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THE OLD-AGE PENSION HOUSEHOLD REPLACEMENT RATE IN BELGIUM

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ABSTRACT

The objective of the paper is to examine the retirement behaviour of Belgian workers in one-earner households who are automatically granted a more generous old-age pension benefits replacement rate, called the household replacement rate. Following a recommendation of the Belgian Pension Reform Committee, this policy is to be suppressed for new pensioners, except for those receiving the minimum pension. We provide an ex-ante impact evaluation of such reform on both pension sustainability and adequacy measures. Specifically, we test whether the household replacement rate entails a work (dis)incentive mechanism promoting (harming) pension sustainability and furthermore, we analyse the role of the household replacement rate in old-age poverty and inequality measures. To do so, we use the survey dataset SHARE and a discrete time logistic duration model to study the link between retirement and financial retirement incentives created by the social security system. We find that the household replacement rate generates slightly higher retirement incentives through an income effect and we find that the household replacement rate plays an important role in decreasing the elderly poverty rate. Since households with asymmetrical working arrangements are often at the lowest part of the equivalized income distribution, the substantial effect of the household replacement rate on poverty measures is a motive to use such mechanism as a poverty alleviation tool. Nevertheless, we advocate that income redistribution measures should not be tied to a specific household composition and policies such as pensionable earning minima, minimum pension benefits and the inclusion of replacement income periods in the pension benefits calculation effectively serve the income redistribution goal without favouring a certain type of household over another. Overall, despite the positive poverty and distributional aspects of this policy, our analysis supports the reform proposal of removing the household replacement rate.

Keywords: retirement, pension policy, Belgium, impact assessment

JEL Codes: J22, H31, H55, J26

1 INTRODUCTION

Public old-age pension systems have four central objectives. From an individual's viewpoint, they should provide (I) a consumption smoothing mechanism over the life cycle and (II) an insurance against the uncertainty of life expectancy after retirement. From a public policy perspective, they should serve as (III) a poverty alleviation mechanism for old age and (IV) an income redistribution tool among the elderly (Barr and Diamond, 2006). However, faced with population ageing, the prime focus of many European governments in recent decades has been to reform their pension systems to ensure financial sustainability (Grech, 2013). Next to these pressing sustainability concerns, pension adequacy[1] matters have traditionally been left aside in both public policy and research.

In Belgium, the government has implemented numerous social security reforms over the last decade curbing incentives for early retirement with the aim of ensuring the sustainability of the country's pension system. At the same time, the poverty rate of the country's elderly population has been decreasing thanks to higher female activity rates and numerous discretional increases in minimum and social pensions. However, there remains a substantial gender poverty gap and the average old-age pension benefits of married women is still lower than that of single women (Hindriks, 2015).

In this paper, we take a closer look at the retirement incentives of workers in one-earner households, i.e. households composed of one earner and one partner who is financially dependent. We leave aside the study of the work (dis)incentives that are potentially associated with these benefits for the financial dependent spouse in the household. While relevant, such analysis should be considered separately as the incentives faced by these individuals are very different from those faced by other types of workers. Married[2] workers in one-earner households are automatically granted a more generous replacement rate in the calculation of their old-age pension benefits, called the household replacement rate. In case of divorce or death, the replacement rate of the old-age pension is brought down to the isolated replacement rate for the main earner and some divorcee entitlements or the survivor pension are granted to the financially dependent spouse.[3] Following the rise of the two-earner household model and pension sustainability concerns, many European countries abolished these benefits and the Belgian Pension Reform Committee has recommended to remove

[1] An adequate pension system provides a retirement income that prevents from old-age poverty and allows for consumption smoothing at older ages (Holzmann and Hinz, 2005).
[2] The household replacement rate is not granted to legally cohabiting partners.
[3] Evidence from our micro data demonstrates that divorces at older ages in our sample are scarce.

the household replacement rate, except for minimum pensions (Pension Reform Committee 2020-2040, 2014). Specifically, we test whether the household replacement rate entails a work (dis)incentive mechanism promoting (harming) pension sustainability and furthermore, we analyse the role of the household replacement rate in ensuring pension adequacy from a public policy perspective.

While contributing to the growing literature focusing on both pension adequacy and pension sustainability, this paper provides valuable insights to guide evidence-based policy making on this policy challenge. In addition, we provide an ex-ante impact evaluation of policy changes - reducing the generosity or eliminating the household replacement rate benefits - on the retirement decisions and poverty measures among the elderly.

Our analysis shows that in contrast to spousal characteristics, financial incentives have a significant effect on the retirement decision across all household types. We find a significant impact for both of our social security wealth and accrual variables, which work in opposite directions. Nonetheless, the overall incentives created by the household replacement rate do not confirm our expectations that the household replacement rate creates a work (dis)incentive as they are very limited. Overall, despite the positive poverty and distributional aspects of this policy, our analysis supports the reform proposal of removing the household replacement rate.

In the next section of this paper, we outline the role of the household replacement rate benefits in Belgium and review the relevant literature for our analysis (i) the retirement behaviour of an individual in a one-earner household and (ii) the impact of additional benefits based on the dependent status of the partner on retirement incentives. In the third section, we present our empirical strategy including information on the dataset, the construction of financial incentive measures and our sampling methodology. Sections 4 and 5 present the model, the results of our analysis and discuss them. Section 6 concludes.

2 CONTEXTUAL INFORMATION

2.1 THE HOUSEHOLD REPLACEMENT RATE

Belgium is one of the last few European countries that still (indirectly) compensates individuals for household and care work by providing additional old-age pension benefits to their spouse. In Belgium, the household replacement rate of 75 percent is granted to married pensioners in one-earner households[4]. In comparison, pensioners who are single or in two-earner households[4] are entitled to receive the isolated replacement rate of 60 percent. To qualify for the household replacement rate, the financially dependent spouse's work income cannot go over a certain earnings threshold[5] and he or she also cannot receive any type of social security benefits, except for an old-age pension. In the latter case, the sum of both spouses' old-age pensions must be lower than the pension of the prime earner calculated at the household replacement rate. If that is the case, the pension benefits of the prime earner are automatically topped up to the pension amount calculated at the household replacement rate – producing an effective benefit replacement rate between 60 and 75 percent.

Many European countries have gotten rid of benefit programs for financially dependent spouses ensuing pension sustainability concerns, which call for a reduction in the overall generosity of the system. At the time of writing, only eight European countries still propose such programs or have recently removed them: Belgium, the United Kingdom (no new claims since 2010), France (no new claims since 2011), Portugal, Norway, the Netherlands (no new claims since 2015), Ireland and Cyprus.[6] Nevertheless, these types of benefits are much more prominent outside of Europe as different variants exist in the USA, Argentina, Canada, Chile, Hong Kong, Colombia, Guatemala, Mexico, Peru, Japan, Jordan, New-Zealand, the Philippines, Taiwan and South-Korea, among others.

Belgium is the European country with the highest proportion of pensioners receiving additional benefits for financially dependent spouse, the so-called household replacement rate benefits[7]. Indeed, although the proportion of male[8] beneficiaries of the household replacement rate has been declining continuously in the last decades, it still amounts to 27.3 percent of total pensioners in 2019 (see figure 2)[9] (National Pension

[4] One-earner households are households composed of one earner and one partner who is financially dependent. Two-earners households where the lowest earner earns a very low wage, i.e. that is below the threshold for the household replacement rate, are also included in our one-earner household definition.

[5] The earnings threshold is similar to that of the combination of work and pension receipt. See Royal Decree of the 20st of January 2015 – *Arrêté Royal modifiant l'article 64 de l'arrêté royal du 21 décembre 1967 portant règlement general du regime de pension de retraite et de survie des travailleurs salaries*, M.B. 23 January 2015.

[6] See the appendix for a table describing the main features of these programs.

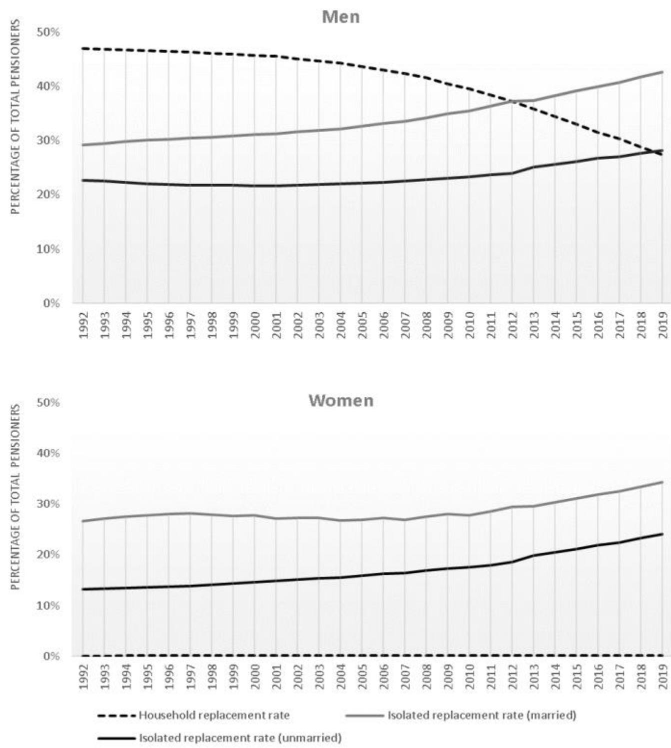
[7] See the appendix for an international comparison of the proportion of pensioners receiving additional benefits based on the financially dependent status of the partner.

[8] In 99.5 percent of cases, it is the man who is the earner in one-earner couples (Berghman, Curvers, Palmans and Peeters, 2007).

[9] Concurrently, the number of stay at home moms has been decreasing from approximately 1,222,000 in 1986 to approximately 440,000 in 2016 (Statistics Belgium, 2015).

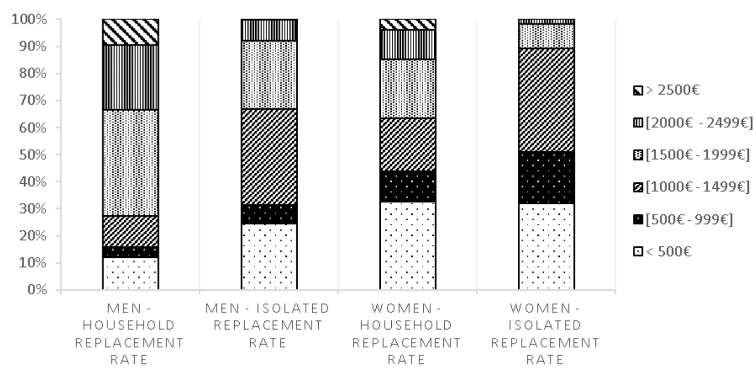
Office reports, 1992-2019). In total, pensions paid at the household replacement rate account for 18.8 percent of total old age pension benefits (National Pension Office official statistics reports, 2019).

