Project MIGAPE: Work Package 2:
Results of the Standard Simulations for
Liechtenstein

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Acknowledgements

Introduction

The aim of the project is to analyze gender-specific differences in pension income. Since pension income is determined by a variety of personal circumstances (gender, educational attainment level, spells of unemployment) and personal choices (labour market participation), the influence of these factors on pension income is analyzed. As labor supply at the extensive and intensive margins is influenced by care obligations, the focus of the analysis is laid on the impact of bringing up children and caring for relatives on pension income.

In order to systematically analyze the various factors influencing pension income, different combinations of personal circumstances and decisions (so-called scenarios) are compared. To present the scenarios in a clear and interpretable manner, we focus on the impact of certain choices (e.g. labor market participation), given circumstances (gender, education level, and spells of unemployment). In doing so, the results illustrate the impact of the choices that are modelled on the later pension, while the variant sets show to what extent these findings are sensitive to the circumstances.

In addition to the sensitivity analysis, the influence of the legal framework on pension income can be shown by comparing the scenarios. First, the mitigating impact of care credits is illustrated by the comparison of the scenario without and with care benefits. Second, illustrate the unemployment and age of retirement variants how the impact of the various options changes when the career is less than full. Third, the comparison of the pension income across gender shows, how results change when the wages of the model persons are different.

The remainder of the report is organized as follows. The next section briefly describes the institutional background with reference to simulated scenarios. Section 2 outlines the simulation model and the estimation of the basic earnings profiles. Section 3 presents the overall picture of the simulation result. Section 4 and 5 analyse the impact of child care and care on pension income. Section 6 concludes the report.

1   Institutional background

Life events, such as raise of children and care for relatives, unemployment and divorce trigger a number of consequences in terms of social security law. For example, periods spent bringing up and caring for children are credited in the first pillar. Other life events, such as unemployment, also affect pension income.

The next sections provide an overview about the institutional background. Section 1.1. provides an overview of the Liechtenstein pension system, section 2.1 outlines the Liechtenstein unemployment insurance.

1.1 The Liechtenstein Pension System

The Liechtenstein pension system comprises three pillars. The first pillar secures with the pensions of the old age and survivors' insurance (OASI)[1] and invalidity insurance (DI) a basic subsistence income level of all retired residents. The second pillar is an employer-based fully funded occupational pensions system and accident insurance, which is mandatory for (almost) all employees. The third pillar is a voluntary, individual, tax-privileged private provision in addition to the first and second pillars.

1.1.1 The First Pillar: OASI, DI and family allowances

The first pillar includes the old age and survivors' insurance (OASI/AHV), invalidity insurance (DI) and family allowances (FAK) and is surveilled and administered by the Government of Liechtenstein. The state pension covers all people living and working in Liechtenstein (who have paid contributions for at least one year), regardless of their residency and is to ensure that the basic needs are covered in an appropriate way (Social Security, 2018). In case when the OASI and DI do not cover these basic needs, supplementary benefits (SB) are granted.

The OASI is intended to replace, at least in part, income from work, which has fallen or ceased to exist as a result of old age and death. OASI is primarily based on solidarity between the generations. It is organized as a pay-as-you-go (PAYG) system, the current pensions are financed by the active population. In addition to solidarity between the generations, there is also an interpersonal solidarity. Higher earners support poorer insured persons as they pay higher contributions than would be necessary to finance their own pension, while the economically worse off receive more benefits than their contributions would. Thus a transfer between rich and poor takes place. The childcare and care credits also reflect the solidarity of childless persons with parents or of persons without care responsibilities with those who look after relatives in need of care. Finally, with the splitting, solidarity between the spouses also plays a role at the OASI.[2]

Income from employment, income credits and childcare and care credits are revalued by a factor that takes into account wage and price developments (see Figure 2, p.20). The revaluation factor, which is set by the government; is currently 2.1. The relevant average annual income is calculated by dividing the total of earned income and income credits by the number of contribution years and contribution months (Art.64 AHVG).

