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ABSTRACT

Retirement Decision of Belgian Couples and the Impact of the Social Security System*

This paper investigates the retirement patterns of married couples in Belgium. To forecast retirement behavior, we use administrative Social Security data from 2003 to 2017 and a discrete choice random utility model. In particular, we concentrate on the spousal bonus of pension payments to comprehend how financial incentives resulting from the social security system's structural design affect both partners' retirement decisions. We simulate the effect of the elimination of the spousal bonus and find that a small portion of women delay their retirement whereas the rest substitute into alternative social security benefits. Our results do not only highlight the significance of cross-program spillovers between various Social Security benefits, but also the heterogeneity in preferences for retirement and asymmetry of retirement behavior between husbands and wives.

JEL Classification: D10, H55, J26

Keywords: old-age labor supply, retirement incentives, spousal bonus, pension reforms

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1 Introduction

Significant public expenditure problems are expected to emerge due to population aging in most developed countries. In order to establish the financial stability of the social security systems, many countries have been implementing or considering several reforms in their social security systems. However, many countries have multiple pathways into retirement and the effectiveness of a reform in one pathway relies on alternative retirement opportunities. In particular, reforms in one social security program may induce individuals to substitute into alternative programs and anticipating how individuals may respond to such reforms can be difficult due to cross-program spillovers. On the other hand, increasing participation of women into the labor market made it crucial to consider retirement decision in a broader household context rather than individual. Disregarding the potential interactions between spouses can be misleading as individual participation in specific programs may impact their spouse's behavior due to correlations between partners' financial incentives and leisure preferences. [1] This, in return, makes it critical to understand the direct and indirect effects of retirement policy reforms along with the factors that tie spouses' retirement decisions together to reduce the financial strain on public pension schemes. In this paper, we study how the so-called "spousal bonus", which is a more advantageous rate of old age pensions that is granted to married individuals whose spouse has no or limited earnings (i.e. 75% instead of the standard 60%), affects retirement behavior of married Belgian workers by paying specific attention to various pathways into retirement and the impact of shared household income.[2]

The spousal bonus is intended to alleviate the poverty of households with a single main earner. In general, households with a dependent spouse consist of a high-wage earner husband and a low-wage earner or inactive wife, whereas households with a low-wage husband and a low-wage wife are categorized as dual-earner households, and are much less likely to benefit from spousal benefits. In an environment with rising concerns on the stability of the Social Security systems, the asymmetric nature of spousal benefits raises concerns regarding the fairness and adequacy of the Social Security benefits. In particular, Steuerle and Favreault (2007) finds that even though reallocating the aggregate resources paid for spousal bonus more equally within society reduces poverty, it has important trade-offs on the welfare of different beneficiaries.

The availability of spousal bonus may affect the retirement behavior of primary earners and dependents in different ways. First, due to the income effect, both partners could have higher demand for goods and leisure, which could increase their likelihood of retiring early. Second, it changes the price of retirement through a substitution effect. While for primary earners, this may lead to a stronger incentive to delay retirement due to high opportunity cost of retirement, for dependents, it decreases work incentives by reducing the reward for extra work. Spousal and survivors benefits are welfare-reducing due to their distortionary impact on the labor supply decision of married households and redistribution of wealth from relatively low-income households to high-income households. On the other hand, if spousal benefits were to be eliminated in an effort to balance the social security budget, relying on the primary earner's pensions would become unattractive motivating the low-earner spouse to build up higher own social security benefits or substitute into alternative early retirement pathways. Consequently, spill-over effects among these government programs carry great importance for the purpose of policy evaluation. Substitution into alternative retirement programs could give rise to a larger burden than the spousal bonus. In this regard, we aim to evaluate a hypothetical policy reform on spousal bonus by taking into account of both spousal spillovers and various retirement alternatives one can benefit from.

Lammers et al. (2013) states that social benefits such as disability insurance (DI) and unemployment insurance (UI) have been used as early retirement pathways in addition to the traditional

[1] Several studies have documented that couples are often observed to exit the labor market around the same time as each other, in a way that cannot only be explained by individual incentives to retire that each spouse faces (Coile, 2004).

[2] When a spouse receives the spousal bonus, her/his partner's pensions are suspended or deducted from the spousal bonus amount, s/he cannot receive unemployment or sickness benefits, s/he can exercise a professional activity, provided that it does not exceed a certain amount (gross earnings below 12 951 Euros below age 65 in 2022).

early retirement programs, while Autor and Duggan (2003) finds that DI is used as a substitute for UI in the US. Moreover, when the eligibility criteria for DI is strengthened, many individuals switch to other forms of social assistance (Borghans et al., 2014). Pestieau and Stijns (1999), Desmet et al. (2007) and Jousten et al. (2014) document the variety of retirement paths in Belgium and highlight that most Belgian workers leave the labor market permanently, receiving their primary income from disability, sickness, unemployment insurances, unemployment with company supplement or old age pensions. On the other hand, Johansson et al. (2014) studies the impact of economic incentives on labor force exit through different income security programs in Sweden and finds that economic incentives generated by income taxes and the income security system significantly affect the timing of the exit from the labor market to different degrees among people with different health status and education levels. Venti and Wise (2015) draws further attention on the heterogeneity of retirement pathways based on education levels. This paper extends this literature by investigating the impacts of a hypothetical policy reform taking the substitution into alternative retirement pathways and household heterogeneity into account.

In order to understand the impact of the spousal bonus of pensions on the primary earner spouse and the dependent spouse, we construct a structural model of retirement which characterizes household decisions by carefully incorporating in the specific structure of the Belgian social security system including disability insurance, sickness benefits, spousal bonuses and unemployment insurance as pathways to retirement. There is a lot of variation in how benefits are determined depending on the household type and average lifetime earnings which potentially generate heterogeneity in retirement incentives. Our model incorporates observed and unobserved heterogeneity to capture differences in individuals' tastes. A prominent feature of our model is the consideration of retirement from a broader perspective. Similar to Lefebvre and Orsini (2012), we model the exit paths from the labor market through the various available schemes. Doing so, we are able to exploit the heterogeneity between different types of households and different types of retirement paths which allows us to better understand the substitution patterns between retirement paths and retirement ages in response to changes in social security rules.

This study contributes to the existing literature in several ways. First, income sharing among spouses can provide insurance especially, to the low-wage spouse. We find that women are on average 4% less likely to retire before reaching the earliest eligibility age when the spousal bonus is hypothetically removed. This result is in line with Knapp (2014), who finds that in response to a decrease in spousal benefits, wives with lower earnings in the household increase their average labor force participation by 1.27 years. Second, similar to Jousten and Lefebvre (2019) who finds that men are less responsive to social security incentives, we do not find a significant change in husbands' retirement behavior. The structure of the social security system creates asymmetric incentives for the primary-earner and the dependent in the household so that for some couples it is more profitable for the dependent to substitute labor income by spousal benefits if s/he does not have access to alternative social security benefits. Third, when the spousal bonus becomes unavailable, individuals not only delay their retirement timing but also some switch to alternative retirement paths. In particular, more than half of the individuals who would be willing to benefit from the spousal bonus switch to alternative retirement via UI/DI, providing evidence of the cross-program spillover effects with respect to hypothetical policy change. Hence, neglecting cross-program spillovers and the interactions among household members can result in an underestimation of the cost of welfare programs and the effects of policy reforms. Fourth, there is a certain degree of heterogeneity in retirement incentives which needs to be taken into account when making policy predictions. For some couples, spousal benefits can create poor work incentives as the low-wage earner may be entitled to lower social security benefits than the spousal bonus. Last, the impact of the policy strongly depends on the magnitude of the default policy in place relative to other social security benefits. In a hypothetical case of reforming the spousal bonus from 50% to 25%, we observe a much stronger shift in retirement probabilities for both sexes.

The remainder of the paper is structured as follows. In Section 2, we sketch the institutional framework of retirement in Belgium. Section 3 details the data used for our analysis. In Section 4, we provide a brief summary of retirement behavior in Belgium. Section 5 presents the estimation

results of our model and policy simulations. Section 6 concludes.

2 Institutional Background

In this section, we carefully detail the Social Security benefit structure in Belgium for the first pillar.[3] The Belgian social protection landscape can be grouped into three main schemes: for wage-earners, for the self-employed and for civil servants. The focus of this research is on the wage-earners scheme as it is the scheme that covers the majority of population and provides variety of benefits. In particular, we describe the general policy environment for old age pensions (OAP), old age unemployment insurance (UI), disability insurance (DI), and conventional early retirement (CER) that are applicable to the cohorts in our sample, over the time period 2003–2017.

2.1 Old Age Pensions for Private Sector Employees

The eligibility conditions in Belgium for old age pensions differ between men and women during the period of study. For men, the key elements have been the following: a complete career consists of 45 years, the full retirement age is set at 65 and early retirement is possible as early as 60. The full retirement age is particularly important as it corresponds to the age at which people on other social insurance benefits are automatically rolled into the regular retirement system. The eligibility conditions for women had a transition phase where the full retirement age and the full career conditions were progressively adjusted upwards from their historical levels of 60 and 40 to 65 and 45, respectively, to align them to those applicable to men. More specifically, the full retirement age for women was 63 in 2004-2005, 64 in 2006-2008 and 65 in 2009. Similarly, the early retirement career condition was 34 years in 2004 and 35 years in 2005 and later.