Figure 2: Evolution of pension benefits by replacement rate, marital status and gender (1992-2019)



Source: National Pension Office annual reports (1992-2019)

Figure 3: Proportion of pension by amount, replacement rate and gender (average 2002-2019)



Source: National Pension Office annual reports (1992-2019)

As a consequence of societal evolutions[10], sustainability pressures and because of the program’s supposed work disincentive effect for dependent spouses, the Belgian Pension Reform Committee recommended

[10] Rise of the two-earner household model, increasing number of divorcees, rise in legal cohabitation practices.

removing the household replacement rate for individuals in one-earner households. Nonetheless, due to their enduring role as an important source of income for many poor households, a (long) transition period for minimum pensions is also recommended.

Two arguments work in favour of keeping the household replacement rate in place. First, although pensioners in one-earner households have higher average pension benefits because of the more generous household replacement rate (see figure 3), households with an unequal distribution of earnings capacity generally have lower average income and are often concentrated in low qualified jobs with low wages (Pension Reform Committee 2020-2040 (2014), Hindriks (2014)).

Secondly, while the trends in old-age pension benefits receipt confirm a decrease in the traditional male breadwinner household model (see figure 2), Höhn, Avramov, and Kotowska (2008) state that we are actually witnessing the rise of a modernized male breadwinner model, in which the husband remains the main earner and the wife often has an incomplete career because of household and care responsibilities.[11] Similarly, Ciccia and Kotowska (2014) observe that childcare remains the responsibility of women across Europe and public child care services still generally assume a generalized traditional male breadwinner model. In fact, there still exists a vast disparity in terms of old-age pension benefits between men and women that are driven by the gender wage gap, longer life expectancy[12], shorter careers[13] and a higher prevalence of part-time work[14], which are partly the result of household and care activities (Hindriks, 2015).[15]

2.2 Retirement incentives and financially dependent spouse

In this subsection, we present a brief overview of the literature on the impact of having a financially dependent spouse on retirement incentives. We divide this impact into two effects: (I) the effect of spousal

[11] Höhn et. al. (2008) mention that the modernized male breadwinner household model is more common than the two-earner household model in the Netherlands and is the second most common model, after the two-earner model, in Northern Belgium. Additionally, Mínguez (2004) reports that the traditional male breadwinner model is persistent in most of Southern Europe.

[12] The OECD (2020) predicts an average of 25.5 years in retirement for women and 21.1 years in retirement for men.

[13] In 2019, the predicted duration of working life for Belgian men was 35.4 years and 31.6 years for Belgian women (Eurostat, 2020).

[14] On average 42 percent of Belgian women and 9 percent of Belgian men aged 15 to 64 were working part-time between 2004 and 2019, compared to 31.2 and 7.9 percent in Europe, respectively (Eurostat, 2020). Likewise, in paper four, we find that 68.7 (67.2) percent of working wage-earner women aged 55 to 59 (60 to 64) were working part-time from 2004 to 2010.

[15] In fact, 38.3 percent of female pensioners receive a pension benefit of less than 1,000 euros compared to only 27.1 percent of male pensioners. Only 0.1 percent of female pensioners receive a pension benefit of more than 2,500 euros, compared to 2.6 percent of male pensioners (OECD, 2016).

characteristics on retirement incentives and (II) the effect of additional benefits granted on the basis of having a dependent spouse.

2.2.1 SPOUSAL CHARACTERISTICS

A person's retirement incentives are influenced not only by individual determinants but also by the characteristics of his or her partner such as age, income and activity status (Coile, 2015). Denaeghel, Mortelmans, and Borghgraef (2011) find that spousal characteristics influence retirement decisions but that individual determinants are stronger while Coile (2004) notes that women are as responsive to their own retirement incentives as men. Coile (2015) mentions that there exist three sources that cause the retirement decision of an individual to be influenced by his or her spouse: (i) common financial resources, (ii) similar preferences (i.e. time preferences) and (iii) complementarities in leisure (an individual will enjoy leisure even more once his or her spouse is retired).

Furthermore, both Coile (2004) and Baker (2002) find that there exists a spillover effect of the spouse's retirement incentives on the individual's own retirement behaviour, caused by complementarities of leisure and joint decision-making. Coile (2004) finds that the inactivity status of the partner has a positive impact on the retirement probability of individuals because of complementarities of leisure. Similarly, Blau (1998) mentions that a spouse values retirement more once the other spouse is retired and both Blau (1998) and Gustman and Steinmeier (2000) find that a husband is more strongly influenced by having a retired spouse than a wife is. Finally, both spouses plan their joint consumption over their life cycle and try to even out their consumption in the best way possible through cooperative retirement decisions (Gustman and Steinmeier, 2000).

2.2.2 THE INFLUENCE OF THE HOUSEHOLD REPLACEMENT RATE BENEFITS

Inside the vast strand of the literature that looks at the effect of social security provisions on the retirement decision[16], a smaller part of the literature looks at the impact of programs that provide (in)direct benefits to the financially dependent spouse. Blau (1998) uses data from the Retirement History Survey and a discrete time choice model to look at the impact of the US dependent spouse benefits on the retirement behaviour of older married couples. He predicts that dependent spouse benefits have a small positive impact on the

[16] See Stock and Wise (1990a), Stock and Wise (1990b), Gruber and Wise (1999), Gruber and Wise (2004) Börsch-Supan and Coile (2020), among others

working probability of husbands and a small negative impact on the working probability of wives. Michaud (2003) provides evidence of the same work (dis)incentive mechanism and finds that the overall effect of the program on labour force participation is negative. Knapp (2014) uses a life-cycle model of household savings, labour supply and benefit claiming decisions on the 1992 Health and Retirement study US data and confirms that the US dependent spouse benefits program creates a work disincentive for the low income earner in the couple (usually the wife) and a work incentive for the high income earner (usually the husband). For the prime earner in the couple, this implies that the substitution effect (increased returns to work lead to lower demand for retirement) is more important than the income effect (higher benefits induce a higher demand for retirement). In fact, he tests the impact of abolishing the spouse and survivor benefits and finds that it would increase the labour force participation of wives by 1.27 years and decrease the labour force participation of husbands by 0.53 years. Michaud and Vermeulen (2004) find almost no impact of the elimination of the dependent spouse benefits on labour supply at older ages, although they indicate that there exists a work disincentive effect associated with the program. Finally, Baker (2002) analyses the effect of the introduction of the spouse's allowance in 1975 in Canada and finds that it led to a decrease in the work incentives for both men and women because of the means-tested nature of the benefits.

3 EMPIRICAL STRATEGY

In this section, we first describe the dataset used in our analysis and our sample selection method. Then, we discuss our pension benefits simulation tool and its validation. Further, we define our classification method of households into one and two-earner types and we provide descriptive statistics of the final sample.

3.1 THE DATASET

In this paper, we use the Survey of Health, Ageing and Retirement in Europe (SHARE) dataset. SHARE is a survey dataset that contains panel micro data on health, socio-economic and family network of individuals aged 50 and over. It is a cross-national project that covers 27 European countries and Israel. The data is collected biannually and is organized into waves from wave 1 collected in 2004/2005 to wave 7 collected in 2017. The target population of the survey is persons aged 50 and over at the time of the sampling who have their regular domicile in the country.[17] Each wave follows the same baseline sample (born in 1954 in the case of Belgium) and adds a refreshment sample[18] to ensure the representation of younger cohorts and to compensate for attrition.

We use the Job Episode panel dataset of waves 3 and 7 for Belgian respondents, which contains working life and employment histories for 6,200 individuals (2,865 in wave 3 and 3,333 in wave 7).[19] This dataset includes a retrospective career and earnings history that was collected in 2008 or 2009 for wave 3 respondents and in 2017 for wave 7 respondents. The data also includes personal characteristics such as gender, age, a variable indicating whether the individual lives with a partner, the marital status, the occupation (in education, working, retired, unemployed, sick, homemaker, other[20]) and the year of birth. Available career information includes the first and last net wage of each new employment, the industry, the working regime (wage earner, self-employed or civil servant) and the working hours (full or part-time). The first old-age pension net amount received is also available if the individual was retired at the time of the survey. The retrospective career and earnings history of the partner is included for part of the sample.

3.2 SAMPLING METHODOLOGY

Since we are working with survey data, we first need to make several adjustments to the initial dataset that contains the life history of individuals. First, we discard information on years spent in education. Moreover, we dispose of individuals who do not report any wage[21] at any point in their adult life and individuals with a reported spouse who did not participate in the survey. We drop the observations of individuals who report a monthly gross income or pension higher than 10,000 euros as we consider them as outliers or encoding errors.

[17] The sampling design also includes stratification based on the provinces and clustering based on municipalities. Individuals are excluded from the target population if they are incarcerated, hospitalized, cannot be located or unable to speak the national language.
[18] The refreshment sample is composed of people born in 1956 in wave 2, 1960 in wave 4, 1962 in wave 5 ad 1964 in wave 6. No refreshment sample was included in waves 3 and 7.
[19] The job panel dataset is only available for waves 3 and 7. In case one individual is identified in both waves 3 and 7, we use only the information contained in wave 7.
[20] The other category includes individuals in training, travelling, volunteering or benefitting from a survivor pension only.
[21] Because we are working with retrospective data, we are missing the career and earnings histories of some individuals who refuse to give this information or simply cannot remember.

We keep the observations of individuals between the ages of 55 and 65[22], who were aged younger than 55 in 1990[23] and those who were still working at age 55. We drop the observations of individuals after they retire because we consider retirement to be an absorptive state. We are mostly interested in individuals who have a wage-earner career because social security rules for the other two working regimes vary considerably in terms of benefits calculation rules, pensionable wage floors, ceilings, etc.[24] Therefore, we discard the observations of individuals who have a wage-earner career of less than 75 percent[25] of total career or individuals who are identified as civil servants or self-employed workers after age 55. Furthermore, we drop individuals who have an estimated pension amount of less than 500 euros and individuals who have a total career of less than or equal to 15 years because we assume that the determinants of retirement for individuals with a low wage or low number of career years are potentially very different from those of individuals with a higher wage. Finally, we drop individuals who have an estimated pension higher than 3500 euros, since it is higher than the maximum pension benefit.

We obtain a total of 3,392 observations for 716 individuals and 625 households. Observation years range from 1990 to 2016. Table 1 summarizes the main characteristics of sampled individuals. Since we are imposing a minimum career length condition, the proportion of men is higher than the proportion of women in our sample.

Table 1: Characteristics of sampled individuals

	Number of individuals	Proportion of total sample
Male	437	61.03 %
Female	279	38.97 %
French speaking	269	37.57 %
Dutch speaking	447	62.43 %
Without partner	176	24.58 %
With partner	540	75.42 %
Total	716	100 %

Source: Authors' own calculations using SHARE dataset

[22] We consider the age range of 55 and 65 as the range during which a worker is most probable to exit the labour force. Indeed, in Belgium, most early labour force exits pathways are not available before age 55 and wage-earners are encouraged to retire at 65.
[23] We restrict the period of our analysis to limit the survivor bias. Indeed, only individuals who have survived until 2008/2009 (wave 3) or 2017 (wave 7) have replied to the survey. As we expect that early death is correlated with health and socio-economic status, the longer the period between the last observation and the time of the survey, the higher the survivor bias.
[24] Additionally, no household replacement rate exists in the civil servant scheme in Belgium.
[25] We tested the robustness of our analysis by sampling only individuals with a 100 percent career as a wage-earner. It did not significantly alter our results, but it decreased considerably the size of our sample. Therefore, to increase the sample size, we allow for mixed careers up to 25 percent of another working regime as it often happens that individuals start their career in a different working regime.

