Does the dismantlement of early retirement schemes increase unemployment in Belgium ?

M. Maes

Discussion Paper 2008-41

Département des Sciences Économiques
de l'Université catholique de Louvain

UCL

Does the dismantlement of early retirement schemes increase unemployment in Belgium?

Marjan Maes

UCLouvain HUBrussel

Abstract

Early retirement is often explained as resulting from a voluntary labour supply choice of a utility maximizing individual. Nonetheless, a lot of individuals perceive retirement as a forced instead of a voluntary decision. This paper tries to accommodate voluntary and involuntary labour supply decisions within one model. On the basis of a large administrative dataset merged with Census data, we estimate a discrete-time competing risk model of transitions from Belgian private-sector employees into unemployment, early and old-age retirement while accounting for forward-looking retirement incentives. The estimated coefficients are used to simulate a cut in early retirement benefits. Although this could enhance the financial sustainability of the social security system for elderly, one might expect that this may force people to retire involuntarily through elderly unemployment where they end up with a lower living standard or even in poverty. Alternatively, it could stimulate employees to work longer until they qualify for old-age pension benefits. The model predicts a strong increase of the exit rates towards unemployment between age 52 and 57 while exit towards the old-age pension system marginally increases until age 63. In particular, blue-collars with physically demanding jobs in traditional industries have a higher risk to become unemployed while white-collar workers, members of voluntary saving plans or occupational pension schemes and highly educated workers are predicted to move in the old-age pension system.

JEL: J26; C25; H55

Keywords: competing-risk model; early retirement; retirement pathways; involuntary retirement

1 Introduction

In almost every industrialized country, population is ageing rapidly. These demographic trends have placed pressure on the financial sustainability of pay-as-you-go pension systems in these countries, in particular Belgium. But at the same time that demographic ageing starts to treat the viability of the Belgian pension system, its government, confronted with reorganisations in the traditional industry, designs several generous early retirement channels under the naïve assumption this would free jobs for the young unemployed. What empirical studies show instead is that these early retirement schemes did not have any impact on the unemployment rate of the young[1] and also models of

[1] See Jousten-Lefebvre-Perelman-Pestieau(2008) and Boldrin et al.(1999) who showed a very weak link, if any, between elderly retirement and the activity of the young and prime-age population.

labour market search undermine the foundations underlying this rhetoric[2]. What empirical studies also show is that one of the most important explanations for the decline of the effective retirement age in industrialized countries is the social security and pension system itself, thereby exacerbating the financial viability problem it faces[3]. It has indeed been shown that social security and pension systems contain strong incentives to retire early in most OECD countries.

A frequent criticism of this explanation challenges however the key underlying assumption, that individuals choose their retirement age voluntarily. According to a survey by Elchardus-Cohen(2003), more than 40(30)% of Belgian male(female) retired involuntarily. Dorn-Souza(2005) show that involuntary early retirement is particularly widespread in Continental Europe and in general in countries facing economic recessions. They add that generous early retirement provisions of the social security system do not only make voluntary early retirement more attractive for individuals, but also induce firms to push more employees into early retirement. In the U.S., nearly one third of the retirees in the Health and Retirement Survey perceive their retirement as "forced".[4] Lindeboom(1998) argues similarly that early retirement schemes in the Netherlands are experienced as " an offer one cannot refuse". The fact that a large share of early retirees perceives retirement as "not by choice" is however difficult to reconcile with purely supply-side explanations.

According to Jousten-Perelman-Desmet(2005), the perception that retirement is a forced decision " does however not mean that this decision is automatically different from the one the individual would have freely and rationally made"[5]. A utility maximizing individual may rationally decide to quit work but nonetheless may perceive this type of retirement as "not by choice"[6]. This means that the incentive literature might also provide an explanation for involuntary retirement.

[2] Bhattacharya-Mulligan-Reed(2001).
[3] Grüber-Wise (1999-2004).
[4] Szinovacz-Davey (2005).
[5] p.1.
[6] A collectively negotiated agreement between employee organisations and employer organisations may be perceived by the individual employee covered by this agreement as "forced".

This does not impede that involuntary labour supply decisions may at the same time be driven by labour-demand factors. Unfortunately, due to lack of micro-data at the level of the firm that could be linked to individual retirement behaviour, few researchers[7] examined the direct role of labour-demand in explaining early retirement. For the same reason, in this paper, we cannot model the labour demand side either. Nonetheless we try to estimate, as a first aim, a competing risk model that allows for transitions of private-sector employees to unemployment, old-age and early retirement since such a model may account for the fact that some exits may be voluntary and others involuntary. In particular, we allow the determinants of the transition from work into retirement pathways to be retirement incentives inspired from a labour supply perspective, but the importance of these incentives is allowed to be different for each of the various pathways. Contrary to most competing risk models in the literature, we account for forward-looking measures of retirement incentives.

As a second aim of this paper, the estimated results are used to simulate the impact of a cut in early retirement benefits. To the extent retirement is involuntary one might expect that this may force people into unemployment where they end up with a lower living standard or even in poverty[8]. We expect that rather blue-collar workers with physically demanding jobs have a higher risk to become unemployed. Alternatively, cutting early retirement benefits stimulates employees to work longer until they qualify for old-age pension benefits. We expect that the white-collar and highly educated workers would opt to work longer and to move into the old-age pension system.

The paper is structured as follows. The dataset that allows to construct individual retirement incentives and relate it to individual retirement behaviour is presented in section 2. Section 3 describes the distribution of retirement incentives specific to the Belgian retirement pathways (in particular old-age and early retirement and unemployment). After a presentation of the relevant empirical literature in 4.1., 4.2.-4.3.

[7] Aubert(2003), Lazear(1986), Crepon-Deniau-Duarte(2003), Paolini(2002).
[8] Several studies on poverty in Belgium (Bonsang-Perelman-Delhausse(2002)) and the EU(Zaidi et al.(2006)) find that the unemployed have a high risk of being poor.

estimates a discrete-time competing risk model while controlling for these incentives. The estimated coefficients are used to simulate in 4.4. the impact of a cut of early retirement benefits on the exit towards unemployment and old-age retirement and to analyze who moves where in 4.5. Appendix I explains how Belgian old-age pension, unemployment and early retirement benefits for private-sector employees are calculated.

2 Incentive variables and data construction

Let an individual at age t consider to retire at age R. The present discounted value of his entitlement to future pension benefits was introduced by Feldstein(1974) as:

$$SSW_t(R) = \sum_{s=R}^{T} \pi(s|t) d^{s-t} P_s(R) - \sum_{s=t}^{R-1} \pi(s|t) d^{s-t} \tau w_s$$

Where d^{s-t} denotes the discount factor with respect to time, $\pi(s|t)$ the conditional probability to survive until s, $P_s(R)$ the pension benefits given retirement at R and τ the payroll tax rate on wages w_s. T denotes the expected end of life. Since an increase of SSW can be interpreted as a genuine increase of non-labour income (like an increase of initial wealth), SSW is supposed to capture an income effect on the retirement decision. If leisure is a normal good, an increase of SSW leads therefore to early retirement. Two other incentive measures can be derived from SSW: the one-year wealth accrual and the peak value. The accrual is the change in SSW due to the postponement of retirement with one year:

$$AC_t = SSW_t(t+1) - SSW_t(t)$$

and measures the financial gains or losses associated with an extra year of work. The accrual will be zero if an extra year of work increases future pension benefits such that it compensates that by working an extra year the worker loses one year of pension benefits and the extra year of payroll taxes that have to be made to the system. In that case the accrual does not distort the retirement decision. If however the accrual is negative, leisure becomes relatively cheaper than consumption such that there is a substitution effect towards early retirement. Depending on the particular rules of social security and pension provisions, it may happen that SSW attains at a certain age a local maximum that

is not a global maximum: it is possible that the gain associated with one extra year of work is weak while the gain of working a few years more may be substantial. To select the global maximum, Coile-Gruber(2000) introduced the concept of the peak value:

$$PV_t = \max_{R \geq t} [SSW_t(R) - SSW_t(t)].$$

It is estimated by taking the difference between SSW at the current date and SSW corresponding to the retirement age that maximizes SSW. The peak value is a forward looking measure while the accrual only takes into account differences in SSW between two subsequent years. Beyond the age at which SSW is maximized, the peak value collapses to the accrual.

In order to analyse whether these incentives play a role in the retirement decision, micro-data are required that allow not only the calculation of streams of potential benefits for different retirement pathways at the individual level but also the link with the effective retirement age of these individuals. The CREPP of the University of Liège provided us with a longitudinal administrative dataset created by the National Institute of Statistics of Belgium[9]. This Institute selected 29.962 Belgian fiscal households (or 50541 individuals) with at least one member in the 50-64 age range in 1996. The was connected to the Income Tax Returns(=ITR) for the years 1990[10]-1996 and the Individual Pension Accounts(1956[11]-1996) by means of the national identification number.

The ITR contain all the information necessary to calculate the income tax such as household composition, number and type of dependants in the household, age, gross labour and replacement incomes (unemployment, conventional early retirement, disability or illness, old-age pension or survivor benefits), housing wealth, occupational pension benefits, employee contributions in occupational pension plans, private voluntary

[9]The original dataset has been set up and used in the context of an international NBER research project. It is also presented in Grüber-Wise(2004).
[10] The tax files were filled in during 1991-1997 but concern income generated in 1990-1996.
[11] This is the year in which the old-age pay-as-you-go pension system for private-sector employees was born.

savings,… of all household members[12]. The ITR show in particular through what retirement path and at what age individuals retire.

The Individual Pension Accounts contain all the information necessary to calculate gross old-age pension rights of private sector employees such as the number of days of work, the number of days spent on replacement incomes and the gross wages for every year of the career since 1956. We transformed them, on the basis of the ITR, into individual net pension rights and also converted them in real terms. With this information, one can calculate for every private-sector employee in the sample for each possible retirement age a stream of net old-age pension benefits and a stream of net unemployment benefits, discounted by a real interest rate of 3%[13] and adjusted by his survival probability. As explained above, SSW allows us to derive the accrual and peak value. This forces us to make forward projections of wages: as in Grüber-Wise(2004) and Grüber-Wise(1999), we assume real wage increases of 0%.

Interestingly, the ITR and Individual Pension Accounts could be merged with the Census of 1st of March 1991[14] that has a response rate of more than 99% and contains information on the education level, the professional status of the household head and his spouse (blue collar private sector, white collar private sector, civil servant, self-employed, ...) and the sector of activity they work or worked in (chemical industry, banking, insurance, agriculture, socio-cultural services,…). In particular, the sector of activity refers to the NACE code of the corresponding employer up to the class level (leading to 999 classes). This allows us to establish a link with all collective employment agreements negotiated at the level of the sector. On the basis of these agreements and information on career and age, one can calculate early retirement rights for all private-sector employees in the sample for all possible retirement ages. Finally, on the basis of life expectancy tables these are converted into a stream of early retirement rights, discounted by a real interest rate of 3% and adjusted by his survival probability.

