

Does the dismantlement of early retirement schemes increase unemployment? Evidence from Belgium.

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Abstract

Early retirement is often presented as a voluntary labour supply choice. Nonetheless, a lot of individuals perceive retirement as a forced decision. This paper tries to accommodate voluntary and involuntary labour supply decisions within one model. On the basis of administrative data, we estimate a competing risk model on transitions from Belgian private-sector employees into unemployment, early and old-age retirement while accounting for forward-looking retirement incentives. The estimates are used to simulate a cut in early retirement benefits. Although this could enhance the financial sustainability of the social security system, this may force people to retire involuntarily through elderly unemployment where they end up with a lower living standard. Alternatively, it could stimulate employees to work longer until they qualify for old-age pension benefits. The model predicts a strong increase of unemployment in particular among blue-collar workers in traditional industries. Members of private saving plans or occupational pension schemes and highly educated workers are predicted to move in the old-age system.

JEL: J26; C25; H55

Keywords: competing-risk; early retirement; involuntary retirement

1 Introduction

In most industrialized countries, population ageing puts pressure on the financial sustainability of their pay-as-you-go pension systems, in particular in Belgium. At the same time the Belgian government, confronted with structural reorganisations in the traditional industry in the 70s, designed generous early retirement schemes under the naïve assumption this would free jobs for the young unemployed. What empirical studies show instead is that these early retirement pathways did not have any impact on the unemployment of the young¹. What they do show is that one of the most important explanations for the decline of the effective retirement age is related to the design of the social security and pension systems themselves, thereby exacerbating the viability problem they face².

¹ Jousten-Lefebvre-Perelman-Pestieau(2008); Boldrin et al.(1999).

² Grüber-Wise (2004).

A frequent criticism of this explanation challenges however the assumption that individuals choose their retirement age voluntarily. According to a survey by Elchardus-Cohen(2003), more than 40(30)% of Belgian male(female) retire involuntarily. Dorn-Souza(2005) show that involuntary early retirement is widespread in European countries. 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. Unfortunately, due to lack of micro-data at the level of the firm that could be linked to individual retirement behaviour, few researchers examined the role of labour-demand in explaining early retirement. For the same reason, in this paper, unfortunately, we cannot model the labour demand side either.

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”³. A utility maximizing individual may rationally decide to quit work but nonetheless may perceive this type of retirement as “not by choice”. This means that the incentive literature may also contribute to explain involuntary retirement. Therefore 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 impact of these incentives on behaviour is allowed to be different for each of the various pathways. As a second aim of this paper, the estimates are used to simulate the impact of a cut in early retirement benefits. To the extent retirement is involuntary this may force people into unemployment where they end up with a lower living standard. Alternatively, cutting early retirement benefits stimulates employees to work longer until they qualify for old-age pension benefits.

³ p.1.

The paper starts with a presentation of the institutional background for Belgium in section 2, followed by a presentation of the micro-data in section 3. Section 4 measures the work disincentives specific to the old-age, early retirement and elderly unemployment pathways. After a survey of the relevant empirical literature in 5.1., 5.2.-5.3. estimates a discrete-time competing risk model while controlling for these work disincentives. The estimates are used to simulate in 5.4.-5.5. the impact of a cut of early retirement benefits.

2 Institutional background⁴

Aside from the old-age pension system (2.1.), the Belgian government introduced for private-sector employees early retirement programs that either operate under the name of early retirement scheme (2.2.) or elderly unemployment (2.3.)

2.1 Old-age pension system for private sector employees

This scheme allows for a flexible retirement age, that we will denote R , between the ages 60 and 65 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 $1/40$ for women as long as the employee has not reached a complete career, denoted Z , of 45 respectively 40 years.

As shown by the benefit formula below, the amount of pension benefits depends on the number of years of the career, denoted C , and the level of wages w_s obtained during each year s of that career (or for periods spent on replacement income wages in the last year of activity). The career sums the periods worked as private-sector employee and spent on replacement income (unemployment, disability, early retirement schemes,...). Wages above a price-indexed ceiling are not taken into account for the calculation of pension benefits. This ceiling, denoted w_s^{\max} , corresponds to the 85th percentile income in our dataset. Wages are for each year of the career indexed to evolution of prices and since

⁴ As far as it concerns the period 1991-1997 covered by our dataset.