3.3 RECONSTRUCTION OF EARNINGS HISTORIES AND CALCULATION OF PENSION BENEFITS

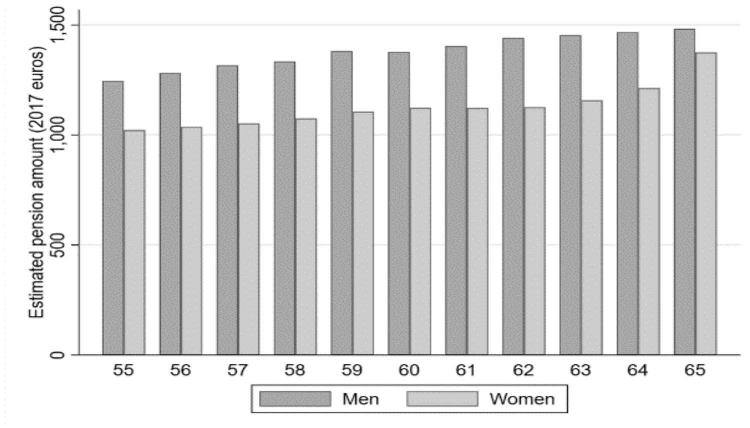
We use the earnings histories that contain the first net wage of each new job to reconstruct complete earnings histories. From these reconstructed earnings histories, we estimate the old-age pension benefits each individual would be entitled to receive at each age between 55 and 65. We detail the method for building our old-age pension benefit calculator below.

First, we transform the currency of wages into euros and we calculate gross wages from net amounts using the respective taxation rules in effect. We fill-in the partial wage information by adjusting the first wage of each new employment for inflation and average wage growth[26] for each year of career. In case there is missing information on the first wage of a new job, we use the closest available wage in the individual's earnings history, adjusted for inflation and wage growth.

We use these reconstructed earnings histories to calculate the old-age pension benefits entitlements at each age between 55 and 65. First, we replace the wage with the corresponding pensionable earnings ceiling (floor), if the former is larger (smaller) than the latter. Second, we re-evaluate past earnings into euros of the retirement year using the corresponding valorisation factor.[27] Finally, we sum the valorized earnings over the entire career, divide the sum by the applicable complete career years and multiply it by 60 percent for individuals in two-earner or single households and 75 percent for individuals in one-earner households (see section 3.5). We replace our estimated old-age pension amount by the minimum pension where needed, adjusted for the proportion of a complete career. Finally, we calculate the net pension amount using the respective taxation rules in effect and we add the pension bonus whenever applicable. For each age between 55 and 65, we obtain an estimation of the net pension amount an individual would be entitled to receive based on his reconstructed earnings history, were he to retire at that age.[28] We find an average estimated old-age pension of 1329.92 euros for men and 1074.17 euros for women (all years combined, in 2017 euros). Figure 4 displays the evolution of old-age pension benefits by age and gender.[29]

[26] We adjust wages to inflation using the historical evolution of Consumer Price Index. For wage growth, we use the historical evolution of average monthly salary for wage earners by age, which is differentiated by gender (see Statbel,2019)
[27] See the Belgian Official pension Office for more information on the valorization factor
[28] We convert every pension amount into 2017 euros using the Consumer Price Index.
[29] The important increase in average pension benefits at age 64 and 65 for women is caused by the fact that individuals with the highest earnings tend to stay on the labour force after the statutory eligibility age.

Figure 4: Evolution of estimated old-age pension amounts by age and gender (2017 constant euros)



Source: Authors' own calculations using SHARE dataset

3.4 VALIDATION OF THE OLD-AGE PENSION BENEFITS CALCULATOR

For each sampled individual, we compare our estimated pension amount at the effective retirement age to the corresponding observed amounts received, as reported in later survey waves (see section 3.1).[30] We find a difference between the observed and the estimated pension amount of less than 250 euros for 50.2 percent of our observations and less than 500 euros for 79.8 percent of our observations.

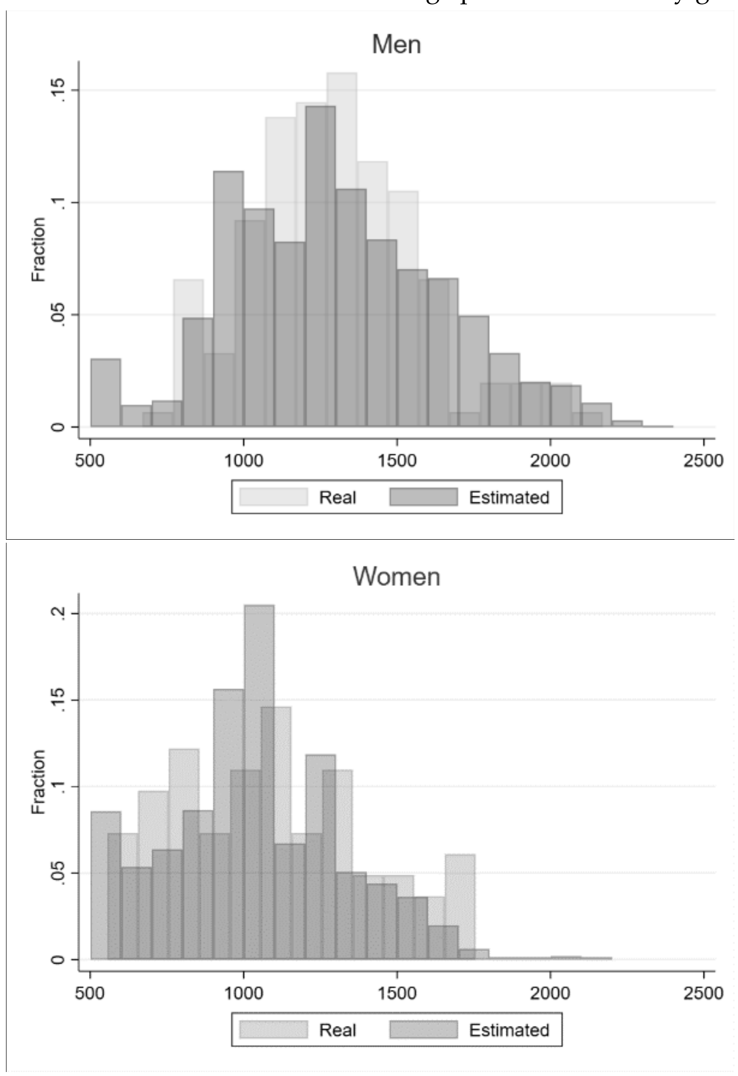
Figure 5 compares the real and estimated pension amounts by age for men and women. The estimation is quite accurate for men but less so for women. First, women more often have interrupted careers or part-time working contracts because of household and care responsibilities. For the same reasons, women exhibit more variations in wage growth and in earnings paths than men. Second, since we do not have precise information on work intensity during a specific career year[31], we cannot truly verify the eligibility criteria for the minimum pension and we may grant it to individuals who would actually not be eligible based on their real career histories. This missing information thus has a stronger effect on the estimates for women for whom part-time work is much more prevalent. In fact, if we run a regression of the absolute difference between the observed and the estimated pension amount, using various personal and job-related

[30] We restrict the sample to individuals who were retired at the time of the survey (to have information on his or her observed old-age pension) and who never worked as self-employed or civil servants. If the old-age pension amount is not observable at the retirement age, we adjust it to the price levels of the retirement year using the pivotal index mechanism (see the Belgian Official Pension Office).

[31] We have information on whether the individual has worked part-time during the year but nothing on how many days or full-time equivalent he or she has worked during that year.

characteristics as explanatory variables, we observe that gender and the education level (tertiary compared to secondary) both have a positive and significant coefficient. This result indicates that the average wage growth we use for the reconstruction of earnings histories is not as appropriate for women and individuals with tertiary education as it is for other types of individuals. Consequently, our estimation of financial retirement incentives is less accurate for women and individuals with tertiary education than other types of individuals.

Figure 5: Estimated and observed old-age pension benefits by gender



Source: Authors' own calculations using SHARE datasets – Modules *Job panel* (waves 3 and 7) and *Employment and pensions* (waves 1, 2, 3, 4, 5, 6)

3.5 CLASSIFICATION INTO ONE AND TWO-EARNER HOUSEHOLDS

In order to be identified as a one-earner household, the couple must be married and the household must include one earner and one financially dependent spouse. We classify an individual as a financial dependent spouse using two criteria: a status-based indicator and an earnings indicator. The status indicator labels an individual as a financially dependent spouse if he or she is identified as homemaker, in training or "*doing nothing*". The earnings indicator compares the individual's earnings (from any of the three working regimes) to the corresponding earnings test thresholds[32]. We exclude individuals who qualify based on the earnings indicator but are identified as sick or unemployed because the household replacement rate cannot be granted to a pensioner whose spouse receives unemployment or sickness benefits. Since the household replacement rate is only available to married individuals, we exclude legal cohabitants from this definition.[33] Households with one spouse identified as a financial dependent using either of the two indicators is labelled a *one-earner household*.[34] Households with two spouses working and earning an income above the wage indicator are labelled *two-earner households* and one-person households are labelled *single households.* Finally, we only keep the observations of the earners in one-earner couples and discard the observations of the dependent spouse.

We obtain a total of 129 individuals (760 observations) in one-earner households, 319 individuals (1,820 observations) in two-earners households[35] and 144 individuals (812 observations) in single households. Table 2 summarizes the main characteristics of individuals by type of household. Predictably, there are more men identified as earners in one-earner households following the prevalence of the traditional male breadwinner model. The proportion of men in two-earner couples is also slightly higher than for women because of our sampling methodology that discards individuals with (very) short careers or who are out of the labour force at older ages. Interestingly, we note that the average retirement age is almost equal between single and two-earner households but is lower for one-earner households. Finally, we observe that there is a lower prevalence of part-time work among individuals in one-earner households compared to other types of households.

[32] We use the 2017 earnings threshold for the combination of work and old age pension benefits receipt that we adjust for prices. The monthly threshold is 1,013.5 euros for wage-earners or civil servants below age 65, 810.7 euros for self-employed workers below age 65, 1,971.4 euros for wage-earners or civil servants above age 65 or 1,899.1 euros for self-employed workers above age 65.

[33] Unmarried individuals who satisfy the one earner household criteria are not used in this analysis. They only constitute a very minor proportion of the sample.

[34] If both household members fulfil the financially dependent spouse criteria, then the observations are dropped.

[35] It is possible that two individuals from the same two-earner household are selected into our sample.