Individuals who worked as an employee in the private sector are entitled to a retirement pension, depending on the length of their career and pensionable earnings. In case one has a mixed career, s/he may be entitled to pensions from several schemes. The required career length to get a full pension is 45 years or 14 040 days. If one works beyond this limit, the pension calculation will be based on the most advantageous 45 years of her/his career. Individuals accumulate pension rights based on pensionable earnings for any given year. For each career year, the pensionable earnings correspond to the last earned wage and it is subject to a floor and a ceiling. The accumulation of pension rights is limited to 60 026.75 Euros in 2021. In order for the minimum wage floor to be applied, one needs to have at least 15 years of work experience for at least one third of a full-time job in each year. For each career year, earned wage is replaced by the minimum wage in case this latter is higher. This minimum amounts to 25 833.78 Euros in 2021 for a pensioner with full career. The beneficiary will receive this alternatively computed pension if this is more favorable. Additionally, individuals with at least two thirds of a full-career, in other words individuals with at least 208 full-time day equivalents per year (or 156 full-time day equivalents per year) can access minimum pensions calculated at the full-time (or part-time) rate. Working beyond meeting the age and career conditions for early retirement is rewarded by pension bonus which is available after the first year of pension claim.[4]

Benefits are calculated based on the following formula:

$$pen_n = \frac{\sum_{t=1}^{n}(\tilde{w_t}d_t + \bar{w_t}a_t)}{N} \tag{1}$$

[3] Belgium has three different pillars in place consisting of public pensions, occupational pensions and individual savings. However, the first pillar provides the main source of income at retirement for the majority of the population, whereas occupational pensions are only available for about 59% of the population in 2016 (2018 OECD Pension Adequacy Report). There is a lot of sector/company specific rules for occupational pensions and by nature they provide a supplementary benefit which usually is paid as lump-sum. Even though for some individuals they might play a role in retirement decision, in this study we abstract from second and third pillar pensions.

[4] Between 2006-2013, the rule for pension bonus for work after the full career was stricter, beyond age 62 and career length of 44 and benefits were based on a fixed amount per day, and for pensioners who claim after 01.01.2015 the pension bonus is abolished. See `https://www.sfpd.fgov.be/fr/montant-de-la-pension/calcul/bonus-de-pension`

where n is the career year in which one claims her/his pension and N denotes the full career to get complete pensions which is equal to 45 for both men and women since 2009. In case $n > N$, the sum is taken over the most advantageous N years. d_t and a_t correspond to the number of days worked and the number of days assimilated during career year t, respectively. The so-called assimilated days correspond to periods that one does not work but keeps building pension rights such as maternity leave and unemployment periods. The reference wage for the days worked is given by $\tilde{w_t} = min(max(w_t, \underline{w_t}), \bar{w_t})$, where w_t denotes the wage one earns in career year t, $\underline{w_t}$ is the minimum wage that is taken into consideration if one earns below this threshold and $\bar{w_t}$ denotes the upper bound for wage that is taken into consideration for pension calculation. For the days worked, one accumulates pension rights based on her/his reference wage, whereas for the assimilated days it is either the last earned wage one had before the assimilated period or the minimum wage for that year.

Additionally, when the pension entitlements are low, one might be eligible for guaranteed full-time/part-time minimum pensions. In order to qualify for the guaranteed full-time minimum pension, one needs to have a career of at least 30 years with at least 208 days of work each year in which case one is entitled to the fraction of minimum guaranteed full-time pension based on the number of years s/he worked for at least 208 days over the full career length.For part-time minimum pensions, one needs to have at least 30 years of work with at least 156 days of work each year and the fraction for the benefit calculation is based on the number of years with days of work of at least 52 over full career.[5]

2.2 Spousal Bonus

In Belgium, individuals can be entitled to a pension at the household rate which is more beneficial for those couples where one of the partners does not have sufficient pension accumulation. The calculation of pensions based on the household rate is up to 25% higher relative to pensions at the individual rate. Married couples can benefit from the spousal bonus when the spouse has no or limited professional revenue, does not receive any replacement income, such as unemployment, sickness, or disability benefits, receives a pension but the amount of which does not exceed the difference between the amount of retirement pension at the household rate and the amount of retirement pension at the isolated rate.[6] If the partner receives pensions which amounts to less than the spousal bonus, then the amount of the partner's pension is deducted from the spousal bonus. On the other hand, cohabitation does not have an impact on a person's pension entitlement, cohabitants each receive their pensions at the individual rate. The maximum amount of pensions someone with a full career can receive at single rate in 2021 is 35 300 Euros, if s/he has a dependent spouse with no income, the spousal bonus amounts to 8825 Euros. However, if the partner has her/his own pensions that are less than 8825 Euros, the individual receives a bonus that is equivalent to the difference between partner's pension amount and 8825 Euros. On the other hand, for someone with full career and receiving minimum pensions (15 911 Euros in 2021), the spousal bonus amounts to at most 3978 Euros. Hence, couples with higher life-time income differences are more likely to benefit from the spousal bonus.

2.3 Survivors' Pension

In case of the death of spouse, the surviving spouse is entitled to a survivors' pension which is calculated as 100% of the deceased person's retirement pension that is computed at the individual rate. If the deceased spouse was not retired at the time of death, the career length of the deceased is calculated as the number of years between the 20th birthday and the time of death and the survivors' pension is calculated as at single rate. Survivors' pensions are subject to a ceiling in case one is to accumulate a survivors' pension with their own old-age pension up to an amount of

[5]Pension benefits are indexed to the smoothed health index (price index, excluding alcoholic beverages, tobacco products and motor fuels) and increased smoothed health index reaches the central index. For more details: `https://statbel.fgov.be/en/themes/consumer-prices/health-index#documents`

[6]The limited professional income for a wage-earner spouse should be below 11 627 EUR, and for a self-employed spouse 9302 EUR as of 2021.

110% of the survivors' pension. Moreover, survivors' pensions can be combined with a professional income if one earns below a certain limit; however, it is not possible to combine it with replacement income after a year. To be entitled to the survivors' pension, one must have reached a given age at the time of death (45 years in 2015, since 2015, the survivors' pension age has increased each year by six months, 48 years in 2021) unless one has a dependent child or an incapacity for work of at least 66%. In case one is below this age threshold, s/he is granted a transitional benefit. The minimum amount of survivors' pensions for someone whose deceased partner had a full career amounts to 15 698 in 2019 and the highest amount depends on whether one accumulates survivors' pensions in combination with other benefits.

2.3.1 The Guaranteed Income For Elderly Persons (GRAPA)

Individuals whose main residence is in Belgium are eligible for a means-tested safety-net income when they reach full retirement age (currently 65). The amount of GRAPA depends on one's resources and family situation. The basic amount was 912.03 Euros for cohabitants, and 1368.05 Euros for singles (in 2022 at index 162.66). When calculating the GRAPA benefits all the financial resources of the individual and their partner is taken into account. For those who have financial resources below the guaranteed amount, an additional payment is made to provide her/him with this minimum level of income. This implies that if the primary earner lower pensions, the couple can receive an additional top up to the extent that the household resources are below the guaranteed income.

2.4 Other Social Security Programs

There are several alternative social security programs in addition to old age pensions that provide a source of income for older workers and are sometimes used as early retirement schemes. These include disability benefits, unemployment benefits, company supplement and career-break. The detailed information on each of these schemes requirements are given below. The main reason these schemes act as alternative retirement paths relies on the access requirements of these programs and the broad availability of these benefits until one reaches the full retirement age. These programs are preferable by many workers as they provide generous replacement rates as well as allowing the worker to accumulate pension rights during the period of unemployment/disability through state subsidies. Furthermore, these programs may also be preferable by the employer, as they allow the company to cut employment costs under financial distress or to replace the work force via younger workers. The availability of these alternative retirement routes provides workers with an option to terminate their career permanently prior to the pension eligibility age.

2.4.1 Old Age Unemployment

Unemployed workers above 50 years old can be considered as an "old-age unemployed". Eligibility for unemployment benefits depends on the employment history of an individual preceding the loss of her/his job. For instance, if an individual loses her/his job after age 50, s/he can be eligible for the UI either with a salaried work for 624 days during the preceding 42 months; 312 days of work in the preceding 42 months and 1,560 days in the 10 years preceding these 42 months; or 416 days in the preceding 42 months and 1664 days in the 10 years preceding these 42 months.[7] The amount of unemployment benefits depends on one's family situation, the last salary received and the employment history. Cohabitants with dependants: 60% of reference earnings, Single persons: 55% of reference earnings, Cohabitants without dependants: 40% of reference earnings, and since 2012 the system has been reformed and benefits are designed to gradually decrease over time if unemployment persists for longer than a year. Since 2012, unemployment benefits are degressive and consist of three compensation periods based on the length of the unemployment period, and benefits are capped by several different limits at each period.[8] Additionally, the unemployment

[7] Younger individuals are subject to different set of eligibility rules based on employment histories. See `https://www.onem.be/fr/documentation/feuille-info/t31`

[8] See `https://www.onem.be/fr/documentation/feuille-info/t67` for details.

benefit with the seniority supplement is awarded after the first year of unemployment to older unemployed. The eligibility criteria for the old age unemployment insurance was to be above 50 years old with 20 years of seniority since 1995, which has been reformed and the age requirement was increased to 55 in 2013. In addition, those with at least 20 years of seniority and older than 58 are exempted from job search between 2004 and 2013, and this requirement was restricted to those above 60 years old or those with at least 38 years of seniority since 2013. In 2015, the old age unemployment insurance is abolished and newly unemployed workers are no longer granted a seniority supplement.

2.4.2 Conventional Early Retirement

Individuals who were made redundant by their employer qualify for the unemployment scheme with company supplement or in other words Conventional Early Retirement (CER) given that they meet the conditions of age, seniority and eligibility for unemployment benefits. The eligibility conditions for the CER has been progressively tightened. Until 2008, the requirement for CER was to be at least 58 years old with 25 years of seniority which was raised to 60 years old with at least 30 years of seniority for men and 26 for women. Since 2015, it is set to 62 years of age with at least 40 years of seniority for men and 31 years for women, that is expected to increase to 40 by 2024. Additionally workers who have long careers, who work in heavy jobs or who suffered from physical problems at their previous job are exceptionally eligible for CER at earlier ages. Moreover, companies are obliged to replace the laid-off workers if the worker is below a certain age except when the company is recognised to be in financial difficulties.[9] The benefits of unemployment with company supplement consists of two parts; an unemployment benefit paid by ONEM, and a supplement paid by the previous employer. The amount of unemployment benefit will be equal to 60% of last capped gross earnings for individuals with dependents, 50% for without dependents and 40% for cohabiting persons, whereas the company supplement corresponds to half of the difference between the net reference remuneration and the unemployment benefits.