[12] Income data were converted into real data with year 2002 as reference year.
[13] Since the interest rate is not estimated within the model, it has to be fixed a priori. As usual, we set it at 3% in order to enhance comparisons across countries.
[14] Every 10 year the Belgian government organizes a Census. Questionnaires are sent by post to every Belgian citizen and they are afterwards personally collected by local civil servants.

Measurement errors however arise since, because of lack of information, we ignore agreements that relax eligibility conditions in case of nightshifts, agreements that are concluded at the level of the firm, agreements in the construction sector where disability is an eligibility criteria and agreements for firms that are in a restructuring phase what could reduce the early retirement age to 52. The latter means eligibility is only taken into account from the age of 55 on, while in our sample 23% of those that retire through early retirement schemes do so before 55. We are thus underestimating early retirement rights what may cause measurement errors when estimating the model.

Of the dataset are only selected the individuals who were working in the first year of observation as a private sector employee[15]. This leads to a sample of 5831 individuals as shown in table 1.

Table 1: Data construction

Dataset	Number of individuals
ITR 1996	50541
ITR 1995	48752
ITR 1994	47291
ITR 1993	47332
ITR 1992	46907
ITR 1991	46346
ITR 1990	46416
Census of 1st march 1991	50136[16] (matching with ITR 1996: 99.2%)
Individual pension accounts 1956-1996	31400[17] (matching with ITR 1996: 62%)
Private-sector employee in1991	9985[18] (matching with ITR 1996: 20%)
Private sector employee working in 1991	5831[19]

[15] First, we do not consider non-statutory employees in the public sector as private-sector employees, since they frequently are nominated as civil servant just before retiring and thus end up in a different old-age pension system with different retirement incentives what could give rise to measurement errors. Second, a lot of self-employed worked in the beginning of their career as private sector employee but more than 90% stopped working as private sector employee at last at age 42. Although these mixed careers accumulated some rights in the old-age pension system of employees besides the self-employed old-age pension system that is governed by different rules with different retirement incentives and for which micro-data are scarce, we do not consider them as private-sector employee to avoid measurement errors.

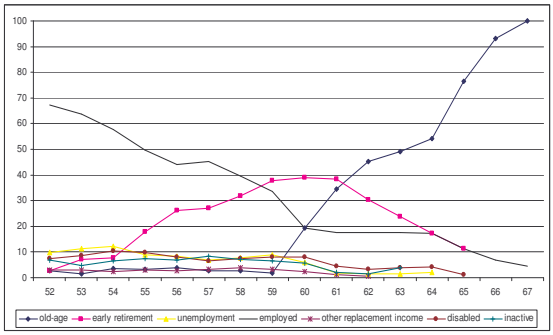
[16] Individuals selected from ITR 1996 and in Census of 1991.

[17] Individuals selected from ITR 1996 and for at least one year in individual pension accounts 1956-1996.

[18] Individuals selected from ITR1996 and for at least one year in individual pension accounts 1956-1996 and declare to be private sector employee in 1991.

To get an idea about the relative importance of the different pathways into retirement in our sample, figure 1 shows on the basis of the ITR of 1996, the distribution of employment status for (formerly) private sector employees by age by distinguishing employed, unemployed, disabled, beneficiaries from early retirement schemes and old-age pensions. If an individual has labour income, he is defined employed. If he receives unemployment benefits (respectively old-age benefits; early retirement benefits; disability benefits; other replacement income) that are higher than the sum of next year other social security benefits[20] and his next year labour income is below the earnings test, he is defined unemployed (respectively old-age retired; early retired; disabled; beneficiary of other replacement income). Otherwise, he is defined inactive.

Figure 1: Distribution of employment status for private-sector employees by age (1996)



This reveals in the first place that the percentage of workers decreases steadily with age, even before 60. Secondly, about 40% of the individuals between 58 and 61 years old receive early retirement benefits. Thirdly, nearly 100% of Belgian private sector employees of 65 are collecting old-age pension benefits. Fourthly the percentage of individuals younger than 60 that is receiving unemployment benefits turns around 8%

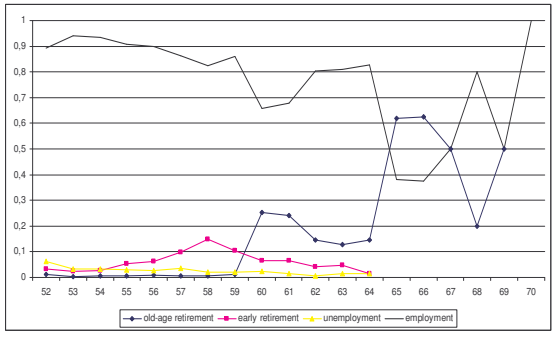
[19] Individuals selected from ITR 1996 and for at least one year in individual pension accounts 1956-1996 and declare to be working private sector employee in 1991.

[20] The use of "next year income" avoids measurement errors by which individuals are erroneously qualified as non-retired while they effectively retired in a given year. Suppose f.e. an individual that becomes 58 in the end of the year, f.e. in November and thus entitled to early retirement benefits. His yearly early retirement benefits for that year are those from November and December while from January until November he receives labour income. Since his yearly labour income outweighs his yearly early retirement income, one could erronously qualify him as employed while he retires at the age of 58.

and drops to 2% at 60 to become 0 at 65. Finally the percentage of disabled is around 6% and drops to 3% after age 60 to become 0 at 65.

The following figure presents, on the basis of 5831 individuals at risk, the exit rates from private-sector employment into unemployment, early and old-age retirement[21]. Since we also plot the individuals at risk of exit (that is still employed or right-censored[22]), the fractions vertically add up to 1. The exit rates constitute the dependent variables of the competing risk model that will be estimated. It should be noted that the number of individuals at risk decreases naturally with age: at age 52 there are 4177 individuals at risk while at the age of 66 there are only 18 individuals at risk. Thus the fact that the exit rate into old-age retirement at age 60 is higher than that into early retirement at age 58 may simply reflect that the former is calculated on a much smaller sample at risk than the latter.

Figure 2: Observed exit rates by age



In order to get an idea what kind of private-sector employees become unemployed, early retired or old-age pension beneficiary, table 2 describes the socio-economic profile of the

[21] In many countries disability pension is an important opportunity for voluntary labour force withdrawal. Parsons(1982) concludes that early retirement in the U.S. can to a large extent be attributed to the generosity of the disability program. In Belgium this is an issue for civil servants who, under weak conditions, may retire as "disabled" while receiving old-age benefits up to 3 years before the early retirement age in the old-age pension system. For private-sector employees this is however no issue at all, since disability benefits are equal to unemployment benefits. There is thus no incentive to apply for disability subject to rather advanced screening if unemployment benefits are available without screening. Moreover, we have no data on the probability distribution of being rejected by the screening. We thus assume that becoming disabled can for a private-sector employee not be imputed to retirement incentives. We therefore do not take account of the disability pathway.

[22] Private sector employees still working in the last year of the observation. We also right-censor private-sector employees that end up as inactive or with disability benefits or with other replacement income.

5831 individuals if they exit to one of these pathways. Most of these variables will be part of the explanatory variables of the competing-risk model that will be estimated.

Table 2: Descriptive statistics of the dataset (1990-1996)			
	Unemployed	**Early retired**	**Old-age pension**
Number individuals that exit: 2419 (+3412 right-censored individuals)	**537**	**1188**	**694**
Average lifecycle wages(in euro) of the individual[23]			
90th percentile	23.229	25.816	32.309
75th percentile	17.873	21.226	26.551
50th percentile	13.372	17.053	20.362
25th percentile	10.809	14.306	13.679
Percentage of the career spent on replacement income by the individual[24]			
90th percentile	0.35	0.21	0.19
50th percentile	0.16	0.11	0.05
Distribution of education level of the individual			
Primary	0.30	0.25	0.20
Secondary inferior professional	0.29	0.32	0.23
Secondary inferior general	0.145	0.14	0.11
Secondary superior professional	0.09	0.07	0.16
Secondary superior technique	0.08	0.10	0.08
Secondary superior general	0.03	0.034	0.038
Professional training	0	0.008	0.01
High school(3 years)	0.04	0.047	0.07
High school(5years)/university	0.03	0.030	0.10
Distribution of socio-economic status of the individual			
Blue-collar	0.70	0.66	0.33
White-collar	0.30	0.34	0.67
Distribution of marital status of the individual			
Single	0.22	0.15	0.22
Married	0.78	0.85	0.78
Distribution of gender of the individual			
Male	0.77	0.89	0.75
Female	0.23	0.11	0.25
Distribution of sectoral activity of the individual			

[23] Calculated on the career from 1956-1996. See 4.1. for the exact definition of this concept.
[24] Calculated on the career from 1956-1996.

Agriculture	0.007	0.002	0.01
Energy, chemical industy	0.09	0.21	0.12
Metallic, electronic and mechanic industries	0.26	0.37	0.15
Construction	0.17	0.10	0.04
Horeca	0.135	0.13	0.16
Transport and communication	0.08	0.025	0.07
Banking, insurance	0.05	0.05	0.17
International institutions, public administration	0.016	0.016	0.02
R&D, teaching, health	0.014	0.02	0.07
Socio-cultural	0.04	0.02	0.09
Other sectors	0.134	0.065	0.10
individuals with employee contributions in occupational pension plans[25]			
	0.13	0.18	0.18
individuals with contributions for private voluntary savings[26]			
	0.26	0.34	0.32
individuals receiving occupational benefits [27]			
	0.06	0.33	0.56
Distribution of region in which the individual lives			
Brussels	0.10	0.06	0.15
Flanders	0.69	0.69	0.55
Wallonia	0.21	0.25	0.30

This table shows that for all income deciles the average lifecycle wages of elderly that retire through unemployment is lower than that of the early retired what is in general lower than those who retire through old-age pension except that the 25% income decile of the early retired is higher than that of the old-age beneficiaries. Concerning the unemployed, one also finds that 50% of them spent 3 times more of their career on replacement income than old-age beneficiaries. Unemployed are less educated than the early retired who are less educated than the old-age pension beneficiaries: 17% of the old-age beneficiaries did higher studies while this is only 7% for the unemployed. 90% of the early retired are men while the decomposition by gender of the unemployed is

[25] At least one contribution during the period 1990-1996.
[26] At least one contribution during the period 1990-1996.
[27] In at least one year in the period 1990-1996.

similar to that of the old-age beneficiaries. This is because early retirement schemes are predominant in traditional industries (chemicals, energy, metallurgy,..) that employ relatively more men. The availability of occupational pension benefits appears to be confined to individuals that retire through the old-age pension. This has among others to do with the fiscal treatment of occupational benefits that becomes very generous at the age of eligibility for the old-age pension. Finally, the results that decompose retirement pathways by region are illuminating: 69% of the elderly unemployed are Flemish and 21% of them are Walloon while the weight of the Flemish region in the whole sample is only 62% and that of the Walloon region 28%. This result is confirmed by statistics of the Federal Office of Employment[28]. These show that in 2002, 55% of the unemployed below age 50 are Walloon and 30% are Flemish while the weight of the Flemish region is 58.5% and of the Walloon region 32.1%. However, if one looks at the elderly unemployed the picture is reversed: in 2002, 57% of all elderly unemployed are Flemish and 33% are Walloon while the weight of the Flemish region is 56.9% and of the Walloon region 32.1% If in addition one looks at the early retired, who also receive generous unemployment benefits, one observes that in the national statistics of 2002, 67% of the early retired are Flemish and 30% are Walloon.