The pension level is computed on the basis of the years of contributions (maximum 44 years) and the average annual income. Anyone who has paid OASI contributions in full every year from the 21st year of age until the regular retirement age will receive a full pension. The conversion from the relevant

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[1] (In German: Alters- und Hinterlassenenversicherung (AHV) and in French: assurance-vieillesse et survivants (AVS)).
[2] For its whole duration the registered same-sex partnership is treated as marriage.

average annual income to the pension income is done by binding tables, which are released by the government (so called "Rententabelle, Vollrente", see Appendices p. 52, Table 28) (Art.64 bis AHVG). The amount of the pension is limited upwards and downwards, whereas the maximum amounts (CHF 2,320 per month) are at most twice as high as the minimum pensions (CHF 1,160 per month). In order to receive the minimum pension, a relevant average annual income of CHF 13,920 must have been achieved, for the maximum pension a relevant average annual income of CHF 83,250. Since the actual income is currently revalued by a factor of 2.1 to compute the relevant average annual income, an actual average annual income of CHF 39,642 (39,642 x 2.1=83,250) results in a correspondingly large relevant average annual income for receiving the maximum pension.

However, in the case of contribution gaps (contributions have not been paid in without interruption or even whole contribution years are missing), only a partial pension is paid out. A missing contribution year usually leads to a pension reduction of at least 2.3% (1/44). Thus, the pension system punishes contribution gaps as well as early retirement and rewards later retirement up to the age of 70 (Art. 63 AHVG). The term "full pension" is used for a full contribution period and "partial pension" for an incomplete contribution period. The pension payments are paid out 13 times per year (Art. 60 AHVG).

All persons who live or are engaged in paid employment in Liechtenstein are subject to compulsory insurance (Art. 34 AHVG).[3] From the age of 21, everyone residing in Liechtenstein must contribute to the OASI, independent of whether the person is gainfully employed or not. Persons who are not in an employment relationship (unemployed, non-working spouses of working persons and non-active spouses of pensioners) have to pay a minimum contribution of CHF 243 per year. The obligation to pay contributions ends on the last day of the month in which a person reaches the age of 65. Employed young people who have not yet reached the age of 18 are exempt from the obligation to pay contributions (Art. 36 AHVG).

All persons who are insured with the OASI are liable to pay contributions, with the exception of children. Although they are insured and therefore entitled to benefits (children's and orphans' pensions), they are not themselves liable to pay contributions. Contributions are calculated on the basis of a person's income from gainful employment. For salaried employees, the employees must contribute 3.95% (Art. 38 AHVG) and the employers are obliged to contribute 4.15% of gross salary (no upper limit). Self-employed must contribute 8.1% of their income (Art. 41 AHVG).[4] The contribution of the non-active persons varies between CHF 353.65 and CHF 11,787.50 per year, depending on the basis of assets, income and other recurrent benefits. All contributions to the OASI are tax-deductible.

Non-employed insured persons who are maintained or permanently supported by public funds or third parties also have to contribute a minimum contribution, which is currently CHF 243 per year (Art. 43

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[3] Some exceptions to this compulsory insurance are permitted by law.

[4] If the income from self-employment is less than CHF 3,000 per year, a fixed contribution of CHF 243 per year must be paid (Art. 41 AHVG).

AHVG). The contributions of inactive persons from insurance periods without compulsory contributions are multiplied by a factor of 100, divided by the contribution rate of 8.1% and credited in the form of income credits like earned income (Art. 63 quinquies AHVG). Hence, the minimum contribution of CHF 243 is equivalent to an annual income of CHF 3,000 (Seeliger, 2020 p. 48). Although the minimum contributions lead to a relatively low relevant pension income, the minimum contributions avoid pension gaps, which in turn would lead to lower pensions.

In addition to the income credits for inactive persons, childcare and care credits are also credited. Childcare credits are credited for calendar years in which persons at that time insured have parental custody over one or more children under the age of 16. Irrespective of the number of children to be cared for, the annual childcare credit for years of upbringing from 1973 corresponds to 48 times the amount of the minimum monthly old-age pension (Art. 63 sexies AHVG). With the current minimum pension income of CHF 1,160 per month, a notional income of CHF 55,680 is thus credited for one year. Since care credits are currently revalued by a factor of 2.1 to compute the relevant average annual income, a care credit of CHF 55680 is thus converted to a relevant average annual income of CHF 116,928 (CHF 55,680 x 2.1 = CHF 116,928), which is above the average annual limit to be entitled to the maximum pension (CHF 83,250). Thus the childcare credits, which are credited over a period of 16 years, compensate for loss of contributions.