2.4.3 Disability Benefits

In Belgium, the sickness and disability insurance consists of two periods: "primary incapacity for work" which lasts a period of maximum of one year and "invalidity" in case of at least 66% loss of capacity for work due to sickness or disability. During the primary incapacity for work employers keep the payment of wages for a limited period (guaranteed salary) and then, income related benefits paid by the mutual insurance fund. To be eligible for these benefits, one needs to prove her/his incapacity by a doctor report, have 180 days of actual work or assimilated periods during the six months prior to the invalidity and have ceased professional activity resulting in a reduction of earning capacity of at least 66%." The amount of the benefits is the same as the unemployment benefits during the first six months and amounts to 60% of the reference salary that is considered to calculate the unemployment benefits for the second six months. In case one's loss of earnings due to sickness persists after the primary period, then s/he is considered as invalid and entitled to DI as long as the incapacity lasts or until the retirement age. The amount of benefits for a worker with dependents is 65%, without dependents 55% and for cohabiting persons 40% of the lost earnings. [10]

3 Data

This paper benefits from a rich administrative data in Belgium. Our data consist of a representative sample of 250 000 individuals from 1917-1966 birth cohorts in Belgium observed over 2003-2017 time period on all their records with social security institutions and full information on career histories for wage-earners since 1956. In order to capture the impact of financial incentives and the value of retirement at different ages, we focus on the wage-earners scheme only. We also eliminate those who are associated with multiple schemes and those who left the labor market prior to age 55. The reason for this is that wage-earners is the only group for which we can trace back the

[9] 60 in 2011, which was raised to 62 in 2015

[10] https://www.missoc.org/missoc-database/comparative-tables/?y=1014&y=1018&y=1053&y=1057

labor market status and earnings since 1956 and calculate their hypothetical stream of pension entitlements at a given year starting from age 55 and until the statutory age, 65. In order to avoid potential endogenous changes in marital status, we concentrate on couples that had been together for at least 5 years by 2003 and observe them until 2017 or for as long as either one of them dies. We restrict our analysis to couples who are at most 6 years apart from each other, which excludes around 7% of the sample on each side of the distribution. To summarize, our sample consists of 5253 individuals from 1948-1952 cohorts, who have at most six years of age difference to their spouse and who has been employed at age 54 as well as her/his spouse.

In order to calculate the accrued pension benefits up to a given year, we follow the rules established for old-age pensions by assuming that the beneficiary retires in a given year between 2003 and 2017, and compute the hypothetical pension amount based on the assumption that the individual will work at the same intensity and wage as s/he did in the last active year until the s/he reaches old age pension eligibility.[11] We assume that individuals know the rules of the pension system and they plan their retirement as if the current pension rules will remain the same in the future. Moreover, in order to account for the present discounted pension wealth at any year, we multiply the discounted pension wealth with the survival probabilities up until age 100 assuming a discount rate of 0.98.[12] Additionally, we simulate the hypothetical UI, DI, CER and entitlement for spousal bonus accounting for the labor market status and wage of the partner during the time frame of our analysis.

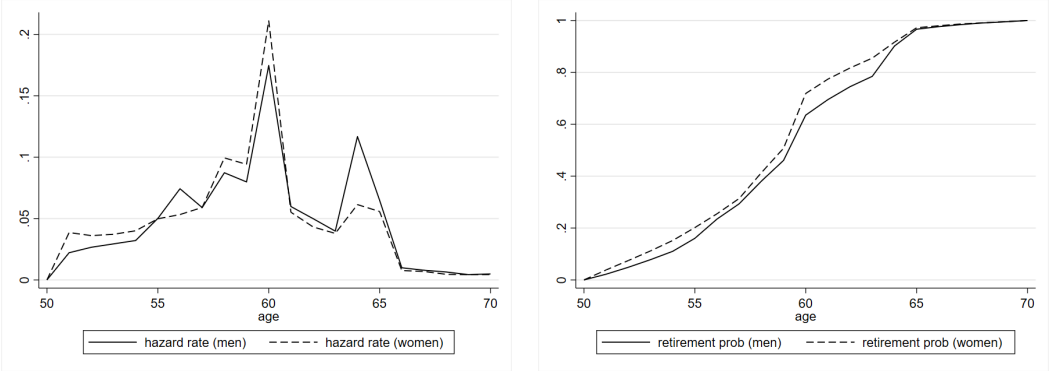
We define retirement as ceasing to earn labor market income permanently, which is assumed to be an absorbing state. One can retire through various alternative ways such as unemployment insurance, unemployment with company supplement, disability insurance, or old age pensions. Earnings are defined as net after tax earnings calculated on individuals' gross annual labor market earnings from SIGEDIS adjusted for inflation at 2019 Euros. Personal income tax is calculated by determining the tax base after deduction of child benefits, family benefits and professional expenses, and assessing the tax due based on 4 different tax brackets. Taxation is proportional and the tax rates on these brackets range between 25% and 50%. In addition to that, there are regional taxes; however, for the sake of simplicity, we do not take regional taxes into account.

4 Retirement Behavior in Belgium

Figure 1 demonstrates the retirement likelihood in Belgium separately for men and women. The left panel plots the hazard rate whereas, the right one shows the cumulative probability of exit from the labor market of the sampled individuals who were active in the labor market at age 50. We observe that in general women leave the labor market sooner than men, with a high spike in retirement hazard at age 60. The average age of exit from the labour market for women is 57, whereas for men, it is 58.4. Even though many people gradually exit the labor market starting from age 50, there are 3 main ages that individuals exit the labor market proportionally more than any other ages. The first one is 58 at which most of the individuals become eligible for CER besides some exceptional cases which allows one to benefit from CER at age 55 or earlier. Then a high number of individuals exit the labor market as soon as they reach the early retirement age of the old age pension system which is 60 for cohorts born before 1953, and most remaining individuals exit at the full retirement age, 65.

[11] See Fraikin (2021) for a detailed description of rules and laws for the Belgian Social Security System.
[12] Survival probabilities at a given age and year is obtained by Statbel.

Figure 1: Retirement age from the job market



Notes: job market exit age conditional on being employed at 50. Left panel: Retirement hazard rates Right panel: cumulative retirement probability of sampled individuals. *Source: CBSS and author's calculations.*

4.1 Exit Routes

Individuals in the wage-earners scheme can benefit from several early-retirement and social safety net programs such as old age unemployment, unemployment with company supplement, sickness and disability benefits as well as retirement pensions. We hereby focus on the cohorts who were born between 1948 and 1952. These are the birth cohorts that had reached the normal retirement age of 65 by 2017 and who were observed from at least age 55. Table 1 shows the percentage share of workers in our sample who exited via different retirement routes. We observe that the exit behavior does not necessarily coincide with claiming of old age pensions. The majority of individuals exit the labor market through unemployment with company supplement, those who exit via old age pensions only consist of 33 % of the sample. This indicates that alternative retirement routes play a significant role in Belgium and the low effective retirement age can be partly attributed to that. Additionally, those who exit the labor market through claiming old age pensions mostly do so as soon as they reach the early retirement eligibility. It is evident from table 1 that there are also significant differences between men and women. Women in general are more likely to exit via unemployment or disability insurance which provide lower replacement benefits. In addition to this, about 5% of women who were active in the labor market at age 54 drops out with no individual benefits, mostly relying on the spousal bonus of old age pension through their partner. This might be a result of income effects due to higher pension income of the partner or reflect the couples' preferences for joint leisure. Women are usually the secondary earner in the household and couples with high earnings gap could find it more profitable to benefit from the spousal bonus that amounts up to 25% higher pension benefits for the primary-earner. Another observation is that more men benefit from CER, compared to women. The potential reason behind this is that in order to benefit from CER one needs to satisfy stricter age and seniority conditions compared to regular UI and DI benefits, and women in general have lower seniority than men.

Table 1: Percentage Share of Exit Routes From the Labor Market

	Men					*Women*				
Age	OAP	CER	UI/DI	ENB	Total	OAP	CER	UI/DI	ENB	Total
55	0.00	0.05	0.03	0.00	0.09	0.00	0.02	0.05	0.01	0.08
56	0.00	0.10	0.03	0.00	0.13	0.00	0.03	0.04	0.00	0.08
57	0.00	0.08	0.02	0.00	0.11	0.00	0.04	0.04	0.01	0.09
58	0.00	0.13	0.03	0.00	0.16	0.00	0.13	0.03	0.01	0.17
59	0.00	0.05	0.01	0.00	0.07	0.00	0.05	0.02	0.01	0.08
60	0.15	0.05	0.01	0.00	0.21	0.20	0.06	0.02	0.00	0.29
61	0.04	0.02	0.00	0.00	0.07	0.04	0.02	0.01	0.00	0.07
62	0.03	0.01	0.00	0.00	0.05	0.03	0.01	0.01	0.00	0.05
63	0.02	0.00	0.00	0.00	0.03	0.01	0.01	0.01	0.00	0.03
64	0.02	0.00	0.00	0.00	0.02	0.03	0.00	0.00	0.00	0.03
65	0.05	0.00	0.00	0.00	0.05	0.05	0.00	0.00	0.00	0.05
Total	0.32	0.52	0.15	0.00	1.00	0.35	0.37	0.23	0.05	1.00

Notes: Exit paths comprise : individuals who leave the labor market via claiming old age pensions (OAP), individuals who were unemployed but receive a supplement from the company on top of unemployment benefits (CER), individuals who benefit from unemployment and disability insurance (UI/DI) and those who were not observed to receive any social security benefits and are assumed to rely on private savings and household income (ENB). *Source: CBSS and author's calculations.*

The asymmetry in exit paths exists not only between men and women, but also across income groups. Table 2 shows the share of individuals who exit via different paths by lifetime income quartile. We observe that individuals who exit the labor market via DI and UI are almost twice many in the bottom of the income distribution compared to the top. This indicates that the experience of retirement is not homogeneous in the society and the majority of low-income individuals potentially exit the labor market through unemployment or disability insurance. In addition, the replacement rate under different retirement paths would differ not only based on one's career history but also the household type inducing further heterogeneities among retirees.