3 Description of financial incentives to retire in Belgium

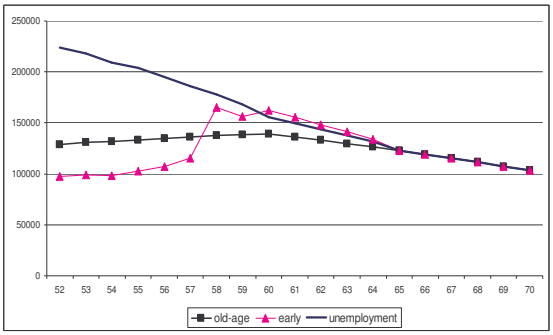
The dataset presented in the previous section allows to calculate and to describe in more detail the retirement incentives (as measured by SSW, accrual, peak value) implicit in the Belgian early retirement, elderly unemployment and old-age pension system for private-sector employees. As will be shown, the several ceilings, floors and eligibility criteria in the systems generate complex incentive patterns.

Calculations are done on the 5831 individuals working as private-sector employees in 1991 **before they have been matched with the ITR 1990-1996**. The idea is to describe how incentives will evolve if one would continue to work until 70 and to avoid

[28] ONEM-RVA(2002).

differential selection into the sample at each age. Figure 3 shows for the 3 retirement pathways, mean SSW[29] as a function of possible retirement age.

Figure 3: Mean SSW by retirement age (in euro)



First note that in the old-age pension system one could in principle stop working before 60 and claim benefits from age 60 on[30] while in the early retirement and unemployment system one cannot separate the claiming of benefits from effective retirement. In order to enjoy early retirement or unemployment benefits, one should effectively be laid off by the employer: retiring and claiming benefits occur at the same time. This is the reason that before the main age of eligibility for early retirement, that is 58, the SSW of the old-age pension is higher than the one of the early retirement pathway. Unemployment is supposed to be available at 52.

Before the age of 55, unemployment wealth dominates early retirement wealth. This is first because due to lack of data on restructuring firms we put early retirement benefit rights equal to zero before age 55[31] and secondly because of different eligibility conditions. Eligibility for unemployment requires only 3 years of work while eligibility for early retirement imposes at least 20 years of work. If one would look at the individual level, one would see that if one is eligible, early retirement wealth is for every age higher

[29] In estimations SSW is highly correlated with the accrual and this is mainly due to the fact that the variation in SSW is driven by the variation in payroll taxes that are a percentage of wages. Therefore we do not deduct payroll taxes when calculating SSW. As most reduced-form studies, payroll taxes are in addition not deducted since one considers that the retirement decision is not taken at the beginning of the lifecycle but rather at an advanced age and by looking ahead. This view emphasizes SSW as the present value of vested pension rights and one considers past contributions as sunk at the moment the retirement decision is taken.

[30] Delays in claiming social security benefits have been studied by Coile-Diamond-Grüber-Jousten(2000).

[31] Early retirement wealth is not zero before age 55 because it also contains the expected value of benefits to be received after the age 55.

than unemployment wealth. The fact that early retirement wealth increases between 55 and 58 reflects purely that more and more individuals become eligible.

Since early retirement benefits correspond to 60 up to 85% of last wages and unemployment 55-65% of last wages while the old-age pension benefits between 60 and 75% of average lifecycle wages, it is not surprising that both early retirement and unemployment wealth dominate old-age pension wealth from the age of eligibility on.

Different factors explain the pattern of SSW. Firstly, in early retirement (and for low wages unemployment) schemes, the "backloading" effect can be quite important in case of strong wage increases at the end of their career since early retirement and unemployment benefits are a percentage of last wage, up to a ceiling. In the old-age pension system an additional year of work can also replace a previous low-wages year but only for employees with a complete career. In addition, as long as the career lasts for fewer than 40 years for women and 45 for men, benefits are increased by a factor of 1/40 respectively 1/45[32]. However we found that in our dataset, at the age of 60, 73% of men and 76% of women have a career less than 40 years. 73% of the men in the sample would thus have to work at least until 65 in order to benefit from backloading. Secondly, an additional year of work after the age of eligibility implies fewer years over which benefits can be received. Mean SSW increases until the age of eligibility to decrease thereafter. Beyond age 65 when means-tested benefits become available for everybody, SSW declines even more quickly. Thirdly, in the unemployment and early retirement channel, the continuous decrease of wealth after the age of eligibility is in addition explained by the fact that unemployment and early retirement periods are assimilated to worked periods in the calculation of old-age benefits. The reason why the lifecycle approach is thus particularly useful is because it captures the effect of the unemployment and early retirement benefits now on the amount of old-age benefits to receive several years later. Fourthly, for all retirement channels, a delay in receiving benefits raises the probability that the employee might die before being able to collect benefits.

[32] Some employees started to work at the age of 14 and have a full career before the normal retirement age.

The 90th percentile early retirement wealth peaks at age 55-56. This corresponds to the age of eligibility in particular sectors (construction, glass, textile, mechanics industry) after a career of at least 33 years. On the other hand, the 10th percentile SSW, that contains mainly individuals with incomplete careers, in particular women, shows that, if the eligibility conditions are not satisfied some workers better wait until age 60 to retire. At age 60, only 20 years of work are required to be eligible for early retirement.

Figure 4: 90th percentile SSW by retirement age (in euro)

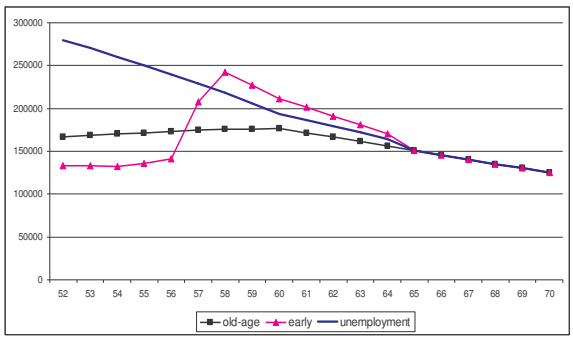
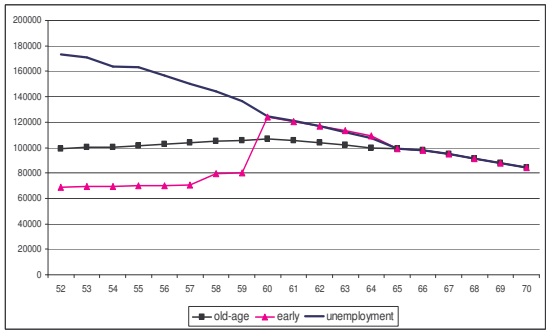


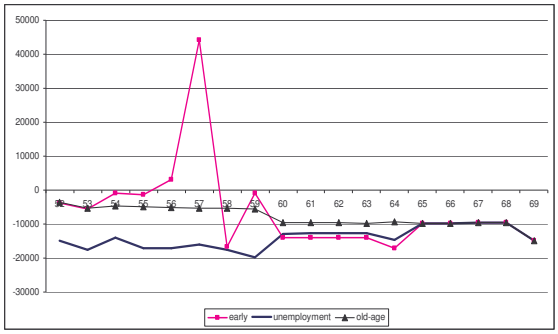
Figure 5: 10th percentile SSW by retirement age(in euro)



Key ages of eligibility for early retirement are reflected in particular by the accrual that becomes very high in the year before eligibility and strongly negative thereafter. Early retirement schemes clearly give rise to particularly extreme accruals, compared to the unemployment or old-age pension scheme. The fact that the old-age pension system is actuarially unfair at the margin is reflected in a negative accrual for all possible retirement ages. The accrual is negative before age 60 because the pension rights grow by less than the discount rate of 3% while payroll taxes have to be paid. At age 60, the age at which the employee becomes eligible for old-age pension benefits, there is in addition a downward jump in the accrual. From then on, working one more year means also the loss of one year of pension benefits. The unemployment accrual reflects

seniority increases in benefits at 52, 55 and 58 and signals that for women, who have a normal retirement age of 60, the transition from unemployment to old-age pension corresponds to an increase in SSW.

Figure 6: Mean accrual by retirement age (in euro)



The 90th and 10th percentile accruals of early retirement schemes show even more neatly that for some employees it becomes very penalizing, from a financial point of view, to retire after age 58 or 60. The 10th percentile accrual also shows that for some employees (that do not satisfy eligibility requirements) the switch from early retirement and unemployment to old-age pension at age 65 corresponds to an increase of SSW.

