Project MIGAPE: Work Package 2:

Results of the Standard Simulations for Belgium

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1. Introduction

1.1. The goal of project MIGAPE

The goal of the project "MInd the GAp in PEnsions" (MIGAPE) is to analyse gender differences in pension income, and to do this from various perspectives and communicate the lessons learned to policy makers and the audience at large. This project is a collaboration between researchers from CEPS, the Federal Planning Bureau and the KU Leuven in Belgium, the University of Lisbon, Portugal, the IER in Slovenia, LISER in Luxembourg, and the University of Liechtenstein, Liechtenstein.

A summary of the project can be found on the MIGAPE website (2020) and more specifically the project description (Dekkers, Hoorens and Van den Bosch, 2019). The objectives of this project can be grouped along three related axes. The first axis aims at providing the public at large with relevant information on the consequences that their choices may have on their future pension. The goal of the second axis is to provide policy makers of various EU countries with information on the possible future developments of Gender Pension Gaps. A third, and complementary axis will study how to raise people's awareness of the consequences of employment decisions. This report is part of the first axis, reporting on results for Belgium.

1.2. Goal and approach of this report

As discussed in the project description (Dekkers, Hoorens and Van den Bosch, 2019), the pension that one can expect to receive after retirement is a function of previous labour market circumstances and decisions, together with the – possibly compensating – elements of the existing pension system. This report is based on standard simulations to demonstrate the impact of choices that women commonly make on the pension benefit that they later receive. The decisions on which we focus concern complete or part-time career interruptions in response to care responsibilities for a child or an older parent.

Standard simulations, also known as hypothetical or model person simulations, are calculations of income packages (or other outcomes) for a hypothetical unit, in this case an individual, solely based on the applicable tax and benefit rules and the characteristics of the unit. In this project the focus is on the effects of labour market decisions, mediated by the rules of the pension system, on the future pension. A pension model is used to calculate the resulting pension at the statutory retirement age (or at the moment of early retirement). The key advantage of standard simulation is that, by fixing the definitions of the hypothetical individuals and varying only particular labour market decisions, the resulting difference in outcome (pension) can be unambiguously attributed to the decision, given her circumstances and the pension regulations. E.g., the effect of working half-time for six years at a certain point in the career is calculated for a woman with a particular employment contract, a particular age and a given wage profile. This makes it possible to illustrate in an accessible way how the pension system operates for persons making different decisions during their career, e.g. working part-time or interrupting work completely for some years in order to care for children. (See Hufkens et al., 2019, for a more general discussion of standard simulation.) A well-known example of standard simulation in the context of pensions are the prospective theoretical replacement rates (TRRs) published by the OECD in "Pensions at a Glance" (2017 and 2019).

Other approaches to this issue are possible, but have important disadvantages. First, one could use observations on a sample of retired persons that included data on their pensions and their past career. Apart from the basic problem that such data do not exist for all MIGAPE countries, results from such observations would reflect regulations and behaviour in the past, which might differ in important ways from current rules and behaviour. Moreover, for any individual making a particular career choice, it might be impossible to find an individual with otherwise the same characteristics, but making a different career choice; also individuals might differ in unobserved traits. A second option would be the application of a dynamic microsimulation model on a large sample of real-life individuals (Dekkers, 2016), simulating their careers and the subsequent pension benefits. Such models typically incorporate current regulations (or future regulations, in so far as these are already legislated now), and so would not suffer from the first disadvantage mentioned above. However, the problem of finding similar individuals making different choices also applies to the results of dynamic microsimulation[1].

The impact of particular career decisions on the later pension is likely to vary by characteristics of individuals, e.g. the impact of a career interruption will differ for a high-wage person compared to a low-wage person. For this reason, it is important that the modelled persons in the standard simulations cover a range of relevant characteristics. We vary model persons by gender, education, unemployment experiences and whether they retire at the standard retirement age or two years earlier (if eligible); in total we simulated 960 different scenario's.

By their specific nature, standard simulations are not fit for distributive analysis and for drawing conclusions about the population as a whole (Hufkens et al., 2019). In other words, they cannot show what the impact of policies or policy reforms are on the actual future gender pension gap. This can only be done on the basis of data for a whole population or a representative sample. In work package three of the MIGAPE project, dynamic microsimulation will be used to project the future gender pension gap.

We must emphasize that the modelled individuals, as presented below, do not always represent realistic career patterns (e.g., a woman is supposed to return to work at age 60, after an interruption of 6 years). However, it is important to make the modelled individuals comparable in every respect but the choice made, in order to show the implications of the pension regulations. The impact on their later pension of certain choices within realistic careers and lives of men and women will be the subject of work package 3 of this project, which focuses on axis 2, and which uses dynamic microsimulation and a large sample of real individuals.

Also, when using the terms 'decisions' and 'choices', we acknowledge that these terms, at least as they are normally used in everyday language, may be not seem appropriate to describe women's (and men's) career transitions. Societal expectations that derive from traditional gender roles may permeate women's professional and personal life through the expectations of partners, relatives, or employers. These expectations impose constraints that may severely limit their options. We therefore emphasize that by using the terms 'decisions' and 'choices', we do not mean fully free choices or fully discretionary decisions, but refer to those degrees of freedom (however limited those in some circumstances may be),

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[1]   Of course, when analysing either observed data, or the results of dynamic microsimulation, researchers generally do not look at particular cases, but compare groups or use statistical techniques, e.g. regression. Results from such analyses are still subject to sampling error, as well as simulation error (for dynamic simulation results). Also, unobserved heterogeneity cannot be controlled for.

that women do have. Yet, one prerequisite for women to optimally use these degrees of freedom is that they are fully and clearly informed about the consequences of such choices. The extent to which women can exercise agency (i.e. the ability to make effective choices and to transform those choices into desired outcomes) is not a given, but can be enhanced in various ways. Providing information can be one of those, as this can reduce the bind of social norms by affecting the costs and benefits of compliance (World Bank, 2012, p. 151). If women have access to adequate information on the pension consequences of various options, this can strengthen their bargaining position vis-à-vis other persons.

The structure of the report is as follows. In the next chapter we introduce our methodology, including the characteristics of the model persons. Given their importance for the resulting pensions, much attention is given to the wage profiles by age of these model persons. In chapter 3 we describe the first-pillar pension system in Belgium, as well as the social security schemes that employees can use when they interrupt their career completely or part-time in order to care for children or older relatives. Chapter 4 presents and discusses the results, and Chapter 5 concludes.

2. Methodology

2.1. Definition of the scenarios

Before we start, let us describe some notions that are important to understand what follows. We use the term *scenario* to denote a single combination of circumstances and options; in the dataset of all results this is contained in a single record We distinguish between *circumstances* (which are assumed given), and *options* (what individuals may choose from). Any scenario is therefore a combination of circumstances and options.

Circumstances are defined by four variables, which together form 24 combinations.

– Gender:
   a. Women
   b. Men
– Age: these are the ages at which a choice is made (or not). The motivation for selecting these ages is that 30 is a typical age at which women and men are confronted with the care of young children, and 54 is a typical age at which some women and men are confronted by care for older parents.

   The women and men are supposed to have been born in 2000.
   c. Age 30
   d. Age 54
– Education: this variable (together with gender) determines the earnings profiles (see below)
   e. Less than Upper secondary education (ISCED 0-2)
   f. Upper secondary education or Post-secondary non-tertiary education (ISCED 3-4)
   g. Higher education (ISCED 5+)
– Full working career or a period of unemployment:
   h. Full working career (see below for starting age by education)

i. A 3-year period of unemployment. It is assumed the cases are entitled to an unemployment benefit, at least until the – possible - exhaustion this benefit. The spell of unemployment happens at ages 26, 27, 28 for the case aged 30, and at ages 49, 50, 51 for the case aged 54.

For each education level. we need to assume an age of entrance into the labour market. Base on labour force survey data for the participant countries in the MIGAPE project, we have chosen the following ages:

– ISCED 0-2: 19;
– ISCED 3-4: 21
– ISCED 5+: 24.

Besides circumstances, there are options that an individual can choose from. For each age at which the choice is made (30 or 54), there are five options, the first of which is the base set of continuing to work full time. The other options are

– i) part time work at 80% for 6 years,
– ii) part time work at 50% for 6 years,
– iii) part time work at 20% for 6 years,
– iv) ceasing to work for 6 years.

Furthermore, we distinguish between situations where the period out of work or the time spent not working when in part time work gives rise to pension credits, and situations where it does not. In Belgium, this depends on whether the person concerned is entitled to specific benefits, which in turn depends on the reason for the move to part time work or full work interruption. We assume that for the individual that considers his or her options at the age of 30, the reason is "caring for a young child", while for the individual that considers the options at 54 it is "caring for a dependent parent". These motivations for interruption or reducing work make the persons eligible for benefits within the schemes of time credit and thematic leave (see below), and we assume that the persons use these schemes to the maximum extent. The alternative (not specified) is a reason that does not make persons eligible for these or similar schemes, and therefore does not entail pension credits for the time not worked[2].

Furthermore, we distinguish scenarios according to two dimensions which do not fit neatly into the distinction between circumstances and options. First, periods of unemployment and of full work interruption can imply that the person when returning to work does not earn the same wage as an otherwise similar individual who worked continuously. In the literature this effect is referred to as a "earnings penalty" or wage scar (Nielsen and Reiso, 2011; Gregg and Tominey, 2004). There can be a number of reasons for this: the first person has less seniority and experience then the second one; she may be regarded as less motivated by employers. In order to show the effect of the resulting loss of earnings on the later pensions, we simulate scenarios with and without a wage penalty, when relevant.[3] Details about the way the wage penalty is modelled are explained in the next section.

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[2] From this it follows that the notion "relevant reason" in no way has a normative meaning.
[3] The wage penalty is only relevant for scenarios which include a period of unemployment or a full career interruption.

Second, many persons retire earlier than the statutory retirement age (SRA), if they are eligible for a retirement pension. We include scenarios where people retire two years earlier than the SRA, if they are eligible for this, in addition to the scenarios where they retire at the SRA.

All combinations of the above circumstances and choices result in 960 scenarios. Hence, we have a dataset that consists of 960 "individuals", which each representing the career of a constructed individual each with his or her unique combination of circumstances and choices. The microsimulation model MIDAS (Dekkers *et al.*, 2010; Dekkers *et al.*, 2015) is then used to run these individuals and simulate the pension benefits that result from their careers.

Finally, a discussion of the Belgian (first pillar) pension system for employees as well as the systems for time credit and thematic leave are necessary in order to understand and interpret the simulation results. This will be the subject of the chapter three.

2.2. Earnings profiles and the wage penalty

In order to simulate the pension amount at the moment of retirement, we obviously need to know the earnings in each year, or, equivalently at each age, of the career. The set of yearly amounts of earnings by age is called a wage profile. The MIGAPE consortium agreed to estimate separate wage profiles by gender and three levels of education (low: ISCED 0-2, medium: ISCED 3-4, high: ISCED 5+). The profiles are intended to represent, as closely as possible, the average yearly wage of a full-time employee by age (civil servants and the self-employed are excluded because they have a different pension system). The persons are supposed to be born in 2000, and to enter the labour market around 2020 (there is some variation by education level, see above). This implies that the simulations refer to the future. The wage profiles were determined in two steps:

– the cross-sectional wage profile by age in 2011 was estimated by regression from administrative data
– these amounts were uprated to future years using projections of future real wage increases

Step 1: estimating the cross-sectional wage profile by age

We used administrative data for a large sample (n of estimation sample = 115,800) of employees, excluding civil servants. Earnings and hours data are from the social security administration, and apply to the year 2011. We excluded part-time workers, and also people who worked less than 500 hours during the year. For the remaining sample, yearly earnings were recalculated to a base of 1976 hours (38 hours per week times 52 weeks; so assuming paid holidays), to account for workers who did not work all year. This had the effect of increasing substantially the average wage, and reducing somewhat the variance of wages. The top and bottom percentiles were excluded, to neutralize the impact of outliers.