1973 also of wages (with I_s a price or revaluation index corresponding to s). This gives the following formula:

$$\sum_{s=R-C}^{\min(R, R-C+, Z)} \frac{1}{Z} * k * W_s$$

with k 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. In addition there is, within the old-age pension scheme, a minimum pension p^{\min} ⁵.

2.2 Early retirement schemes

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 national agreement admits early retirement at the age of 60 after a career of 20 years. Sectoral agreements allow in addition early retirement at the age of 58 after a career of 25 years. Some sectors such as metallurgic, glass and textile industry allow early retirement at the age of 55 after a career of 38 years. The chemical and construction sector allow early retirement at the age of 56 after a career of 33 years. Finally restructuring firms allow early retirement at 52 after a career of 20 years.

Early retirement benefits actually consist of generous unemployment benefits (60% of last wages) that are in addition 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 becomes binding in our dataset from the 75th income percentile on.

⁵ This should be distinguished from the means-tested benefit assistance that is available for all citizens from the age of 65.

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 system. For women, this is at 60. During the period in which they enjoy early retirement benefits, they do not pay payroll taxes anymore but continue to accumulate entitlements in the old-age system as if they continued working at their last wage. The early retired are exempted from job search.

2.3 Elderly unemployment

Eligibility for unemployment requires, for individuals older than 50, a working career of 624 days in the 3 years preceding the claiming of unemployment benefits. Benefits are calculated as 40% (50%) of last wages for married individuals, respectively singles. Conditional on a career of 20 years, replacement rates increase to 45% (respectively 55%) when beneficiaries are 50 years old, to 50% (respectively 60%) when they are 55 years old and to 55% (respectively 65%) when they are 58 years old. Last wages are taken into account up to a price-indexed wage ceiling that becomes binding in our dataset from the 35th income percentile. During unemployment one does not pay payroll taxes anymore but continues to accumulate entitlements in the old-age system as if one continued working at the last wage. Unemployed older than 58 and unemployed older than 50 with a career of 38 years are exempted from job search.

3 Incentive variables and data construction

Let an individual at age t consider to retire at age R through pathway $j=1, \dots, J$. The present value of his entitlement to future pension benefits is:

$$SSW_{jt}(R) = \sum_{s=R}^T \pi(s|t) d^{s-t} P_{js}(R) - \sum_{s=t}^{R-1} \pi(s|t) \bar{d}^{s-t} \tau_j w_s$$

Where d^{s-t} denotes the discount factor with respect to time, $\pi(s|t)$ the conditional probability to survive until s , $P_{js}(R)$ the benefits given retirement at R through pathway j and τ_j 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, SSW captures an income effect on the retirement decision. If leisure is a normal good, an increase of SSW leads therefore to early retirement. The change in SSW due to the postponement of retirement with one⁶ year is called the wealth accrual:

$$AC_{jt} = SSW_{jt}(R+1) - SSW_{jt}(R)$$

and measures the financial gains or losses associated with an extra year of work. AC 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. If however AC is negative, leisure becomes relatively cheaper than consumption such that there is a substitution effect towards early retirement.

In order to analyse whether these incentives play a role in the retirement decision of private-sector employees, 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 National Institute of Statistics of Belgium⁷ randomly sampled 2.5% of Belgian households subject to the income tax with at least one member in the 50-64 age range in 1996. The resulting sample of 29.962 Belgian fiscal households (or 50541 individuals) was connected to the Income Tax Returns(=ITR) for the years 1990-1996 and to the Individual Pension Accounts(1956⁸-1996) by means of the national identification number.

The ITR contain all the information necessary to calculate the income tax such as household composition, age, gross labour and replacement incomes (unemployment, early retirement, disability, old-age benefits), housing wealth, occupational pension benefits, subsidized private savings,... of all household members. The ITR show in particular through what retirement path and at what age individuals retire. An individual

⁶ We also alternated the accrual with another incentive measure, the so-called peak value.

⁷The original dataset has been set up for an international NBER research project for the CREPP of the University of Liège. It is also presented in Grüber-Wise(2004).

⁸ This is the year in which the old-age pay-as-you-go pension system for private-sector employees was set up.

is attributed the labour market status (employed, old-age beneficiary, early retired, unemployed, other replacement income or inactive) from which he draws most of his income⁹.