In the case of married persons, half of the credit is distributed among the spouses during the marriage years. For divorced or non-married parents jointly exercising parental authority, the entire childcare credit is paid to the parent mainly caring of the children or the childcare credit is divided by two when both parents are equally taking care for the children. (Art. 63 sexies AHVG). However, it is possible to make an agreement on whether the childbirth contribution credits will be completely given to one parent (Art. 63 octies AHVG).

Besides the childcare credits, there are also care credits. Care credits may be credited for the years in which insured persons have cared for their relatives who require considerable care. The relatives must live in the same household or in a household which is not more than 30 km away. If an entitlement to a childcare credit exists, a credit for care-giving may not be attributed to cover the same period. The bonus is recorded in the individual account; however, it is divided equally between spouses during the calendar years of their marriage (Art. 63 septies AHVG).

The entitlement to old-age benefits arises from the attainment of the statutory retirement age in accordance with the AHVG (Art. 8 Abs. 1 BPVG). Upon retirement, the insured person gets a retirement pension. Entitlement to an OASI pension exists when the statutory retirement age of 65 for both men and women is reached and if contributions have been paid for at least one full contribution year.

In order to determine the pension of married, widowed or divorced persons, the income earned by the two spouses during the marriage years is divided and credited equally to each spouse (splitting method).

Under the OASI scheme, pensioners can draw their pension one or two years before retirement age, or postpone it by one to a maximum of five years. The pension can be prepaid from the age of 60. In case of early retirement, the old-age pension will be calculated on the same basis as if it had been taken at statutory retirement age. The amount will then be reduced by 5% for the first year, 9.7% for the second year, 14% for the third year, 18% for the fourth year and 21.8% for the fifth year of early pension payments before the statutory retirement age is reached[5]. After reaching the statutory retirement age, the pension is then raised back to the level that would have been reached without the advance withdrawal. Thus, early retirees are treated the same way as pensioners who retire at the statutory retirement age. In case of early retirement, the pensioner is still required to pay OASI contributions as a non-employed person. However, the contributions made during this period will no longer count for the purposes of calculating pension income (Art. 73 AHVG). In contrast, in case of postponed retirement, the pension is increased by between 4.5% and 26.1%.

The widow's or widower's pension is 80% of the old-age pension corresponding to the revalued average annual income (a minimum of CHF 928 per month and a maximum of CHF 1,856 per month). Persons receiving an old-age pension are entitled to a child's pension for each child who would be entitled to an orphans' pension on the death of such persons; the child's pension amounts to 40% of the old-age pension in question (but a minimum of CHF 464 per month and a maximum of CHF 928 per month).

1.1.2   The Second Pillar: Occupational pension

The occupational pension provision (BV) is a funded pension plan insurance which covers old-age and risk by providing old-age, disability and child, widow/widower and orphan's pensions. As the AHV/DI provides only basic benefits, the BV pension income is crucial to maintain the accustomed standard of living. The pension depends on the sum and duration of the contributions paid and on the insured income of the employee.

The occupational pension is mandatory for any employee who is subject to the OASI (Art. 2 BPVG), has reached the age of 19 and earns an annual income of at least the annual amount of the minimum annual OASI retirement pension (which is currently CHF 13,920) (Art. 4 BPVG).[6] The insurance obligation ends when the statutory retirement age is reached, the employment relationship is terminated or the salary falls below the contribution limit (Art. 4, Abs. 3 BPVG).

The salary to be insured corresponds to the relevant annual salary, according to which the statutory contributions for old age and survivors' insurance are also calculated (Art. 6 BPVG). Temporary wage supplements may be excluded and income components that fluctuate over time may be covered by appropriate lump sums (Art. 6, Abs. 1-2 BPVG). The regulations of the pension fund may set an upper

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[5] Widows', widowers' and orphans' pensions which replace an old-age pension taken early will be reduced by the same amount.