Separate regressions (OLS) were performed for each each gender-education group, using age and age-squared as independent variables. This specification allows that the age profile differs by gender and by education, not just in level but also as regards the form of the curve. The resulting curves revealed a good fit to the average earnings by age. Adding the third power of age had the unfortunate effect that for some gender-education groups, the wage profile became convex at higher ages (i.e. wage growth

increased with age). This seemed an artefact of that specification, as it is intrinsically implausible in the Belgian context, and is not visible in the graphs of average earnings by age.

The estimates from those regressions were saved, and used to simulate the wage profiles over all ages from 19 to 66 (so extrapolating beyond the current statutory retirement age as this will be increased in 2030 to 67 in Belgium) for the six gender-education groups. Finally, the wage profiles were updated from 2011 to 2019, using the observed average wage increases during that period.

Step 2: uprating to future years

The wage amounts were uprated to future years using the projections of average wages by the Ageing Working Group of the Economic Policy Committee of the European Council (FBP, 2017). So, e.g., the wage for a person aged 45 was uprated from 2011 to the year 2045.

Projected wage curves

Graph 1   Wage profiles of full-time employees, by gender and educational level

Source: Administrative data for the Datawarehouse Labour Market and Social Protection, 2011, own calculations
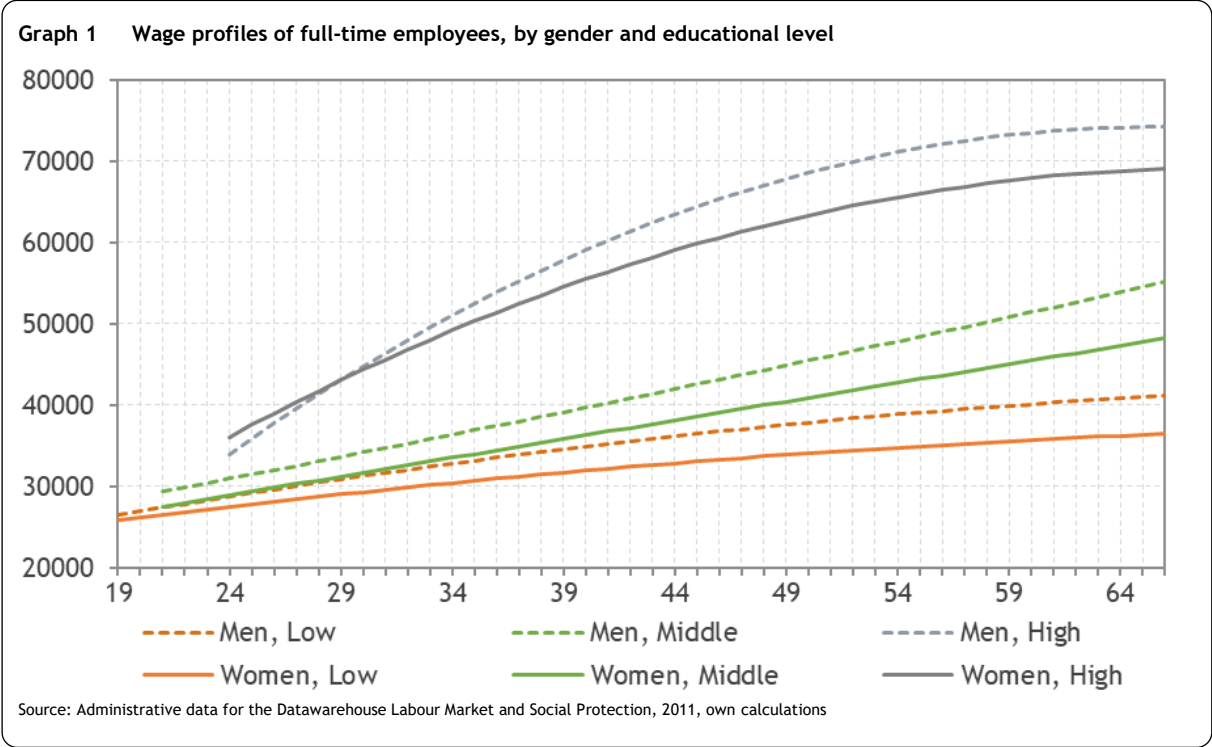
The dashed lines show the earnings profile for men of various educational attainment levels, and the solid ones for women. Typically, the earnings of men and women with higher educational attainment levels increase faster at younger ages. However, earnings growth phases out in the highest age group for persons with tertiary education, and – to a lesser extent – for those with the lowest educational attainment level. Furthermore, and not unexpected, the earnings of women gradually lag behind those of men. This is especially so for the highest educational attainment level. Possibly, the lagging behind of women's earnings shows the impact of the earnings penalty, resulting from previous disruptions of the career.

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Validation of the concave wage curves

The derivation of the wage profiles as described above can be criticized on several grounds. Estimation on cross-sectional data implies that the different ages refer to different birth cohorts, while our simulation is about a single birth cohort, born in 2000. Also, the concavity of the curves (i.e. the fact that earnings growth declines as the age increases) could be due to people at higher ages having gone through work interruptions earlier in their career, due to unemployment, disability, or care responsibilities, and suffering wage penalties as a result. As will become clear below, the concavity of the wage curves has important implications for the outcomes of various scenarios. Therefore, we were concerned to validate this aspect of the wage curves.

For this purpose, we used the same administrative data mentioned earlier, which include yearly panel data on earnings and hours of work for the period 2005-2012. Observed wages were recalculated to full-year full-time equivalents following the same rules as above, and converted to amounts in constant prices using the consumer price index. For each pair of observations of wages for the same individual in subsequent years, the wage growth was calculated. Plotting these yearly real wage growth estimates by age for each gender-education group results in the curves plotted in Graph 2.

Graph 2 Real yearly wage growth by age, for each gender - educational group

Notes: Graphs for women and men have the same vertical scale
Source: Administrative data for the Datawarehouse Labour Market and Social Protection 2005-2012, own calculations
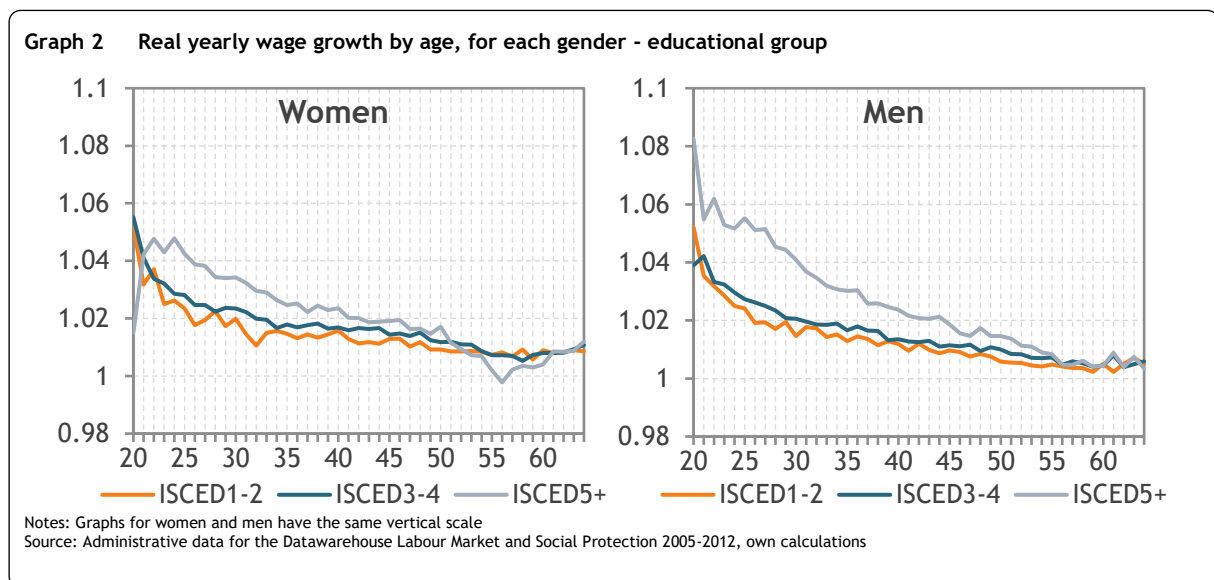
While these curves are not directly comparable to those shown in Figure 1 (no smoothing has been applied; and they have not been uprated), they show the key features of the simulated wage profiles. First, below age 50, wage increases are higher for people with tertiary education than for those with lower educational attainment; the difference is largest when people are in their twenties. Secondly, wage increases are larger for men with the highest level of education than for their female counterparts; among those with less education, there is no systematic difference in wage growth by gender. (Also in these groups, men still earn more than women, apparently because their starting wage is higher.)

Modelling of the wage penalty

The wage penalty refers to the phenomenon that after an interruption, people returning to work generally earn a lower wage than otherwise similar persons who did not interrupt their career. During

an interruption, human capital is likely to stagnate, and can even decay because of technical and organizational progress or due to the fact that the employee's knowledge is not maintained and brushed up during absence (Beblo and Wolf, 2002) Perceptions by employers that persons interrupting their job for family-related reasons are less committed to their work, may also play a role. In the context of these standard simulations, which are intended to show the consequences on the later pensions of partial or complete interruptions of work due to care responsibilities, it is important to take this phenomenon into account. In the economic literature, especially in the context of the effects of unemployment, this phenomenon is often referred to as "scarring". Below we use these terms interchangeably.

For the purpose of the standard simulations, we had to model the wage penalty in a rather stylized way. Given the way the wage profiles have been estimated, the wage w of a simulated case i at age t can be represented by the following equation:

$$w_{it} = w_{it-1} * a_{it} * g_t$$

where a_{it} represents the age-related individual increase in the wage, and g_t the overall increase in wages, due to productivity gains in the national economy. Both factors are represented as growth rates in a multiplicative equation. We assume that after an interruption, the person returns to work at the wage she earned during her last year in work, increased by the general wage growth during the period of interruption. (These general wage increases may for instance be part of collective labour agreements.) During the interruption, there is no age-related individual wage increase, as the person does not gain in experience or seniority. After the interruption, these increases resume. We considered two options about the level of the age-related wage increases after the interruption. In the first option, named "delay of wage increases", it is assumed that after an interruption, the wage increases resume the path that they would have taken if there had been no interruption, at the level when the career was interrupted, though with a delay. In the second option, "loss of wage increases", it is assumed that after an interruption, the wage increases resume at the level that a person of the same age with an uninterrupted career would experience.

A simple example may make the difference between the two options more clear. Suppose that there are two women of the same age who at the same day started in the same job. They enjoy a yearly wage increase, which starts rather high, at 5%, but falls off heavily by 1% per year; we abstract here from the overall economy-wide wage increases. Suppose that after the second year in office, the second one interrupts her job for two years, and returns to it in the fifth year. The yearly wage increases for the two women under both options are shown in the Table 1 below.