Table 2: Percentage Share of Exit Routes From the Labor Market by Income Quartile

	Men				*Women*			
	q1	q2	q3	q4	q1	q2	q3	q4
OAP	0.43	0.27	0.20	0.43	0.37	0.31	0.33	0.40
CER	0.28	0.55	0.64	0.41	0.28	0.47	0.50	0.43
UI/DI	0.29	0.16	0.12	0.13	0.30	0.19	0.14	0.13
ENB	0.00	0.02	0.04	0.03	0.06	0.03	0.03	0.04

Notes: Income quartile is based on one's lifetime earnings at age 54. Exit paths comprise : individuals who leave the labor market via claiming old age pensions (OAP), individuals who were unemployed but receive a supplement from the company on top of unemployment benefits (CER), individuals who benefit from unemployment and disability insurance (UI/DI) and those who were not observed to receive any social security benefits and are assumed to rely on private savings and household income (ENB). *Source: CBSS and author's calculations.*

4.1.1 Benefit Levels by Retirement Path

Based on the family situation of each individual, Table 3 reports the observed pension benefits in 2019 Euros for those who receive pensions at the single rate and the household rate separately. Additionally, we report the average career length at age 65 for each exit path. The sample used in these tables is the sub sample of those who are observed to receive pension benefits from the Social Security institution. 99 % of the individuals who receive pensions at the household rate are male, and hence we only report the pensions at the household rate for males. Regardless of the type of exit, women have lower pension entitlements than men; however, to some extent this can be explained by the lower seniority of women the moment they leave the labor force. The most advantageous exit path appears to be CER since regardless of the exit age, individuals who benefit from this option keep accumulating pension rights until age 65. In addition, the group of individuals who exit the labor market via CER has a high seniority level to be eligible for this option hence, on average those who benefit from CER receive relatively higher pension benefits

compared to other exit paths from the labor market whereas, those who leave the labor market with unemployment or disability insurance are the least advantageous group, as they have shorter careers, which translate into lower pension benefits. On average an individual with a dependent spouse receives spousal bonus around 6500 Euros which is equivalent to an individual pension with 19 years of work at minimum wage. Hence, having a high earning primary earner in the household can encourage the couple to benefit from the spousal bonus if the secondary earner has a short career, especially below 20 years.

Table 3: Benefit Levels and Seniority by Type of Exit

	Seniority		Single Pensions			
	Women	Men	Women	Men	HH Pensions	Spousal bonus
DI						
mean	29.98	36.67	16227	23201	30000	6000
sd	8.89	6.24	5493	4607	6142	1228
UI						
mean	31.91	35.41	17995	23164	29137	5827
sd	8.04	7.50	5880	5449	6838	1368
CER						
mean	39.02	40.17	22119	27290	35045	7009
sd	4.54	3.63	5315	4460	5954	1191
OAP						
mean	38.68	42.50	18705	26720	31191	6238
sd	8.08	5.60	6683	5932	8511	1702
Total						
mean	34.33	39.65	19101	26327	32455	6491
sd	10.04	5.91	6664	5387	7688	1538

Notes: The sub-sample consists of individuals who are observed to receive pension benefits based on the data coming from ONP. The HH pensions are for those who have dependent spouse and benefit from the spousal bonus for pensions. All the monetary values are in 2019 Euros. *Source: CBSS and author's calculations.*

5 Model

In order to incorporate in different sources of heterogeneity and reflect the difference in the type of exit from the labor market, we formulate a mixed logit model. A sampled individual i, who contemplates retirement at age 54, faces a choice amongst 11 retirement ages via up to 4 different retirement routes.[13] We assume that these states are mutually exclusive and each state is associated with a different level of consumption, while leisure only varies over different retirement ages and stays the same among different retirement paths at a given retirement age. Retirement is a terminal state, once a worker exits the labor market, s/he cannot return. We assume that spouses share the household income equally. Bonke (2015) show that the vast majority of households pool their incomes and find that although the wife's income share is on average 43% of the household income, she gets 53% of the assigned consumption. Based on the analysis of couples in Switzerland, Bütikofer et al. (2009) finds that on average the female share of household income is about 0.48, but not significantly different from 0.5 while this share increases to almost 0.55 when the wife contributes half of household income. In the light of these evidence, we believe that equal household income sharing can be an appropriate assumption. By considering the full set of available alternatives in choice situation t, it is assumed that the individual will choose the alternative with the highest utility. Individuals know their preferences with certainty, but we cannot observe individuals' preferences hence, there is a stochastic part of utility which is distributed as extreme value type-1. We assume a stylized functional form of utility as in Van Soest and Vonkova (2014). The discounted sum of within-period utilities depends on employment status and income. Individual n has an indirect utility function for retirement age r, at retirement path a that is composed of two

[13]Depending on the eligibility for each alternative, the number of alternatives vary for each individual at any age and equal to at most 4. The details of eligibility conditions for each social security program is given in Table 8 in the Appendix. All individuals are assumed to retire latest by the full retirement age.

additive parts, a systematic component V_{ira}, and a stochastic component ϵ_{ira} where,

$$U_{ira} = V_{ira} + \epsilon_{ira} \tag{2}$$

$$V_{ira} = \alpha_i^c \sum_{t=55}^{T} \beta^{t-55} \pi_{t|55} log(c_t^a) + \alpha_i^l \sum_{t=r}^{T} \pi_{t|55} log(l_t) + \epsilon_{ir} \tag{3}$$

We allow for variation of preferences across the population through observed individual characteristics denoted by X_k for $k \in \{c, l\}$. In our specification X_k denotes a vector including own income quartile, relative earnings, eligibility status, age difference and age difference squared. We assume that preferences vary across individuals based on one's location in the income distribution, one's relative earnings compared to their spouse, the age difference between partners and one's eligibility status for receiving old age pensions. The coefficients α_i^{l1} determines the influence of a change in those factors on marginal utility of leisure, and α_i^{c1} for consumption, whereas α^{c0} and α^{l0} reflect the unobserved heterogeneity of preferences.

$$\alpha_i^l = \alpha^{l0} + \alpha_i^{l1\prime} X_1 \tag{4}$$

$$\alpha_i^c = \alpha^{c0} + \alpha_i^{c1\prime} X_2 \tag{5}$$

Consumption and leisure are defined as follows;

$$c_t^a = \frac{1}{2}\Big[I_{work=1}^t w_t + I_{ret=1}^t b_t^a + I_{work^p=1}^t w_t^p + I_{ret^p=1}^t (b_p)_t^a\Big] \tag{6}$$

$$l_t = \begin{cases} 1 & if \quad I_{work}^t = 0 \\ \frac{2}{3} & if \quad I_{work}^t = 1 \end{cases}$$

for each $r \in \{55, 56, ..., 65\}$, $t \in \{55, 56, ..., 100\}$, and $a \in \{1, 2, 3, 4\}$.[14] We assume that the difference between the time endowment and hours worked constitutes leisure time, l_t. Individuals are endowed with 1 unit of time at each period. If one decides to work at age t, then s/he devotes one third of her time to work until she retires permanently. At the moment, we abstract from partial retirement and part-time work. We assume that the maximum life span is 100 years. The systematic component of the indirect utility function is assumed to be concave in consumption and the remaining lifetime leisure after retirement. The discount factor β is assumed 0.98, and $\pi_{t|55}$ denotes survival probabilities conditional on being alive at age 55. w_t is the observed wage at age 54, and b_t^a is the simulated social security benefits one would be entitled to if s/he were to retire at age, t via retirement path, a. There is no wage uncertainty, assuming an individual is working at the baseline, s/he may continue to receive the same level of nominal annual earnings until age 65 if s/he chooses not to retire earlier.[15] The household consumption is determined by the earnings of both partners. Additionally, our purpose is to understand the impact of household financial incentives on partners' retirement decision. Individuals own earnings depend on her/his retirement age and path choice whereas, partner's expected earnings are estimated by the sample probabilities of being at any possible state. The detailed description of individual and spouse earnings under different retirement paths is described in table 4. We calculate the estimated income of the spouse based on the sample probabilities of being in any state at the partner's age. Our data do not contain any information on the amounts of consumption or savings hence, we follow a static framework. The individual compares her/his discounted utility at age 54 for all possible retirement path choices until the statutory retirement age and chooses the alternative which gives her/him the highest utility.

[14] Path 1 corresponds to retirement by claiming old age pensions, path two is unemployment with company supplement, path 3 consists of UI and DI, and path 4 is retirement without any individual social security benefits.

[15] This is a simplification for the baseline model, however we believe that this is not very restrictive as we observe stationary wages in our sample especially, after age 50. See Appendix.

Table 4: Benefit Levels by Retirement Path

Exit Path	SS Benefits (b_t^a)	Partner's SS Benefits ($E[(b_p)_t^a]$)
ENB	0	$(0.6w_{t-1}^p)p_{t,ui/di}^p + (0.6w_{t-1}^p + s_t^p)p_{t,cer}^p + (1.\mathbf{25}pen_t^p)p_{t,ret}^p$
UI/DI	$(0.4w_{t-1})$	$(0.4w_{t-1}^p)p_{t,ui/di}^p + (0.4w_{t-1}^p + s_t^p)p_{t,cer}^p + (pen_t^p)p_{t,ret}^p$
CER	$(0.4w_{t-1} + s_t)$	$(0.4w_{t-1}^p)p_{t,ui/di}^p + (0.4w_{t-1}^p + s_t^p)p_{t,cer}^p + (pen_t^p)p_{t,ret}^p$
OAP	$pen_t + (\mathbf{0.25}pen_t)p_{t,enb}^p$	$0p_{t,enb}^p + (0.4w_{t-1}^p)p_{t,ui/di}^p + (0.4w_{t-1}^p + s_t^p)p_{t,cer}^p + (pen_t^p)p_{t,ret}^p$

Notes: b_t^a represents the amount of benefits one can receive in a given period if s/he were to choose path a among the 4 retirement paths. We assume that individual does not know ex-ante when her/his partner will retire, but knows the probability of retirement by each path at each age, which is represented by $p_{t,a}^p$ and the household income is calculated by the sum of one's own income under each path and her/his partner's expected income. The unemployment and disability benefits are calculated based on one's reference wage which is the last earned wage subject to floors and ceilings. Here we represent one's reference wage by w_{t-1}. The single rate unemployment and disability benefits are on average 40 % of the reference wage for the relevant time frame and the household rate amounts to 60%. The minimum amount of company supplement, s_t is equal to half the difference between one's net reference wage and unemployment benefits. Pensions are calculated based on the formula given in section 2. Exit paths comprise : individuals who leave the labor market via claiming old age pensions (OAP), individuals who were unemployed but receive a supplement from the company on top of unemployment benefits (CER), individuals who benefit from unemployment and disability insurance (UI/DI) and those who were not observed to receive any social security benefits and are assumed to rely on private savings and household income (ENB).