[6] Some exceptions to this compulsory insurance are permitted by law.

limit on the relevant annual salary. However, the limit may not be lower than three times the annual amount of the maximum old-age pension under the old-age and survivors' insurance (Art. 6, Abs. 3 BPVG).

If the employee has several employers, he is considered to be partially employed by each of these employers, provided that it is not only a secondary employment and thus the insurance obligation does not apply (Art. 6 BPVG). Hence, if an employee has several part-time jobs, these are treated separately and not combined under BPVG. It may therefore be the case that there is no insurance obligation for several part-time jobs in the second pillar, although the exemption limit would be exceeded by adding the respective incomes.

The pension fund determines the contribution rate, whereby the contribution to old-age insurance shall amount to at least 8% of the insured salary (Art. 7, Abs. 1-2 BPVG). The employer must pay at least half of the contributions for each employee (Art. 7, Abs. 4 BPVG), whereby the employer is free to pay a larger proportion of the contributions for the benefit of its employees.[7]

The insured person can improve his retirement benefits if he pays additional purchases into his retirement account during his insurance period. The purchases made are credited to the individual retirement account as retirement assets and bear interest from the date of receipt. The maximum purchase amount is the difference between the actual retirement savings and the maximum possible retirement savings, calculated on the basis of the current insured salary. However, purchases can always be made up to a maximum of 12% of the insured annual salary. Purchases are no longer possible once the retirement age has been reached.

The entitlement to old-age benefits arises from the attainment of the statutory retirement age in accordance with the AHVG (Art. 8, Abs. 1 BPVG). Upon retirement, the insured person can apply for a retirement pension, a lump-sum withdrawal or a combination of the two options (partial withdrawal and pension) (Art. 9 BPVG). If only part of the retirement savings capital is drawn, the remaining pension must amount to at least 20% of the maximum OASI pension per year (currently just under CHF 6,000).

However, pensions from the OASI and BV can be taken at different times. If the pension relationship is extended beyond the normal retirement age under the AHVG, only retirement benefits are insured (Art. 8, Abs. 2 BPVG). Persons who have already received an old-age pension under the AHVG may also receive the full or half pension for each month under this act (Art. 8, Abs. 3 BPVG).

Under the occupational pension scheme, it is possible to take early retirement (starting from the age of 58). However, early retirement reduces the conversion rate for old-age pensions by 0.2 percent for each year of prepayment. Withdrawal of the old-age pension can be deferred if the insured person continues

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[7] According to the FMA's annual reporting documents, the ratio of contributions paid between employer and employee is 56% (employer) to 44% (employee) on a national average.

to work beyond the normal retirement age. Deferment is possible until the insured person reaches the age of 70. In the case of an old-age pension, the conversion rate is increased by 0.15 percent per deferred year.

In the field of disability, DI and BV are closely linked. If a claim to DI exists as a result of invalidity, a disability pension amounting to 30% of the insured annual salary and a children's pensions of 6% of the insured annual salary is granted (Art. 8a, Abs. 1 BPVG). In the case of partial invalidity, they may be lowered according to the degree of invalidity (Art. 8a, Abs. 2 BPVG). The disability pension is granted until the statutory retirement age is reached. Subsequently, the insured person is entitled to BVs. In order to ensure retirement benefits, the exemption from contributions is also included in the insurance for the savings part of the insurance.

In the event of death before reaching the statutory retirement age, a lifelong widow's or widower's pension of 18% of the insured salary per annum is payable; and an orphan's pension of 6% of the insured salary per annum (Art. 8b, Abs 1 BPVG). In the event of the death of a person who has received an old-age or disability pension, the widow's or widower's pension is 60 %, the orphan's pension 20 % of the last old-age or disability pension paid (Art. 8b, Abs. 2 BPVG). The surviving spouse is entitled to a widow's or widower's pension if, at the death of the insured person, he or she is responsible for the maintenance of at least one child; or is older than 45 years and the marriage has lasted at least five years (Art. 8b, Abs. 3 BPVG). The surviving spouse who does not fulfil any of the conditions set out in Art. 8b, Abs. 3 BPVG is entitled to a lump-sum settlement amounting to three years' pension. Entitlement to a widow's or widower's pension expires upon remarriage or upon the death of the widow or widower.