Table 1: implementation of the wage penalty

Year	No interruption	Interruption with option 1: delay of wage increases	Interruption with option 2: loss of wage increases
1	5%	5%	5%
2	4%	4%	4%
3	3%		
4	2%		
5	1%	3%	1%

So under option 1, the interruption woman obtains in year 5 a wage increase of 3 %, as if she was in the 3rd year of her career: wage increases are delayed during the interruption. Under option 2, she gets in year 5 a wage increase of only 1%, corresponding to that of the person with an uninterrupted career: the wage increases of 3% and 2% during the interruption are lost to her.
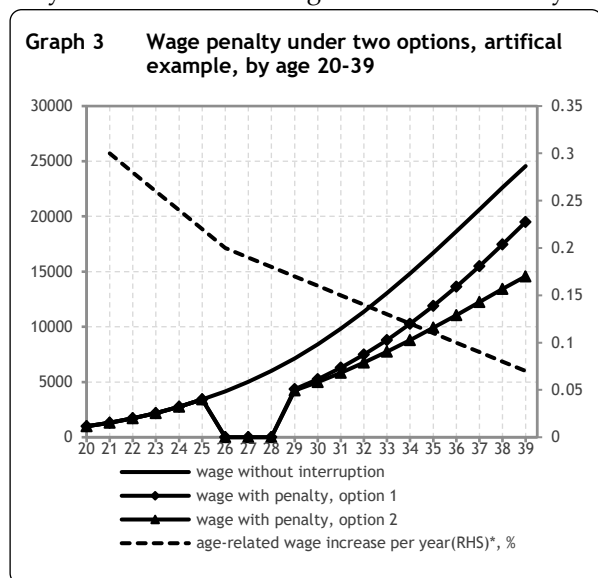
Graph 3   Wage penalty under two options, artifical example, by age 20-39

- wage without interruption
- wage with penalty, option 1
- wage with penalty, option 2
- age-related wage increase per year(RHS)*, %

When wage increases are large during the beginning of the career, and then level off, the difference between these two options can be important. Graph 3 illustrates this with an artificial and extreme example, where wages increases by 30% in the first career year, while later the growth rate slows down. The cumulative effect of a higher wage increase at each age under option 1, compared to option 2, produces a difference between the resulting wage levels which gets larger over time.

We chose to follow option 2, loss of age-related wage increases during the interruption. One might argue that to option 1 more accurately reflects the effect of seniority in a job affects the wage, if this is supposed to stop when people interrupt their job, and resumes from the previous level when they return to work. However, option 1 implies that over time individuals will recover much of the wage lost during their absence from the labour market. This implication runs counter to the literature on the scarring effects of unemployment, which suggests that individuals suffer important wage losses after unemployment and that these remain significant over time (e.g. Arulampalam, 2001).

For the scenarios specified, the wage penalty applies to periods of unemployment and of full interruption, but not to part-time work.

3.   Pensions, unemployment benefit, time credit and thematic leave for employees in Belgium

3.1. Pensions

The first pillar of the Belgian pension system is essentially a statutory Bismarckian-style, Pay-As-You-Go pension system, mitigated by various floors, ceilings and redistributive elements. There are three

main separate schemes: one for wage earners (in the private sector as well as for contract employees in the public sector), another for civil servants and a third for the self-employed (AWG, 2017). The public pension insurance system is complemented by a means-tested minimum pension benefit (an assistance scheme named the Guaranteed Income for the Elderly). This first pillar is the principal part of the Belgian pension system. The two other pillars, which are not taken into account for reasons to be explained later, are private occupational pension schemes (second pillar) and private voluntary individual pension schemes (third pillar). The following description is based on the AWG Country Report for Belgium (*op. cit.*).

In the employees' scheme, the maximum career length is 45 years, and this results in a gross pension benefit that equals 60% of the earnings base. Hence the normal accrual rate is 60%/45 = 1.33% per year. However, if the employee is head of a household with a dependent spouse then (s)he can opt for the household pension benefit, which equals 75% of the earnings base. In this case, the spouse foregoes his or her own pension benefit, if any. Furthermore, the system has redistributive elements that increase (decrease) the accrual rate for those that have earnings below (above) a threshold. For example, in the calculation of pensions, earnings are being included up to a certain ceiling, sometimes also referred to as the "earnings cap" (though this cap does not apply to the social security contributions levied on earnings). Also, there is a minimum pension benefit for those that have at least 2/3 of the maximum career in the wage earners' scheme. Finally, there is a minimum claim (or minimum right) per working year for those that have a career of at least 15 years (with at least 104 days effectively worked per year). This system essentially sets a floor for earnings per year (corrected for part-time factor) in the calculation of pensions. In the simulations, the earnings ceiling and the minimum claim per year are uprated by 1.25 % per year, following the assumptions of the Ageing Working Group of the Economic Policy Committee of the European Council (FBP, 2017, Table 3, page 7).

The Standard Retirement Age (SRA) is currently 65 for men and women. However, it will increase to 66 in 2025 and to 67 from 2030 onward. Since 2018, early retirement currently is possible from the age of 63 on with a minimum number of career years 42 years as of this year, though exceptions are still be possible for those with very long careers: those aged 61 with a career of 43 years and those aged 60 with a career of 44 years.

3.2. Unemployment benefit

People who become involuntarily unemployed are generally entitled to an unemployment benefit, if they have worked a sufficient number of days as an employee during a specific period before the unemployment spell (RVA, 2020a). The exact conditions vary somewhat by age, but people who have worked full-time during 12 months are always eligible, so covering all scenarios involving unemployment in the simulations. Unemployment benefits can be received for an indefinite period. The amount starts at 65 % of the last wage (up to a ceiling), but decreases over time to a fixed amount, depending on work history and family situation (RVA, 2020b).

The first pillar pension systems for employees has general rules about the way in which some periods out of paid work are considered. This includes periods of unemployment, disability, and interruptions of the career due to care responsibilities which may make persons eligible for specific benefits (see

below). It does not include periods that an individual chooses to step out of the labour market while not using these benefits). If an individual becomes unemployed or disabled at some point, then the earnings base for that particular year is fictitious. In most cases, the "fictitious wage" equals the earnings that the individual received in the last period that he or she was working, again subject to the aforementioned ceiling. In some cases, a lower ceiling is used. This happens in case of unemployment after the age of 58, in case of long-term unemployment or Unemployment with Company Allowance an even lower minimum ceiling is applied (Federal Pension Service, 2019). The fictitious wage is indexed for inflation, but is not uprated to real increases in wages.

3.3. Time credit and thematic leaves: how are they considered in the pension benefit of employees[4]?

There are various systems available that allow employees in the private sector to temporarily reduce their activity on the labour market (i.e. to work part time or to withdraw completely) in order to take up a task as a carer for a child or sick adult in their household or family, or to enrol in education or training. There are two systems, the system of time credit (*tijdskrediet*), and the system of thematic leaves (*thematische verloven*) (Federal Government of Belgium, 2019).

The system of <u>time credit</u> allows employees to interrupt their career, work half-time (50%) or work part-time (20%) up to 51 months. This is allowed if the employee wants to care for i) a child up to 8 years of age, ii) a terminally ill member of the household or family member (palliative care; at most 2 months, and 20% part-time), iii) a severely ill or disabled member of the household or family member, iv) a handicapped child up to 21 years of age, v) a severely ill child (FPS ELSD, 2019). If the time credit is taken up to enrol in education or training, then the maximum duration is 36 months. The maximum duration of 51 months pertains to the entire career and is independent from whether the time credit is taken up full-time or part-time (Federal Pension Service, 2019b).

There is an additional condition for partial time credit. In case of 20% (50%) time credit, employees must have worked full time (respectively 75%) during the last year prior to entering the time credit system and must have been working at his or her current employer for at least two years (FPS ELSD, 2019b). These conditions do not apply for full time credit.

Besides time credit for employees in the private sector, employees as well as civil servants can also apply for so-called <u>thematic leaves</u> (*thematische verloven*; Federal Government of Belgium, 2019). These include i) parental leave (*ouderschapsverlof*), ii) leave for palliative care (*verlof voor palliatieve zorg*), and iii) leave for medical assistance (*verlof voor medische bijstand*).

Parental leave allows the claimant to partially or fully cease to work to care for a child younger than the age of 12 (RVA, 2019). The maximum duration depends on the nature of the interruption. If the claimant takes full parental leave, the maximum duration is 16 weeks (i.e. 4 months). In case of 50% parental leave, the maximum duration is 8 months, and in case of 20% parental leave, the maximum duration is 20 months, to be taken up in clusters of 5 months.

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[4] This section describes the systems of time credit and thematic leave in force on March 3rd, 2020.

The second option is leave for palliative care (RVA, 2019b). This can be taken up full time, half-time and part-time (20%), under the same conditions as in case of time credit. The maximum duration is 3 months.

The third option is leave for medical assistance (RVA, 2019c). This leave can be taken up to care for related or blood-related family members to the 2nd degree, as well as unmarried partners. Like in the other cases, leave for medical assistance can be taken up full time, half-time and part-time (20%), under the same conditions as in case of time credit. The maximum duration is 12 months in case of a full-time interruption, or 24 months if the reduction is 50% or 20% (i.e. if the individual continues to work 50% or 80%)..

As this description makes clear, there is no provision for part-time work at 20 %, so a reduction of work by 80 %. When simulating the 20 % part-time work scenario, we assume that in this situation time-credit and thematic leave can be taken up on conditions that are analogous to those for half-time work and complete interruption. However, it should be kept in mind that this is in fact fictitious.

In these cases, the loss in earnings is compensated by a benefit and the pension upbuilding essentially continues, based on a (partial) fictitious income. In other words, the length of the career continues to increase as if the individual was working (full time), and the level of the fictitious income used to add to the pension upbuilding depends on the situation:

- In case of time credit and subject to the above-mentioned maximum durations, the normal fictitious wage (*normaal fictief loon*) is used, unless the individual is at least 57 years old and fully interrupting the career. In the latter case the low fictitious wage (*laag fictief loon*) is used (Federal Pension Service, 2019b; idem, 2019c).

- In case of thematic parental leave, the full period is taken into account for the pension, and based on the normal fictitious wage (Federal Pension Service, 2019d). This is also the case for the thematic leave for palliative care and thematic leave for medical assistance (Federal Pension Service, 2019e).

The normal fictitious wage (*normaal fictief loon*; Federal Pension Service, 2019c) is the total of earnings in the career year that immediately preceded the period of time credit and/or thematic leave[5]. Like the actual wage, it is subject to the normal earnings ceiling. This ceiling equals € 57 602,62 in 2018 and for a full year (i.e. about € 4 800 per month). The low fictitious wage (*laag fictief loon*) used in case of the full-time time credit of individuals of at least 57 years old is the same fictitious wage (i.e. last year's wage), but then subject to a lower earnings ceiling. This (roughly 5%) lower ceiling equals € 54 978,21 in 2018 and for a full year (i.e. about € 4 581 per month). See (Federal Pension Service, 2019) for a discussion. The fictitious wage is indexed for inflation, but is not uprated to real increases in wages.

People can use time credit and thematic leave consecutively, provided they meet the eligibility conditions when starting on the second benefit.

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[5] If this is unknown, then the actual earnings in the year that immediately succeeded the period of time credit is taken instead (*op. cit.*). For the years prior to 1968 a lump-sum amount is used, with values depending on the year. See (Federal Public Service, 2019f) for a discussion.

For brevity, in the discussion below time credit and thematic leave are sometimes referred to as "care benefits". The model used for simulations is MIDAS, which is an annual model. Thus, the above durations, expressed in months, must be "translated" to years. The total number of months of time credit and thematic leave are added up and rounded to the nearest year. Furthermore, for the fictitious scenarios with 80% interruption, we assume the same conditions as for the full interruption. Finally, in case of childcare, we assume that Time Credit and Thematic Leave are taken after the obligatory period of 15 weeks (3.5 months) of Mothers full-time leave. This leads to the following maximum durations used in the model.

Care benefits due to child care: full interruption; 51 months plus 4 months plus 15 weeks, or 3.5 months, of maternity leave is nearly equivalent to 4 years and 9.5 months which is rounded to 5 years. For the fictitious scenario with 80% interruption (i.e. 20% part time work), we assume the same duration. For the part time interruption scenario (50% interruption, and 50% work) the duration is 51+8+3.5 months, or 5 years and 1.5 months; again rounded to 5 years. Finally, for the 20% interruption (i.e. 80% part time work), the total duration is 51+23.5 months, or 6 years and 1.5 months; rounded to 6 years.