It is likely that different respondents will have different preferences even after controlling for the observable individual and household characteristics. In order to incorporate in the potential unobserved preference heterogeneity, a random parameters logit model is used (Train, 2001). This approach assumes that preferences can vary across the population with density $f(\alpha)$, and each individual knows her/his own α_{ira} and ϵ_{ira}. Hence, the conditional choice probability at α_{ira} is given by;

$$P_{ira}(\alpha_{ira}) = \frac{\exp(\alpha_{ira}x_{ira})}{\sum_k \sum_n \exp(\alpha_i x_{ikn})} \tag{7}$$

for each $k \in \{55, 56, ..., 65\}$, and $n \in \{1, 2, 3, 4\}$. As a result, the unconditional choice probability takes the following form:

$$P_{ira} = \int \frac{\exp(\alpha_{ira}x_{ira})}{\sum_k \sum_n \exp(\alpha_i x_{ikn})} f(\alpha)d(\alpha) \tag{8}$$

which is approximated by simulation and over M random draws, resulting in the following simulated probability:

$$\hat{P}_{ira} = \frac{1}{M}\sum_{m=1}^{M} P_{ira}(\alpha_m) \tag{9}$$

The distinguishing feature of mixed logit with unobserved heterogeneity is that the taste parameters α_{ira} are case-specific. In particular, α_{ira} is normally distributed around an individual specific parameter μ_i, i.e. $\alpha_{ira} \sim \mathcal{N}(\mu_i, \Sigma_W)$. The distribution of the individual specific parameter is then also multivariate normal, i.e. $\mu_i \sim \mathcal{N}(\zeta_i, \Sigma_B)$ where ζ is a mean vector and Σ_B is a covariance matrix. In Maximum Simulated Likelihood estimation, the parameters are treated as fixed, unknown quantities. Point estimates of $\theta = (\zeta, \Sigma_B, \Sigma_W)$ are obtained via maximisation of the simulated log-likelihood function by BHHH algorithm with 500 draws.[16] After computing the point estimate, the posterior distribution is obtained through equation (8). Our results on table 5 report the mean and the standard deviation of this posterior distribution.

Mixed logit model not only accounts for the random taste variation across individuals, but also incorporates in the substitution between alternative choices and correlation in unobserved factors. This allows us to better understand individuals' preferences for consumption and leisure. In order

[16]See Train (2009) for a detailed description.

to obtain efficient estimates of choice model parameters, one should take the potential preference heterogeneity into account. Daniels and Hensher (2000) indicate that the error correlation between alternatives could be confounded with unobserved preference heterogeneity if the variation in unobserved heterogeneity is ignored. One way to control for this is to specify the parameters associated with each attribute as random (Hensher and Greene, 2003). It is also natural to expect that the random components associated with different attributes are correlated. For example, individuals may prefer to consume more when they have more leisure time. Hence, controlling for the potential correlation between random parameters can be of great importance in obtaining efficient estimates.

Table 5: Parameter Estimates

	(All Sample)	(Women)	(Men)
Consumption (α_i^c)			
Constant	0.489^{***}	0.601^{***}	0.558^{***}
	(0.029)	(0.078)	(0.045)
Own Income Quartile	0.035^{***}	0.041^{***}	0.031^{***}
	(0.002)	(0.003)	(0.002)
Relative Earnings	-0.457^{***}	-0.353^{**}	-0.641^{***}
	(0.048)	(0.171)	(0.073)
Leisure (α_i^l)			
Constant	1.341^{***}	1.027^{***}	3.078^{***}
	(0.113)	(0.225)	(0.204)
Own Income Quartile	-0.026	0.119^{***}	-0.145^{***}
	(0.025)	(0.040)	(0.029)
Relative Earnings	2.031^{***}	2.377^{***}	-0.145
	(0.257)	(0.580)	(0.367)
Eligible	0.109	0.601^{***}	-0.399^{***}
	(0.073)	(0.115)	(0.089)
Age Difference	-0.006	0.025^{*}	0.011
	(0.009)	(0.014)	(0.016)
Age Difference Squared	-0.004^{*}	-0.007^{*}	-0.003
	(0.002)	(0.004)	(0.004)
Eligible	1.636^{***}	3.021^{***}	0.424^{**}
	(0.175)	(0.283)	(0.201)
σ_c	0.038	0.156	0.019
σ_{cl}	0.116	0.436	0.066
σ_l	0.527	1.386	0.240
Observations	5,253	2,190	3,063
Log Likelihood	$-14{,}391.730$	$-5{,}997.122$	$-8{,}193.381$
AIC	29817.634	12385.223	17113.770

*p<0.1; **p<0.05; ***p<0.01

Notes: Age difference is calculated by subtracting the reference individuals' age from her/his partner's age. Relative earnings is the ratio of lifetime average wage to the lifetime household average wage. Income quartile is calculated as the quartile of one's lifetime total earnings at age 54. Eligible is a dummy variable reflecting whether one has reached the earliest age to be able to claim OAP. *Source: CBSS and author's calculations.*

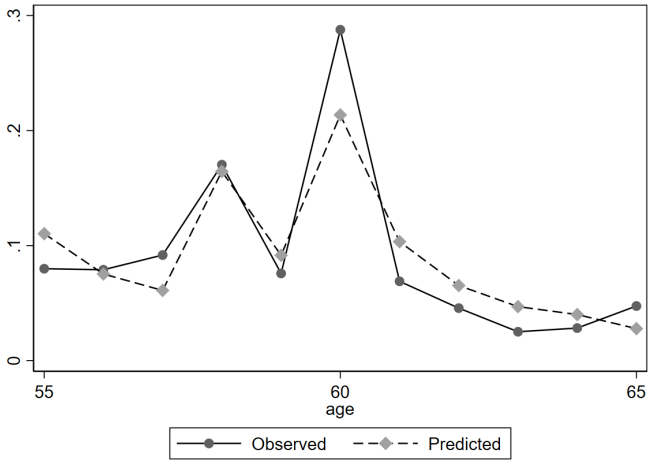
Parameter estimates from the method of simulated maximum likelihood estimation are shown in table 5. The first column refers to the combined sample of women and men, whereas columns two and three represent the results for the subset of women and men, respectively. The results are in line with theoretical predictions and recent empirical findings. Both of the estimated parameters in our model are significantly different than zero, individuals' valuation of consumption and leisure are of great importance in determining their retirement path. However, the observed heterogeneity alone does not explain the preference heterogeneity. We have significant variation in both consumption and leisure parameters and the correlation between the two is also significant, which is confirmed

by Wald, likelihood ratio and Lagrange multiplier tests.[17] Individuals' utility is affected positively with higher levels of consumption and leisure. Those who belong to higher income groups have higher preference for leisure. Relative earnings within the household also is an important factor behind preference heterogeneity. The age difference, on the other hand, seems to matter for women only. Wives who are younger than their husbands are more likely to have higher leisure preferences. Since retirement eligibility for couples with larger age gap tends to be farther, leisure preferences can be dominating financial incentives for them.

5.1 Model Fit

We have a good prediction of retirement age. Our model captures the spikes in the earliest eligibility age for CER and OAP. Figures 2 and 3 show the actual hazard rates observed in the data along with the predictions of our model under the current retirement rules. These hazard rates are obtained by averaging up each individual's probability of retiring by any retirement path over the whole sample. Overall, it can be seen that the model gives a good prediction of the actual retirement timing. However, the predicted frequencies for retirement paths are less accurate as we use a static model, and hence do not capture any potential uncertainty. In order to improve the precision of the retirement path predictions, it might be better to add uncertainty. Though, our model does a fairly good job to explain the effects of all social insurance alternatives rather than the old age pensions alone or the maximum one can achieve by any retirement path. In particular, the common practice is taking the maximum attainable pension wealth in order to analyze the impact of financial incentives; however, it is crucial to note that individuals are not necessarily able to access all alternative social insurance paths, and considering all the options gives us the flexibility to capture the opportunity cost of choosing one alternative compared to the other. In addition to predicted hazard rates, we use another criterion based on the alternative with the highest estimated probability of choice. The deviation of the predicted retirement age from the observed retirement age is reported in figures 10, 11 and 12 for the full sample, women and men, respectively.[18] Our estimates for the most likely retirement age is within 2 years of the observed retirement age for about 67% of women and 73% of men.

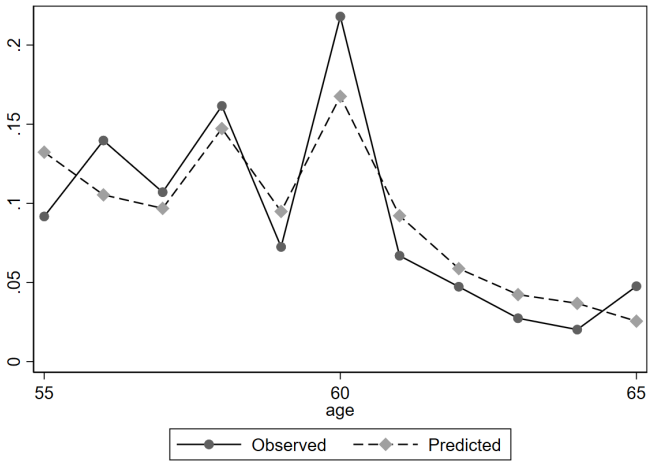
Figure 2: Female Labor Force Exit by Age



Notes: Hazard rates are obtained by averaging up each individual's probability of retiring by any retirement path. The spike at age 58 and correspond to common early eligibility ages. *Source: CBSS and author's calculations.*

[17] see appendix table 9 and table 10.
[18] See section 7.1 .