The Individual Pension Accounts contain all the information necessary to calculate gross old-age pension rights of private sector employees such as the career and the wages for every year of the career. We 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% and adjusted¹⁰ by his survival probability.

Interestingly, the ITR and Individual Pension Accounts could be merged with the Census organized by the government in 1991 that has a response rate of 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, agriculture,...). In particular, the sector of activity refers to the NACE code of the corresponding employer what 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. Again, 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 survival probability. Measurement errors may however arise since we ignore agreements that are concluded at the level of the firm 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

⁹ In many countries, disability pension is an important opportunity for voluntary labour force withdrawal. In Belgium, this is not an issue at all for private-sector employees since disability benefits are equal to unemployment benefits and subject to rather advanced screening. We therefore do not account of a disability pathway. We will right-censor private-sector employees that are still working in the last year of the observation period or that end up as inactive or with disability benefits or with other replacement income.

¹⁰ On the basis of life expectancy tables.

account from the age of 55 on, while in our sample 23% of those that retire through early retirement schemes do so before 55.

Note that when calculating the stream of unemployment and early retirement benefits, we suppose that at the normal retirement age one switches to old-age benefits. Finally, as explained above, SSW allows us to derive the accrual. This forces us to make forward projections of wages: as in Grüber-Wise(2004), we assume real wage increases of 0%.

Of the dataset are only selected the individuals who were working in the first year of observation (=1991) as a private sector employee. This leads to a sample of 5831 individuals¹¹. In order to get an idea what kind of private-sector employees become unemployed, early retired or old-age pension beneficiary, table 1 describes the socio-economic profile of the 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 1: Descriptive statistics of the dataset (1990-1996)			
	Unemployed	Early retired	Old-age beneficiary
Number individuals that exit: 2419 (+3412 right-censored individuals)	537	1188	694
Average lifecycle wages(in euro) of the individual¹²			
90 th percentile	23.229	25.816	32.309
75 th percentile	17.873	21.226	26.551
50 th percentile	13.372	17.053	20.362
25 th percentile	10.809	14.306	13.679
Percentage of the career spent on replacement income by the individual¹³			
90 th percentile	0.35	0.21	0.19
50 th percentile	0.16	0.11	0.05
Distribution of education level			
Primary	0.30	0.25	0.20
Secondary	0.145	0.14	0.11
High school or university	0.03	0.030	0.10
Distribution of socio-economic status			
Blue-collar	0.70	0.66	0.33
White-collar	0.30	0.34	0.67
Distribution of marital status			
Single	0.22	0.15	0.22
Married	0.78	0.85	0.78
Distribution of gender			
Male	0.77	0.89	0.75

¹¹ Income data were converted into real data with year 2002 as reference year.

¹² Calculated over the career from 1956-1996.

¹³ Calculated over the career from 1956-1996.

Female	0.23	0.11	0.25
Distribution of sectoral activity			
Agriculture	0.007	0.002	0.01
Energy, chemical industry	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 plans¹⁴			
	0.13	0.18	0.18
individuals with contributions for subsidized private savings¹⁵			
	0.26	0.34	0.32
individuals receiving occupational benefits¹⁶			
	0.06	0.33	0.56

This table shows that for all income deciles the average lifecycle wages of the unemployed are lower than those of the early retired what is in general lower than old-age beneficiaries except that the 25% income decile of the early retired is higher than that of the old-age beneficiaries. Concerning the unemployed, 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 beneficiaries. 90% of the early retired are men. 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. It also means that although the old-age benefits may seem low, they are at least for high income white-collars frequently accompanied by occupational benefits or private savings.

4 Description of financial incentives to retire in Belgium

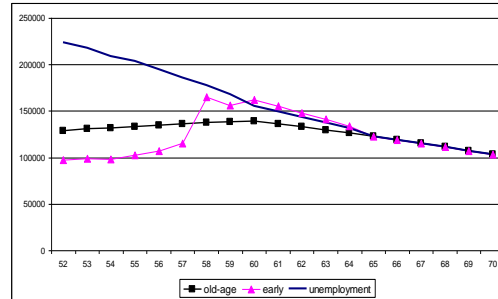
¹⁴ At least one contribution during the period 1990-1996.

¹⁵ At least one contribution during the period 1990-1996.

¹⁶ In at least one year in the period 1990-1996.