Care benefits due to care for medical assistance: full interruption and fictitious 80% interruption (i.e. 20% part time work) scenario; 51+12 months, or 5 years and 3 months; rounded to 5 years; for the part time and 20% scenario (i.e. work 50% and 80%) the total number of months is 51+24, or 6 years and 3 months; rounded to 6 years.

4. Results

4.1. Introduction

In this chapter, the results of the standard simulations are presented and discussed. As said in section 1.2 above, all combinations of circumstances and choices result in 960 scenarios. Hence, we have a dataset that consists of the careers and subsequent simulated pension benefits of 960 "individuals", each representing a unique combination of circumstances and choices.

In order to present the results of the standard simulations in a sensible way, we proceed as follows. First, we organize the scenarios in a smaller number of sets, and we define two *reference sets*.

– The first reference set includes the scenarios for women who make a choice at age 30, with no period of unemployment, who retire at the SRA and who use the care benefits (time credit and thematic leave).
– The second reference set is defined in a similar way, except that it refers to women who make a choice at age 54, so it includes the scenarios for women who make a choice at age 54, with no period of unemployment, who retire at the SRA and who use the care benefits (time credit and thematic leave).

For these women, the scenarios referring to all education levels, as well as all options are included. Furthermore, the option of full-time interruption is included with and without wage penalty (for the other options, the wage penalty is not relevant, see above). Other, *variant sets* are defined by changing

one dimension (gender, unemployment spell or not, retirement at the SRA or early retirement, use or not of care benefits) at a time. All sets comprise 18 scenarios.

Second, within each set we use the scenario with no work interruption as the *base scenario*, and express the pension amounts corresponding to the other scenarios (options) as a percentage of the base scenario amount for the same education level. In addition, for the variant sets, a table is included showing the pension amount for each scenario (option) as a percentage of the amount for the corresponding option in the reference set. In each table, we include the scenarios involving complete interruption with and without a wage penalty. This simplifies the discussion of the results; also, presenting a special variant table for scenarios with a wage penalty made little sense, as the wage penalty affects only the scenarios with complete interruption.

This way of organizing the results implies that many possible comparisons, viz. those between variant sets of scenarios, are neither shown nor discussed. However, many if not most of those are not very relevant in the context of this study, where the focus is the impact of certain choices, given circumstances. The discussion of the reference sets should inform about the impact of the choices that are modelled on the later pension, while the variant set show to what extent these findings are sensitive to the circumstances. Besides serving as sensitivity tests, the variants have their own purpose. First, the variant without eligibility for the care benefits shows the mitigating impact of these systems. The unemployment and age of retirement variants illustrate how the impact of the various options changes when the career is less than full. The variant with men instead of women indicates how results change when the wages of the model persons are higher than in the reference set.

The results section is organized as follows. First, we present and discuss a graph showing the overall variation in pension amounts across all scenarios. Second, we show the results for reference set one (a woman who makes a choice at age 30) and its variant sets. Thirdly, we do the same for the sets about the woman who makes a choice at age 55.

4.2. Overall results

This section will present some general results describing the variation in pension amounts across all circumstances and options. This will be done using a box and whisker plot. A box plot is a graph that shows in a comprehensive way the distribution of a variable, in this case the simulated retirement benefit. The actual simulated pension benefits may seem very high. Over all scenarios, the average simulated gross retirement benefit for women is € 28 427 per year or € 2372 per month. This is considerably higher than the currently observed retirement benefits. But the simulations assume that the individual is born in 2000, and therefore retires in 2067 (or in 2065 in the scenarios with early retirement), so their pension reflects the projected wage increases during the period 2020-2067. Also, the simulated careers are considerably longer than what we observe today for most retiring women.

Graph 4 shows the box plots of the simulated retirement benefit of men and women for all combinations of circumstances, distinguished by the choice made (working full time, working part time 80, 50% and 20%, or not working for 6 years) and by whether the individual is eligible for time credit and thematic leave, and so earns pension credit for the time not worked, or not. The results in Graph 4 exclude the

scenarios where people retire early, at SRA – 2, though, and so only contain those where individuals are assumed to retire at the SRA. The reason is that including these "early retirement scenarios" would distort the simulation results, as early retirement is only possible within some circumstances, but not in others, and the proportion of scenarios where it is feasible varies across choices made.

In these box-plots, the vertical axis denotes the gross simulated retirement benefit. The lower and upper ends of the box equal the 25th and 75th percentile, while the line in the middle shows the 50th percentile or median. The whiskers reflect the minimum and maximum values, excluding outliers[6]. Note, finally, that the distribution of observations is not to be interpreted as one would do in case of sample data of actual individuals. This is the variation of the retirement benefit caused by all circumstances that are not used to separate box plots, e.g by different combinations of educational attainment level, whether or not there was unemployment throughout the career, the age of the choice (30 or 54), the gender and whether or not earnings profiles are affected by scarring

Graph 4   **Distribution of pensions by choice made (work full time, work part time 80, 50% and 20%, and not working), and whether pension credits are earned during (part of) the time not worked - retirement at SRA..**
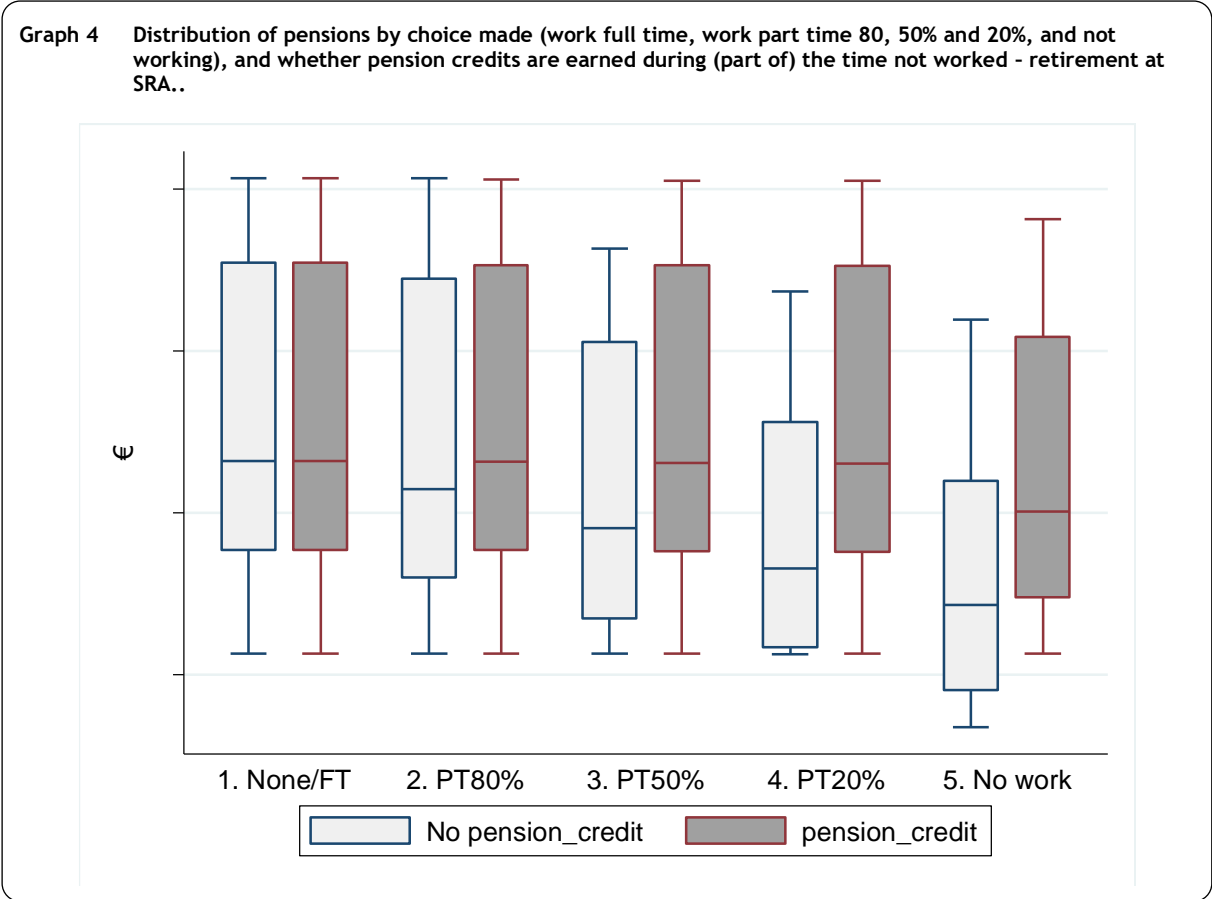
In Graph 4, the light box plots show results for situations where no pension credit is gained for times not worked during complete or partial interruptions of work (because the reduction in work were not made for a reason entail eligibility for one of the care benefits). The dark (red) box plots present the

[6] Technically speaking, the thresholds that determine the length of the whiskers by convention are a function of the width of the distribution itself. The upper whisker is the last observation that is lower than p[75] + (2/3)*(p[75] - p[25]) and the lower whisker is the first observation that exceeds p[25] - (2/3)*(p[75] - p[25]), where p[x] denotes the xth percentile of the distribution (StataCorp, 2019).

variation in pensions when pension credit is earned. A comparison between these plots therefore provides an indication of the impact of these pension credits on the later pension. (For the situation where the person worked full-time during the entire career, there is of course no difference between the two plots.) Comparing within the sets of the dark/light box-plots indicates the effect of the choice made on the resulting pension. A comparison of the light box-plots shows, unsurprisingly, that working part time or interrupting work results in a lower retirement benefit, when no pension credit is gained for the time not working. The difference will full-time work is smallest when working 80% for 6 years and larger when interrupting work or working for only 20% for 6 years. We can also observe that in all cases the retirement benefit is skewed to the right (i.e. the median is closer to the minimum than to the maximum, which is mostly the result of minimum protection regulations, such as the minimum pension and the minimum right per career year.

The dark box-plots show, perhaps unexpectedly, that in case pension credits are gained, the pension in the part-time work scenarios are virtually the same as in the continued full-time work scenario. Only when fully interrupting the career for six years do we see a substantial impact, even though it is much dampened by being eligible for the care benefits, and so earning pension credits.

4.3. Women: Reference set and variant sets with choice age 30.

4.3.1. Reference set

This section will present the results of the first reference set, of a woman who faces a choice at the age of 30, with the reason for this choice being to care for a child and so using the care benefits. In other words, she is eligible for time credit and thematic leaves. She has not experienced an unemployment spell and the simulations are done taking into account wage scarring a.k.a. wage penalty pertaining to periods of inactivity, while the retirement benefit is simulated under the assumption that she retires only at the statutory retirement age. For each of these reference sets and variants, there are three standard tables with results. Each of these covers three education attainment levels, as well as the simulated options. The first standard table contains the pension amounts. This is the point of departure for the other two tables and will only be presented for the reference sets. The second standard table presents "within set (or within table) results", i.e. the ratio of pension amounts for the various options relative to the base scenario of continuing to work full time uninterrupted. The third standard table is only presented for the four variant sets and presents the "between-sets" comparison. It presents the ratio of simulated pension amounts for an option relative to the pension amount for the corresponding option in the reference set. [7]

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[7] The numbering of the tables reflects this organization. For each set (reference set or variant set), table X-1 shows the pension amounts (only for the reference set), table X-2 shows the within-set comparison to the base scenario, and table X-3 the comparison of a variant sets with the reference set.

Table 2-1: Reference set: pension amounts

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	26902	30995	39484
PT 80% 6 years	26892	30980	39458
PT 50% 6 years	26647	30705	39063
PT 20% 6 years	26494	30532	38810
No work 6 years (no wage penalty)	26308	30301	38428
No work 6 years (wage penalty)	25649	28307	35360

Reference set: Woman, age at interruption 30, pension credit for work interruptions, no unemployment, wage penalty, retirement at statutory retirement age

Table 2-2: Reference set: pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.96	99.95	99.94
PT 50% 6 years	99.05	99.07	98.93
PT 20% 6 years	98.48	98.51	98.29
No work 6 years (no wage penalty)	97.79	97.76	97.33
No work 6 years (wage penalty)	95.34	91.33	89.55

Reference set: Woman, age at interruption 30, pension credit for work interruptions, no unemployment, wage penalty, retirement at statutory retirement age

The above Table 2-1 presents the pension amounts for the reference set. One should realise that the amounts are much higher than the average pension benefits of today. This is because they are projected amounts for someone born in 2000 and retiring in 2067. Hence, their value lies not so much in the amounts but in the comparison between scenarios.