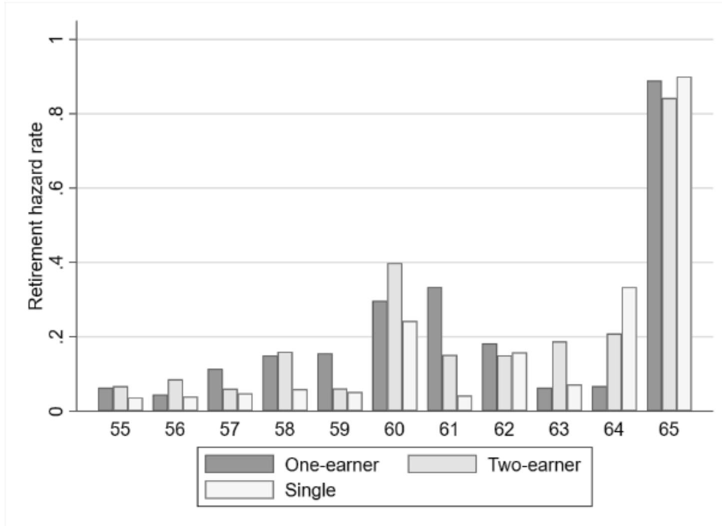
Table 2: Main characteristics of sampled individuals by type of household

Personal characteristics		One-earner		Two-earners		Single	
		Number of individuals	Proportion (%)	Number of individuals	Proportion (%)	Number of individuals	Proportion (%)
TOTAL (individuals)		129	100	319	100	144	100
Gender	Male	113	87.6	176	55.17	77	53.47
	Female	16	12.4	143	44.83	67	46.53
Level of education	Primary	10	7.75	28	8.78	10	6.94
	Secondary	65	50.39	170	53.29	74	51.39
	Tertiary	54	41.86	121	37.93	60	41.67
Native language	French	43	33.33	122	38.24	57	39.58
	Dutch	86	66.67	197	61.76	87	60.42
Average retirement age		60.98 (2.81)		61.16 (2.93)		61.82 (2.79)	
Job-related characteristics		Number of observations	Proportion (%)	Number of observations	Proportion (%)	Number of observations	Proportion (%)
TOTAL (observations)		760	100	1,820	100	812	100
Part-time work		48	6.32	314	17.25	129	15.89
Full-time work		712	93.68	1,506	82.75	683	84.11
Sector of activity							
	Primary	30	3.95	20	1.10	10	1.23
	Secondary	432	56.84	857	47.09	295	36.33
	Tertiary	298	39.21	943	51.81	507	62.44
Proportion of career worked as wage-earner		97.80 (4.64)		97.77 (5.16)		97.24 (6.07)	

Source: Authors' own calculations using SHARE dataset

Looking at the retirement hazard rates (figure 6), we see that the retirement hazard of individuals in single households is generally lower than other types of households at lower ages and present peaks at ages 60, 64 and 65. The retirement hazard rate of individuals in one-earner households is generally higher than other types of households before age 62. The only two exceptions are at ages 58 and 60, the eligibility ages for the conventional early retirement and the early eligibility age of the old-age pension benefit, at which the retirement hazard rates of individuals in two-earner households are the highest. At age 65, the retirement hazard rate of two-earner households is the highest but is closely followed by the other two types of households.

Figure 6: Retirement hazard rates by age and type of household



Source: Author' own calculations using SHARE dataset

3.6 FINANCIAL RETIREMENT INCENTIVES

From the estimated old-age pension benefits, we construct two measures of financial retirement incentives at the individual level: the social security wealth measure and the accrual. We define social security wealth (SSW) as the present discounted value of all future pension benefit[36] flows for individual i at age a if he retires at age R[37].

$$SSW(i,a,R) = \sum_{s=R}^{T} \beta^{s-a}\, E[B_{iR}(s)]$$

where $E[B_R(s)]$ is the expected after-tax benefit of individual i at age s for retirement at age R and received until the end of life T. Discounting is done allowing for time preference β^{s-a} is the time discount rate that we assume to be equal to 3 percent real.

[36] We only consider the incentives stemming from the old-age pension program and no benefits from other labour force exit pathways because we have access to less detailed status information and we cannot verify most of the eligibility criteria for other programs. In fact, individuals who are marked as receiving disability, conventional early retirement or unemployment insurance after the age of 54 are not included in the sample (see section 3.4). Also, due to a lack of precise information on the individual's wage, we do not construct the ITAX measure.

[37] We assume that the individual retires as soon as benefits become accessible.

We follow Jousten and Tarentchenko (2014) and calculate the expected benefit as

$$E[B_R(s)] = \begin{cases} \rho(s)\ B_{R,isolated}(s) \quad for\ singles \\ \\ \rho(s)\ \tau(s)B_{R,single}(s) + \ \rho(s)\ \big(1-\tau(s)\big)B_{R,isolated}(s) \\ +\big(1-\rho(s)\big)\tau(s)B_{R,survivor}(s)\ for\ two-earner\ hhs \\ \\ \rho(s)\ \tau(s)B_{R,household}(s) + \ \rho(s)\ \big(1-\tau(s)\big)B_{R,isolated}(s) \\ +\big(1-\rho(s)\big)\tau(s)B_{R,survivor}(s)\ for\ one-earner\ hhs \end{cases}$$

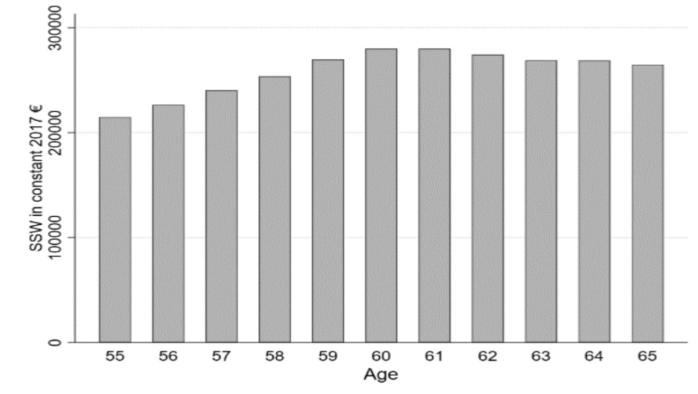
Where $B_{R,isolated}(s)$ refers to the old-age pension benefit paid at the isolated replacement rate at age s if the worker retires at age R. $B_{R,household}(s)$ refers to the old-age pension benefit paid at the household replacement rate at age s if the worker retires at age R. $B_{R,survivor}(s)$ refers to the survivor pension paid to the spouse if the worker retires at age R and in case of the worker's passing. $\rho(s)$ refers to the survival probability of the reference person at age s conditional on being alive at age a, and $\tau(s)$ refers to the survival probability of the spouse at age s conditional on being alive at age a.[38]

If the individual is not eligible for the old-age pension benefit at age a, then we compute his social security wealth by imputing an income of zero until he or she becomes eligible for old-age pension benefits at age R[37]. If the individual is eligible for old-age pension benefits at age a, then a is equal to R and we compute his SSW by imputing pension benefits starting at age a.

Figure 7 shows the evolution of social security wealth by age. An individual's social security wealth increases until the individual becomes eligible for the old-age pension benefit (age 60 in most cases) and then slightly decreases because the additional pension wealth gained through increased pension benefits is lower than the wealth lost because the individual foregoes one year of benefits.

[38] The survival probabilities are based on age and gender specific survival tables retrieved from the Human Mortality. We assume that both spouses are the same age.

Figure 7: Evolution of social security wealth by age



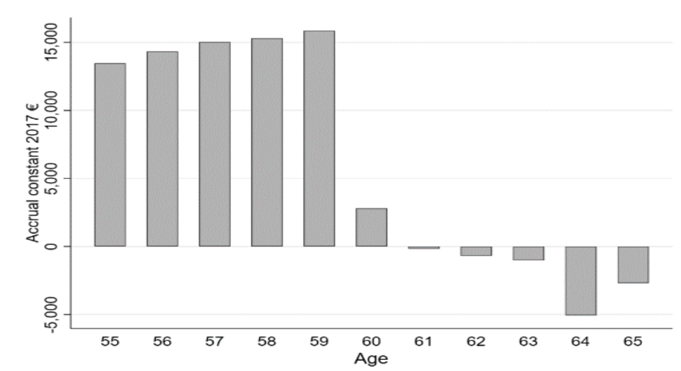
Source: Authors' own calculations using SHARE dataset

The accrual represents the variation in SSW that is obtained if the worker stays on the labour force for one additional year. A positive accrual represents an incentive to stay on the labour force because the pension wealth to be gained by working for one more year is higher than the effect of losing one year of benefits. In the opposite case, a negative accrual represents an incentive to leave the labour force.

$$ACC_t(i,a) = SSW_{t+1}(i,a+1) - SSW_t(i,a)$$

Figure 8 shows the evolution of accruals by age. Similarly to the literature (see Gruber and Wise, 1999), we find large positive accruals before benefits become available and smaller accruals thereafter. The accruals before age 60 (the early eligibility age of the old-age pension) are positive and thus indicate that there is an incentive for the individual to stay on the labour market before he or she can access old-age pension benefits.

Figure 8: Evolution of accruals by age



Source: Authors' own calculations using SHARE dataset

4 ANALYSIS

In this section, we first define the model we use in our analysis, namely a discrete time logistic duration model. Then, we discuss censoring and truncation issues that arise with our data and which are common in duration model analysis. Finally, we define the explanatory variables we include in our analysis.

4.1 THE MODEL

We use a discrete time[39] duration model to study transitions from employment into retirement.[40] The use of such framework allows us to model the conditional probability that the employment spell will end during a certain period, given that it has lasted until the preceding period.

We refer to the transition from employment to retirement as a *failure event*, which can only occur after the *onset of risk,* the individual's first entry on the labour market. Failure can only happen once since we define the retirement decision as absorptive. We define T a discrete random variable that represents employment duration. Our time axis is divided into a number of non-overlapping continuous time intervals where the boundaries are the employment duration years $a_0, a_1, a_2, a_3, \ldots, a_k$. Thus, the intervals are defined as $[a_{j-1}, a_j[$ with $j \in \{1,2,3, \ldots k\}$.

The survival function of interval a_j, $S(a_j)$, is the probability that the employment spell will last until at least a_j. Said differently, it is the probability that no retirement occurs before a_j. The failure function, $F(a_j)$, is the reverse of $S(a_j)$ and is the probability of retirement before or during interval a_j.

$$S(a_{j-1}) = \Pr[T > a_{j-1}] = 1 - F(a_{j-1}) \tag{1}$$

$$S(a_j) = \Pr[T > a_j] = 1 - F(a_j) \tag{2}$$

[39] Retirement occurs on a continuous timeline but since our data is grouped into annual intervals, discrete time duration models are more appropriate than continuous time duration models (Jenkins, 2004). When one has access to intervals grouped in months, continuous time duration models can still be used to analyse the retirement decision (see Aranki and Macchiarelli (2013)) for instance).

[40] See Diamond-Hausman (1984), Schils (2006), Wolthoff, Euwas and Vuuren (2006), Euwals- and Vanvuuren- and Wolthoff(2006), Lindeboom (1998), Antolin and Scarpetta (1998) and Aranki and Macchiarelli (2013) for duration models of retirement transitions.