Figure 3: Male Labor Force Exit by Age



Notes: Hazard rates are obtained by averaging up each individual's probability of retiring by any retirement path. The spike at age 58 and correspond to common early eligibility ages. *Source: CBSS and author's calculations.*

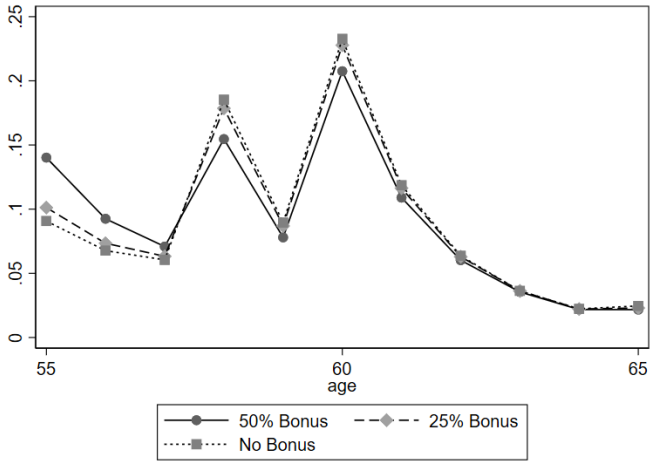
5.2 Policy Simulations

Using the preference parameters in Table 5, we simulate eliminating the spousal pension benefits. We then repeat the same exercise with a more radical approach of increasing spousal pension benefits to 50%. These two reforms would influence household consumption and in the absence of the spousal bonus, the couple might face insufficient means which could trigger the secondary earner to delay retirement age. On the other hand, those who have strong leisure preferences may still retire at the same age either by converting to alternative retirement paths or exit without individual benefits as before.

The predicted probabilities at each age between 55 and 65 in these two hypothetical cases are presented in figures 4 and 5 for women and men, respectively. On average the share of women who retires before 58 drops from 23% to 21% when the spousal bonus is removed, whereas the difference in retirement probabilities when the bonus is raised to 50% is much higher. The increase in the spousal bonus increases the likelihood to retire before age 58 from 23% to 30 %. We believe that this result reflects individuals' ability to substitute between various retirement alternatives.

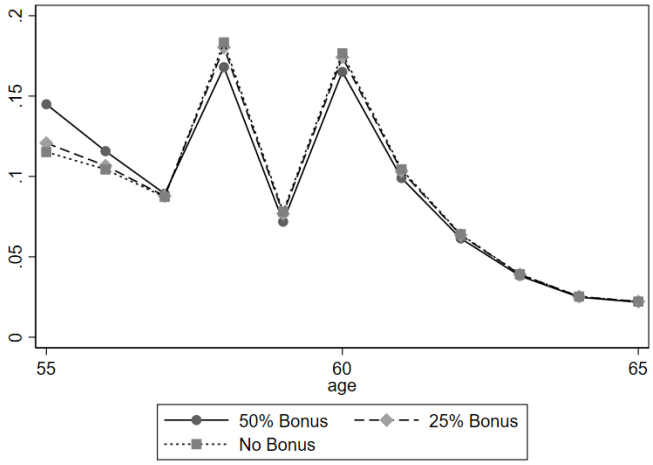
When the bonus amount is doubled, it can become as high as social security benefits one would receive under different retirement paths such as UI/DI or CER which in turn can result in earlier retirement ages instead of waiting for the eligibility age for early retirement schemes especially, for those who have high valuations of leisure time. Additionally, we observe that the impact of policy change is more pronounced for women than men. The reason behind this could be the fact that the primary earner in most of the households have access to higher benefits due to longer careers and higher earnings potential. Surprisingly, we do not observe any delay in men's retirement age, though on average men are 3% more likely to retire before age 58 if the spousal bonus is raised to 50%. These results highlight that the receipt of spousal bonus can result in the secondary earner to leave the labor market upon retirement of her/his spouse. Hence, the secondary earner in the household, who has low expected social security wealth, are more likely to coordinate labor market behavior based on the incentives of the primary earner.

Figure 4: Retirement Hazard Rates, Policy Simulation, Women



Notes: Hazard rates are obtained by averaging up each individual's probability of retiring by any retirement path. The 25% Bonus is the current policy in place. No bonus is the hypothetical case when we calculate lifetime consumption without the spousal bonus and 50% Bonus is the hypothetical case where every individual faces twice of the bonus they face now if they were to retire without individual benefits and their partner is receiving old age pensions. *Source: CBSS and author's calculations.*

Figure 5: Retirement Hazard Rates, Policy Simulation, Men



Notes: Hazard rates are obtained by averaging up each individual's probability of retiring by any retirement path. The 25% Bonus is the current policy in place. No bonus is the hypothetical case when we calculate lifetime consumption without the spousal bonus and 50% Bonus is the hypothetical case where every individual faces twice of the bonus they face now if they were to retire without individual benefits and their partner is receiving old age pensions. *Source: CBSS and author's calculations.*

5.3 The impact of Policy Change on Retirement path

In the first part of our analysis, we develop a discrete choice model where one chooses between four alternatives at from 55 till 65 which consist of exiting the labor market with no individual social security benefits, exiting the labor market via DI, UI, exiting the labor market via CER and exiting the labor market by claiming pensions. Additionally, we assume that these alternatives are mutually exclusive as individuals are in general not allowed to combines multiple social security benefits and a very small number of people keep working beyond claiming pensions which we believe is negligible. In these 4 cases, individuals enjoy different levels of consumption. The reason that we include exit without individual social security benefits in our choice set is to be able to detect the impact of the spousal bonus as the patterns in the data show that when one partner has low pension entitlements the couple could benefit from the spousal bonus instead and claim only the pensions of the principal owner, while the other exits the labor market without any benefits. In this regard, we now focus on individuals' preference for different retirement paths.

Table 6: Change In Retirement Probabilities In Response To Hypothetical Policy Change

	Women			Men		
	50% Bonus	25% Bonus	No Bonus	50% Bonus	25% Bonus	No Bonus
ENB	0.301	0.18	0.144	0.183	0.128	0.114
UI/DI	0.313	0.379	0.403	0.413	0.44	0.448
CER	0.266	0.308	0.316	0.296	0.312	0.315
OAP	0.119	0.135	0.14	0.113	0.12	0.122

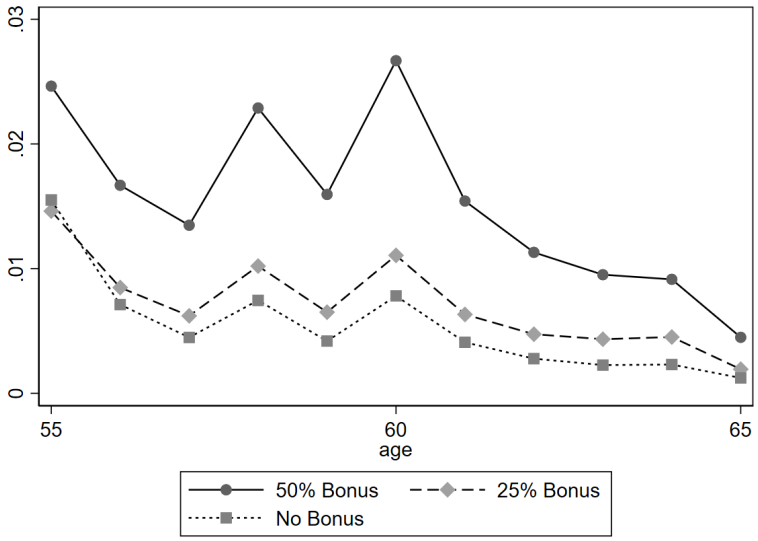
Exit paths comprise : individuals who leave the labor market via claiming old age pensions (OAP), individuals who were unemployed but receive a supplement from the company on top of unemployment benefits (CER), individuals who benefit from unemployment and disability insurance (UI/DI) and those who were not observed to receive any social security benefits and are assumed to rely on private savings and household income (ENB). *Source: CBSS and author's calculations.*

Table 6 represents the change in retirement probabilities by retirement path in response to a hypothetical chance in spousal bonus policy. We observe that the change in retirement behavior of women is more pronounced compared to men. When the spousal bonus is removed, there is almost no change in men's expected retirement path, while women are 4% less likely to exit the labor market without individual social security benefits compared to the baseline. Furthermore, the results provide evidence for the substitution patterns between retirement paths based on changes in the benefit structure. More than half of individuals who normally retire through ENB switch to UI/DI which indicates that removal of the spousal bonus may hardly decrease the financial burden on the social security system. In Figure 6, we take a closer look at the predicted probabilities for ENB. The difference between predicted retirement probabilities with and without spousal bonus is much smaller before age 58. This indicates that those who leave the labor market at younger ages usually do so due to high leisure preferences and a change in the policy structure would have a smaller impact on their behavior. On the other hand, above 58, the probability of retirement through ENB is much smaller when the spousal bonus is eliminated. This results highlights the preference heterogeneity in the population. Individuals who have high attachment to the labor market tend to retire later and when they face a decrease in the household income the substitution effect between consumption and leisure leads them to delay retirement to compensate for the lost household income. On the other hand, those with lower attachment to the labor market either keep their initial choice unchanged or only substitute into alternative social insurance program instead of delaying their retirement age.

5.4 Cost-Benefit Evaluation

We now turn our focus on the implications of a hypothetical elimination of spousal bonus on aggregate cost/benefit to the social security budget. Choice models appear to have income effects

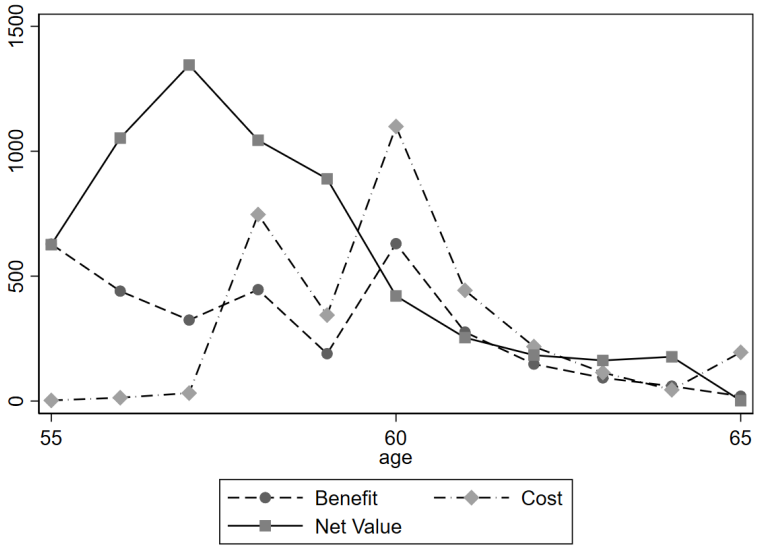
Figure 6: Retirement Hazard Rates, Policy Simulation, Women, ENB