The dataset presented in the previous section allows to calculate and to describe in more detail the retirement incentives implicit in the Belgian early retirement, elderly unemployment and old-age pension system for private-sector employees¹⁷. Figure 1 shows for the 3 retirement pathways, mean SSW as a function of retirement age.

Figure 1: 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 vested benefits from 60 on while in the early retirement and unemployment system one cannot separate the claiming of benefits from effective retirement. In order to receive early retirement or unemployment benefits, one should effectively be laid off by the employer: vesting does not exist for unemployment or early retirement. This is the reason why before the main age of eligibility for early retirement, that is 58, old-age SSW is higher than early retirement SSW.

If mean unemployment wealth dominates mean early retirement wealth this is mainly because of different eligibility conditions. Eligibility for unemployment requires only 2 years of work while eligibility for early retirement imposes at least 20 years of work. If one would look at individual instead of mean wealth levels, one would see that from the moment one is eligible for early retirement, early retirement wealth is higher than unemployment wealth. The fact that early retirement wealth increases between 55 and 58 reflects that more individuals become eligible in that age range.

From the moment one is eligible for early retirement or unemployment, these seem to dominate old-age pension wealth. This is because in these schemes the “backloading”

¹⁷ Calculations are done on the 5831 individuals working as private-sector employees in 1991 before they have been matched with the ITR 1990-1996 in order to avoid that a descriptive analysis be affected by differential selection into the sample at each age.

effect can be quite important in case of wage increases at the end of the career since early retirement and unemployment benefits are a percentage of last wages, up to a ceiling. For old-age benefits, in case of a complete career, benefits are only 60 to 75% of lifecycle wages. In addition, as long as the career lasts fewer than 40 years for women and 45 for men, benefits are increased by 1/40 respectively 1/45. In the three channels, mean SSW increases until the age of eligibility to decrease thereafter. This is because an additional year of work after the age of eligibility implies fewer years over which benefits can be received. 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 in the calculation of old-age benefits unemployment and early retirement periods are assimilated or “upgraded” to worked periods. The reason why the lifecycle approach is thus particularly useful to measure financial incentives is because it captures the effect of unemployment and early retirement now on the amount of old-age benefits one will receive from the normal retirement age on..

The 90th percentile early retirement wealth peaks at age 56. This corresponds to the age of eligibility in particular sectors (construction, glass, textile, mechanics) after a career of 33 years. On the other hand, the 10th percentile SSW, that contains mainly employees with incomplete careers, in particular women, shows that, if 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 2: 90th percentile SSW by retirement age (in euro)

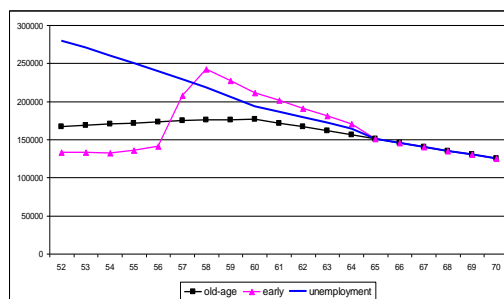
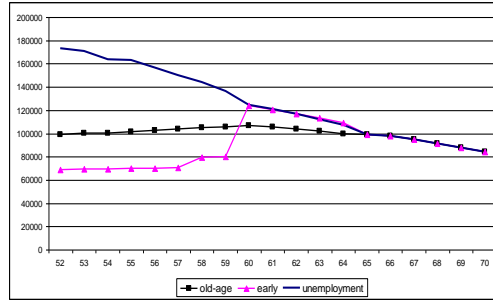
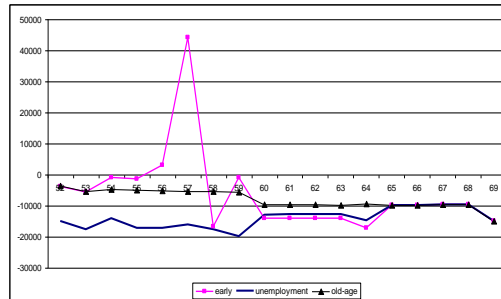


Figure 3: 10th percentile SSW by retirement age(in euro)



Key ages of eligibility for early retirement are reflected by AC that becomes extremely high in the year before eligibility and strongly negative thereafter. The fact that the old-age pension system is actuarially unfair at the margin is reflected in a negative AC for all possible retirement ages. It is negative before age 60 because the payment of payroll taxes is not compensated by the accrual in pension rights. At age 60, the age of eligibility for old-age benefits, there is in addition a downward jump in AC. From then on, working one more year means also the loss of one year of pension benefits. The pattern of the unemployment AC reflects seniority increases in benefits at 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 on average to an increase in SSW.