The probability of retirement during the interval $[a_{j-1}, a_j[$ is written as

$$Pr[a_{j-1} < T \leq a_j] = \mathrm{F}(a_j) - \mathrm{F}(a_{j-1}) = S(a_{j-1}) - \mathrm{S}(a_j) \tag{3}$$

The discrete time hazard rate at interval a_j, $h(a_j)$, is the conditional probability of retirement during interval $[a_{j-1}, a_j[$, provided the individual was still employed at the end of interval a_{j-1}, and is written as

$$h(a_j) = Pr[a_{j-1} < T \leq a_j \mid T > a_{j-1}] \tag{4}$$

We follow the methodology of Maes (2008) and Andriopoulou and Tsakoglou (2011) and we use a logistic discrete time hazard duration model in which the dependent variable is the logit transformation of the hazard rate at interval j[41] (see 5).[42]

In the logistic model, the log of the relative odds[43] of failure during interval j, conditional upon having survived until the end of the interval (j-1), is the sum of a baseline hazard that is common to every individual and an individual-specific scaling factor.

$$logit(h(j,X)) = \log\left(\frac{h(j,X)}{1-h(j,X)}\right) = f(j) + \beta' X'$$

$$h(j,X) = \frac{1}{1 + e^{(-f(j)-\beta' X')}} \tag{5}$$

Where $h(j,X)$ is the scaled hazard rate for a certain individual in interval j. $f(j) = logit(h_0(j))$ is the baseline hazard specification, common to every individual. And X is the vector of household, personal and job characteristics for a certain individual, which can be time constant or time-varying.

[41] Hereafter, since all intervals have the same length, we refer to interval a_j as interval j.
[42] There exist two main hazard specification functions in discrete time models: the complementary log-log and the logistic model. The main difference between the two models is that the complementary log-log model assumes proportional hazards and the logistic model assumes proportional odds (Andriopoulou and Tsakloglou, 2011). In fact, the logistic model converges to the complementary log-log model as the hazard becomes increasingly small, which is the case in most applications (Jenkins, 1995).
[43] Therefore, the exponentiated coefficients of the logistic model can be interpreted as odds ratio, or the probability of failure over the probability of non-failure. We follow Maes (2008) and Wolthoff, Euwas and Vuuren (2006) and we present the marginal effects rather than the exponentiated coefficients for the sake of clarity and simplicity of interpreation.

Because unobserved effects like ability, motivation, general attitudes towards employment or retirement and preferences for leisure might affect the retirement behaviour (Maes, 2008), we control for individual heterogeneity using a random effects model where c is the unobserved individual-specific error term that we assume uncorrelated with vector X.

$$logit(h(j,X)) = \log\left(\frac{h(j,X)}{1-h(j,X)}\right) = f(j) + \beta' X' + c \tag{6}$$

Jenkins (1995, 2004) shows that a discrete time duration model with panel data is equivalent to estimating a logit model using the failure event as the dependent variable and a set of explanatory variables representing duration.

Therefore, we use the following binary response logit model

$$y_{ij}^{*} = \beta' X' + f(j) + c_i + u_{ij}$$

where y_{ij}^{*} is the latent probability for individual i to retire in interval j, β' is the vector of coefficients associated with time-constant and time-varying explanatory variables X' and $f(j)$ is the baseline hazard specification of employment duration.

4.2 CENSORING AND TRUNCATION

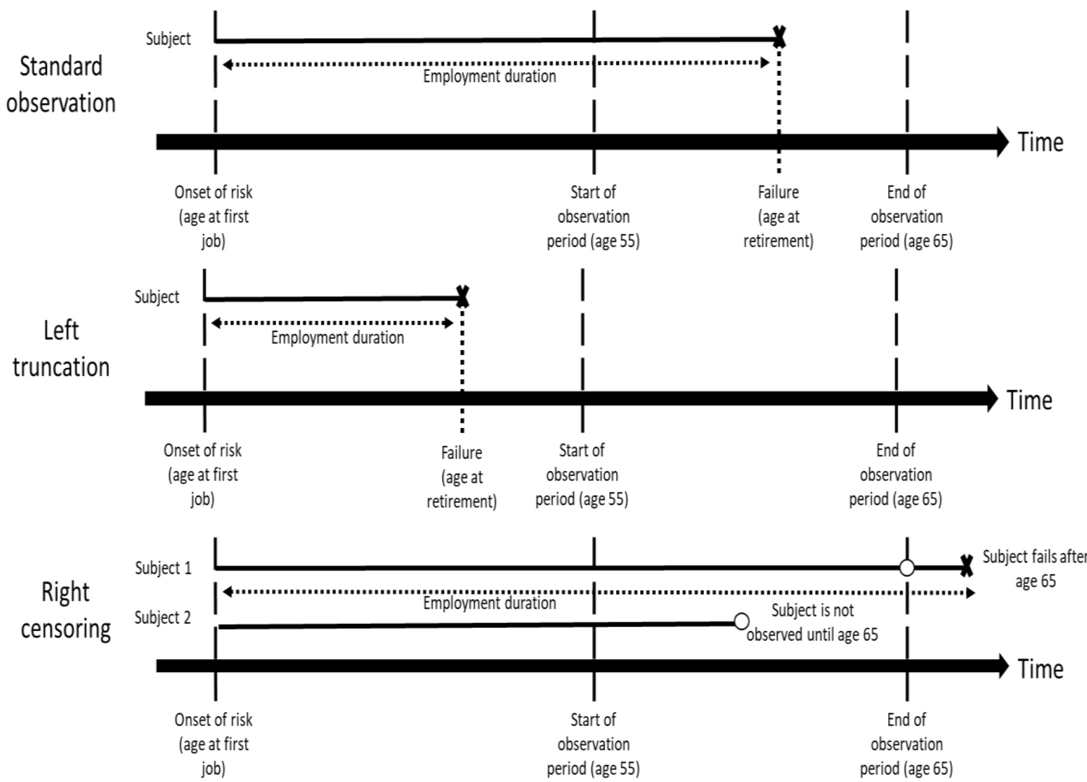
One of the advantages of duration models lies in the fact that they effectively deal with the presence of right-censored and left-truncated data. Figure 9 summarizes the types of censoring and truncation issues we face with our data.

Left truncation is caused by our sampling methodology, according to which we only keep individuals who are still employed at age 55 and leave aside individuals who retired before that age. Therefore, our results are not valid for the portion of the population who can retire at a (very) early age.[44] Another source of truncation is caused by the fact that we only observe individuals who are still alive at the time of survey. As mentioned above, we restrict our sample to individuals who were aged 55 or less in 1990 and discard the observations of older individuals to reduce a potential attrition bias.

[44] For instance, sailors, flying personnel, etc. have different old-age pension eligibility rules and are more likely to retire early. Since they might respond to different retirement incentives based on specific eligibility rules, they are left out of our analysis.

Right censoring occurs because not everyone who replied to the survey in wave 3 and wave 7 have retired. Indeed, 28.77 percent of individuals in our initial sample were still employed at the end of our observation period (2008 or 2009 for wave 3 and 2017 for wave 7). We assume that censoring is independent of the probability to retire since it is solely based on the year in which the survey took place. Moreover, because we use a logit random effect model on panel data, we are effectively dealing with censoring issues.

Figure 9: Illustration of standard observation, left truncation and right censoring in the data



Source: Authors' own illustration

4.3 DEPENDENT AND EXPLANATORY VARIABLES

Our dependent variable is a binary indicator of retirement, defined as a transition from employment status to the "retired from work" status[45] during period interval j.

$$Retirement_{ij} = \begin{cases} 1 \text{ } if \text{ } working \text{ } in \text{ } interval \text{ } (j-1) \text{ } and \text{ } retired \text{ } in \text{ } interval \text{ } j \\ 0 \text{ } otherwise \end{cases}$$

[45] The status *Retired from work* indicates the receipt of (part or full-time) old-age pension benefits.

We use our financial retirement incentive measures, the social security wealth measure and the accrual, as explanatory variables[46]. Maes (2008) mentions the identification issue of social security wealth, according to which social security wealth might capture the unobserved effect of individuals' taste for work. Indeed, individuals with a high taste for work have higher average wages and social security wealth and will likely retire later than individuals with low taste for work. In fact, while the lifecycle theory suggests a positive effect of social security wealth on retirement, this omitted variable bias might lead to a negative coefficient for social security wealth. Coile and Gruber (2001) found that there was still substantial variation in the SSW and accruals even after controlling for lifetime and current earnings. Therefore, following the non-linearity in the relationship between SSW and earnings, we add a variable indicating the last net monthly wage[47] received by the individual as a proxy for the unobserved effect of taste for work.

In additional to financial retirement incentives, we control for job characteristics including the sector of activity (primary, secondary or tertiary), part-time working contracts (at least one period of part-time work during interval j takes the value of 1) and the years worked as wage-earner expressed as a percentage of the career[48]. Next, we control for personal and household characteristics including gender, the year of birth[49], the level of education (primary, secondary or tertiary), an interaction term between education and gender, the language spoken[50], age difference with the partner (in absolute value), a binary variable indicating whether the spouse is older than the worker (1 if the spouse is older than the worker and 0 otherwise) and the retirement status[51] of the partner (1 if the partner is retired from work and 0 otherwise). We add a variable indicating whether the individual is an earner in a one-earner household following our classification method detailed above.

Finally, we add a set of variables representing the baseline hazard function of employment duration. We use a second order polynomial function of employment duration.[52]

$$f(j) = z_1 j + z_2 j^2 \tag{6}$$

[46] One unit change in the social security wealth and accrual variables is equal to a change of 100,000 euros.
[47] A unit change in the net wage variable is equal to a change of 100 euros. The wages are expressed in 2017 euros.
[48] One unit change in this variable is equal to a change of 10 percentage points.
[49] Since we merged two waves of the data (wave 3 and 7), we tested for the impact of belonging to one wave or another and have found no significant effect.
[50] French speakers live in a region that broadly corresponds to Wallonia and Flemish speakers live in a region that broadly corresponds to Flanders. The German speaking community is not included in the survey.
[51] To be identified as retired, the partner must have had a career. Therefore, not every dependent spouse in one-earner household is defined as retired.
[52] We tried various baseline hazard specifications: linear, dummies, dummies of 5 years, log, etc. All specifications yielded very similar results.

Duration can be proxied by age itself (Maes (2008), Spataro (2002)), and it can thus become difficult to discern the difference between the effect of the duration variable and the pure age effects. Coile and Gruber (2001) note that they find very little difference in their coefficients when including the age dummies or another specification of age. We follow the methodology of Maes (2008), Meghir-Whitehouse (1997) and Lindeboom (1998) and include employment duration and an age variable as we expect that individuals with the same employment duration and a different age can have a different retirement behaviour.

Regarding age, we use three different model specifications. Indeed, age is plausibly correlated with decreasing health, increasing preferences for leisure, social norms and eligibility conditions for various social security programs (Maes, 2008). We control for the correlation of age with unobservable variables by using a random effects model. However, age might still capture eligibility for social security programs, which should be captured by our financial incentive variables. We are faced with a dilemma. On the one hand, the use of a set of age dummies serves to capture non-linearity in the effect of age, but it avoids our financial incentive measures from capturing the eligibility effect of social security programs. On the other hand, the use of a non-linear function of age foregoes this latter issue but might not capture the social norms effect of reaching a certain age on the retirement probability. In view of these assumptions, we present three models with different age specifications: (i) a cubic form specification of age, (ii) age dummies and (iii) a cubic form specification of age and a set of social security eligibility variables. Therefore, in the third specification, we add a set of binary variables indicating eligibility to old-age pension at the early (EEA) and statutory (SEA) ages and eligibility to the standard conventional early retirement regime.[53]

5 RESULTS

In this section, we first present and discuss the results of our discrete time logistic duration model. Then, we present a simulation of the impact of a change in the generosity of the household replacement rate on predictions of the retirement probability and on poverty measures.