The second Table 2-2 shows the simulated pension amounts relative to the base scenario within the reference set. For example, it shows that working 80% part time for 6 years, while being eligible for time credit and thematic leaves reduces the retirement benefit by only 100-99.96=0.039 pp for the woman with a low educational attainment level. For the higher education levels, the losses are 0.047 and 0.065 pp. respectively. The third and fourth lines shows the impact of working part time for 50% or 20% for 6 years. Obviously, the loss in retirement benefit is higher for these options, as will be explained below. The fourth line of Table 2-2 shows the impact of ceasing to work for 6 years while being eligible for time credit and thematic leave, but not being affected by wage scarring. Over all three educational attainment levels, the loss is larger than in the options involving part-time work, ranging from 4.6 pp. to 10.4 pp.. The main reason for the larger drop in pension when moving from the 20% part-time work scenarios to the 0% work (i.e. full interruption) scenario, compared with the difference between the 50% and 20% scenarios, is that the care benefits are limited to the first five years of the interruption. So in the full-interruption scenario no pension rights at all are earned during the last year of the interruption. The reason that the difference between the base scenario (continuing to work) and the 80% part time scenario is so small is that the total duration of time credit plus thematic leave in this case equals the full 6 years, whereas it is 5 years for the other scenarios. Finally, the last two lines of this table shows the impact of the wage penalty. In the scenario without wage penalty, having a 6-year full interruption which the system of time credit and thematic leave cover for 5 years, results in a loss of retirement benefit ranging between 2.2 and 2.6 pp. When the wage penalty is assumed to affect the wage during the remaining career, the effect is much larger again: from 4.7 pp up to 10.4 pp.

Note, finally, that in all scenarios the loss increases with the educational attainment level. This is especially the case in the scenario with the career interruption with wage scarring. The wage penalty

increases with the educational attainment level because of the difference in earnings profile between people with a higher and lower educational attainment level. The flatter the earnings profile is, i.e. the less it increases with age, the smaller the penalty if one does not work for one (extra) year. Hence, given that the earnings profile is steeper for individuals with higher educational attainment levels, the penalty for not working is higher.

Furthermore, the pension credits related to time credit and thematic leave are based on a fictitious income (corrected by the part time factor, of course) that is equal to the last income prior to entering into part-time work. This fictitious income is indexed for inflation but does not increase with age, unlike actual wages. The more the latter increases with age, therefore, the larger the loss resulting from replacing actual income by fictitious income. This is the reason for the impact of part-time or full interruption of work on the later pension, scenarios where there is no scarring effect. In the case of complete interruption, there can be a scarring effect in addition to the replacement effect. The scarring effect is more important than the replacement effect, because the former applies to all career years following the interruption. Hence, the gradient of the loss by educational attainment level is stronger in case of a full interruption with wage scarring than in the case of part time work.

4.3.2. Variant set 1: no pension credits

Next we turn to the variant sets. Table 3-2 shows the impact of the various choices (working part time, not working) compared to the base scenario, but now in the case that the woman is not eligible for time credit and thematic leaves. Hence she does not get pension credits for the part of time (or full time) that she does not work. Clearly the impact of the choices are now stronger, because they are no longer mitigated by the systems of time credit or thematic leave. The loss in case of working 80%, 50% and 20% for 6 years now ranges around 2 pp, 4.8 pp and 6.8 pp. The impact of a full career break for 6 years is now considerably stronger, and varying from 8.9 pp to 10.4 pp for a full interruption with no wage penalty and with a loss up to 18.1 pp for the highly educated when there is a wage penalty. This is because, contrary to working part time, ceasing to work not only reduces the reference wage that is taken into account in the calculation of the pension benefit, but also stops the upbuilding of the career length. Hence, if the individual is not eligible for time credit and thematic leaves, then the loss associated with a full interruption of work is more important than with working part time. As was the case with the reference set, the loss increases with the educational attainment level, but this difference is now stronger than before, because of the scarring effect. For the woman with low education, the scarring effect makes no difference, because even without it, she is already on a minimum pension.

Table 3-2 Variant set 1 (No time credit or thematic leave): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	98.02	98.11	97.93
PT 50% 6 years	95.34	95.28	94.82
PT 20% 6 years	95.34	92.44	91.70
No work 6 years (no wage penalty)	91.11	90.55	89.63
No work 6 years (wage penalty)	91.11	84.12	82.86

Reference set: Woman, age at interruption 30, reason for interruption childbirth, no unemployment, retirement at statutory retirement age

Table 3-3 Variant set 1 (No time credit or thematic leave): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	98.06	98.16	97.99
PT 50% 6 years	96.26	96.17	95.84
PT 20% 6 years	96.81	93.84	93.30
No work 6 years (no wage penalty)	93.16	92.62	92.09
No work 6 years (wage penalty)	95.56	92.10	91.41

Reference set: Woman, age at interruption 30, reason for interruption childbirth, no unemployment, retirement at statutory retirement age

Table 3-3 presents the ratio of simulated pension amounts for the various options in the variant set, relative to the pension amount for the same option in the reference set. Hence it shows the impact of no eligibility for time credit and thematic leave. As a result of not being eligible, the retirement benefit at the standard retirement age decreases between 1.94 pp and 2.01 pp for the lowest and highest educational attainment levels in case of 80% part time work for 6 years. For all three education groups, this is 1.93 pp. For working part time for 50% and 20% the loss is around 3.9 pp and 5.3 pp. Finally, for a full work interruption of 6 years, the loss is around 7 to 8 pp when there is no wage penalty, and around 7 pp when there is one. Hence, a first and obvious conclusion is that the pension benefit is lower if the woman does not qualify for time credit and thematic leave. Also rather obviously, the impact of not qualifying increases with the loss in earnings that results from the choice made, and so is largest for a full interruption, and smaller when working 80%. Inversely stated, the impact of qualifying for time credit and thematic leave is the strongest in case of the full career interruption, followed by working 20%, and 50% for 6 years, and it is the smallest in case of working 80% for 6 years. The explanation for this was given in the discussion of Graph 4 above: the less people work, the more the real wage is replaced by a lower fictitious wage.

4.3.3. Variant set 2: unemployment spell

Tables 4-2 to 4-3 describe the various scenarios in case of a three-year unemployment spell, that starts at the age of 26. All other characteristics remain the same as in the reference scenarios. During the full unemployment spell, the persons are entitled to an unemployment benefit, and obtain pension credits based on the wage in the last year of full employment (see also section 3.2). The unemployment spell comes with a wage penalty, though, so wages after the spell are lower than for persons who were never unemployed. For this variant, we exclude from all tables the row referring to "no work for six years (no wage penalty)". In the modelling of the scenarios it is assumed, for reasons of consistency, that the wage penalty applies to all periods of non-employment, whether due to unemployment or another kind of interruption. So if the six-year interruption does not lead to a wage penalty, neither does the unemployment spell. This would make the results incomparable to those of the part-time scenarios, and we therefore left them out.

Table 4-2 largely reproduces the results of Table 2-2 for the reference set: working part-time when eligible for a care benefit hardly reduces the later pension, and this is also true when an unemployment spell was experienced early in the career. A full interruption with a wage penalty has more severe consequences for those with medium or higher education;

Table 4-3 shows that experiencing unemployment reduces the simulated pension benefit compared to the reference scenario set; for the base scenario and the part-time working scenarios, the patterns are more or less equal, with a reduction of around 4 pp for the lowest educational attainment level, increasing to 7 and 9 pp for the higher educational attainment levels. This is because for the years of unemployment as well as the part-time career interruption, the pension credits are fully (in case of unemployment) or partially based on the fictitious (last-earned) earnings. Thus, the increase of earnings for these years is fully or partially missed, which results in a lower pension benefit. Only for the scenario with the full employment break are the results different. For the woman with the lowest educational attainment level, the unemployment spell does not result in a reduction of the pension benefit because she is already at the minimum pension. For the middle and higher educational attainment levels, however, the losses are even more important than the effect of working part time. This suggests that the underlying cause is the wage penalty associated with the unemployment spell.

Table 4-2 Variant set 2 (unemployment): pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	100	99.95	99.94
PT 50% 6 years	100	99.05	98.93
PT 20% 6 years	100	98.48	98.28
No work 6 years (wage penalty)	100	91.14	87.31

Reference set: Woman, age at interruption 30, reason for interruption childbirth, no unemployment, retirement at statutory retirement age

Table 4-3 Variant set 2 (unemployment): pension amount as percentage of pension for the same option in the reference scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	95.34	93.18	90.86
PT 80% 6 years	95.38	93.18	90.86
PT 50% 6 years	96.26	93.16	90.86
PT 20% 6 years	96.81	93.15	90.85
No work 6 years (wage penalty)	100	92.99	88.59

Reference set: Woman, age at interruption 30, reason for interruption childbirth, no unemployment, retirement at statutory retirement age

Note that the comparison of the results in Table 4-2 with those in the reference set of Table 2-2 show that, for the highest education level, the impact of the 6-year full interruption is stronger in combination with the 3-year unemployment period than in the reference set when there is no unemployment. This is because in the base scenario with the highest education level in the reference set, the upbuilding of the pension benefit is limited by the wage ceiling from the second half of the career on. This is not the case in the reference scenario with the 6-year interruption. Hence the pension in the reference scenario of Table 2-2 is lower than it would have been without the ceiling, while this is not so in the case of the 6-year interruption. Hence the impact of the wage ceiling limits the impact of the 6-year interruption in the reference case. In Table 4-2, the wage penalty that results from unemployment causes the earnings to remain under the wage ceiling in both the scenario with and without the 6-year interruption. Hence the impact of this interruption is stronger in this scenario than in the corresponding scenario in the reference set.

4.3.4. Variant set 3: early retirement

The Tables 5-1 to 5-3 show the impact of retiring at SRA-2 (i.e. the age of 65) instead of SRA. As said in the introduction to this chapter, retirement at SRA − 2 is not possible in some scenarios, where the minimum career length to be eligible has not been reached. Those scenarios are not presented, and the corresponding cells in the tables are left blank.

Table 5-2 Variant set 3 (early retirement): pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100	100	
PT 80% 6 years	99.96	99.95	
PT 50% 6 years	98.99	99.00	
PT 20% 6 years	98.90	98.40	
No work 6 years (no wage penalty)	98.90		
No work 6 years (wage penalty)	98.90		

Reference set: Woman, age at interruption 30, reason for interruption childbirth, no unemployment, retirement at SRA

Table 5-3 Variant set 3 (early retirement): pension amount as percentage of pension for the same option in the reference scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	94.98	93.98	
PT 80% 6 years	94.98	93.98	
PT 50% 6 years	94.92	93.92	
PT 20% 6 years	95.38	93.88	
No work 6 years (no wage penalty)	96.06		
No work 6 years (wage penalty)	98.52		

Reference set: Woman, age at interruption 30, reason for interruption childbirth, no unemployment, retirement at SRA

The key element for the eligibility is the length of the career. This, in the current standard simulations depends on the age of entry of the individual and whether or not she interrupts her career. The higher the educational attainment level, the later one enters the labour market and, ceteris paribus, the shorter the career at a given age. This is why the highest educational attainment level is not eligible to early retirement at SRA-2. The person with medium education who interrupts her work fully for six years is not eligible, because she spends one year out of work without any benefit. Table 5-3 shows that the retirement at SRA-2 results in a slightly lower retirement benefit for those who are eligible, compared to the corresponding reference scenario. This effect is a bit higher for women with medium education than for those with low education, because the earnings of the former increase more strongly at the end of their career than the wages of the latter. Table 5-3 indicates that the effect of moving to part-time work, while being eligible for care benefits, relative to continuing full-time work, on the later pension are negligible, as was true for the corresponding reference scenarios.