Figure 4: Mean AC by retirement age (in euro)



The 90th and 10th percentile AC of early retirement schemes suggests 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 AC also shows that for some employees (that do not satisfy eligibility requirements) the switch from early retirement and unemployment to old-age pension at the normal retirement age corresponds to an increase of SSW.

Figure 5: 90th percentile AC by retirement age (in euro)

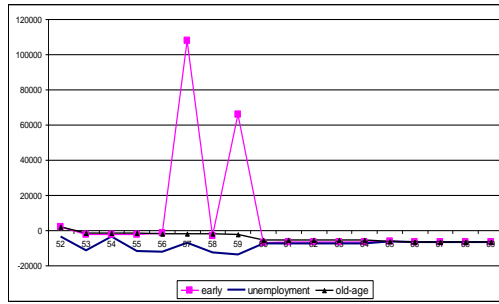
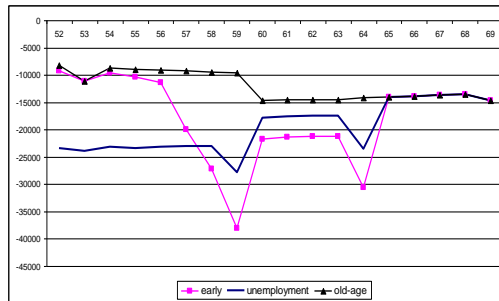


Figure 6: 10th percentile AC by retirement age (in euro)



To conclude, it appears that the three retirement pathways under consideration provide strong incentives to retire early, although the ceilings, floors and eligibility criteria specific to each pathway generate a specific incentive pattern for each pathway.

5 Estimation of a competing-risk model

The previous section showed that Belgian social security provisions for elderly provide strong incentives to retire early. This section presents a discrete-time competing risk model (5.2.) of which the estimated coefficients (5.3.) will be used to simulate a cut of early retirement benefits (5.4.) and to analyse whether individuals with particular characteristics have a higher likelihood to move towards unemployment than to the old-age pension (5.5.). To start, we briefly overview the relevant empirical literature.

5.1 Overview of the literature

Most studies that analyse the relationship between retirement incentives and retirement behaviour implicitly assume the behavioural response to incentives is the same whether

one retires through old-age, disability or unemployment and that these pathways can be considered as perfect substitutes. For instance, Grüber-Wise(2004) and Jousten-Perelman-Desmet(2005) propose a binary response model with a weighted incentive measure $RI_t = \sum_{j=1}^J w_{ij} RI_{ij}$ in which the weight w_{ij} of the retirement pathway $j = 1, \dots, J$ corresponds to the proportion of the population that chooses j at t :

$P(y_t = 1) = F(RI_t \beta)$ with $\sum_{j=1}^J w_{ij} = 1$. Some researcher argue however that 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 others involuntary. Dahl-Nilson-Vaage(2002)¹⁸ use a multinomial logit model to account for the fact that “individuals are either pushed into or choose different early retirement pathways”. Also Bloemen(2006¹⁹) 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”.

Mitchell-Philips(2000) estimate a conditional logit that accounts for the impact of a path-specific SSW on the transitions from work towards disability, early retirement and old-age retirement in the US. They estimate the probability that an individual retires through pathways $j=1, \dots, J$ at time $t=1, \dots, T$ as

$$P(y_t = j) = F(L_t \alpha + RI_{ij} \beta)$$

with L_t the expected length of the retirement period as a proxy for leisure. Note that although a conditional logit allows for different pathways, it imposes the same coefficient β across all pathways. More flexible models, like Bloemen(2008), allow for a different α_j and β_j according to the pathway chosen:

¹⁸ P.11.

¹⁹ P.27.

$$P(y_t = j) = F(x_t \alpha_j + RI_{ij} \beta_j)$$

with x_t a vector of individual characteristics. Some allow for complex patterns of substitution between pathways. For example, Dahl-Nilsen-Vaage(2002) and Wahlberg(2001) use as RI_{ij} for one exit route the replacement rates of all possible exit routes. The former finds that a higher potential income of an exit route increases retirement through that route while it decreases exit towards other routes.