5.1 REGRESSION RESULTS

In this section, we present and discuss the results of our discrete time logistic hazard duration model divided into three models with different age and social security eligibility specifications (see table 3): (i) a

[53] Since we do not have access to the days worked during each year of career, we consider that each year of the career was worked full-time when checking the eligibility criteria.

cubic polynomial of age, (ii) age dummies and (iii) a cubic polynomial of age with social security eligibility variables.

First and foremost, we take a look at the effect of our financial retirement incentive variables. We find a significant and positive impact of social security wealth on retirement in all three models. This result indicates that higher social security wealth leads to higher retirement probability, thus correctly predicting an income effect (Coile, 2004; Maes, 2008). As expected, the effect of our last net wage variable is negative and significant and represents the negative relationship between taste for work and retirement. Similarly to Gruber and Wise (2004), we observe that part of the social security wealth effect is captured by the wage coefficient as the coefficient of the former decreases as the latter is added as a regressor. In the end, we find that a 100,000 euros increase in social security wealth would increase the retirement probability by approximately 6 percentage points.

The effect of the accrual variable is negative and significant, thus correctly predicting a substitution effect (Coile, 2004). Indeed, a positive (negative) accrual indicates that there is a gain (loss) to be made in terms of social security wealth by staying on the labour force for one additional year. A negative accrual coefficient correctly predicts a decrease (increase) in the retirement probability following a positive (negative) accrual.

We find that age is highly correlated with our financial retirement incentive variables because they all capture the effect of eligibility to social security programs. Once we allow for non-linearity in age (second model), the coefficients of both the social security wealth and the accruals become smaller because they no longer capture the effect of eligibility to social security programs. As a matter of fact, once we include social security eligibility variables (third model), the accrual variable becomes insignificant.

We find that both the age and the social security eligibility variables have a very strong effect on the retirement probability. In the second model, we find a significant effect of ages 58, 60 and 65, the standard eligibility age of conventional early retirement and the early and statutory eligibility ages of the old-age pension regime, respectively. In the third model, we find a positive and strongly significant effect of our three social security eligibility variables.

Corresponding to the findings of Maes (2008), we do not find a significant effect of our employment duration variables.[54] This result hints at the fact that there is low duration dependence and once eligibility criteria are accounted for (through the age or eligibility variables), employment duration does not influence the retirement decision. Moreover, most of the effect of omitted variables that are correlated with time such as health are captured by the age regressor. In fact, we expect a positive bias of age on retirement since age and health are negatively correlated and health is plausibly negatively correlated with retirement.

We find that being a woman decreases the retirement probability by approximately 3 percent. This counter-intuitive result might be explained by our sampling methodology according to which we only keep women with relatively long careers and thus high taste for work, high motivation, low demand for leisure, etc. The level of education does not significantly influence the retirement decision, except for women with tertiary education who have a significantly higher probability of retirement compared to women with secondary education. It is possible that our financial incentive measures capture the effect of socio-economic status, which leads to an insignificant effect of education.

Unlike Coile (2004), Denaeghel et. al. (2014), Gustman and Steinmeier (2000), we find that spousal characteristics do not have a significant impact on the retirement decision. Interestingly, if we include individuals with lower pension benefits, spousal characteristics become significant. First, having a retired spouse has a positive and significant impact on the retirement probability and the effect is lower for women than for men, which corresponds to the findings of Blau (1998) and Gustman and Steinmeier (2000). Second, we find that having a younger spouse has a positive and significant impact on the retirement probability.

Working in the primary sector of activity leads to lower retirement probability compared to working in the secondary sector of activity. Working part-time does not influence the retirement probability. We tried interacting the part-time variable with gender but the effect remained non-significant. This result is potentially again caused by the sampling methodology that only allows for women with long careers and the way the part-time variable indicator is built (no information on work intensity for instance). The proportion of years worked as wage earner in total career does not have a significant impact on the retirement probability but following our sampling method, we only allow for a maximum of a 25 percent

[54] We tried several functional form for employment duration : linear, cubic polynomial, log, dummies, group of 5 years. All were insignificant.

of non-wage-earner career. Finally, we find a small negative effect of the year of birth, indicating that younger workers tend to retire later.

We find no impact of being in a one-earner household on the retirement probability. It is important to note that part of the effect of being in a one-earner household is captured by the social security wealth variable because pension benefits are calculated using different replacement rates. Moreover, since we use a random effect model, we control for the effect of unobservable variables such as demand for leisure, taste for work, etc. It is plausible that since individuals in one-earner households are the only providers for the household, they tend to tune their retirement decisions to determinants linked to financial retirement incentives rather than personal or spousal characteristics. We tried controlling for an interaction between our financial retirement incentives variables and the one-earner household status, but the coefficients were not significant, indicating that the financial incentive measures have the same effect between the different types of household. In fact, the predicted probability of retirement is higher for one-earner households, following the effect of social security wealth, which is higher for one-earner households.

Table 3: Discrete time logistic hazard duration model with random effects - Regression results

	(i) Cubic age polynomial	(ii) Age dummies	(iii) Cubic age polynomial and eligibility variables
Social security wealth / 100,000	0.063***	0.041**	0.081***
	(0.023)	(0.019)	(0.025)
Accrual / 100,000	-0.267***	-0.153***	-0.071
	(0.059)	(0.051)	(0.046)
Last net wage (in 2017 €)	-0.004*	-0.003*	-0.005**
	(0.002)	(0.002)	(0.003)
Female	-0.037**	-0.033**	-0.070***
	(0.018)	(0.016)	(0.024)
Primary school	0.027	0.020	0.046
	(0.028)	(0.024)	(0.036)
Tertiary education	0.015	0.013	0.028
	(0.018)	(0.016)	(0.024)
French speaker	-0.016	-0.013	-0.027
	(0.015)	(0.013)	(0.020)
Retired partner	0.007	0.004	0.005
	(0.019)	(0.017)	(0.021)
Older partner	0.003	0.002	0.008
	(0.019)	(0.017)	(0.026)
Age difference with partner	0.001	0.002	0.000
	(0.002)	(0.002)	(0.003)
One-earner household	-0.024	-0.006	-0.033
	(0.025)	(0.022)	(0.033)
Primary sector of activity	-0.077**	-0.073**	-0.091
	(0.037)	(0.031)	(0.057)
Tertiary sector of activity	-0.009	-0.007	-0.006
	(0.014)	(0.013)	(0.020)
Part-time	0.036	0.024	0.039
	(0.023)	(0.020)	(0.030)
Wage-earner proportion	0.007	0.008	0.001
	(0.014)	(0.013)	(0.020)
Birth year	-0.002*	-0.002	-0.002
	(0.001)	(0.001)	(0.002)
Age	10.111***		11.168***
	(3.016)		(3.592)
Age squared	-0.170***		-0.185***
	(0.050)		(0.061)
Age cubic	0.001***		0.001***
	(0.000)		(0.000)
Age dummies			
56		-0.005	
		(0.016)	
57		-0.004	
		(0.017)	

58		0.046** (0.021)	
59		0.023 (0.023)	
60		0.240*** (0.040)	
61		0.055 (0.040)	
62		0.063 (0.047)	
63		0.057 (0.052)	
64		0.072 (0.062)	
65		0.706*** (0.079)	
Eligibility EEA OAP			0.035** (0.016)
Eligibility SEA OAP			0.196*** (0.033)
Eligibility CER			0.143*** (0.023)
Employment duration	0.035 (0.025)	0.019 (0.023)	0.003 (0.029)
Employment duration squared	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)

Note: Marginal effects calculated at the mean. Robust standard errors are in parentheses. Interaction effects are not shown. *** p<0.01, ** p<0.05, * p<0.1.

5.2 SIMULATION OF A CHANGE IN THE GENEROSITY OF THE HOUSEHOLD RATE BENEFITS

In this section, we simulate the effect of a change in the generosity of the household replacement rate on the retirement probability of individuals in one-earner households and on various poverty measures. First, we estimate the impact of a decrease of 15 percentage points of the household replacement rate to 60 percent, which is equivalent to abolishing the household replacement rate. Next, we look at the effect of increasing the household replacement rate in gradual steps of 5 percentage points starting from a replacement rate of 60 percent. This simulation allows us to get an insight on whether the household replacement rate leads to a work (dis)incentive[55] and to put a figure on the role of the household replacement rate in pension adequacy.

5.2.1 IMPACT ON THE RETIREMENT PROBABILITY

First, we analyse the change in retirement probability caused by the removal of the household replacement rate. Decreasing the household replacement rate to 60 percent has two effects: (i) on the social security wealth and (ii) on the accrual.

A decrease in the household replacement rate leads to a decrease in the social security wealth and thus a decrease in the retirement probability following the income effect observed in section 5.2. Indeed, the poorer the individual, the more likely he or she will stay in the labour force and the lower the retirement probability.

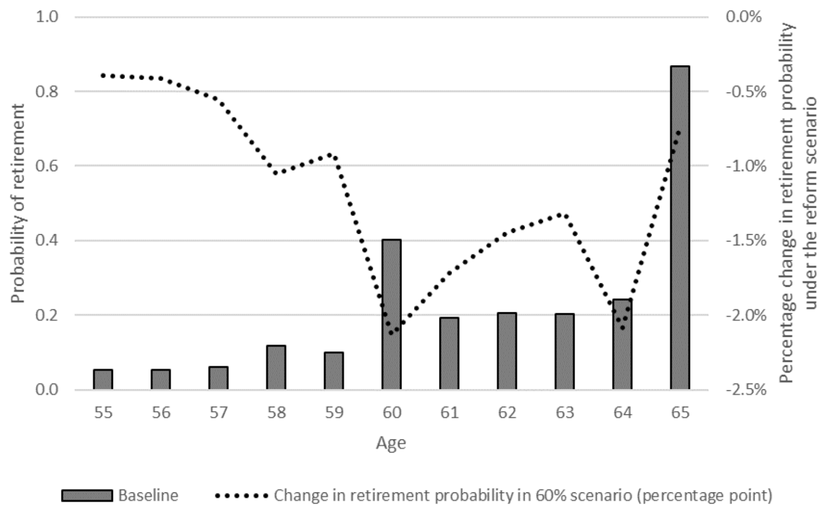
A decrease in the household replacement rate also generates a change in the accrual. In fact, before the individual is eligible for old-age pension, a decrease in the generosity of the system leads to a lower work incentive and thus a higher retirement probability (i.e. the positive accrual decreases), because there is less to be gained by working for one additional year. However, after the individual gains access to the old-age pension regime, the reform creates a lower work disincentive and thus a lower retirement probability (i.e. the negative accrual increases) because there is less to be lost by working for one additional year. The total effect of the reform depends on whether the income or the substitution effect is higher and on whether the individual has access to old-age pension benefits.