The regulations of the pension fund may stipulate that the entitled person may demand withdrawal of the retirement assets instead of an old-age, disability or widow's or widower's pension, which must amount to at least 90% of the actuarial present value of the pension to be redeemed (Art. 9, Abs. 2 BPVG). In the case of a full withdrawal of the retirement assets, the right to survivor benefits lapses. In order to better protect the spouse in the event that the retirement assets are paid out, the payment is only permissible if the spouse agrees in writing. The pension fund must inform the spouse of the associated loss of survivor benefits before consent is given (Art. 9, Abs. 2a BPVG). In the case of a lump-sum withdrawal, the remaining capital of the former insured person is included in the freely inheritable assets, to which the statutory or testamentary succession thus applies. Thus it is no longer the surviving spouse who is covered, but the children in adulthood and the other heirs who benefit.

In the event of divorce, the pension entitlements determined for the duration of the marriage are divided in accordance with Articles 89b and 89c of the EheG (Art. 12a, BPVG). If the spouses are mutually entitled to claims, only the difference is to be divided. The pension entitlements received within the scope of this divorce settlement must in principle be transferred to each spouse's own pension fund. If a spouse does not have a pension fund to which the vested benefits received can be transferred, they are transferred to a bank blocked account or paid into a premium-free vested benefits policy with an

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insurance company. The pension entitlements can then be drawn either upon fulfillment of a cash payment reason pursuant to Art. 12 BPVG or upon reaching retirement age. If the withdrawal benefit was deposited in a bank blocked account, it can only be withdrawn as a lump sum and not as a pension.

1.1.3 The Third Pillar: Private pension

The third pillar is voluntary and is intended to reduce or close gaps in pension provision from the first and second pillars. In fact, the first and second pillars are designed to equal merely 60% of the last income earned during working life (Marxer & Hornich 2016, p. 9). Gaps exist especially in the accumulation of retirement capital to finance the third stage of life and in disability and survivor benefits in the event of illness.

The third pillar comprises all private savings and voluntary old-age insurance policies. With regard to life insurances, a distinction can be made between whole life insurance policies (endowment and annuity policies) and term life insurance policies which last for a certain period of time and pays the death benefit only if the policyholder dies during that time.

The third pillar does not include state or employer contributions, but enjoys tax advantages depending on the type of assets.

1.2 The Liechtenstein Unemployment Insurance

The unemployment insurance (UI) (Arbeitslosenversicherung, ALV) ensures, that a person who becomes unemployed in Liechtenstein is provided with a reasonable alternative income in the form of daily allowances (Art. 1 ALVG).

The number of daily allowances is determined by the age of the insured, the contribution period as well as personal circumstances. Persons who have not yet reached the age of 25 and who have no obligation to maintain children are entitled to a maximum of 200 daily allowances. Persons elder than 25 years are entitled to a maximum of 260 daily allowances, provided he/she can prove a contribution period of at least 12 months. Persons who have reached the age of 50 and can prove a contribution period of at least 18 months are entitled to a maximum of 400 daily subsistence allowances. If a person can demonstrate a contribution period of at least 22 months and receives a disability pension corresponding to a degree of disability of at least 40%, they will receive a maximum of 500 daily allowances (Art. 32 ALVG).

Persons who have not been in an employment relationship for a total of more than twelve months within the framework period laid down for this purpose and who were unable to complete the contribution period because they were in education, retraining or continuing education are exempt from the contribution period. This only applies if they have been resident in Liechtenstein for at least ten years. Also excluded are persons who were unable to work due to illness, an accident or maternity, provided that they were resident in Liechtenstein during this period. Furthermore, persons who are forced to take

up or expand an employed gainful activity due to judicial separation or divorce of marriage, due to invalidity or death of the spouse, or due to reduction or discontinuation of a disability pension, are exempt from the contribution period. This provision only applies if the event in question occurred no more than one year ago and the person concerned was resident in Liechtenstein when the event occurred (Amt für Volkswirtschaft 2019, p. 8). If a person is exempt from contributions, they receive a maximum of 130 daily allowances (Amt für Volkswirtschaft 2019, p.10).