Notes: Hazard rates represent each women's probability of retiring by ENB. The 25% Bonus is the current policy in place. No bonus is the hypothetical case when we calculate lifetime consumption without the spousal bonus and 50% Bonus is the hypothetical case where every individual faces twice of the bonus they face now if they were to retire without individual benefits and their partner is receiving old age pensions. *Source: CBSS and author's calculations.*

when the predictions of the model change due to changes in income. Our model is based on a random utility model with significant preference heterogeneity; hence, there are substantial income effects that aggravate complexity in defining cost/benefit analysis. In the presence of income effects Marshallian and Hicksian surplus diverge. The common practice is to calculate the Hicksian surplus, which is the expected change in utility normalized by price. This allows one to obtain a representation of the welfare change in monetary units. However, income effects are present and price is not fixed in our model, hence it makes it complicated to obtain a monetary representation of welfare change. We instead focus on the cost of spousal bonus of pension benefits on the social security budget. We calculate the average burden on the social security system under the existing policy scheme by making use of the estimated parameters and predicted probabilities for each alternative. Then, we calculate the predicted probabilities when the spousal bonus is eliminated and compare the average burden under the no spousal bonus case to the initial expected utility. We find that the average benefit and cost on the social security budget per person will be as indicated on Table 7. Due to substitution between different paths, the realized benefit and cost will vary at different potential retirement ages. The overall financial benefit of removing the spousal bonus policy will almost cancel out the burden of alternative social security programs. However, our analysis only represents the effects on those women who were active in the labor market at age 55. Majority of the spousal bonus beneficiaries leave the labor market much earlier hence, our analysis does not reflect the total cost/benefit to the social security system. Potentially, financial gains would be much larger than we estimated assuming that those early exiting individuals would not come back to the labor market. Those individuals who are at the bottom of the income distribution are those who are hurt the most relative to the rest. The potential reason is that for individuals that are located in the middle or the right of the income distribution, the decrease in disposable income following the removal of the spousal bonus is almost offset by the increase in income due to substitution in alternative social insurance programs. On the contrary, the poorest individuals have limited access to alternative social insurance programs, which causes them to be influenced the most by a policy change.

Figure 7: Cost/Benefit Analysis of Policy Elimination



Notes: Women only. Cost refers to providing other types of social security benefits when spousal bonus is removed. Benefit refers to unspent social security funds by eliminating the bonus. *Source: CBSS and author's calculations.*

5.5 Robustness Check on the Functional Form of the Utility Function

A common problem in structural econometric models is that the parameter estimates can be sensitive to the functional form of the utility functions. An alternative way to check for the robustness of our results is to practice our analysis with a more flexible utility function. In this regard, we consider a second order polynomial utility function as in Van Soest et al. (2002). A polynomial function provides a more general structure and is capable of capturing preferences with a higher accuracy. We present the parameters under this case in Table 7. Parameter estimates under quadratic utility specification are in general in the same direction as our estimates. The marginal utility of consumption and leisure are both positive.Under quadratic specification, age difference between partners lose its significance. This implies that leisure preferences on average are not dependent on the spouses' age differences.

6 Conclusion

This paper explores retirement spillovers induced by the financial incentives embedded in the Belgian Social Security system. In order to understand the impact of joint financial incentives of spouses, we pay specific attention to the spousal bonus, a 25% pension premium granted to a pensioner if his/her spouse has no or limited pension entitlement or labor income. In doing that, we use a broader definition of retirement. We do not only define individuals who leave the labor market by claiming pension benefits as retired but also, we consider those who stop labor market participation terminally through old age unemployment, disability insurance or unemployment with company supplement. We use detailed micro-level data to simulate potential social security benefits of Belgian private sector employees by applying the rules and formulas of the taxation and social security system for a sample of married individuals. Based on these simulations, we have constructed individual consumption and leisure levels assuming that spouses share household income equally.

In order to understand married individuals' retirement behavior and predict the impact of changes in the benefit structure, we have employed a discrete choice model of retirement path. The main underlying assumption of our model is that individuals choose the optimal retirement age and

Table 7: Parameter Estimates, Quadratic Utility

	(All Sample)	(Women)	(Men)
Consumption			
Constant	0.209^{***}	0.190^{***}	0.255^{***}
	(0.009)	(0.018)	(0.017)
Own Income Quartile	0.012^{***}	0.020^{***}	0.007^{***}
	(0.001)	(0.003)	(0.002)
Relative Earnings	-0.262^{***}	-0.260^{***}	-0.294^{***}
	(0.016)	(0.037)	(0.025)
$Consumption^2$			
Constant	-0.0003^{***}	-0.0002^{***}	-0.0004^{***}
	(0.00002)	(0.00004)	(0.00003)
Own Income Quartile	0.00000	-0.00002^{**}	0.00002^{***}
	(0.00000)	(0.00001)	(0.00000)
Relative Earnings	0.0003^{***}	0.0003^{***}	0.0003^{***}
	(0.00003)	(0.0001)	(0.00004)
Leisure			
Constant	-0.466	-0.789	1.099
	(0.375)	(0.621)	(0.738)
Own Income Quartile	0.060	0.345^{**}	-0.127
	(0.090)	(0.143)	(0.122)
Relative Earnings	6.192^{***}	6.518^{***}	3.439^{***}
	(0.815)	(1.594)	(1.292)
Eligible	9.521^{***}	10.050^{***}	9.140^{***}
	(0.582)	(0.915)	(0.781)
Age Difference	-0.079^{***}	-0.008	-0.057
	(0.030)	(0.049)	(0.062)
Age Difference Squared	0.003	-0.010	0.008
	(0.008)	(0.013)	(0.014)
$Leisure^2$			
Constant	-0.508^{***}	-0.407^{***}	-0.578^{***}
	(0.087)	(0.138)	(0.168)
Own Income Quartile	0.010	0.061^{**}	-0.017
	(0.019)	(0.030)	(0.026)
Relative Earnings	1.121^{***}	1.071^{***}	0.831^{***}
	(0.180)	(0.342)	(0.281)
Eligible	1.605^{***}	1.593^{***}	1.714^{***}
	(0.102)	(0.156)	(0.146)
Age Difference	-0.021^{***}	-0.010	-0.017
	(0.007)	(0.011)	(0.014)
Age Difference Squared	0.001	-0.002	0.003
	(0.002)	(0.003)	(0.003)
Consumption*Leisure	0.0001	0.001^{**}	-0.001
	(0.0004)	(0.001)	(0.001)
Eligible	15.011^{***}	16.424^{***}	13.686^{***}
	(0.826)	(1.307)	(1.090)
σ_c	0.0004	0.001	0.0003
σ_{cl}	0.009	0.015	0.007
σ_l	0.239	0.440	0.135
Observations	5,253	2,190	3,063
Log Likelihood	$-13{,}280.600$	$-5{,}602.762$	$-7{,}583.000$

Notes: Age difference is calculated by subtracting the reference individuals' age from her/his partner's age. Relative earnings is the ratio of lifetime average wage to the lifetime household average wage. Income quartile is calculated as the quartile of one's lifetime total earnings at age 54. Eligible is a dummy variable reflecting whether one has reached the earliest age to be able to claim OAP. $Consumption^2$ refers the the quadratic f*Source: CBSS and author's calculations.* Source: BCSS.

path conditional on the attainable net wealth and remaining lifetime leisure that optimize their utility. Our model is able to capture important details of the retirement decision of both sexes, with pronounced labor force exit at ages 58 and 60. To evaluate the implications of our estimates, we simulated the effects of two hypothetical policy reforms on retirement age and retirement path. In the first policy reform, the spousal pension bonus which is granted to the primary earner is removed. In other words, those couples who consist of one primary earner and one dependent are no longer able to benefit from extra pension benefits. In the second reform, we consider the spousal bonus to be 50% of the primary earner's pensions rather than 25%.

Our results show that there is a considerably small impact of the hypothetical policy change of removing the spousal bonus. Women are on average 4% less likely to exit with no individual social security benefits when their partner no longer receives a spousal bonus. Furthermore, more than half of the individuals, who would be willing to benefit from the spousal bonus initially, switch to alternative retirement via UI/DI. This highlights that those who benefit from the spousal bonus have high leisure preferences, and even when the bonus is removed they would exit the labor market before they reach the earliest eligibility age for retirement schemes. Furthermore, both individual and spousal financial incentives play a strong role in couples' retirement decision.

From a policy perspective, our study suggests that policy reforms aiming to achieve a certain goal can have significant spillover effects and may even push individuals to consider alternative options rather than delaying their retirement. The significant heterogeneity in preferences indicates that behavioral response to policy reforms can be hard to predict when the alternative paths are disregarded. In particular, women are more likely to leave the labor market earlier via alternative routes which consist mostly of unemployment or disability benefits. Hence, efforts to increase the effective retirement age should not be restricted to the regular retirement or auxiliary benefits, but instead should cover the entire set of welfare programs that allow old age people to leave the labor market earlier. On the other hand, those who mostly benefit from spousal pension benefits are usually women with low earnings potential and the availability of spousal bonus protects them against the risk of old age poverty. Removing the spousal bonus might trigger a small number of individuals to delay retirement, however this may also leave certain households with insufficient means.

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7 Appendix

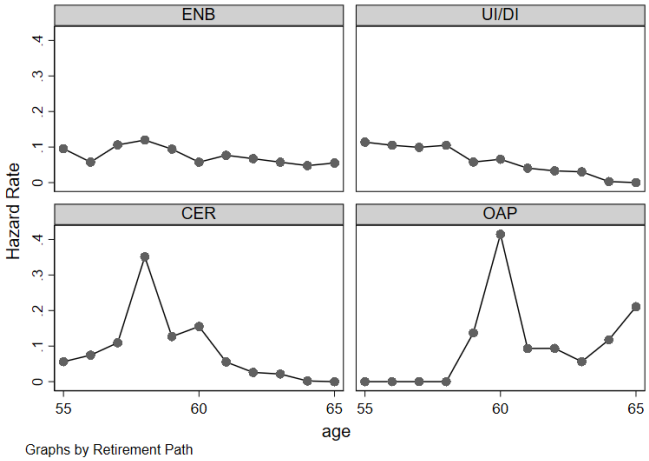
Table 8 demonstrates the evolution of eligibility conditions for various social security benefits. Access requirements have been strictened over time. Note that there is a pattern of uniformity among social security programs, the reforms are converging so that the requirements for different retirement alternatives are becoming similar over time. Figure 8 shows the retirement hazard rates per path. The strongest spike is at age 60 for OAP and at age 58 for CER. These ages are the most common eligibility ages for these programs. Note that UI and ENB rather follow a continuous pattern rather than jumps and discontinuities.