We predict the retirement probability of workers in one-earner households using our second model with age dummies. In figure 10, we present the change in retirement probability in percentage points in the case of a removal of the household replacement rate. Under the 60 percent replacement rate scenario, the average predicted probability of retirement decreases by an average of 1.2 percent at all ages. The impact is larger at ages 60 and 64 with a decrease of the retirement probability of 2.1 percent at both ages. We note that the decrease in retirement probability is smaller at lower ages, because of the effect of the household replacement rate on the accrual. Indeed, the decrease in accrual caused by the removal of the household replacement rate leads to higher retirement probability before the individual has access to the old-age

[55] See Blau (1997), Knapp (2014) and Michaud (2003) for an analysis of the impact of other programs targeted at the dependent spouse on retirement.

pension regime and offsets some of the effect of the social security wealth. Therefore, on average, the removal of the household replacement rate has a small negative effect on the retirement probability (i.e. a work incentive) and the effect is stronger once the individual has access to the old-age pension regime.

Figure 10: Retirement hazard rates for workers in one-earner households – baseline (75% replacement rate) and suppression of household replacement rate (60% replacement rate)

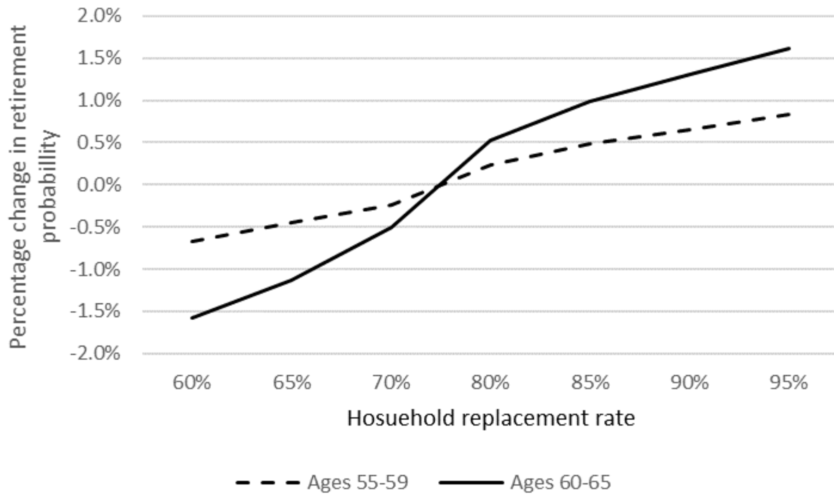


Source: Authors' own calculations using SHARE data

In figure 11, we look at the average change in retirement probability in percentage points by age groups (ages 55-59 and ages 60-65) for several scenarios of change in the generosity of the household replacement rate compared to the baseline scenario (75 percent replacement rate). Again, we observe that the effect is overall quite small. We find that a decrease in the household replacement rate leads to a decrease in the retirement probability and the effect is larger at older ages. An increase in the household replacement rate leads to an increase in the retirement probability and the effect is also larger at older ages.

In conclusion, we find that the removal of the household replacement rate would lead to a minor decrease in the retirement probability. In turn, an increase of the household replacement rate would lead to an increase in the retirement probability. Specifically, a change of 5 percentage points of the household replacement rate leads to a change in the retirement probability of approximately 0.24 percentage points below age 60 and 0.51 percentage points above age 59 and the effect is the largest at age 60.

Figure 11: Change in retirement probability for individuals in one-earner households for different reform scenario of the household replacement rate



Source: Authors' own calculations using SHARE data

5.2.2 IMPACT ON POVERTY MEASURES

As highlighted in the introduction, the objectives of an adequate old-age pension system from a public policy perspective is poverty alleviation and income redistribution among the elderly (Barr and Diamond, 2006). The redistributive effect of the old-age pension program is embedded in the calculation of benefits through the minimum pension and the set of pensionable earnings minima and maxima, among other things. In addition, the household replacement rate serves as a redistribution mechanism between one-earner households and the rest of the population. Indeed, we test for the probability of being in a one-earner household using a probit model and we control for individuals and job-related characteristics. We find that being a male, having secondary education, working full-time and a lower total number of years of career all increase the probability of being in a one-earner household (see table 4). Most importantly, we find that being is a one-earner household is associated a lower average wage, which corresponds to the findings of Hindriks (2014) and the Pension Reform Committee (2014) that individuals in one-earner households are generally concentrated at the lower end of the income distribution. In this section, we present elderly poverty measures and we assess the impact of various reform scenarios of the household replacement rate on these same measures.

Table 4: Probit model of the probability of being in a one-earner household

	Probit coefficients
Estimated old-age pension benefits	0.003***
	(0.000)
Last net wage	-0.000***
	(0.000)
Male	0.543***
	(0.184)
Primary education	-0.568***
	(0.198)
Tertiary education	-0.568***
	(0.198)
French speaker	-0.169
	(0.145)
Retired partner	-0.596***
	(0.156)
Age difference (absolute value)	0.007
	(0.026)
Primary sector of activity	-0.533
	(0.373)
Tertiary sector of activity	-0.469
	(0.382)
Part-time work	0.567*
	(0.295)
Birth year	-0.104***
	(0.012)
Age	-0.001
	(0.012)
Total years of career	-0.050***
	(0.018)

Note: Table reports average marginal effects. Clustered standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

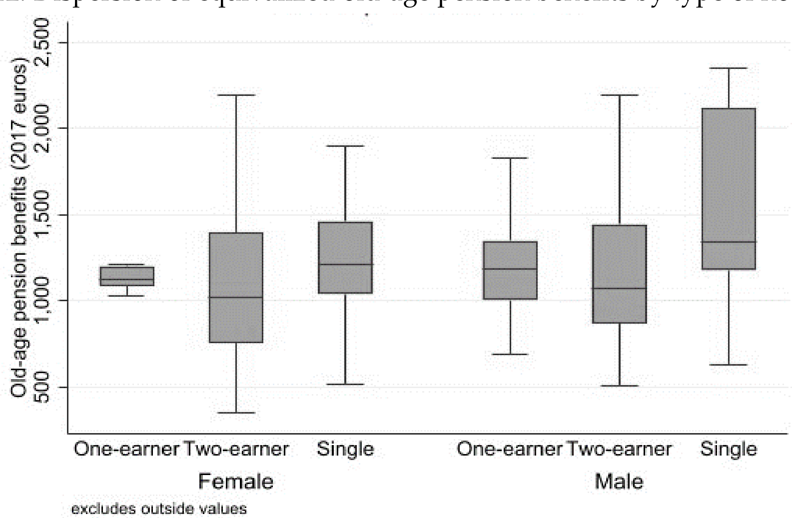
First, we estimate the old-age pension benefits entitlements of spouses using the same benefit calculation rules as for our sampled individuals and express the benefits into constant 2017 euros. Then, we sum the estimated old-age pension benefit of our sampled individuals and that of their spouses at the effective retirement age of the reference individual to obtain an indicator of the household income based on old-age pension benefits entitlements at retirement.[56] Finally, in order to take into account differences in household size and economies of scales within the household, we transform the household old-age pension benefits

[56] We restrict our sample to individuals who were retired at the time of the survey because we look at the old-age pension benefits they effectively receive at retirement and not their benefits entitlements. Therefore, we compute our poverty measures for a sample of 327 individuals.

entitlement into the equivalized household old-age pension income for a one-member household using the OECD modified equivalence scales[57].

We observe that pensioners in one-earner households have slightly higher average equivalized household old-age pension income (1185.10 euros) compared to individuals in two-earner households (1169.53 euros). Besides, the average equivalized household old-age pension income is lower for individuals in one-earner and two-earner households compared to singles (1494.89 euros). There are two reasons that can explain why individuals in one-earner households have higher average old-age pension benefits, even though they have a lower average wage and there is only one prime-earner in the household: (i) they are granted the household replacement rate and (ii) they have characteristics that are associated with higher wages (for instance, male and less part-time work). Finally, we note that there is less variation in household old-age pension income for individuals in one-earner households than for other types of households (see figure 12).

Figure 12: Dispersion of equivalized old-age pension benefits by type of household



Source: Authors' own calculations using SHARE data

We measure the poverty of individuals[58] at retirement using the equivalized household old-age pension income by means of the headcount ratio and the average poverty gap from the Foster, Greer and Thorbecke (1984) measures of poverty and a relative poverty line set at 50 percent of the median equivalized household

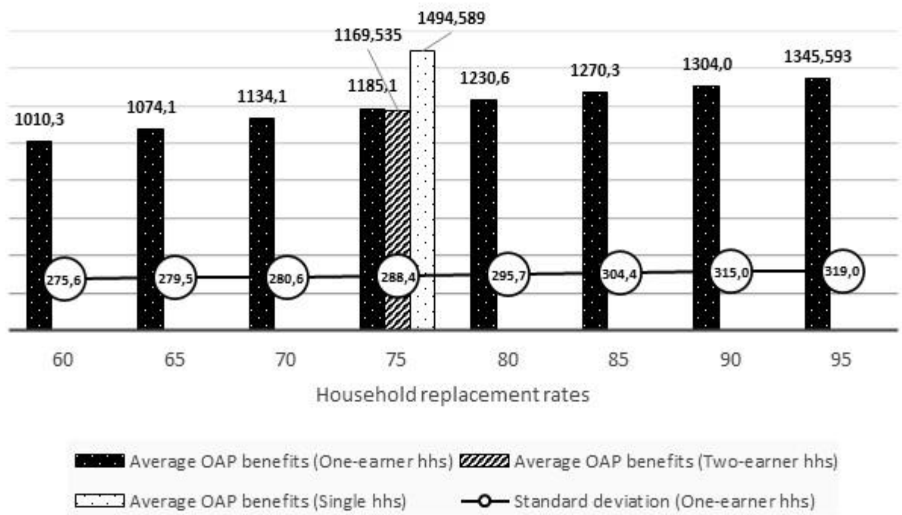
[57] We use the OECD modified equivalence scale that assigns a value of 1 to the household head and a value of 0.5 to each additional adult. (OECD, n.d.)

[58] Because of data limitations, we calculate the poverty rate of individuals based on their old-age pension benefits entitlements only. For a complete assessment of old-age poverty rates, one should include house ownership and other types of revenues.

old-age pension income in our sample.[59] In our baseline scenario, we find a headcount poverty ratio of 5.77 percent for the sample and 2.75 percent for individuals in one-earner households.

Next, we look at the effect of increasing the household replacement rate in gradual steps of 5 percentage points starting from 60 percent. Figure 13 displays the average equivalized household old-age pension income (and its standard deviation) at retirement of individuals in one-earner households in each of these scenarios. For individuals in one-earner households, the removal of the household replacement rate would lead to a decrease of their average equivalized household old-age pension income from 1185.10 to 1010.34 euros, their headcount ratio would increase from 2.75 percent to 4.59 percent and their average poverty gap would increase from 0.79 percent to 1.33 percent of the poverty line. We observe that as the household replacement rate increases, so does the standard deviation, meaning that inequality between individuals in one-earner households increases.