A full daily allowance is 80% of the insured earnings. A daily allowance in the amount of 70% of the unsure earnings is paid to insured persons who either have no maintenance obligation towards children up to the age of 25 (compulsory school attendance or in education) or do not receive a full daily allowance of more than 140 CHF and do not receive a disability pension corresponding to a degree of disability of at least 40% (Art. 26 ALVG). The maximum insured annual salary is CHF 126, 000 (Art. 30, Abs. 2 ALVG).

Unemployment compensation is taxable income according to the Liechtenstein tax law (SteG) and is subject to income tax. The ALV therefore deducts the income tax from the unemployment benefit and transfers it to the tax administration (Amt für Volkswirtschaft 2019, p. 16).

The daily allowances are regarded as wages and are handled accordingly for the insurance contribution obligation and for the benefit prerequisites. The ALV deducts the contribution share from the compensation for wages and salaries and pays it together with the employer's share to be paid by it. This measure helps to avoid losses in the pension career. There is no obligation to contribute to the ALV. In the event of illness, pregnancy or accident, the employee is entitled to ALV daily allowance for the first 30 calendar days after the start of your incapacity for work. The requirement for this is that all other conditions for entitlement are fulfilled and that there is no entitlement to daily insurance benefits (Amt für Volkswirtschaft 2019, p. 17).

In the event of pregnancy, there is a general entitlement to daily allowance from the ALV until birth, provided there is no incapacity to work. If a person is insured for daily sickness benefit with a health insurance fund, he or she can receive daily sickness benefit for a period of 20 weeks. If there is no daily sickness benefit insurance with the health insurance fund, it is possible to re-register with the AMS after the birth, at the earliest after the 8th week. A medical certificate (confirmation of employability) and proof of childcare (proof of employability) are required for re-registration (Amt für Volkswirtschaft 2019, p. 18).

2 Methodology

Future pension income is determined using a microsimulation model. The microsimulation model of the Liechtenstein Pension System (MiLiPE) is a static microsimulation model (henceforth, MSM). Static models – in contrast to dynamic models – assume constant individual characteristics, such as family status, labor market participation, and educational level. In doing so, static models, such as EUROMOD (Sutherland, 2007) are often used to evaluate the immediate distributional impact upon households/individuals of policy changes without behavioral adjustment (Li & O'Donoghue, 2013).

MSM can be further classified as cohort or population models (Harding, 1993). Whereas cohort models model a single cohort over the lifetime, population models model a population cross-section over a defined period of time. As the MSM is used in the first stage of the project to analyze the impact of the regulatory framework and specified circumstances (gender, educational level, unemployment) and options (full time work/ part time work, early retirement), a static MSM with a cohort model is applicable (Dekkers, 2015).

The static model serves as the starting point for the development of a dynamic model. Dynamic MSMs simulate the behavior of individuals and families over time. In doing so, dynamic MSMs allow to analyze the impact of changing labor market participation, educational decisions, fertility decisions and household formation. Due to these diverse dimensions, dynamic MSMs can be used to evaluate the future performance of pension policies, health and long-term care, by analyzing simulated future cross-sectional data. Li & O'Donoghue (2013) provide an overview of existing dynamic MSMs.

2.1 The database

The MSM is based on a unique microdata set generated by a combination of data from wage statistics with data from the census. Wage statistics are compiled from administrative data of the Liechtenstein Tax Administration.

The Liechtenstein Population Census 2015 is a complete census of the permanent population of Liechtenstein on 31 December 2015. The census is based on a combination of interviews (full census)[8] and register census. All persons who were older than one year on the reference date were recorded by means of a written questionnaire. The register survey was based in particular on the Central Register of Persons (Zentrale Personenregister, ZPR) of the Liechtenstein National Administration and the Register of Buildings and Housing (Gebäude- und Wohnungsregister, GWR) of the Office of Statistics. Characteristics such as place of residence, age, sex, nationality, acquisition of Liechtenstein citizenship, country of residence at birth, residence abroad, marital status and employer were taken from the ZPR.