The results are a bit different for the scenario of retiring early in combination with a 6-year career interruption. This is only simulated for women with the lowest educational attainment level, and the loss associated with early retirement is in this case smaller compared to working part time for 6 years or continuing to work, both when a wage penalty is effective and when it is not. Detailed analysis showed that this is the impact of the minimum right per career year (which sets a floor on the pension credits that can be earned in a year). The 6– year work interruption still leaves the woman eligible to the minimum right per career year, even in case of retirement two years before the SRA, because she entered the labour market at the (comparably early) age of 19. The reduction of the retirement benefit caused by

retiring early in combination with the 6-year career interruption brings the retirement benefit before the application of the minimum right below the threshold for this minimum right, and the pension is brought up to this level. As a result, the impact of retiring early is quite limited. The mechanism of the minimum right also explains why it does not make much difference whether the wage penalty is effective or not.

As table 5-3 shows, given that a person with low education retires early, the impact of a full work interruption at age 30 is quite small, compared with the corresponding reference scenarios. The minimum right per career year is also the reason for this finding.

4.3.5. Variant set 4: men

The pension legislation in Belgium has no gender-specific rules. Since in this variant, only the gender is changed relative to the reference set of scenarios, the only reason for different pension amounts is that the wage profiles by age differ. As shown in section 2.2, the average earnings of men are higher than those of women with the same level of education. Moreover, among employees with tertiary education (but not among those with less education), earnings growth by age is stronger for men than for women. The following table shows the difference in average simulated earnings over the course of the full-time and uninterrupted career.

Table 6 Average simulated gross earnings by gender and educational attainment level

	Education		
Gender	Low	Medium	High
Man	46 586	54 430	74 051
Woman	41 507	48 429	63 040
Man / Woman (%)	112.2	112.4	117.5

The earnings of men exceed those of women for all three levels of education, but the relative difference is largest for in the case of the highest educational attainment.

As explained in section 2.2, the wage profiles were estimated on cross-sectional data. Wages at higher ages are likely to be affected by the wage scarring due to previous spells of unemployment or inactivity. It is plausible that the women in the sample were more affected by this phenomenon that men; during the relevant years before 2011, employment was always higher among men than among women. So if women are going to have full careers, their wage profiles are likely to shift in the direction of the current profiles of men. However, there may be many other reasons why the full-time full-year earnings of women are lower than those of with similar levels of education; including differences in sector of employment.

Table 7-2-Variant 4, men: pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.96	99.95	99.91
PT 50% 6 years	99.07	99.09	98.81
PT 20% 6 years	98.51	98.55	98.09
No work 6 years (no wage penalty)	97.80	97.81	96.85
No work 6 years (wage penalty)	92.51	90.77	93.73

Reference set: Woman, age at interruption 30, reason for interruption childbirth, no unemployment, retirement at statutory retirement age

Table 7-3 Variant 4, men: pension amount as percentage of pension for the in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	112.12	112.31	102.18
PT 80% 6 years	112.12	112.31	102.15
PT 50% 6 years	112.14	112.34	102.05
PT 20% 6 years	112.15	112.35	101.97
No work 6 years (no wage penalty)	112.12	112.36	101.68
No work 6 years (wage penalty)	108.79	111.61	106.94

Reference set: Woan, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table 7-2 shows the impact of the various choices with respect to the base set of continuing to work full time, and this given the systems of time credit and thematic leave. As with the results for the female reference set in Table 2-2, it shows that the impact of the interruption is the strongest, especially when the earnings penalty or wage scarring is effective.

Table 7-3 presents the difference with the simulation results of women in the same scenario (Table 2-1). Clearly the higher earnings base of men causes the resulting pension benefits to end up higher as well. However, this difference is about 12% for the low and middle educational attainment levels, very near the gap in average earnings throughout the career, as shown in Table 6. For the highest education level in the base and part time work scenarios, the difference is only 2%. The reason is that the yearly earnings are used in the pension computation only up to a cap. In the case of women and men of low and middle education levels, this cap is not reached, and the complete earnings are therefore included in the pension calculation. But in case of men with the highest educational attainment level, the earnings are limited by this cap, and this limits the pension benefit. This also explains why the difference between men and women is still somewhat larger in the case of the full interruption scenario than in the part-time work scenarios. The earnings penalty implies that earnings stay below the cap in a larger number of years. For the group with the lowest educational attainment level, the difference between men and women is smaller compared to those with a medium level of education. A similar mechanism explains why the impact of the interruption in Table 2-2 is proportionally stronger for women with tertiary education (89.55) than it is for men with the same level of education in Table A1-2 (93.75) in the appendix:the pension in the base scenario for men is limited by the earnings cap. The impact of the interruption and subsequent wage scarring would have been stronger if the cap had not been there.

As explained in section 1.2, for each age at which the choice is made (30 or 54), there are 6 options, the first of which being the base set of continuing to work full time. The next section discusses the various scenarios when the age that the choice is made is 54 instead of 30.

4.4. Women: Reference set and variant scenario's with choice at age 54.

This section discusses the various sets when the age that the choice is made is 54. As before, each set is described by the same three standard tables as in the previous section, and one extra. The first presents the simulated retirement benefits in this set, and this for the five options. This table will only be presented for the reference set. The second table presents the results of each choice relative to the base option of continuing to work fulltime at 54, and within the same scenario; these are the "within set (or within table) results". The third standard table presents the "between-sets" comparison. It presents the ratio of simulated pension amounts for an option relative to the pension amount for the corresponding

option in the reference set. Finally and contrary to the previous section, there is a fourth and final table, which expresses the simulation results in case of the choice of 54 with the results from the previous section, i.e. in the scenario with the choice made at the age of 30.[8]

For the first three tables, the results generally are going to be discussed only briefly, except when they differ from the results presented in the earlier tables (i.e. based on the choice made at 30). Hence many of the arguments and conclusions made in the previous section are not going to be repeated. Besides that, the discussion will obviously include the fourth table of each scenario, showing the impact of having the choice or event happening later instead of earlier in life.

Finally, note that the assumption underlying the scenarios for the woman at 30 was that she would take up time credit and thematic leave to care for a minor in the household; for the woman of 54 we assume that she takes care of a sick or dependent member of the household. This changes the maximum duration of the thematic leave in the case of the 50% interruption, implying that the total number of years allowed for time credit plus thematic leave in the case of 50% part time work changes from 5 to 6 years.

4.4.1. Reference set

We start our discussion with the reference scenarios using Tables 8-1 to 8-4.

Table 8-1: Reference set; choice age 54: pension amounts

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	26902	30995	39484
PT 80% 6 years	26888	30971	39484
PT 50% 6 years	26868	30934	39484
PT 20% 6 years	26275	30167	38566
No work 6 years (no wage penalty)	26005	29764	38118
No work 6 years (wage penalty)	25972	29438	38118

Reference set: Woman, age at interruption 54, reason for interruption care for a sick or dependentmember of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table 8-2: Reference set; choice age 54: pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.95	99.92	100
PT 50% 6 years	99.87	99.81	100
PT 20% 6 years	97.67	97.33	97.68
No work 6 years (no wage penalty)	96.67	96.03	96.54
No work 6 years (wage penalty)	96.54	94.98	96.54

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

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[8] This table is numbered table X-4.

Table 8-4: Reference set; choice age 54: pension amount as percentage of pension for the equivalent scenario when the age of choice is 30

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.99	99.97	100.07
PT 50% 6 years	100.83	100.75	101.08
PT 20% 6 years	99.17	98.81	99.37
No work 6 years (no wage penalty)	98.85	98.23	99.19
No work 6 years (wage penalty)	101.26	104.00	107.80

Reference set: Woman, age at interruption 54, reason for interruption care for a sick or dependentmember of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table 8-1 shows the retirement benefits in case somebody at the age of 54 faces a choice to work part time (or not) for 6 years. As we found for the case of a person making a choice at age 30, the impact on the later pension of partially or fully interrupting work at age 54 are negligible (Table 8-2), if the person uses time credit or thematic leave, so that pension credits are granted for the missing time at work. The effect is somewhat stronger if full interruption is accompanied by a wage penalty, because this implies that wages are a bit lower after return to work.

Note that the working part time for 80 or 50% for 6 years results in the same pension benefit in Table 8-1. The reason is that the combination of actual and fictitious earnings is subject to a maximum, in this case the normal earnings ceiling (see section 3.2). This ceiling is reached in both cases, so the earnings base in both scenarios is the same. In the base scenario there is no fictitious benefit and so the ceiling does not apply. Finally, in the case of the working part time for 20% the contribution of the (lower) fictious earnings on the total earnings base is strong, and the latter therefore remains below the ceiling.

Table 8-4 shows the results of a comparison of table 8-1 with the results of Table 2-1, which contains the simulated retirement benefits if one faces the same choices at the age of 30. Obviously, these simulation results are exactly the same in case of the base scenario (continue to work full time), because they represent the situation of no reduction or interruption, neither at 30 nor at 55. But the retirement benefits in the other sets are different. In the part time work scenarios, the difference between the choice at 30 and 54 is very small; Table 8-4 shows that the retirement benefit is at most 0.15% *lower* if one decides to work part time at 54 instead of 30. The exception is the case of working part time at 50%: here the benefit increases slightly because the system of time credit and thematic leave now applies for the full 6 years instead of the 5 years at age 30. In the case of the full career interruption with no wage penalty, the difference is around 1%. But when the wage penalty is effective, the results are quite different: when the interruption occurs at 54 and for the lowest educational attainment level, the retirement benefit ends up 1.26% *higher* compared to the retirement benefit in case of an interruption at 30. For the middle and highest educational attainment level, the positive effect of having the interruption at 54 instead of 30 increases to 4 and almost 8%.

Rather obviously, the retirement benefit is a little bit lower if one decides to work part time at 54 instead of 30 (with the exception of working 50%), because wages, and thus foregone wages, are higher at age 54 than at age 30. The same reason applies for the scenarios with full interruption and no wage penalty. But why are the results of this comparison reversed when the wage penalty is imposed? First, a wage penalty at age 30 affects wages for 32 years (67-35), while a wage penalty at age 54 is effective for only 7 years (67-60). Second, the age-related wage growth is much stronger at age 30 than at age 54 (the concave wage profile flattens out at higher ages), so even within each year, the wage penalty at age 30

is substantially larger than the one at age 54. The larger wage penalty effect of an interruption at age 30, compared to one at age 54, clearly dominates the impact of the foregone earnings during the interruption, which is somewhat more important at age 54. So for the scenarios with full interruption and a wage penalty, aggregate earnings across the career turn out be higher in the scenario with an interruption at age 54 then at age 30. This mechanism also explains why the difference is largest for those with high education, since they suffer the severest wage penalty at age 30, due to the strong wage growth around that age within this group.

4.4.2. Variant set 1: no pension credits

Tables 9-2 to 9-4 show the impacts of the now well-known choices if these are made at 54 and assuming no eligibility for time credit or thematic leave.