Figure 13: Average equivalized old-age pension benefits by type of households under different reform scenarios of the household replacement rate

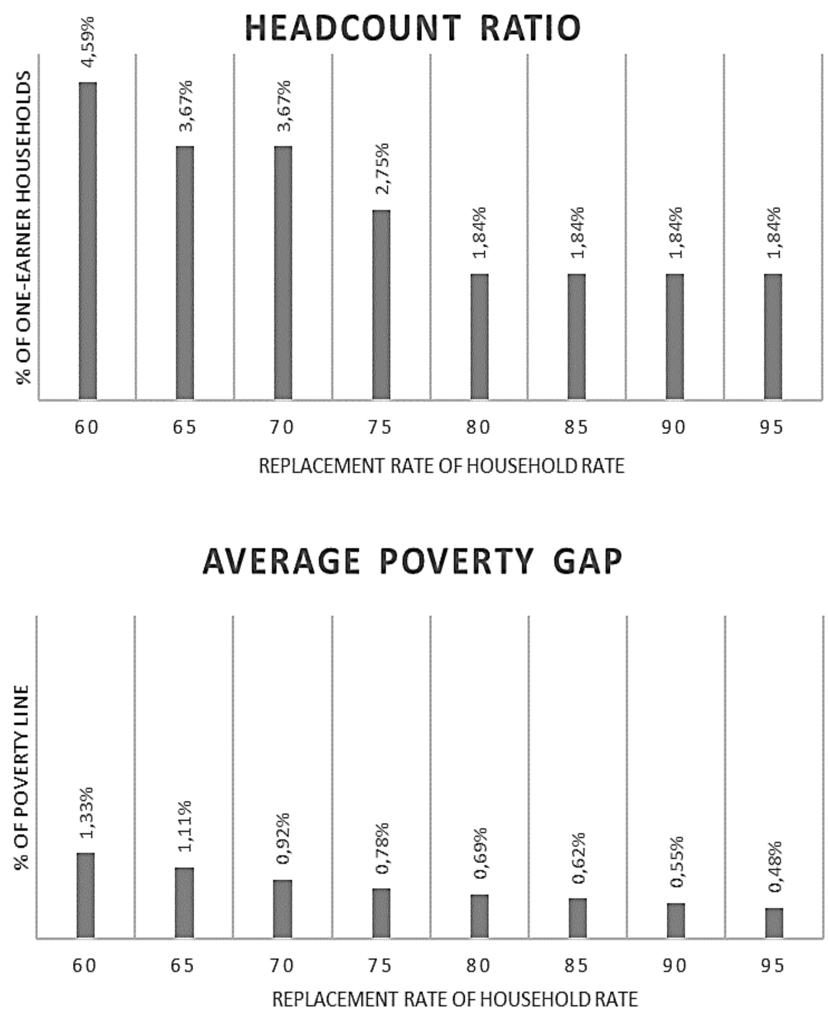


Source: Authors' own calculations using SHARE data

[59] The Foster, Greer and Thorbecke (1984) poverty measure is written as $FGT(\alpha) = \frac{1}{n}\sum_{i=1}^{p}\left(\frac{z-X_i}{z}\right)^{\alpha}$. Where X is the equivalent household income for individual i and z is the poverty line. We use a relative poverty line set at 50% of the median individual old-age pension at retirement in our sample, which is equal to 648.67 euros (2017 euros). If α = 0, then the measure indicates the headcount ratio, or the proportion of the sample that lives in a poor household. If α=1, then the measure indicates the intensity of poverty by adding up the relative difference between the household income and the poverty line.

Figure 14 displays the headcount ratio and the average poverty gap for each household replacement rate reform scenario. We note that the decrease in both the poverty headcount ratio and average poverty gap slows down as the household replacement rate increases.

Figure 14: Headcount ratio and average poverty gap of one-earner households under different household replacement rate reform scenarios



Source: Authors' own calculations using SHARE data

6 CONCLUSION

In this paper, we study the retirement incentives of workers in one-earner households. Pensioners in one-earner households are granted the more generous household replacement rate for the calculation of their old-age pension benefits, which takes the form of a 15 percentage point increase of the standard replacement rate. While one-earner households are generally concentrated at the lower end of the income distribution, their average pension benefits is commonly above those of individuals in two-earner or single households thanks to the household replacement rate. However, we find that pensioners in one-earner households have the lowest average equivalized old-age pension benefits in our sample.

We use a discrete time logistic duration model to study the transitions from employment to retirement using a sample of older Belgian workers from the survey dataset SHARE. We construct financial retirement incentive measures (social security wealth and accruals) and find that they have a significant effect on retirement. Firstly, we find that the higher the social security wealth, the higher the retirement probability. This result thus correctly predicts the income effect of social security benefits according to which an individual with higher social security wealth will leave the labour force earlier. Since pensioners in one-earner households have higher average social security wealth thanks to the household replacement rate, the income effect of social security benefits is larger for them than for other types of households. Secondly, we find that the lower the accrual, the higher the retirement probability. Thus correctly predicting the substitution effect of social security benefits according to which the higher the returns of an additional year of work, the lower the retirement probability. After controlling for financial retirement incentives, we find that the effect of being a worker in a one-earner household on the retirement probability is insignificant. Moreover, we find that the effect of the financial retirement incentives on the retirement probability is not significantly different according to the type of household the worker lives in.

We estimate the effect of a change in the household replacement rate on the retirement probability of individuals in one-earner households. We start by comparing our baseline scenario (75% replacement rate) to a scenario in which the household replacement rate is set to 60 percent, which is equivalent to suppressing it. We find that such a reform would create a work incentive because of the ensuing decrease in social security wealth. The impact of the removal of the household replacement rate on the accruals is slightly more complex. In fact, before the individual is eligible for old-age pension, a decrease in the generosity of the system leads to a lower work incentive (i.e. the positive accrual decreases), because there is less to be gained by working for one additional year. However, after the individual gains access to the old-age pension regime, the reform creates a lower work disincentive (i.e. the negative accrual increases) because there is less to be lost by working for one additional year. We find that the total effect of removing the program would have a negative effect on the retirement probability, which would be more important at older ages. Similarly, we find that an increase in the household replacement rate would lead to a limited increase in the retirement probability of individuals in one-earner households. Unsurprisingly, increases in the generosity of the household rate benefits lead to substantial decreases in the poverty measures among the elderly. However, this effect becomes smaller as the replacement rate increases

In view of these results, we advocate in favour of the recommendation of the Belgian Pension Reform Committee to remove the household replacement rate except for minimum pensions. Since households with asymmetrical working arrangements are often at the lowest part of the income distribution, the substantial effect of the household replacement rate on poverty measures is motivating. Moreover, we have found only low working incentives imbedded in the program.

Despite the continued need for income redistribution among the elderly to avoid the persistence of income inequality into old age, such redistribution need not be targeted at financially dependent spouses, especially given that we are witnessing an increase of the modernized male breadwinner model and a rise in divorces and durable legal cohabitation arrangements. Indeed, pensionable earning minima, minimum pension benefits and the pension benefits calculation accounting for periods spent on replacement income serve the income redistribution goal.

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APPENDIX

A.1 HOUSEHOLD RATE BENEFITS AROUND EUROPE

Country	Form of household rate benefits	Percentage of pensioners	Discontinuation
United-Kingdom	The dependent's supplement is paid for a dependent adult if the earnings from work are below a specified amount.	16.000 individuals or 0.2% of 12.980.800 pensioners in 2106 76.700 individuals in 2006 or 0.7% of total 11.734.100 number of pensioners[60]	New claims are no longer possible. The payment of the supplement will cease in April 2020
France	Dependent's supplement for a spouse older than age 65 (or 60 in case of disability), who does not receive any social security benefits or personal resources that exceed 833€ monthly	105.540 individuals in 2015 or 0.8% of 13.041.056 total number of pensioners [61]	No new claims since January 2011
The Netherlands	Supplementary allowance for younger partner: the pensioner must be aged 65 or older and the partner younger than age 65 with income from employment less than €1,324.46 a month (or income from benefits less than €734.41 a month). The allowance is paid until the younger partner is 65. An earnings test on the household income exists.	162.454 at the end of 2015 or 4.8% of 3.371.258 total pensioners in 2015[62] 313.374 at the end of 2012 , or 10.4% of 3.016.955 total pensioners	No new claims since January 2015
Belgium	A supplement of 15% of the average past 45 years of career is granted if the spouse receives a work income or social security benefits below a certain threshold.	307.261 individuals in 2016 (305,626 men and 1636 women)[63] , or 15.2% of total of 2.015.338 pensioners 349.766 individuals in 2006 or 20% of 1.747.111 total number of pensioners	
Norway	Income tested dependent's supplement for a dependent	3 063 individuals in 2009 or 0.5% of 647 388 pensioners	

[60]Retrieved from http://tabulation-tool.dwp.gov.uk/5pc/sp/ccdepind/ccbentyp/a_stock_r_ccdepind_c_ccbentyp_sep06.html

[61]Retrieved from https://www.lassuranceretraite.fr/portail-info/files/live/sites/pub-bootstrap/files/pdf/rapports-documents-reference/Abrege-15-site-en-ligne.pdf

[62]Retrieved from http://www.svbkennisplatform.nl/FbContent.ashx/pub_1002/downloads/v1606151328/KB%202015%204e%20kwartaal.pdf (p.28, p.30) and http://www.svbkennisplatform.nl/kennisbank/zoeken.kerncijfers/a1447_Kerncijfers-SV-en-Niet-SV

[63] Retrieved from http://www.onprvp.fgov.be/RVPONPPublications/FR/Statistics/Annual2016/FR_Statistique_2016.pdf

	spouse who does not receive a personal OAP benefits	2028 or 0.2% of 889043 total pensioners[64] in 2015	
Ireland	Dependent's supplement is paid for a dependent spouse with an income below a certain threshold, varies with the dependent spouse's age.	3162 individuals or 0.6% of 95.570 total number of recipients of non-contributory state pension in 2014 [65] 72.193 individuals or 13.8% of 522.244 total number of pensioners in 2011	
Portugal	Dependent's spouse supplement		
Cyprus	Dependent's spouse supplement increases the basic pension to 80% of the average past earnings		
Isle of Man			
Changes in minimum or maximum pension			
Italy	Increase of minimum monthly OAP benefits if the annual income of the household is below a certain threshold		
Spain	Increase of minimum and maximum monthly OAP benefits if the annual income of the household is below a certain threshold		
Sweden	Higher social pension if in a couple.		
Austria	Higher social pension if in a couple.		
Greece	Increase of minimum monthly OAP benefits if the annual income of the household is below a certain threshold		

Declaration of interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

[64]Retrieved from https://www.nav.no/no/NAV+og+samfunn/Statistikk/Pensjon+-+statistikk/Alderspensjon

[65]Retrieved from https://www.welfare.ie/en/downloads/Social-Stats-AR-2014-SectionB.pdf and https://www.welfare.ie/en/Pages/Annual-SWS-Statistical-Information-Report-2014.aspx

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