Since retirement can be considered as an irreversible state, some models, like Lindeboom(1998), account for duration dependence in the employment spell and use a competing risk model. Hazard models have the advantage they can account for the endogenous selection of those still working at older ages. Hakola(2002), Tompa(1999) and Schils(2008) estimate a competing risk model controlling in addition for unobserved heterogeneity. Schils(2008) uses yearly wages and Tompa(1999) yearly wages/pension payments and/or replacement rates as incentive variables. However few of these competing risk models (Antolin-Scarpetta(1998), Schnabel(2003), Hakola(2002)) consider the retirement decision from a life-cycle perspective. Both the theoretical and empirical literature on retirement however pointed out that it is not simply the size of the annual pension payments or replacement rates but the present value of the pension benefits and how it accrues with continued work that emerges as important. Antolin-Scarpetta(1998) and Schnabel(2003) estimate a competing-risk model that includes SSW and accruals of wealth. Hakola(2002) controls in addition for unobserved heterogeneity. However the results are very similar without control for unobserved heterogeneity.

5.2 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 state²⁰, a competing risk model will be used. Like Antolin-Scarpetta(1998), Schnabel(2003), Mitchell-Phillips(2000), Hakola(2002) 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 use, following Jenkins(2005), a 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. The procedure to estimate such a model is equivalent to that of a multinomial logistic regression. The probability that an employee $i=1, \dots, N$ transits to retirement path $j=1, \dots, J$ at time $t=1, \dots, T$ after a career of duration d is

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

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 spells (individuals that are neither unemployed, early retired nor old-age retired in the last year of the observation period) under the assumption they are randomly censored.

As explained by Lancaster(1990), individual-specific unobserved effects like ability 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 in hazard models, one should allow for an unobserved effect. However, it

²⁰ 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.

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 AC. We also control for individual observed characteristics such as education level of the employee, region, socio-economic status, gender and the sector he works or worked in.²¹ As time-varying variables we include age, age squared of the employee, year dummies, housing wealth, number of dependent children and disabled. We also included membership of a private savings plan considering that this decision is anterior to the decision to retire and membership is for fiscal reasons expected to continue to the age of 65, for fiscal reasons, independently of the retirement age. 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(2008nakijken hoe gedaan). 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 leading to inconsistent estimation of the coefficients. In our case SSW may be endogenous if correlated with unobserved individual tastes for work. Those with a taste for work would have worked hard all their life, 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 thus end up with a coefficient on SSW suggesting that a higher SSW decreases the probability

²¹ 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.

to retire while the lifecycle theory suggests instead a positive income effect. There are at least two possible solutions to this identification issue²². A first possible solution is a 2SLS procedure in which SSW is replaced by an instrumental variable that is 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 since the variability of SSW is induced by policy changes over time. 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 effect²³. 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 Grüber-Wise(2004) and Spataro(2002).

5.3 Estimation results.

The estimated²⁴ coefficients with standard errors in parenthesis (and marginal effects in **bold**) are in table 2.

Table 2: 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
AC (/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)

²² 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

²³ See Wooldridge(2002) p.63-65.

²⁴ The model is estimated in SAS 9.2. by the procedure “glimmix” that models unordered dependent variables of a multinomial logit model and allows for dependence among repeated observations at the level of the individual.

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)
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			

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 AC 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 unemployment²⁵. This may signal that unemployment might be driven by other factors than retirement incentives.

²⁵ 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

The unexpected sign of AC in the early retirement path may be the result of measurement errors²⁶ since early retirement pension rights at the firm level could not be calculated. We tested whether the coefficient of AC 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 probability of retirement in general. If we control for average lifetime wages, the estimated coefficient on SSW turns more positive.

In order to ease the interpretation of the results, we follow Euwals-Vanvuuren-Wolthoff(2006) who calculate in a 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 AC 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

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.

²⁶ 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.

ceteris paribus condition when calculating marginal effects is satisfied: by definition, if AC (respectively SSW) changes, the ceteris paribus condition that everything else remains constant cannot be satisfied because SSW (respectively AC) 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 instead of a quadratic age trend. Since the incentive variables barely change our results are robust to the specification of the age variable.

Being blue-collar strongly increases the probability of early retirement and unemployment²⁷ but is not significant for those who retire through the old-age 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 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.²⁸ 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

²⁷ 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.