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[8] The census achieved a very high response rate of 97%. Nevertheless, it is not excluded that for a certain number of observations information on individual characteristics is missing. As part of the data preparation for the census, a number of plausibility checks were carried out to remove implausible data.

The data of the ZPR also served to delimit the permanent population. The definitions used are based on the definitions of Eurostat, the Statistical Office of the European Union. In addition, definitions from the Swiss population census (structural survey) and definitions from the Liechtenstein population census 2000 are used (Amt für Statistik, 2015, Band 1).

The Liechtenstein wage statistics are based on the employers report to the Tax Administration. The employers report the gross wages paid to employees and the period of employment. This information is enriched by the Office of Information on the basis of the employee-employer combination with data from the Liechtenstein company register as of 31 December. Wage payments of the same employee-employer combination are consolidated into a single wage payment and period of employment. Part-time work is extrapolated to a uniform full-time workload. This data record is available to the Office for Statistics in anonymized form (Amt für Statistik, 2019).

Both datasets were merged by the Office for Information Technology by the AHV number, the Office of Statistics received an anonymized data set as a result. Observations that did not have a corresponding observation in the census data set were removed from the data set. These were mainly persons who lived abroad or who had moved in during 2016. While the population of the wage statistics consists of persons employed in Liechtenstein, the census consists of the inhabitants of Liechtenstein. Hence, the combined data set contains only the residents of Liechtenstein who are employed in Liechtenstein (Amt für Statistik, 2019).

Figure 1: Merged dataset of working inhabitants in Liechtenstein

Wage statistic	Employees in Liechtenstein	
Census		Inhabitants in Liechtenstein
Merged data set		Working Inhabitants in Liechtenstein
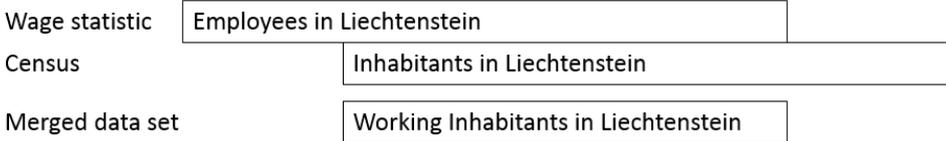
Source: Amt für Statistik (2019, p.3).

The information from the census was reported as of 31 December 2015. The data on gross wages and length of employment from the wage statistics refer to the calendar year 2016, while the other data on the employment relationship are from the cut-off date of 31 December 2016.

A number of filters were applied to create the data set on which the model is based. The filters were applied in three steps. In a first step the cases were reduced to the main occupation. The reason for this is that only the main job is recorded in the census, but all employment relationships are recorded in the wage statistics. To avoid the possibility that the occupation might be incorrectly assigned to the secondary employment if it is different from the main employment, only the information on the main employment is used in the case of multiple employment. The employment relationship with the higher employment level was chosen to determine the main job. If the largest employment relationships were the same size, the employment relationship with the higher gross monthly salary was chosen. After

applying this filter, the data set still contains 15,473 cases. In a second step, cases with abnormal wages, low employment, low workloads and of persons under 19 years of age were excluded.[9] After applying these filters, a total of 13,211 observations remain in the data set. In a third step, different employment groups are filtered out. First, the employees in the sector "Agriculture and forestry" and all persons who belonged to the occupational group "Agricultural and forestry workers" were removed. The reason for this filter was the difficulty of effectively describing wages in the agricultural and forestry sector by the chosen model. Furthermore, those observations were removed from the data set which belonged to the occupational group "Self-employed", "In own capital company", "Employee family member" or "Apprentice". This filter was set because these entries have only limited significance. Persons who work in their own company pay themselves a wage, but this was not obtained on the market. Apprentices are also removed from the data set because of the small number of cases and the special wage structure. Finally, persons over 65 years of age are also excluded from the data set. After applying these filters, a total of 10,746 observations remain in the data set. Finally, a further 768 observations were filtered out of the data set, as no information was available for at least one characteristic used in these data. The data set used for the model thus consists of 9,978 observations (Amt für Statistik, 2019).