Table 8: Social Security Eligibility Conditions in Belgium

	UI		CER			OAP	
year	age	career	age	career		age	career
				men	women		
2002	50		60(58)	20(25)	20(25)	60	30
2003	50		60(58)	20(25)	20(25)	60	32
2004	58	20	60(58)	20(25)	20(25)	60	34
2005	58	20	60(58)	20(25)	20(25)	60	35
2006	58	20	60(58)	20(25)	20(25)	60	35
2007	58	20	60(58)	20(25)	20(25)	60	35
2008	58	20	60(58)	30(35)	26(30)	60	35
2009	58	20	60(58)	30(35)	26(30)	60	35
2010	58	20	60(58)	30(37)	26(33)	60	35
2011	58	20	60(58)	30(37)	26(33)	60	35
2012	58	20	60(58)	35(38)	28(35)	60	35
2013	60(<60)	20(>38)	60(58)	35(38)	28(35)	60.5	38
2014	60(<60)	20(>38)	60(58)	35(38)	28(38)	61	39
2015	60(<60)	20(>38)	62	40	31	61.5	40
2016	60(<60)	20(>38)	62	40	32	62	40
2017	60(<60)	20(>38)	62	40	33	62.5	41

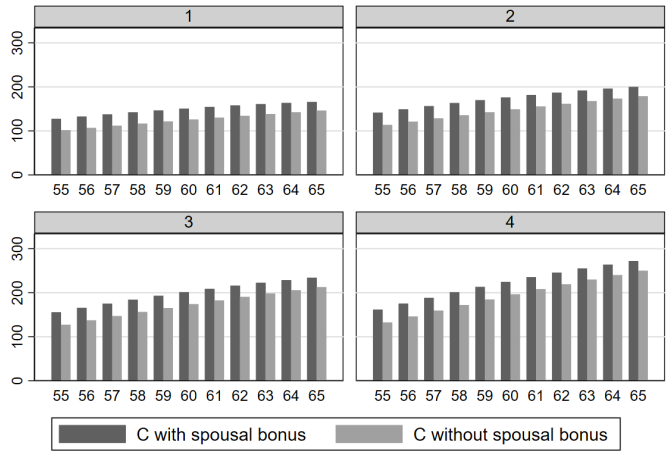
The above conditions represent the earliest eligibility conditions for the specified social insurance program. The UI conditions are for no job search obligation. Individuals who get unemployed and have the required conditions are no longer obligated to search for a job and can retain UI benefits until they have access to OAP or until the full retirement age which is 65. In parenthesis, we report alternative requirements for those with longer careers. Source: Mutual Information System on Social Protection (MISSOC) `https://www.missoc.org/missoc-database/comparative-tables/`

Figure 8: Hazard Rates by Retirement Path



Notes: Exit paths comprise : individuals who leave the labor market via claiming old age pensions (OAP), individuals who were unemployed but receive a supplement from the company on top of unemployment benefits (CER), individuals who benefit from unemployment and disability insurance (UI/DI) and those who were not observed to receive any social security benefits and are assumed to rely on private savings and household income (ENB). *Source: CBSS and author's calculations.*

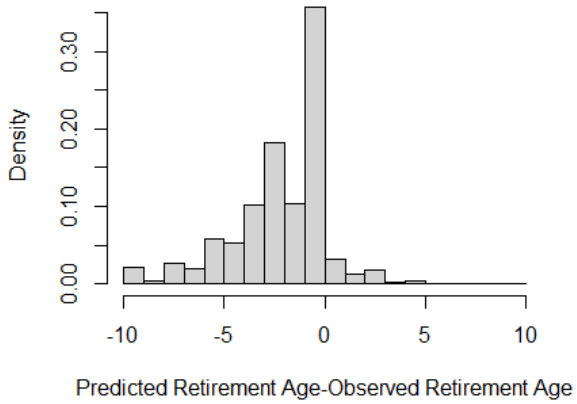
Figure 9: Change in Wives' Consumption By Income Quartile Due to Removal of the Spousal Bonus



Notes: The graph is only for the alternative exit with no individual social security benefits. C represents the lifetime discounted consumption if one is to retire at a given age and in 1000's of Euros. *Source: CBSS and author's calculations.*

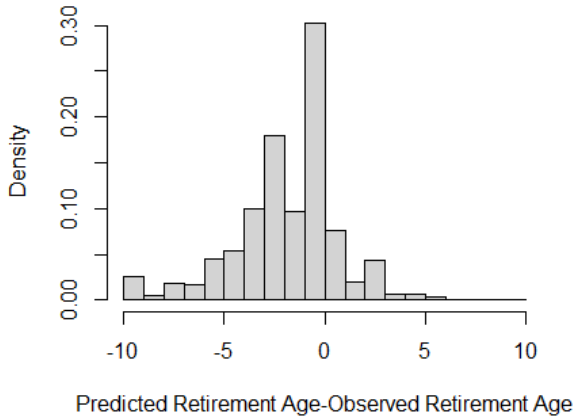
7.1 Model Fit

Figure 10: Model Fit, All Sample



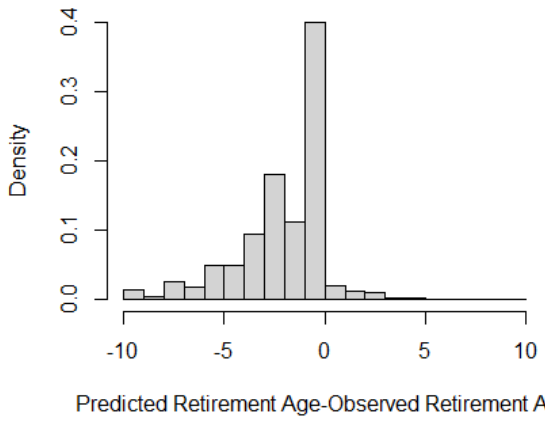
Notes: The deviation of the predicted retirement age with the highest predicted probability from the observed retirement age. *Source: CBSS and author's calculations.*

Figure 11: Model Fit, Women



Notes: The deviation of the predicted retirement age with the highest predicted probability from the observed retirement age. *Source: CBSS and author's calculations.*

Figure 12: Model Fit, Men



Notes: The deviation of the predicted retirement age with the highest predicted probability from the observed retirement age. *Source: CBSS and author's calculations.*

McFadden and Train (2000) proposed the Lagrange Multiplier tests to test the presence of random components which provides us with a statistical basis for the fixed point estimates to be preserved or not. Moreover, we also report Wald and Likelihood Ratio tests. All of the tests indicate that we strongly reject the null of no random effects. Hence, mixed logit estimation method is used in our analysis. Additionally, in the next step, we test the correlation between random factors consumption and leisure and our tests indicate that we strongly reject the null of no correlation between random components.

Table 9: Model Specification Tests, The Presence of Random Effects

Model	wald	lagrange multiplier	likelihood ratio
All Sample			
stat	625.688	497.993	830.159
p-value	0	0	0
Women			
stat	393.993	308.774	672.784
p-value	0	0	0
Men			
stat	311.084	325.498	338.552
p-value	0	0	0

Note:The hypothesis of no random parameters is strongly rejected.

Table 10: Model Specification Tests, Correlation Tests of Random Effects

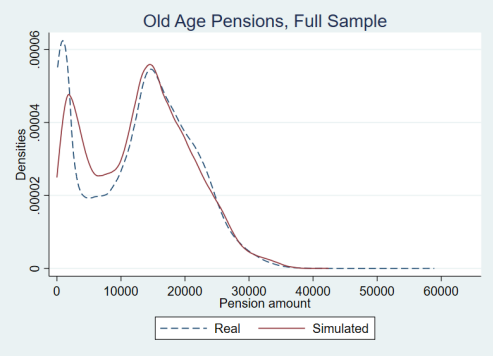
Model	wald	lagrange multiplier	likelihood ratio
All Sample			
stat	111.518	45.792	70.037
p-value	0	0	0
Women			
stat	191.417	57.951	103.956
p-value	0	0	0
Men			
stat	41.811	28.053	33.675
p-value	0	0	0

Note:The hypothesis of no correlated random parameters is strongly rejected.

7.2 Simulation of Social Security Benefits

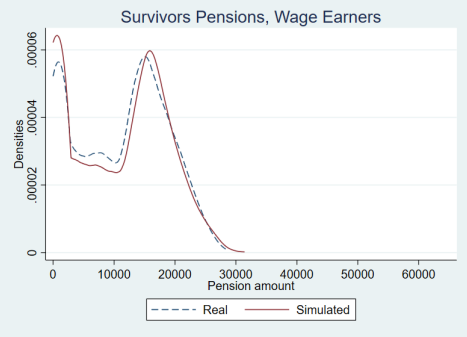
In order to calculate financial incentives one would face at every alternative over ages 55 till 65, we have simulated the eligibility and benefit rules of the social security system in Belgium. The following graphs represent how close our calculations of hypothetical social security benefits under different schemes get to the observed social security benefits.

Figure 13: Simulation of Pension Benefits



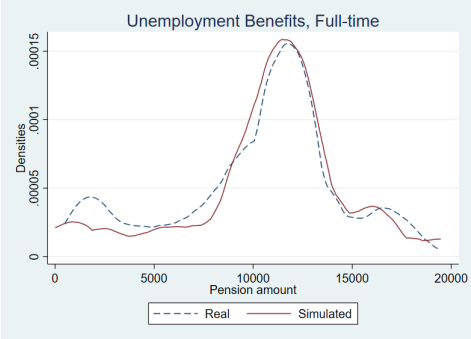
Source: CBSS and author's calculations.

Figure 14: Simulation of Survivors' Pension Benefits



Source: CBSS and author's calculations.

Figure 15: Simulation of Unemployment Benefits



Source: CBSS and author's calculations.