Figure 7: 90th percentile accrual by retirement age (in euro)

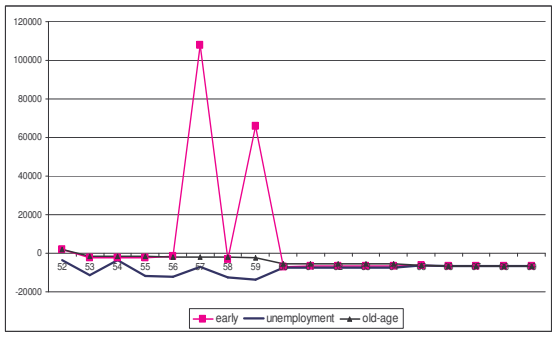
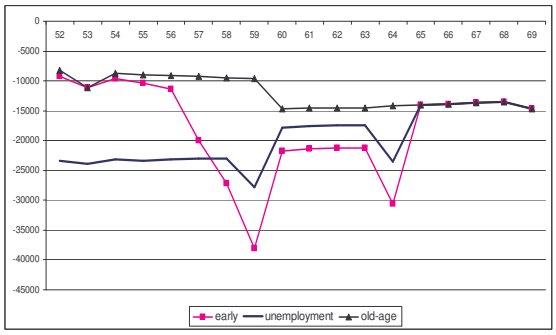
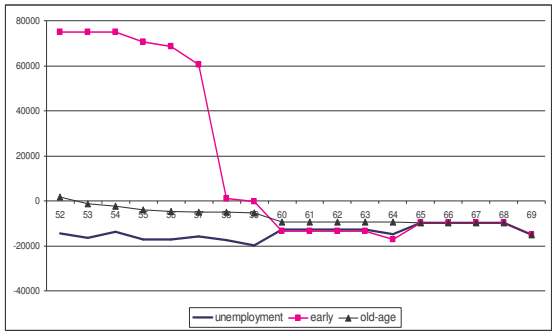


Figure 8: 10th percentile accrual by retirement age (in euro)



Finally, are also reported the results concerning the peak value. From the moment that the global maximum in SSW is attained, the peak value collapses to the accrual.

Figure 9: Mean peak value by retirement age (in euro)



For the unemployment and old-age channel, the peak value is always negative and thus equal to the accruals presented in previous figures. On the contrary, for early retirement wealth the peak value stays strongly positive until the main age of eligibility 58.

Figure 10: 90th percentile peak value by retirement age (in euro)

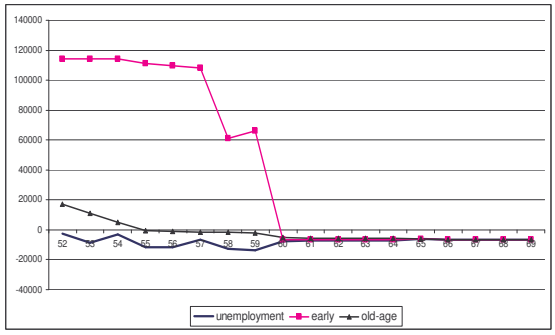
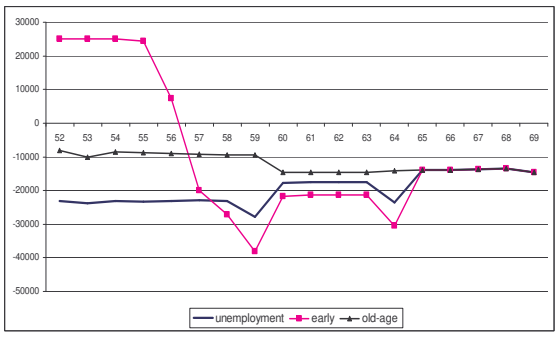


Figure 11: 10th percentile peak value by retirement age (in euro)



To conclude, this section described retirement incentives in the social security provisions for Belgian elderly. It appears that the three pathways under consideration provide strong incentives to retire early, although they differ a lot in eligibility criteria. Up to now, we gave only a description of the incentives to retire. Once that the 5831 private-sector

employees have been merged with the ITR(1990-1996), we can relate individual retirement incentives to individual retirement behaviour what will be done next.

4 Modelling different retirement pathways

The previous section showed that the Belgian social security provisions for elderly provide strong incentives to retire early. This section explains the discrete-time competing risk model (4.2.) that will be used to estimate exits from private-sector employment to unemployment, early and old-age retirement, while accounting for retirement incentives (4.3.). The estimated coefficients are then used to simulate a cut of early retirement benefits (4.4.) and to analyse whether individuals with particular characteristics, for example blue-collar workers working in specific sectors, have a higher likelihood to move towards unemployment than to the old-age pension system (4.5.). To start, we briefly overview in 4.1. how this issue has been modelled in the literature.

4.1 Overview of the literature

Most studies that analyse the relationship between retirement incentives and retirement behaviour assume implicitly the responsiveness to incentives is the same whether one retires through old-age, disability or unemployment pathways and that these pathways can be considered as substitutes. For instance, Grüber-Wise(2004) and Jousten-Perelman-Desmet(2005) propose a weighted SSW in which the weights of the retirement pathway correspond to the proportion of the population that chooses that retirement pathway. However a competing risk or multinomial logit model may be more appropriate since it may account for the fact that some exits may be voluntary and other channels are involuntary. Dahl-Nilson-Vaage(2002) use a multinomial logit model to account for the fact that "individuals are either pushed into or choose different early retirement pathways". Also Bloemen(2006) and Bloemen(2008) models a multinomial logit of transitions to early/old-age retirement and to unemployment/disability. He finds that in the Netherlands: "the latter is governed by demand side factors, health risks and eligibility conditions while the former is more likely to be taken by choice".

Some of these models are silent about the impact of financial retirement incentives and only account for observed individual characteristics, dummies for eligibility for benefits or current wages in the explanatory variables[33]. Mitchell-Philips(1999) estimate a multinomial logit that accounts for the impact of SSW on the transitions from work towards disability, early retirement and old-age retirement in the US. They estimate the probability that an individual i retires through pathway j=1,…,J at time t=1,…,T as

$$P(y_{it} = j) = F(L_{it}\alpha + RI_{itj}\beta)$$

where F is the distribution of error terms, RI_j a measure of retirement incentives corresponding to pathway j and L_{it} the expected length of the retirement period as a proxy for leisure. Although they allow for different pathways, they impose the same coefficient β across all pathways. More flexible models allow for a different α_j and β_j according to the pathway chosen and allow for complex patterns of substitution between alternatives:

$$P(y_{it} = j) = F(x_{it}\alpha_j + RI_{itj}\beta_j)$$

where x_{it} denotes a vector of individual characteristics. For example, Dahl-Nilsen-Vaage(2002) estimate a multinomial logit that allows for transitions from work to unemployment, disability and inactivity. Examining substitute effects across exit routes, they find that a higher potential income of the exit route increases retirement through that route while it decreases exit towards other routes[34]. Another example is Wahlberg(2001) who models transitions from work to early retirement and partial old-age retirement[35].

[33] Quinn-Burkhauser-Cahill-Weathers(1998) for US; Miniaci-Stancanelli(1998) for UK; Schils(2006) for Netherlands, Tompa(1999) for Canada.
[34] They include as explanatory variable for one exit route the potential incomes of all possible exit routes.
[35] He includes as explanatory variable for one exit route the potential incomes of all possible exit routes.

Since retirement can be considered as an irreversible state, some models account for duration dependence in the employment spell and use a competing risk model in discrete-time with a piecewise constant baseline hazard. Hazard models have the advantage they can account for the endogenous selection of those still working at older ages. Duration of the employment spell is proxied by the time period between the age of eligibility and the effective retirement age or by age itself. It is however not always clear how in that case duration of a spell can be identified from pure age effects and from age-specific eligibility rules in pension systems. Lindeboom(1998) estimates a competing-risk model that allows for transitions from work towards unemployment, early retirement and disability in the Netherlands. He allows the potential replacement rate of one route to affect the transition to other routes[36]. Hakola(2002), Tompa(1999) and Schils(2006) estimate a competing risk model for transitions of work to disability, unemployment and old-age retirement, while controlling for unobserved heterogeneity, that is the variation between individuals that is not captured by the observed variables and may lead to misestimation of duration dependence and biased coefficients. They use current yearly wages and Hakola(2002) uses in addition potential yearly pension income and/or replacement rates as incentive variables. Hakola(2002) analyzes substitutability between pathways into retirement by including eligibility dummies for early retirement in the unemployment channel with ambiguous results.

However extremely few of these competing risk models (Antolin-Scarpetta(1998), Schnabel(2003)) consider the labour supply and retirement decision from a life-cycle perspective, in the sense that decisions might be influenced by the expected stream of pension benefits to receive in the future. Both the theoretical and empirical literature on retirement however pointed out that it is not simply the size of the annual pension payments but the present value of the pension benefits and how it accrues with continued work that emerges as important. Antolin-Scarpetta(1998) model transitions towards early/old-age retirement and disability retirement and find that in Germany old-age retirement wealth is a more important determinant of old-age than disability retirement

[36] He includes as explanatory variable for one exit route the potential replacement rates of all possible exit routes.

and that a higher option value decreases both disability, early and old-age retirement. Schnabel(2003) estimates a multinomial model of transitions from work to unemployment or old-age pension while including option value/accrual of old-age pension wealth, maximum unemployment insurance duration and unemployment replacement rates. He finds that a higher option value/accrual decrease old-age retirement but are insignificant in the unemployment pathway. These few competing-risk models that allow for a lifecycle-perspective have the common weakness they do not allow for unobserved heterogeneity.

4.2 The model

Since we want to account explicitly for the variety of pathways from employment into retirement and since we consider retirement as an irreversible state[37], a competing risk model will be used. Like Antolin-Scarpetta(1998), Schnabel(2003), Mitchell-Phillips(2000), our aim is in addition to account for forward-looking retirement incentives.

Since the variables in the dataset are grouped in intervals of one year, we apply, as explained in Jenkins(2005) and Schils(2006), the discrete-time competing risk model, assuming that if during the interval there is an exit to one retirement pathway, there can be no exit to another pathway in the same interval. It has furthermore been shown by Jenkins(2005) that the procedure to estimate such a model is equivalent to that of a multinomial logistic regression. Then one can estimate the probability that an employee i=1,…,N transits to a retirement path j=1,…,J at time t=1,…,T after a career of duration d as

$$P(y_{it} = j | x_{it}) = \frac{\exp(\beta_0^j + \beta^j x_{it} + \theta_d^j)}{1 + \sum_{h=1}^{J} \exp(\beta_0^h + \beta^h x_{it} + \theta_d^h)}$$

[37] A single-spell model is used. We looked for evidence of reentry in the labour market: 0.7% (respectively 9% and 0.3%) of those with old-age retirement (respectively unemployment and early retirement) benefits in last year have positive labour income in subsequent year. For the elderly unemployed one would have enough observations to model simultaneously reentry. On the contrary, for exit to old-age and early retirement, reentry is inexistent and modeling reentry would not make any sense.

with β_0^j a path-specific intercept, β^j a vector of path-specific coefficients associated with x_{it} a vector of exogenous and possibly time-varying explanatory variables that will be discussed below and θ_d^j is the path-specific baseline hazard that represents dependence on the duration d of the career. The model takes account of right-censored[38] spells (individuals that are neither unemployed, early retired nor old-age retired in the last year of the observation) under the assumption they are randomly censored. Because the response probabilities must sum to unity,

$$P(y_{it} = 0 | x_{it}) = \frac{1}{1 + \sum_{h=1}^{J} \exp(\beta_0^h + \beta^h x_{it} + \theta_d^h)}$$

As explained by Lancaster(1990), individual-specific unobserved effects like ability, motivation or attitudes, may affect the probability of retirement. If these increase the propensity to retire, the population at risk of retiring may be over time more and more composed of individuals that have a low propensity to retire. In order to correct for the selection bias this generates, one should allow for an unobserved effect. However, in the estimation below, it was not possible to make the model converge while allowing for unobserved heterogeneity across competing risks.