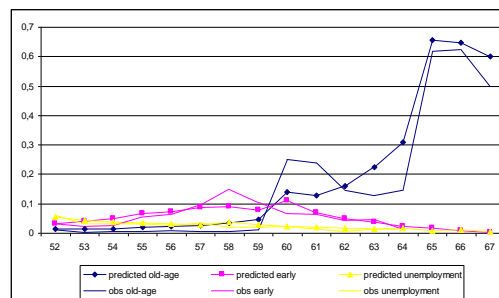
²⁸ We also experimented with variables that cross sector dummies with year dummies to detect possible business cycle effects that could be sector-specific. In the energy, chemical, mechanic and “other” sectors there is a significant upward trend of early retirement and unemployment over time. The fit in terms of log-likelihood and R² was slightly worse than the current version and in order to save space (of 56 dummies) we kept the current version.

statistics in table 1. 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 study²⁹. This would also mean that the gender dummy reflects differences in the incentives structure for men and women instead of a pure gender effect. .

Higher educated individuals are significantly less likely to exit the labour market through unemployment. Individuals with high human capital investment appear “insured” against unemployment³⁰. 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 unemployed³¹. Similarly, those who participate in a subsidized private saving plan are significantly less probable to leave the labour market through unemployment³². This suggests that these plans are confined to higher income individuals.

The goodness of fit tests 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 10: predicted and observed exit rates by age



²⁹ 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)

³⁰ Antolin-Scarpetta(1998) and Dahl-Nilson-Vaage(2002) find the same results.

³¹ Schnabel(2003) finds similar results for Germany.

³² Bloemen(2006) finds that “participation in individual pension schemes does not seem to affect the job exit rate by any route”.

Note that the fact that the exit rate into old-age retirement at age 60 is higher than that into early retirement at age 58 reflects that the former is calculated on a much smaller sample at risk.

5.4 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 for those that are eligible to early retirement benefits. This involves calculating:

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

where the retirement incentives (SSW and AC) 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. Thus only the early retirement wealth and AC change, while the wealth and AC of unemployment and old-age retirement path remain unchanged. Table 3 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 63³³. 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.

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

³³ 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 normal retirement (at age 65) by twice as much as disability retirement. Antolin-Scarpetta(1998) simulated a reform of the German early retirement and old-age pension system and predict that adjusting old-age benefits with 6-8% for each age of retirement deviating from the normal retirement age of 65 would increase the retirement age 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 of exit through other pathways.

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
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.

5.5 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:

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

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

Where j=0 denotes old-age retirement and j=2 unemployment. The results of this simple OLS-regression are presented in table 4 with standard errors in parenthesis.

Table 4: Who moves into unemployment and into old-age pension?		
Explanatory variables	Unemployment	Old-age pension
Intercept	1.144** (0.077)	-0.042** (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 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)
Other variables		
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)

Age	-0.037** (0.002)	0.0007 (0.0005)
Member occupational plan	-0.0088** (0.001)	0.008** (0.0002)
Private subsidized saver	-0.00219** (0.0006)	0.00027** (0.0001)
Goodness-of-fit statistics		
	R ² =0.122 R ² adjusted=0.121 F-value: 104,63 (P<0.0001)	R ² =0.05 R ² adjusted: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, living in Flanders, no member of private savings plan, no member of occupational plan; 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. As expected, white-collars, 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 unemployment.

5 Concluding remarks

A competing risk model was estimated that allows for transitions from employees towards unemployment, early and old-age retirement while controlling for forward-looking retirement incentives. Work disincentives inherent in all retirement pathways under consideration have large and significant impacts on retirement behaviour. This suggests 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 early retirement schemes and the inability to correct fully for a sorting effect in exit behaviour. In particular, the model predicted that a cut of early retirement benefits leads to a strong increase of unemployment and a very small increase

of old-age retirement. Those who initially had chosen the early retirement path, in particular the blue-collar workers, would in response to a reduction in the benefits of the early retirement scheme be more likely to move towards unemployment. As expected, white-collar workers with a high education level, participating in private savings or occupational pension schemes are more likely to work longer and to retire through old-age retirement.

6 Bibliography

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

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.

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

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 professionnelle”, TOR Group, Free University Brussels.

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

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.

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

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

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.

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

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”, CER Working Paper 28, CERP.

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.