Table 9-2 Variant set 1 (No time credit or thematic leave; choice age 54): pension amount as percentage of pension for base scenario

| | Education | | |
Option	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	96.89	96.58	97.11
PT 50% 6 years	95.34	91.45	91.78
PT 20% 6 years	95.34	86.33	86.45
No work 6 years (no wage penalty)	91.11	82.91	82.90
No work 6 years (wage penalty)	91.11	81.86	82.90

Reference set: Woman, age at interruption540, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table 9-3 Variant set 1 (No time credit or thematic leave; choice age 54): pension amount as percentage of pension for the same option in the reference scenario

| | Education | | |
Option	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	96.93	96.66	97.11
PT 50% 6 years	95.46	91.63	91.78
PT 20% 6 years	97.62	88.69	88.51
No work 6 years (no wage penalty)	94.25	86.34	85.87
No work 6 years (wage penalty)	94.37	86.19	85.87

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table 9-4: Variant set 1 (No time credit or thematic leave; choice age 54): pension amount as percentage of pension for the equivalent scenario when the age of choice is 30

| | Education | | |
Option	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	98.84	98.44	99.17
PT 50% 6 years	100	95.99	96.80
PT 20% 6 years	100	93.38	94.27
No work 6 years (no wage penalty)	100	91.56	92.49
No work 6 years (wage penalty)	100	97.31	101.27

Reference set: Woman, age at interruption 30, reason for interruption unspecified, no unemployment, wage penalty, retirement at statutory retirement age

The findings shown in Tables 9-2 and 9-3 are broadly the same as when the choice was made at age 30 (cf. Tables 3-2 and 3-3. The pension benefit is substantially lower if the woman does not qualify for time credit and thematic leave, and the impact of not qualifying increases with the loss in earnings that results from the choice made.

Table 9-4 shows the difference between the results when the choices are made at the age of 54 instead of 30. For the base scenario of continuing full-time work, there is no difference, for the reasons discussed earlier for Table 6-4. For women with the lowest educational attainment level, the difference is nil for most other choices as well, and this is because of the minimum right per career year. The exception is the scenario where she works 80% at 54 instead of 30, which results in very slightly lower pension benefit. The same explanation as in Table 8-4 holds: given that earnings are higher later in the career, working 50% at 54 will result in a larger loss in retirement benefit than working half-time at 30. This also explains why this impact increases with the part-time factor, and is highest for those with a complete work interruption.

Finally, Table 9-4 shows for the scenario's with a full work interruption, a wage penalty and no care benefit, and so no pension credits, the difference between the pension for the person making a choice at age 30 and the one doing the same at age 54 is much smaller, and even reversed for the high-education scenario. As explained above, the reason for this is that the impact of the wage penalty after an interruption at age 30 is much larger than when interrupting the career at age 54.

4.4.3. Variant set 2: unemployment spell

Tables 10-2 – 10-4 show the impact of a 3-year unemployment spell in set of the choice at 54. This unemployment spell takes place between the ages 49 and 51 instead of 26 to 28. As discussed for the corresponding variant for the choice-at-age-30 set, during the full unemployment spell, the persons are entitled to an unemployment benefit, and build up pension rights based on the wage in the last year of full employment (see also section 3.2). The unemployment spell potentially comes with a wage penalty, though for these scenarios this is quite limited, as age-related wage growth after age 49 is small, or even non-existent. As we did in tables 4-2 and 4-3, we exclude from all tables the row referring to "no work for six years (no wage penalty)", because in this scenario the wage penalty does not apply to the unemployment spell either, which would make the results incomparable to those of the other options.

Table 10-2 Variant set 3 (unemployment; choice age 54): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	100	99.92	100
PT 50% 6 years	100	99.80	100
PT 20% 6 years	100	97.21	97.51
No work 6 years (wage penalty)	100	94.75	96.30

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table 10-3 Variant set 3 (unemployment; choice age 54): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	95.34	93.08	93.39
PT 80% 6 years	95.39	93.07	93.39
PT 50% 6 years	95.46	93.07	93.39
PT 20% 6 years	97.62	92.96	93.23
No work 6 years (wage penalty)	98.76	92.85	93.16

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table 10-4 Variant set 2 (unemployment; choice age 54): pension amount as percentage of pension for the equivalent scenario when the age of choice is 30

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100.00	99.89	102.79
PT 80% 6 years	100.00	99.85	102.85
PT 50% 6 years	100.00	100.64	103.90
PT 20% 6 years	100.00	98.60	101.97
No work 6 years (wage penalty)	100.00	103.84	113.36

Reference set: Woman, age at interruption 30, reason for interruption childbirth, unemployment spell, wage penalty, retirement at statutory retirement age

As in the results for the choice age at 30 (Table 4-3), the results of table 10-2 to 10-3 show that experiencing unemployment reduces the simulated pension benefit, and, for the reference set and the part-time working scenarios, the patterns are more or less equal. As before, for the woman with the lowest educational attainment level, when she had a spell of unemployment, further reduction of work does not result in a reduction of the pension benefit because she is already at the minimum pension. For the other education levels, in the part-time work scenarios and in the scenario with full-time interruption without a wage penalty, the loss in pension relative to the reference set with no unemployment is between 4.5 pp and 7 pp (Table 10-3).

Note also that the impact of the 6-year full interruption is now comparable to that of the reference scenario in case of the highest education level. This is in contrast to the case where the unemployment spell was early in the career, because Table 4-2 showed that the impact of the interruption on the pension benefit of the highest education level was larger in with the variant with an unemployment spell than in the reference set. This is no longer the case here because the wage penalty associated with the unemployment spell is later (and thus affects fewer years until retirement), and it is smaller because the earnings curve has flattened out. Thus, earnings of the individual with the highest education level surpasses the ceiling in both the reference scenarios and the scenario with unemployment, and both with and without the 6-year interruption. As a result, the impact of the latter interruption is comparable with and without the unemployment spell.

Table 10-4 shows that for all scenarios for the low-education woman, there is no difference between the pensions for the choice-at-age-54 set and the choice-at-age-30 set, as all these scenarios end up with the minimum pension. For the part-time scenarios for the medium-education woman, this difference is virtually zero; and for the high-education woman in the same scenarios, the pension of the choice-at-age-54 set is even a bit higher than that of the choice-at-age-30 set. As persons receive pension credits, based on the last full-time wage, for the whole period of unemployment, this difference in pensions is mainly due to the wage penalty as a result of the unemployment spell. As explained above, among the high-education persons, the wage penalty is more severe if it starts at a younger age. For the scenarios with full interruption and medium or high education, the comparison between the choice-at-age-54 set and the choice-at-age-30 set hinges on whether a wage penalty is applied or not. When it is not, the pension of the former is higher than that of the latter; when it is applied, the difference is reversed. The mechanisms behind these results were explained above in the discussion of the reference set of scenarios with choice at age 54. The wage penalty for the scenarios with a choice-at-age-30, is more severe than the same for the scenarios with a choice-at-age-54 (when it is very small or even non-existent), and here this is reinforced with the wage penalty for the unemployment spell. Finally, as in the reference scenario

at 54, the retirement benefit at the 50% part time scenario also ends up somewhat higher as a result of the increase of the number of years that the time-credit and thematic leave applies from 5 to 6 years.

4.4.4. Variant set 3: early retirement

We turn to the results assuming retirement at SRA-2 and the labour market choices at 54 instead of 30. These are shown in Tables 11-2 to 11-4.

Table 11-2 Variant set 3 (early retirement; choice age 54): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	
PT 80% 6 years	99.95	99.92	
PT 50% 6 years	99.87	99.79	
PT 20% 6 years	98.90	97.13	
No work 6 years (no wage penalty)	98.90		
No work 6 years (wage penalty)	98.90		

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table 11-3 Variant set 3 (early retirement; choice age 54): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	94.98	93.98	
PT 80% 6 years	94.97	93.98	
PT 50% 6 years	94.97	93.97	
PT 20% 6 years	96.18	93.79	
No work 6 years (no wage penalty)	97.18		
No work 6 years (wage penalty)	97.30		

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table 11-4 Variant set 3 (early retirement; choice age 54): pension amount as percentage of pension for the equivalent scenario when the age of choice is 30

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	
PT 80% 6 years	99.99	99.97	
PT 50% 6 years	100.88	100.80	
PT 20% 6 years	100	98.72	
No work 6 years (no wage penalty)	100		
No work 6 years (wage penalty)	100		

Reference set: Woman, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, early retirement

In broad lines, the conclusions of Tables 11-2 to 11-3 are the same as based on Tables 5-2 to 5-3. First, the highest educational attainment level is not eligible to early retirement at SRA-2, because they entered the labour market at a later age and therefore have a shorter career at each age. Second, the impact of retiring at SRA-2 is from the same in the base scenario and the part time work scenarios (except for the 20% work scenario). This is because working part time does not affect the career length, and because the change in the earnings base is for the largest part mitigated by the system of time credit and thematic leave. Again, we see that the loss associated with early retirement is in this case smaller compared with working part time for 6 years or continuing to work. As before, this is the impact of the minimum right

per career year. Table 11-4 shows the impact of retiring at SRA-2 when the age of choice is 54 instead of 30. The differences seem negligible.

4.4.5. Variant set 4: men

Tables 12-2 to 12-4 show the results if the reference person was a man instead of a woman, with the correspondingly higher wage profiles.

Table 12-2 Variant set 4 (gender is male; choice age 54): pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.94	99.91	100
PT 50% 6 years	99.85	99.78	100
PT 20% 6 years	97.54	97.22	97.87
No work 6 years (no wage penalty)	96.42	95.80	96.62
No work 6 years (wage penalty)	95.90	94.37	96.62

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table 12-3 Variant set 4 (gender is male; choice age 54): pension amount as percentage of pension for the same option in the reference scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	112.12	112.31	102.18
PT 80% 6 years	112.11	112.29	102.18
PT 50% 6 years	112.09	112.27	102.18
PT 20% 6 years	111.97	112.18	102.39
No work 6 years (no wage penalty)	111.83	112.04	102.26
No work 6 years (wage penalty)	111.37	111.58	102.26

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table 12-4 Variant set 4 (gender is male; choice age 54): pension amount as percentage of pension for the equivalent scenario when the age of choice is 30

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	99.98	99.96	100.09
PT 50% 6 years	100.78	100.69	101.21
PT 20% 6 years	99.02	98.66	99.77
No work 6 years (no wage penalty)	98.59	97.95	99.76
No work 6 years (wage penalty)	103.66	103.97	103.08

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table 12-2 shows the impact of the various choices with respect to the base set of continuing to work full time, and this given the systems of time credit and thematic leave. As with the results for the female reference set in Table 8-2, it shows that the impact of the work interruption is the strongest, especially when the earnings penalty or wage scarring is effective.

Table 12-3 presents the difference with the simulation results of women in the same scenario; the ratios are quite close to those presented in Table 7-4 for the male variant for the scenarios set choice-at-age-30. Clearly the higher earnings base of men causes the resulting pension benefit to end up higher as well, though for the high-education scenarios, the effect is limited due to the earnings cap, as discussed in section 4.3.4.

Table 12-4 is quite similar to the corresponding Table 8-4 for women, so we do not repeat the discussion there. For many scenarios, the pension is slightly lower for men making a choice at 54 than if they would be making a similar choice at 30, because foregone earnings are higher at older ages. However, a full work interruption with a wage penalty at age 30 is more disadvantageous in pension terms than doing the same at age 54, because in the former scenario the wage penalty is much larger.

5.   Conclusions

The goal of the project "MInd the GAP in Europe" (MIGAPE) is to analyse gender differences in pension income from various perspectives and communicate the lessons learned to policy makers and the audience at large. The Belgian pension system is essentially a Bismarckian one, and so the pension that one can expect to receive after retirement is a function of previous labour market decisions, together with the compensating elements of the existing pension system.

This report uses standard simulations to demonstrate the impact of these choices on the future pension benefit that one might receive. Standard simulations are simulations based on constructed 'individuals' with specific careers. The advantage of this approach is that a careful design of the scenarios allows for comparisons of specific effects that are by design unbiased by the effects of other factors.