The explanatory variables include in a first place retirement incentives, in particular SSW and accrual.[39] Besides retirement incentives, we include individual observed characteristics such as education level of the employee, region where he lives in (Brussels, Wallonia or Flanders), socio-economic status, gender and the sector he works or worked in.[40] The age difference between the individual and his eventual partner was included to account for possible coordination of household members of their retirement decision. As time-varying variables we include age, age squared of the employee, year dummies, housing wealth, the number of dependent children and disabled. We also

[38] Each individual contributes to the likelihood function for every year he is in the dataset but depending on whether the last interval is censored or not the dependent variable of the last contribution equals 0 or 1.
[39] We experimented also with the peak value but the accrual gave more accurate results. This is probably due to the measurement error in early retirement rights before age 55.
[40] Since these are measured at the start of the observation period (in 1991) they are sequentially exogenous. We consider it very improbable they would vary in the sampling period and treat them as exogenous.

included membership of a private voluntary savings plan considering that the decision to save in a private voluntary savings plan is anterior to the decision to retire and is expected to continue to the age of 65, for fiscal reasons, independently of the retirement age. According to Bloemen(2006), "the motives for participating in individual pension schemes may be quite diverse: we can imagine that poor occupational pension schemes may add to the participation in individual pension schemes, but an alternative may come from high income people who have more financial means to invest". We finally add the log of occupational pension benefits that elderly may receive. This variable might be simultaneously determined with retirement itself, especially old-age retirement. Up to now, we did not account for this possible endogeneity problem through the simultaneous estimation of a competing-risk retirement model and an occupational wealth equation, like Bloemen(2008). The reason is that it is difficult to find suitable exclusion restrictions. As in Bloemen(2006), our model therefore "assumes that there is no correlation in unobservables between wealth and the labour market state next period. Any possible correlation between the two runs via the observables that are included in the regression. The approach is therefore to include as many as possible observable characteristics to explain as much as possible of the correlation between occupational wealth and job exit."

Endogeneity may arise due to an omitted variable bias where the omitted variable is correlated with an explanatory variable of interest leading to inconsistent estimation of the coefficients. The identification problem of SSW" concerns the possibility that SSW is endogenous since it is correlated with unobserved individual tastes for work. Those with a taste for work would have worked hard all their live, have higher wages and hence be eligible for larger benefits and thus a higher SSW. If one is unable to separate preferences for work from financial incentives, one could end up with a coefficient on SSW suggesting that a higher SSW decreases the probability to retire while the lifecycle theory suggests instead a positive income effect. Neglecting this identification issue, as sometimes happens in the literature, may lead to significant bias in the estimated

coefficients. There are at least two possible solutions[41]. A first possible solution is a 2SLS procedure in which SSW is replaced by an instrumental variable highly correlated with SSW but not with "tastes for work". If f.e. our dataset would cover a period before and after a pension reform, this would create interesting conditions for a natural experiment, as used by Krueger-Pischke(1992), Ranzani(2006) and Meghir-Whitehouse(1997). They use interactions between birth cohorts and time dummies as identifying instruments of SSW. In that case, the main source of variability of SSW is the one induced by policy changes over time that affect benefits. Since however our data fall between two pension reforms, we opt for the second solution that is to control directly for a proxy for "tastes for work" in x_{it}. A good proxy should be sufficiently correlated with tastes for work such that once it is included, SSW is no more correlated with the unobserved effect[42]. If one looks at the way how SSW is constructed, the obvious input in SSW that might be correlated with unobserved tastes for work is average lifetime wages as suggested by Coile-Grüber(2000), Grüber-Wise(2004) and Spataro(2002). They include average lifetime wages directly in the equation in order to capture unobserved taste for work and allow average lifetime wages to be time-varying in order to allow for upward wage increases. A little bit different is the notion of "permanent income" of Diamond-Hausman(1984) that we used: a time-constant concept of average lifetime wages based on effectively worked periods where they "excluded from the averaging procedure years when the individual reported himself as retired, out of the labor force for much of the year or working only part time"(p.84).

4.3 Estimation results.

The estimated[43] coefficients with standard errors in parenthesis (and marginal effects in **bold**) in parentheses are in table 3.

[41] Schils(2006) uses on the basis of survey data a variable "wants a reduction in working hours" as a proxy for the impact of individual preferences for working
[42] See Wooldridge(2002) p.63-65.
[43] The model is estimated in SAS 9.2. by the procedure "glimmix" that models unordered dependent variables of a multinomial logit model and produces standard errors and test statistics that allow for dependence among repeated observations at the level of the individual.

Table 3: Discrete time competing risk model			
	Unemployment	**Early retirement**	**Old-age pension**
Intercept	29.705* (12.41)	-78.048** (10.41)	46,677** (8.70)
SSW (/1000)	0.00067** (0.00002) **-0.03**	0.000263** (0.00002) **-0.026**	-0.00012** (0.00003) **-0.07**
accrual (/1000)	-0.00006 (0.47) **0.002**	0.000124** (0.00002) **-0.0001**	-0.00016** (0.00006) **0.006**
Duration of career	-0.037** (0.005)	0.0167** (0.005)	0.0134* (0.005)
Average lifecycle wages(/1000)	-0.0023** (0.0002)	-0.0011** (0.0001)	-0.00045** (0.00015)
Age	-1.223** (0.44)	2.490** (0.36)	-2.005** (0.30)
Age^2	0.0107** (0.003)	-0.021** (0.003)	0.0197** (0.002)
Age difference partner	0.0046 (0.009)	-0.001 (0.007)	-0.0099 (0.009)
Education level of the individual			
Low secondary general	-0.216* (0.09)	-0.051 (0.08)	-0.067 (0.11)
Low secondary tech/professional	-0.276* (0.12)	-0.094 (0.09)	0.067 (0.13)
High secondary general	-0.238* (0.14)	-0.230 (0.12)	-0.149 (0.14)
High secondary technical	-0.342** (0.15)	-0.182 (0.11)	-0.164 (0.161)
High secondary professional	-0.221 (0.19)	-0.240 (0.16)	-0.161 (0.19)
High school 3 years	-0.665 (0.73)	-0.355 (0.62)	0.081 (0.45)
High school(5 years) or university	-0.554** (0.19)	-0.211 (0.15)	-0.227 (0.17)
Professional training	0.029 (0.20	-0.127 (0.17)	-0.292 (0.18)
Sector of activity of the individual			
Energy and chemical sector	-0.003 (0.23)	0.430* (0.17)	0.190 (0.18)
Mechanics and electronics	0.482* (0.20)	0.542** (0.16)	0.075 (0.17)
Construction	0.790** (0.22)	0.174 (0.18)	-0.059 (0.21)

Horeca	0.515** (0.21)	0.277 (0.17)	0.128 (0.165)
Transport and communication	0.450 (0.25)	-0.251 (0.22)	0.465* (0.21)
Banking, insurance and consultancy	0.246 (0.17)	-0.170 (0.19)	0.246 (0.17)
International organisation, public administration	0.450 (0.30)	0.261 (0.26)	0.067 (0.27)
Social and cultural sector	0.408 (0.23)	-0.103 (0.22)	0.161 (0.19)
Other sectors	0.651** (0.21)	0.128 (0.18)	0.117 (0.18)
Region			
Brussels	0.0299 (0.13)	-0.261* (0.12)	-0.097 (0.12)
Wallonia	0.037 (0.08)	-0.039 (0.06)	-0.018 (0.086)
Blue-collar	0.332** (0.10)	0.484** (0.08)	0.0114 (0.099)
Log(occupational pension benefits)	0.024 (0.023)	0.235** (0.009)	0.273** (0.009)
Female	-0.566** (0.11)	-0.465** (0.10)	0.711** (0.11)
Number of disabled	-0.045 (0.13)	0.030 (0.11)	0.421** (0.12)
Number of children	-0.041 (0.05)	-0.037 (0.04)	0.007 (0.06)
Member private voluntary savings plan	-0.184** (0.08)	-0.015 (0.06)	-0.103 (0.08)
Housing wealth(/1000)	0.00022 (0.0004)	-0.0001 (0.0004)	-0.00000 (0.0004)
Year dummies			
1991	-0.146 (0.19)	0.145 (0.18)	-0.147 (0.20)
1992	-0.050 (0.17)	0.609** (0.16)	0.023 (0.19)
1993	0.218 (0.16)	0.742** (0.16)	0.185 (0.18)
1994	0.221 (0.16)	0.707** (0.16)	0.407** (0.17)
1995	0.584** (0.16)	0.954** (0.15)	0.348* (0.18)
1996	1.314** (0.15)	1.118** (0.15)	0.791** (0.175)
Goodness of fit			
Likelihood ratio: 8802 (p-value < 0.001) Score test: 11690 (p-value < 0.001) Pseudo R^2: 0.480			

** denotes significance at 1% level, *denotes significance at 5% level; reference person is white collar men, in 1990, in the education/health/R&D sector, living in Flanders, with primary education, no member of private savings plan, without children, without disabled; number of observations: 23972

It was explained that the level of SSW can be interpreted as an income effect on labour supply while the adjustment of pension benefits for every year of delayed retirement can be interpreted as a substitution effect. If the estimated coefficient of SSW is positive, as for unemployment and early retirement, this suggests that the income effect is positive. If the estimated coefficient of accrual is negative, as for old-age retirement and unemployment, this suggests a negative substitution effect. The incentive measures have a significant impact on the probability of retirement for all pathways, except the accrual for unemployment[44]. This may signal that unemployment might be driven by other factors than retirement incentives.

The unexpected sign of the accrual in the early retirement path may be the result of measurement errors[45] since early retirement pension rights at the firm level could not be calculated. We tested whether the coefficient of accrual in the early retirement path would change if one excludes the sectors of activity from the explanatory variables since these may absorb some eligibility rules but this had no effect. In a second place, the unexpected negative sign of SSW in old-age retirement may be due to differential selection: individuals that like to work remain longer in the sample than individuals that do not like to work. The sample may be over time more and more composed of individuals that like to work long. We were unable to make the model converge while correcting for this sorting effect. However we controlled for the fact that people with greater preferences for work may work harder and had higher levels of SSW by including a proxy for work preferences. Higher average lifecycle wages tend to decrease the

[44] Schnabel(2003) finds similarly that option value is insignificant in the transition from employment to unemployment while is it significant in the transition from employment to old-age retirement. He did not include SSW. Mitchell-Phillips(2000) and Antolin-Scarpetta(1998) only included SSW that has a positive significant effect on all retirement pathways. In another model, Antolin-Scarpetta(1998) included only option value that has a significant negative effect on all retirement pathways.

