reduction is allowed of €1,478.76 (per year) for single people and €1,726.65 (per year) for families. Wage-earner pensions 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.

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 take what is referred to as 'pre-retirement'. Labour force exit before age 60 is frequent: about 45% of all men call themselves retired at age 59. Only about half of them retire because of disability; the other half make use of the many official and unofficial pre-retirement schemes.

REVISER – Research Training Network on Health, Ageing and Retirement

REVISER was launched by several members of the ENEPRI network in August 2003. The project was financed under the programme on Improving the Human Research Potential & the Socio-Economic Knowledge Base of the 5th EU Research Framework Programme.

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This project is coordinated by Jorgen Mortensen, Associate Senior Research Fellow at CEPS. For further information, contact him at: jorgen.mortensen@ceps.be.

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