A first and very important conclusion from the analysis is that working part time for six years, when the person is eligible for time credit/thematic leave during this period, results in only negligable reductions in the later pension. The difference will full-time work is smallest when working 80% for 6 years and larger when interrupting work. In the case of the simulations without eligibility for time credit/thematic leave, the pension benefit decreases with a lower part time factor and is lowest if one interrupts work completely. Conversely, we find that the impact of qualifying for time credit and thematic leave is the strongest in case of the full career interruption, followed by working 50% for 6 years, and it is the smallest in case of working 80% for 6 years.

A key element in the impact of the work interruption and unemployment spells is wage scarring or the earnings penalty. When an interruption of employment implies that wages after return to work are lower than those of a person who continued to work, the impact of such an interruption on the later pension is much larger than if no wage penalty is assumed. The impact of ceasing to work for 6 years while being eligible for time credit and thematic leave increases with the educational attainment level. This impact is even stronger under the assumption of no eligibility to time credit and thematic leave, because the interruptions are no longer mitigated by the system of time credit or thematic leave.

Furthermore, we show that it makes a difference whether the choice is being made early or late in the career, though the direction and magnitude of this effect depends strongly on whether a wage penalty is assumed or not. Mostly, the loss associated with a career interruption is lower when taken later rather than earlier in the career, because wage growth flattens out as people get older. Finally, the loss associated with an unemployment spell can be considerable, and may exceed those of working part time for a longer period, especially for the groups with higher education levels.

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7. Appendices

7.1. Results for men

7.1.1.   Reference set and variant scenario's for men with choice age 30

Because the results for men are very similar to those for women, we presented and discussed in the main text only the scenarios where men were substituted for women in the reference set of scenarios. As documentation and for reference, we reproduce in this appendix all tables for men, organized in the same way as in the main text, though without discussion or explanation.

Table A1-1 Reference set for men: pension amounts

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	30163	34809	40345
PT 80% 6 years	30150	34793	40308
PT 50% 6 years	29882	34493	39864
PT 20% 6 years	29714	34304	39576
No work 6 years	27903	31595	37815

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A1-2 Reference set for men: pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.96	99.95	99.91
PT 50% 6 years	99.07	99.09	98.81
PT 20% 6 years	98.51	98.55	98.09
No work 6 years	92.51	90.77	93.73

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A1-4 Reference set for men: pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	112.12	112.31	102.18
PT 80% 6 years	112.12	112.31	102.15
PT 50% 6 years	112.14	112.34	102.05
PT 20% 6 years	112.15	112.35	101.97
No work 6 years	108.79	111.61	106.94

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A2-2 Variant set 1 for men (No time credit or thematic leave): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	98.10	98.18	97.83
PT 50% 6 years	95.24	95.44	94.59
PT 20% 6 years	92.38	92.71	91.34
No work 6 years	85.19	83.85	86.05

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A2-3 Variant set 1 for men (No time credit or thematic leave): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	98.14	98.22	97.93
PT 50% 6 years	96.13	96.32	95.73
PT 20% 6 years	93.78	94.08	93.11
No work 6 years	92.09	92.37	91.81

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A2-4 Variant set 1 for men (No time credit or thematic leave): pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	112.12	112.31	102.18
PT 80% 6 years	112.21	112.38	102.08
PT 50% 6 years	112.00	112.51	101.93
PT 20% 6 years	108.64	112.63	101.77
No work 6 years	104.84	111.94	107.41

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A3-2 Variant set 2 (no wage penalty): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.96	99.95	99.91
PT 50% 6 years	99.07	99.09	98.81
PT 20% 6 years	98.51	98.55	98.09
No work 6 years	97.80	97.81	96.85

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A3-3 Variant set 2 (no wage penalty): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	100	100	100
PT 50% 6 years	100	100	100
PT 20% 6 years	100	100	100
No work 6 years	105.72	107.76	103.33

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A3-4 Variant set 2 (no wage penalty): pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	112.12	112.31	102.18
PT 80% 6 years	112.12	112.31	102.15
PT 50% 6 years	112.14	112.34	102.05
PT 20% 6 years	112.15	112.35	101.97
No work 6 years	112.12	112.36	101.68

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A4-1 Variant set 3 (unemployment): pension amounts

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	28269	32380	37741
PT 80% 6 years	28256	32365	37709
PT 50% 6 years	28001	32080	37326
PT 20% 6 years	27840	31900	37078
No work 6 years	26108	29304	32779

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A4-2 Variant set 3 (unemployment): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.96	99.95	99.91
PT 50% 6 years	99.05	99.07	98.90
PT 20% 6 years	98.48	98.52	98.24
No work 6 years	92.36	90.50	86.85

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A4-3 Variant set 3 (unemployment): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	93.72	93.02	93.55
PT 80% 6 years	93.72	93.02	93.55
PT 50% 6 years	93.70	93.01	93.63
PT 20% 6 years	93.69	93.00	93.69
No work 6 years	93.57	92.75	86.68

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A4-4 Variant set 3 (unemployment): pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	110.21	112.11	105.20
PT 80% 6 years	110.16	112.11	105.18
PT 50% 6 years	109.17	112.14	105.17
PT 20% 6 years	108.54	112.16	105.16
No work 6 years	101.79	111.32	104.65

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A5-1 Variant set 4 (early retirement): pension amounts

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	28541	32617	
PT 80% 6 years	28528	32600	
PT 50% 6 years	28258	32298	
PT 20% 6 years	28088	32106	
No work 6 years	26395		

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A5-2 Variant set 4 (early retirement): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	
PT 80% 6 years	99.95	99.95	
PT 50% 6 years	99.01	99.02	
PT 20% 6 years	98.41	98.43	
No work 6 years	92.48		

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A5-3 Variant set 4 (early retirement): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	94.62	93.70	
PT 80% 6 years	94.62	93.70	
PT 50% 6 years	94.57	93.64	
PT 20% 6 years	94.53	93.59	
No work 6 years	94.59		

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

Table A5-4 Variant set 4 (early retirement): pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	111.70	111.97	
PT 80% 6 years	111.70	111.97	
PT 50% 6 years	111.72	112.00	
PT 20% 6 years	111.15	112.01	
No work 6 years	104.45		

Reference set: Man, age at interruption 30, reason for interruption childbirth, no unemployment, wage penalty, retirement at statutory retirement age

7.1.2. Men: Reference set and variant scenario's with choice age 54

The next tables A6-1 to A6-4 present the reference scenarios again, but this time when the age of choice of the man is 54 instead of 30.

Table A6-1 reference scenario; choice age 54: pension amounts

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	30163	34809	40345
PT 80% 6 years	30144	34778	40345
PT 50% 6 years	30116	34731	40345
PT 20% 6 years	29422	33843	39487
No work 6 years	28925	34848	38979

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A6-2 reference scenario; choice age 54: pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.93	99.91	100
PT 50% 6 years	99.85	99.76	100
PT 20% 6 years	97.54	97.22	97.87
No work 6 years	95.90	94.37	96.62

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A6-3 reference scenario; choice age 54: pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	100	100	100
PT 50% 6 years	100	100	100
PT 20% 6 years	100	100	100
No work 6 years	100	100	100

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A6-4 reference scenario; choice age 54: pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	112.12	112.31	102.18
PT 80% 6 years	112.11	112.29	102.18
PT 50% 6 years	112.09	112.27	102.18
PT 20% 6 years	111.97	112.18	102.39
No work 6 years	111.37	111.58	102.26

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A7-1 Variant set 1 for men (No time credit or thematic leave; choice age 54): pension amounts

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	30163	34809	40345
PT 80% 6 years	29192	33595	40345
PT 50% 6 years	27736	31774	37941
PT 20% 6 years	26280	29952	35333
No work 6 years	25151	28238	33593

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A7-2 Variant set 1 for men (No time credit or thematic leave; choice age 54): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	96.78	96.51	100
PT 50% 6 years	91.95	91.28	94.04
PT 20% 6 years	87.13	86.05	87.58
No work 6 years	83.39	81.12	83.27

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A7-3 Variant set 1 for men (No time credit or thematic leave; choice age 54): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	96.84	96.60	100
PT 50% 6 years	92.10	91.49	94.04
PT 20% 6 years	89.32	88.50	89.48
No work 6 years	86.96	85.97	86.18

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A7-4 Variant set 1 for men (No time credit or thematic leave; choice age 54): pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	112.12	112.31	102.18
PT 80% 6 years	112.00	112.23	105.22
PT 50% 6 years	108.13	112.09	104.70
PT 20% 6 years	102.46	111.94	103.51
No work 6 years	102.62	111.30	102.63

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A8-1 Variant set 2 for men (No wage penalty; choice age 54): pension amounts

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	30163	34809	40345
PT 80% 6 years	30144	34778	40345
PT 50% 6 years	30116	34731	40345
PT 20% 6 years	29422	33843	39487
No work 6 years	29082	33348	38979

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A8-2 Variant set 2 for men (No wage penalty; choice age 54): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.94	99.91	100
PT 50% 6 years	99.85	99.78	100
PT 20% 6 years	97.54	97.22	97.87
No work 6 years	96.42	95.80	96.62

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A8-3 Variant set 2 for men (No wage penalty; choice age 54): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	100	100	100
PT 50% 6 years	100	100	100
PT 20% 6 years	100	100	100
No work 6 years	100.55	101.52	100

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A8-4 Variant set 2 for men (No wage penalty; choice age 54): pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	112.12	112.31	102.18
PT 80% 6 years	112.11	112.29	102.18
PT 50% 6 years	112.09	112.27	102.18
PT 20% 6 years	111.97	112.18	102.39
No work 6 years	111.83	112.04	102.26

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A9-1 Variant set 3 for men (unemployment; choice age 54): pension amounts

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	28314	32220	37736
PT 80% 6 years	28295	32190	37736
PT 50% 6 years	28268	32144	37736
PT 20% 6 years	27586	31287	36870
No work 6 years	27097	30302	36370

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A9-2 Variant set 3 for men (unemployment; choice age 54): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	100
PT 80% 6 years	99.93	99.90	100
PT 50% 6 years	99.84	99.77	100
PT 20% 6 years	97.43	97.10	97.71
No work 6 years	95.71	94.05	96.38

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A9-3 Variant set 3 for men (unemployment; choice age 54): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	93.87	92.56	93.53
PT 80% 6 years	93.87	92.56	93.53
PT 50% 6 years	93.86	92.55	93.53
PT 20% 6 years	93.76	92.45	93.37
No work 6 years	93.68	92.25	93.30

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A9-4 Variant set 3 for men (unemployment; choice age 54): pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	110.39	111.69	102.33
PT 80% 6 years	110.32	111.67	102.33
PT 50% 6 years	110.21	111.65	102.33
PT 20% 6 years	107.55	111.57	102.55
No work 6 years	105.65	110.86	102.42

Reference set: Woman, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A10-1 Variant set 4 for men (early retirement; choice age 54): pension amounts

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	28541.10	32616.67	
PT 80% 6 years	28522.19	32585.03	
PT 50% 6 years	28493.82	32537.57	
PT 20% 6 years	27792.88	31640.72	
No work 6 years	27338.07		

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A10-2 Variant set 4 for men (early retirement; choice age 54): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100	100	
PT 80% 6 years	99.93	99.90	
PT 50% 6 years	99.83	99.76	
PT 20% 6 years	97.38	97.01	
No work 6 years	95.79		

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A10-3 Variant set 4 for men (early retirement; choice age 54): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	94.62	93.70	
PT 80% 6 years	94.62	93.70	
PT 50% 6 years	94.61	93.69	
PT 20% 6 years	94.46	93.49	
No work 6 years	94.52		

Reference set: Man, age at interruption 54, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age

Table A10-4 Variant set 4 for men (early retirement; choice age 54): pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	111.70	111.97	
PT 80% 6 years	111.69	111.95	
PT 50% 6 years	111.67	111.93	
PT 20% 6 years	109.98	111.83	
No work 6 years	108.18		

Reference set: Woman, age at interruption 30, reason for interruption care for a member of the household, no unemployment, wage penalty, retirement at statutory retirement age