[45] Euwals-Vuuren-Wolthoff(2006) have the same problem: "Measurement error may occur if the dataset does not allow to observe the exact early retirement and pension rights. In particular for the construction of the financial variables we need to make assumptions"(p.23). Eklof-Hallberg(2006) have a similar problem. Also Grüber-Wise(2004) find that the estimated effect of SSW is in several of the 11 OECD countries of the wrong sign.

probability of retirement in general. If we control for average lifetime wages, the estimated coefficient on SSW turns more positive.

In general if one wants to calculate marginal effects in a multinomial logit model, one follows the approach of Wooldridge(2002) and calculates them as follows, for continuous x_k:

$\frac{\partial P(y_{it}=j|x_{it})}{\partial x_k} = P(y_{it}=j|x_{it})\left\{\beta^{jk} - \left[\sum_{h=1}^{J}\beta^{hk}\exp(\beta_0^h+\beta^h x_{it}+\theta_d^h)\right]/g(x_{it})\right\}$ with β^{hk} the kth element of the vector β^h and $g(x_{it})=1+\sum_{h=1}^{J}\exp(\beta_0^h+\beta^h x_{it}+\theta_d^h)$. The direction of the effect is not determined entirely by the sign of β^{jk} because of, as Bloemen(2006) notes, the competing risk nature of the model:" In the extreme case, the total effect of an explanatory variable may be opposite to the sign of its coefficient. If the impact of a variable on the probability of job exit into retirement, measured by its coefficient is positive, but there is also a very strong impact of this same variable on the probability of job exit into unemployment the sign of the eventual effect of the job exit probability may even reverse"[46]. Bloemen(2006) calculates the marginal effect at different ages in a multinomial logit model and finds that the sign is opposite when it is calculated at the age of 52 (what is the mean age in his sample) rather than 60. This raises questions about the usefulness of calculating marginal effects in this kind of models in this way, given that the only reason to calculate marginal effects is to ease interpretation. As confirmed by Euwals-Vanvuuren-Wolthoff(2006), "probit regressions per age allow for a different impact of the financial incentives at different ages. In our hazard model, we restrict the impact of a given financial incentive to be the same over different early retirement ages.[47]" In order to avoid a marginal effect of which not only the magnitude but also the sign depends on age, we prefer the approach of Euwals-Vanvuuren-Wolthoff(2006) who calculate in a discrete time hazard model the effect of a change in the explanatory variable on the expected retirement age. An increase of SSW with 10.000euro leads to a decrease of expected old-age retirement age with 0.07 years. An increase with accrual

[46] P.16.
[47] P.16.

with 1000 euro leads to an increase of the expected old-age retirement age of 0.006 years. These are small magnitudes what may be due to the substitutability of retirement pathways: if all pathways become less attractive or all pathways become more attractive, there is not necessary a reason to switch to a different pathway. Things will be different if only the attractiveness of one pathway will be modified, what will be the explicit subject of 4.4. In addition, it is not clear whether calculating marginal effects for retirement incentives makes sense in this context since it is difficult to assume that the ceteris paribus condition when calculating marginal effects is satisfied: by definition, if the accrual (respectively SSW) changes, the ceteris paribus condition that everything else remains constant cannot be satisfied because SSW (respectively accrual) changes at the same time. To get an idea of total impact of a change in retirement incentives one should compare predicted exit rates before and after a reform in incentives, as we do in the next section.

The variable age has a strong effect on retirement probability: it suggests a concave relationship in the unemployment path and a convex form in the old-age and early retirement path. A legitimate question is whether the impact of SSW and accrual will disappear if we allow for a more flexible specification of age and use age dummies instead of a linear age trend. We also estimated the model with age dummies but instead of a quadratic age trend. By comparing the results, one can note the incentive variables barely change. This shows that the results are robust to the specification of the age variable.

Being blue-collar strongly increases the probability of leaving the labour market through early retirement and unemployment[48] but is not significant for those who retire through the old-age pension system. Working in particular sectors (mechanics, electronics and metallurgy) is also very significant in explaining early retirement and unemployment (construction, horeca, transport, other sectors) but is far from significant for explaining entry in the old-age pension. This suggests that early retirement and unemployment may

[48]Antolin-Scarpetta(1998) finds the same result for Germany. Schnabel(2003) found for Germany that the disincentives created by the welfare system led to more unemployment of unskilled older workers.

be related to labour market developments at the demand side such as permanent lower labour demand for blue collar workers, employed in physically demanding jobs. We also experimented with variables that cross sector dummies with year dummies to detect possible business cycle effects that could be sector-specific. In the energy, chemical, mechanic and "other" sectors there is a significant upward trend of early retirement and unemployment over time. The fit in terms of log-likelihood and R^2 was slightly worse than the current version and in order to save space (of 56 dummies) we kept the current version. The year dummies, controlling for business cycles, show a significant positive trend of retirement.

Women are less likely to retire through unemployment or early retirement schemes and are more likely to retire through old-age pension as already suggested by the descriptive statistics in table 2. An explanation may be that the normal retirement age in the old-age pension system is 60 for women while 65 for men in the period under study[49]. This would also mean that the gender dummy reflects differences in the incentives structure for men and women instead of a pure gender effect. Having dependants reduces the probability of unemployment or early retirement, possibly because of the higher income needs of such a household that are better met by continuing to work[50].

Higher educated individuals (with a university or high school degree) are significantly less likely to exit the labour market through unemployment. Individuals with high human capital investment appear "insured" against unemployment[51]. The withdrawal of occupational pension benefits is clearly associated with the decision to retire in the old-age pension system while it is, as expected, insignificant for those who become unemployed[52]. Similarly, those who participate in a subsidized private saving plan are

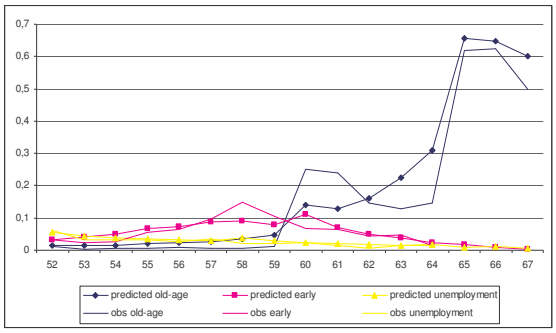
[49] In the same line, Antolin-Scarpetta(1998) find hat in Germany women then to move more into early retirement than men because of "the early retirement arrangements allowed (before the 1992 reform) women to go on early retirement before men"p.17)
[50] Schils(2006) finds for the UK and the Netherlands the same results. Bloemen(2006) finds also for the Netherlands that the absence of children advances the retirement decision. Lindeboom(1998) found however no significant effect of the impact of being women and/or having dependants.
[51] Antolin-Scarpetta(1998) and Dahl-Nilson-Vaage(2002) find the same results.
[52] Schnabel(2003) finds similar results for Germany.

significantly less probable to leave the labour market through unemployment[53]. This suggests that these plans are confined to higher income individuals.

Concerning regional effects, table 2 showed that the proportion of elderly Flemish that are early retired and unemployed is higher than the weight of Flanders in the elderly population. Regional effects become however spurious after controlling for incentives and individual characteristics. Finally, the age difference with the partner was also insignificant.

The goodness of fit tests all strongly reject the null hypothesis that all explanatory variables are zero. Another way to test whether the model fits well is to plot the predicted and observed exit rates by age. The fit seems rather good except that the peak in early retirement at 58 and old-age retirement at 60 is underestimated.

Figure 12: predicted and observed exit rates by age



4.4 Simulating responses to a cut in early retirement benefits

To get an idea how retirement patterns might change in response to changes in the generosity of early retirement schemes, we simulate the effect of a reduction of early retirement benefits to the amount of unemployment benefits. This involves calculating:

$$\hat{P}(y_{it} = j | x'_{it}) = \frac{\exp(\hat{\beta}_0^j + \hat{\beta}^j x'_{it} + \hat{\theta}_d^j)}{1 + \sum_{h=1}^{J} \exp(\hat{\beta}_0^h + \hat{\beta}^h x'_{it} + \hat{\theta}_d^h)}$$

[53] Bloemen(2006) finds that "participation in individual pension schemes does not seem to affect the job exit rate by any route".

where the retirement incentives (SSW and accrual) of *only* the early retirement pathway are replaced by those under the reformed system and we use the parameter estimates β^j, β_0^j and θ_d^j saved from the model in 4.3. Thus only the early retirement wealth and accrual change, while the wealth and accrual of unemployment and old-age retirement path remain unchanged. Table 4 shows that the cut of early retirement benefits leads to a strong increase of the exit rates into unemployment between 52 and 57 and to a very small increase of the exit rates into old-age pension between the ages 57 and 63[54]. For the ages 58-60 both exit to unemployment and early retirement is lower and old-age exit remains almost unchanged what suggests that individuals work longer.

Table 4: The impact of an early retirement benefit cut on exit rates

age	Old-age pension	Early retirement	Unemployment	Old-age pension	Early retirement	Unemployment
	Before reform			After reform		
52	0.014	0.031	0.056	0.012	0.036	0.083
53	0.015	0.039	0.043	0.013	0.045	0.067
54	0.016	0.050	0.037	0.014	0.060	0.059
55	0.020	0.065	0.034	0.018	0.072	0.050
56	0.022	0.073	0.030	0.021	0.080	0.042
57	0.026	0.086	0.029	0.027	0.087	0.037
58	0.034	0.091	0.037	0.036	0.087	0.0030
59	0.046	0.077	0.028	0.047	0.075	0.025
60	0.140	0.110	0.022	0.141	0.107	0.020
61	0.128	0.069	0.020	0.129	0.068	0.019
62	0.160	0.048	0.017	0.160	0.048	0.017
63	0.225	0.037	0.015	0.226	0.037	0.015
64	0.307	0.024	0.016	0.307	0.024	0.016

[54] Mitchell-Phillips(2000) found on the basis of a similar exercise that the elimination of early retirement benefits in the U.S.(between age 62-65) would boost the probability of normal retirement (at age 65) by twice as much as the probability of disability retirement. Antolin-Scarpetta(1998) simulated a reform of the German early retirement and old-age pension system and predict that making this system actuarially fair at the margin(by adjusting benefits with around 6-8% for each age of retirement deviating from the normal retirement age of 65) would increase the average age of retirement of men with almost one year. They use however the estimates to old-age pension while keeping constant job exit into alternative exit routes; However, in a competing risk model, the total effect on old-age retirement depends also on the probability to exit through other pathways.

65	0.657	0.018	0.008	0.657	0.018	0.008
66	0.646	0.007	0.012	0.646	0.007	0.012
67	0.599	0.002	0.007	0.599	0.002	0.007
68	0.851	0.000	0.004	0.851	0.000	0.004
69	0.870	0.000	0.001	0.870	0.000	0.001
70	0.931	0.000	0.000	0.931	0.000	0.000

The decrease in the exit rates into early retirement with 1% point may seem small compared to the strong increases of the exit rates into unemployment. This has to do with the fact that the total number of individuals that initially choose early retirement is much higher than the total number of individuals that initially ended up as unemployed[55].

4.5 Who moves where?

In order to assess what socio-economic characteristics explain that an individual moves towards unemployment rather than the old-age pension system, the change in the predicted probability of unemployment and of old-age retirement before and after the reform is regressed on socio-economic characteristics such as education level, sector of activity, blue-collar versus white-collar worker, age…. The dependent variable takes the following form:

$$\hat{P}(y_{it}=2\left|x_{it}^{'}\right.)-\hat{P}(y_{it}=2\left|x_{it}\right.)=\frac{\exp(\hat{\beta}^{2}x_{it}^{'})}{1+\sum_{h=1}^{J}\exp(\hat{\beta}^{h}x_{it}^{'})}-\frac{\exp(\hat{\beta}^{2}x_{it})}{1+\sum_{h=1}^{J}\exp(\hat{\beta}^{h}x_{it})}$$

$$\hat{P}(y_{it}=0\left|x_{it}^{'}\right.)-\hat{P}(y_{it}=0\left|x_{it}\right.)=\frac{\exp(\hat{\beta}^{0}x_{it}^{'})}{1+\sum_{h=1}^{J}\exp(\hat{\beta}^{h}x_{it}^{'})}-\frac{\exp(\hat{\beta}^{0}x_{it})}{1+\sum_{h=1}^{J}\exp(\hat{\beta}^{h}x_{it})}$$

Where j=0 denotes old-age retirement and j=2 unemployment. The results of this simple OLS-regression are presented in table 5 with standard errors in parenthesis.

Table 5: Who moves into unemployment and into old-age pension?		
Explanatory variables	**Unemployment**	**Old-age pension**
Intercept	1.144**	-0.042**

[55] Note also that in the age range below 55 exit rates into early retirement increase: this is because we put early pension rights equal to zero until age 55 due to lack of data on restructuring firms while unemployment rights are positive before age 55.

	(0.077)	(0.01)
Blue-collar	0.010** (0.0007)	-0.00058** (0.0001)
Sector of activity of the individual		
Energy and chemical sector	0.009** (0.003)	0.0014* (0.0007)
Mechanics and electronics	0.020** (0.003)	0.0007 (0.0007)
Construction	0.0167** (0.003)	0.0011 (0.0007)
Horeca	0.013** (0.003)	0.00048 (0.0001)
Transport and communication	0.002 (0.003)	0.0016 (0.0007)
Banking, insurance and consultancy	0.0087* (0.003)	0.0014* (0.0007)
International organisation, public administration	0.0128** (0.003)	0.0010 (0.0007)
Education, R&D, health sector	0.0087** (0.003)	0.0008 (0.0007)
Social and cultural sector	0.0069* (0.003)	0.001 (0.0007)
Other sectors	0.0125** (0.003)	0.0007 (0.0007)
Education[56]level of the individual		
Low Secondary school	0.00005 (0.0007)	-0.00006 (0.0001)
High Secondary school	-0.0019* (0.0008)	-0.00000 (0.0001)
High school (3 years)	-0.001 (0.001)	0.00037 (0.0002)
High school (5years) or university	-0.00268** (0.01)	0.00018 (0.0002)
Female	-0.0074** (0.0007)	0.00005* (0.0001)
Walloon	0.031** (0.0006)	-0.00015 (0.0001)
Brussels	-0.0004 (0.001)	-0.000197 (0.0002)
1991	-0.0044* (0.001)	0.0005* (0.0002)
1992	-0.008** (0.001)	0.00029 (0.0002)
1993	-0.009** (0.001)	0.0006** (0.0002)
1994	-0.016** (0.001)	0.00096** (0.0002)
1995	-0.018** (0.001)	0.00075** (0.0002)
1996	-0.022 (0.001)	0.00158** (0.0002)

[56] The nine education levels were grouped into smaller classes to get more significant results.

Age	-0.037** (0.002)	0.0007 (0.0005)
Member second pillar	-0.0088** (0.001)	0.008** (0.0002)
Member third pillar	-0.00219** (0.0006)	0.00027** (0.0001)
Goodness-of-fit statistics		
	R^2=0.122 R^2adjusted=0.121 F-value: 104,63 (P<0.0001)	R^2=0.05 R^2adjusted:0.0475 F-value: 38.37 (P<0.0001)
* denotes significance at 5%, ** denotes significance at 1%; reference individual is a white-collar men, in R&D/teaching/health sector, with primary education level, living in Flanders, no member of private savings plan, no member of second pillar; Number of observations: 23972.		

The most striking result is that blue-collar workers are significantly more likely to move to unemployment in response to a cut in early retirement benefits and less likely to work longer and to retire through the old-age pension system. This is in particular true for the individuals that were active in traditional industries like energy, chemical, mechanical and construction sector. This is not surprising since these are typically the sectors that may be physically demanding. As expected, individuals with a high education level (university or high school) and individuals that are able to participate in a subsidized private savings plan and occupational pension scheme are significantly less likely to move towards the unemployment system.

5 Concluding remarks

A discrete-time competing risk model was estimated that allows for transitions from employees towards unemployment, early and old-age retirement while controlling for forward-looking retirement incentive measures. Early retirement and unemployment are significantly related to being blue collar and working in specific sectors. On the other hand, the highly educated, white-collar workers with high average lifecycle wages, that are saving in an occupational pension or private saving plan are more likely to retire through the old-age pension system.

Work disincentives inherent in all retirement pathways under consideration have large and significant impacts on retirement behaviour. The significant impact of retirement

incentives suggest that reforms of the system can play a role in response to the financial crises that the pension system is confronted with. However, alternative exit routes should be taken into account, since changes in the regulation of one exit route affect the transition towards other exit routes. Results appear however to be affected by measurement errors in the incentive structure of the early retirement schemes and the inability to correct fully for a sorting effect in the exit behaviour.

In particular, the model predicted that a cut of early retirement benefits leads to a strong increase of unemployment between the ages 52 and 57 and a very small increase of the exit rates to old-age retirement between the ages 57 and 63. We found that those who initially had chosen the early retirement path, in particular the blue-collars, would in response to a reduction in the benefits of the early retirement scheme be more likely to move towards unemployment. This is not surprising since these are typically the sectors that may be physically demanding. As expected, white-collar workers with a high education level, able to participate in a private savings plan and occupational pension schemes are more likely to work longer and to retire through old-age retirement.

6 Appendix I: Institutional background

This section describes how old-age, unemployment and early retirement benefits are calculated. The Belgian old-age pension system consists of 4 schemes. Three schemes are organised on a contributory base: the private-sector employees, the civil servants and the self-employed. The fourth consists of means-tested benefits targeted at the poor elderly independently of whether these paid payroll taxes. The latter are available from the normal retirement age[57]. The old-age pension system of private-sector employees that is financed on a pay-as-you-go basis is described in 6.1., as far as it concerns the period 1991-1997 covered by our dataset. Aside from the old-age pension system, the Belgian government introduced for private-sector employees early retirement programs

[57] That is, until 1st July 1997, 65 for men and 60 for women. Since 1st July 1997, the age of eligibility for women gradually increased to 65 in 2009.

that either operate under the name of early retirement scheme (6.2.) or as elderly unemployment (6.3.)

6.1 Old-age pension system for private sector employees

The private sector employee scheme allows for flexible retirement between the ages 60 and 65[58] while it does not impose any actuarial adjustment of benefits on the choice of the retirement age. Nonetheless pension benefits increase by 1/45 for men and 1/40[59] for women as long as the employee has not reached a full career of 45 respectively 40 years.

The amount of pension benefits depends on the career and the level of wages obtained during each year of that career. The career sums the periods worked as private-sector employee and spent on replacement income (unemployment, illness, disability, early retirement schemes,…). Pension benefits are calculated for each year of the career on the basis of real wages or, for periods spent on replacement income, fictive wages. The latter is a fixed amount for periods during 1955-1967. Since 1967 fictive wages are based on the real wages in the last year of activity.

Wages above a price-indexed ceiling (44.994euro in 2007) are not taken into account for the calculation of pension benefits. This ceiling corresponds to the 85th percentile income in our pooled dataset. Wages are for each year of the career price-indexed and since 1973 to the evolution of wages between the year of the career and the year of retirement.[60] From the moment the pension has been taken up, benefits are only adjusted to price inflation.

---

[58] Before 1st January 1991, the normal retirement age is fixed at 65 for men and 60 for women and retirement could be advanced by maximum 5 years at the cost of a reduction of benefits with 5% for each year of anticipation before the normal retirement age. Since 16 July 1986(Royal Decree 415) it was not allowed anymore for women to retire in the old-age system before 60. Since 1st January 1991, the actuarial adjustment of benefits is abolished. Since 1st July 1997, flexible retirement before the normal retirement age is conditional on a career of 20 years. The required number of years of the career gradually increased to 35 in 2005.

[59] Women are since 1st July 1997 in a transitory regime that increases the full career from 40 tot 45 years and the normal retirement age from 60 to 65 by the year 2009.

[60] The adjustment to general wages gradually disappeared for pensions taken up after 1st July 1997.

Benefits are thus computed according to the following formula:

$$\sum_{n=N-C}^{\min(N,N-C+,Z)} \frac{1}{Z} * k * \min(w_n^{\max}, w_n) * \frac{I_N}{I_n}$$

Where n denotes a year during the career, Z the number of years of a complete career, N the year corresponding to the take up of the pension, C the number of years of the career, I_n the price or revaluation index corresponding to n, $w_n^{\max}$ the wage ceiling corresponding to n, w_n real or fictive wages corresponding to n and k is a replacement rate equal to 75% or 60% depending on whether the beneficiary is married or single. Only married individuals of whom the partner does not receive any labour or replacement income are entitled to the 75% rate. The widow(er) obtains a survival benefit equal to 80% of the pension benefit of the former husband or spouse, calculated at the 75% rate. Note that while the age of eligibility for old-age benefits is 60 that survivor benefits are available from the age of 45 on.

In addition, when the career is complete, the pension benefit cannot be inferior to a price-indexed minimum amount. If the career is not complete but at least equal to two third of a complete career, the same amount but proportional to the length of the career is guaranteed.

Old-age pension benefits are subject to a health insurance tax of 3.55% and a solidarity tax between 0.5 and 2% depending on income[61] and the income tax. Old-age pensions are also subject to an earnings test. For earnings above a limit, pension entitlement is fully suspended. The earnings limit is higher after age 65 and higher for survivor beneficiaries. The effective income tax rate on retired people is generally very low due to income splitting, tax allowances in function of household composition and income related tax deductions for replacement incomes.

6.2 Early retirement schemes

[61] Since 1st January 1995.

Conventional[62] early retirement schemes apply to private-sector employees that are laid off by their employer, eligible for unemployment benefits and covered by a collective agreement at the national, sector or firm level. The collective agreement at the national level allows for early retirement at the age of 60 after a career of 20 years(less a period on replacement income of maximum 3 years). Agreements at the level of the sector allow in many cases in addition early retirement at the age of 58 after a career of 25 years(less a period on replacement income of maximum 3 years). Some sectors such as metallurgic, glass and textile industry allow for early retirement at the age of 55 after a career of 38 years(less a period on replacement income of maximum 13 years). The chemical and construction sector and sectors with nightshifts allow for early retirement at the age of 56 after a career of 33 years (less a period on replacement income of maximum 8 years). Finally restructuring firms allow early retirement at 52 after a career of 20 years(less a period on replacement income of maximum 3 years).

Early retirement benefits are composed of generous unemployment benefits (60% of last wages) supplemented by an allocation financed by the employer. The employer finances at least the difference between 50% of reference wages and the unemployment benefit. Some sectors, such as the insurance, banking and petroleum industry, guarantee the employee 85 to 95% of his reference wage. Reference wages are defined as last gross wages up to a price-indexed wage ceiling minus employee payroll taxes. The ceiling (3.325euro per month at 1-1-2008) becomes binding in our pooled dataset from the 75th income percentile on.

One particularity is that once male employees enter early retirement they stay in this scheme until the normal retirement age 65 at which they switch automatically to the old-age pension system. For women, this is at 60. During the period in which they enjoy early retirement benefits, they do not pay payroll taxes anymore (except a tax of 3.5%

[62] Aside conventional early retirement schemes another kind of scheme emerged “Canada Dry” pensions referring to a drink that looks like beer but is no beer. We had to neglect Canada Dry arrangements that are non-official arrangements and thus absent from the federal office of employment statistics, by which the employer lays off the employee in compensation for a lump-sum or annuity payment on behalf of the employer. Officially this payment does not correspond to a pension entitlement (and thus the employer escapes payroll taxes due on conventional benefits) although it looks like one.

and a tax of 3% for social security) but continue to accumulate pension entitlements in the old-age pension system as if they continued working at their last wage. The early retired are exempted from job search.

6.3 Unemployment benefits for elderly

Eligibility for unemployment benefits requires, for individuals older than 50, a working career of 624 days in the 3 years preceding the claiming of unemployment benefits. Conditional on eligibility, unemployment benefits are calculated as:
-40% of last wages for married individuals without dependants
-50% of last wages for singles without dependants
-60% of last wages for married individuals and for singles with dependants.

Conditional on a career of 20 years, replacement rates are increased respectively to 45% for singles and 55% for married without dependants when beneficiaries are 50, to 50% and 60% when they are 55 and to 55% and 65% when they are 58. Unemployed older than 58 and unemployed older than 50 with a career of 38 years are exempted from job search.

Last wages are taken into account up to a price-indexed wage ceiling(1.832euro per month at 1-1-2008) that becomes binding in our pooled dataset from the 35th income percentile.

7 Bibliography

Antolin, P.-Scarpetta, S.(1998), "Microeconometric analysis of the retirement decision: Germany", Economics Department Working Papers 204, OECD, Paris.

Aubert , P.(2003), "Salaire, productivité et demande de travailleurs ages", INSEE.

Bhattacharya, J.-Mulligan, C.-Reed, R.(2001), "Labor market search and optimal retirement policy", NBER Working Paper 8591, NBER.

Bonsang, E.- Perelman, S. - Delhausse, B.(2002), "Les conditions de vie des prépensionnés", CREPP Working Papers 0211, University of Liège.

Bloemen, H.(2006), "The impact of wealth on job exit rates of elderly workers", IZA Discussion papers 2247, IZA, Bonn.

Bloemen, H.(2008), "Private Wealth and Job Exit at Older Age: A Random Effects Model", IZA Discussion Papers 3386, IZA, Bonn.

Boldrin, M.-Dolado,J.-Jimeno,J.-Perachhi,F.(1999), "The future of pensions in Europe, *Economic Policy*, 289-320.

Borsch-Supan, A.(2000), "Incentive effects of social security on labor force participation: evidence in Germany and across Europe", *Journal of Public Economics* 78, 25-49.

Coile, C.-Grüber, J.(2000), "Social security and retirement", NBER Working Paper 7830, NBER.

Coile, C.-Diamond,P.-Gruber, J.-Jousten, A.(1999), "Delays in claiming social security benefits", *Journal of Public Economics* 84(3), 357-385.

Crepon, B.- Deniau, N.- Duarte, S.(2003), "Wages ,productivity and workers characteristics: a French perspective", CREST Working paper 2003-04.

Dahl, S.-Nilson, O.-Vaage, K.(2002), "Gender differences in early retirement behaviour", Department of Economics, University of Bergen.

Diamond, P. – Hausman, J. (1984), "Individual retirement and savings behaviour", *Journal of Public Economics* 23(1-2), 81-114.

Dorn, D.-Souza, A.(2005), "Early retirement: free choice or forced decision?", CESifo Working paper 1542.

Eklof, M.-Hallberg, D.(2006), "Estimating retirement behaviour with special early retirement offers", Department of Economics Discussion Paper, Uppsala University.

Elchardus, M.-Cohen(2003), "Attitude et attentes en rapport avec la fin de la carrière professionelle", TOR Group, Free University Brussels.

Euwals, R.-vanVuuren, D.-Wolthoff, R.(2006) "Early retirement behaviour in the Netherlands", Tinbergen Institute Discussion paper 021/3.

Feldstein, M.(1974), "Social security, induced retirement and aggregate capital accumulation." *Journal of Political Economy* 82(5), 905-926.

Grüber, J.-Wise, D.(eds.)(1999), *Social security and retirement around the world*, University of Chicago press, Chicago.

Grüber, J.-Wise, D.(eds.)(2004), *Social security programs and retirement around the world: micro-estimation,* University of Chicago Press, Chicago.

Hakola, T.(2002), "Economic incentives and labor market transitions of the finnish workforce", Academic dissertation, Upsula University.

Jenkins, S.(2005), *Survival analysis*, ISER, University of Essex.

Jousten, A.-Perelman, S.-Desmet, R. (2005), "The benefits of separating early retirees from the unemployed: simulation results for belgian wage earners", CEPR Discussion Paper 5077, CEPR.

Jousten, A. – Lefebvre, M. – Perelman, S.- Pestieau, P.(2008), “The effects of youth unemployment on early retirement », Working Paper 08/30, IMF.

Krueger, A.-Pischke, A.(1992), "The Effect of Social Security on Labor Supply: A Cohort Analysis of the Notch Generation," *Journal of Labor Economics* 10(4), 412-37.

Lancaster, T. (1990), *The econometric analysis of transition data*, Econometric Society Monographs, Cambridge University Press.

Lazear, E. (1986) "Incentive Contracts," NBER Working Paper 1917, NBER.

“Les allocataires à charge de l’ONEM depuis 5 ans et plus-De uitkeringsgerechtigden ten laste van de RVA gedurende 5 jaar en meer”(2002), ONEM-RVA, Brussels.

Lindeboom, M.(1998), “Microeconometric analysis of the retirement decision: the Netherlands”, Economics Department Papers 207, OECD, Paris.

Meghir, C.-Whitehouse, E.(1997), “Labour market transitions and retirement of men in the UK”, *Journal of econometrics* 79, 327-54.

Miniaci, R.-Stancanelli, E.(1998), “Microeconometric analysis of the retirement decision: United Kingdom”, Economics Department Working Papers 206, OECD, Paris.

Mitchell, O.-Phillips, J.(2000), “Retirement responses to early social security benefits reduction”, NBER Working Paper 7963, NBER.

Paolini, D.(2002) “Demande de travail et âge de la retraite », CREPP Working Paper 0213, University of Liège.

Parsons, D. (1982) “The Male Labour Force Participation Decision: Health, Reported Health and Economic Incentives.” *Economica* 49, 81-93.

Quinn, J.-Burkhauser, R.-Cahill, K.-Weathers, R.(1998), "Microeconometric analysis of the retirement decision: United States", Economics Department Working Papers 203, OECD, Paris.

Ranzani, M.(2006), "Social Security and Labour Supply: the 1992 Reform as a Natural Experiment", Working Paper DEFAP, Catholic University, Milan .

Schils, T.(2006), "Early retirement in Germany, the Netherlands and the United Kingdom: a longitudinal analysis of individual factors and institutional regimes", Working Paper 44, University of Amsterdam.

Schnabel, R.(2003), "The joint effects of unemployment insurance and public pensions in Germany", Working paper, University of Essen.

Spataro, L.(2002), "New tools in micromodelling retirement decisions: overview and applications to the Italian case", CERP Working Paper 28, CERP.

Szinovacz, M.E.-Davey, A.(2005). "Predictors of Perceptions of Involuntary Retirement", *Gerontologist* 4, 36-47.

Tompa, E.(1999) , "Transitions to retirement: determinants of age of social security take up", Social and Economic Dimensions Ageing Population Research Papers 6.

Wahlberg, R.(2001), "Early retirement of older Swedish males", Working Paper, Goteborg University.

Wooldridge, J.(2002), *Econometric analysis of cross-section and panel data,* MIT Press, Cambridge.

Zaidi A., Makovec M., Fuchs M., Lipszyc B.,Lelkes O., Rummel M., Marin B., DeVos K.(2006), "Poverty of elderly people in EU-25", European Commission.

Département des Sciences Économiques
de l'Université catholique de Louvain
Institut de Recherches Économiques et Sociales

Place Montesquieu, 3
1348 Louvain-la-Neuve, Belgique

ISSN 1379-244X D/2008/3082/041