2.2 Estimation of the wage profiles

Graph 1 shows the lifetime monthly wage profiles by gender and educational level[10], constructed using the combined census-wage dataset. The educational levels are defined according to the International Standard Classification of Education/ISCED and are categorized as low (up to lower secondary education, ISCED 0-2, medium (upper and post-secondary, ISCED 3-4) and high (tertiary, ISCED 5+).

The wage profiles differ both in their level and in the degree of curvature. While the curvature is more pronounced at higher education levels, the profiles for the lowest education level are almost flat. Comparing the wage profiles of a given educational level in terms of gender, it is striking that the average monthly wages of men are higher than those of women.

To smooth the wage profiles, they were estimated using a Mincerian wage equation (Mincer, 1974). The estimation was performed by the Statistical Office, since, due to data protection regulations, the microdata set may only be used by the Statistical Office.

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[9] A description of these filters and their effects on the median wage is given in section "1.5 Data preparation" of the 2016 wage statistics (Amt für Statistik, 2016).

[10] An overview of the Liechtenstein education system and the ISCED levels is given in the appendices.

Graph 1: Average monthly wage of full time employees, by gender and educational level
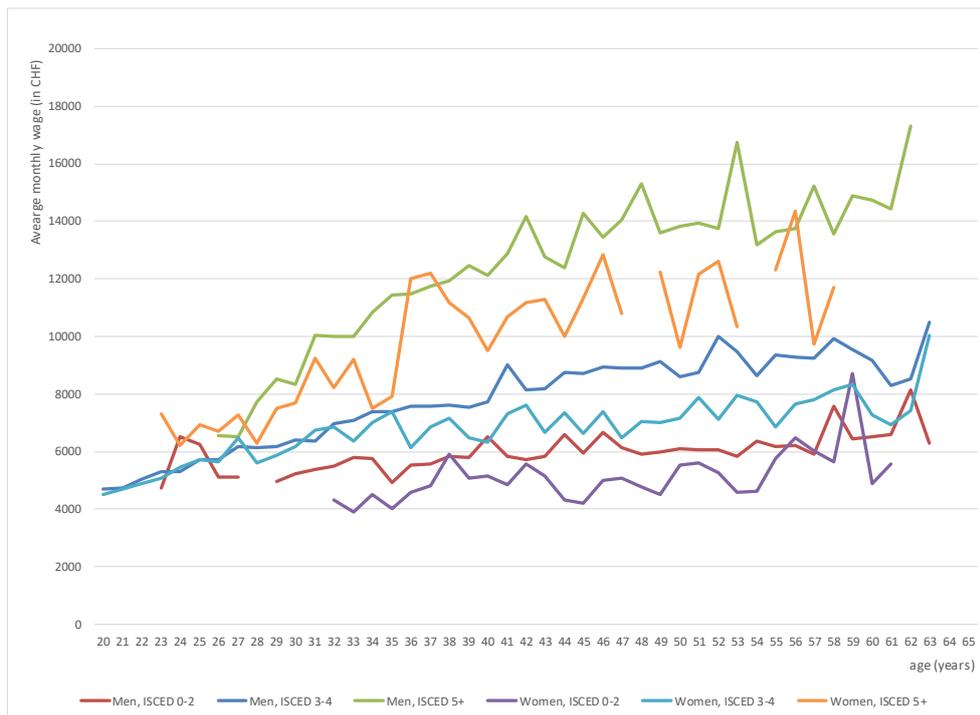
Source: 2015 Census and 2016 wage statistics; Amt für Statistik (2019b).

As wage profiles vary according to gender and educational level, they are estimated separately according to these characteristics. Thus, separate estimation by educational level keeps the potential experience constant (e.g. Casnova, 2018).

The wage profiles are estimated by a Mincerain wage equation (Mincer, 1974). To capture the concave relationship between wage and age, age enters in a quadratic form into the equation

$$\log w_i = \beta_0 + \beta_1 age + \beta_2 age^2 + \varepsilon_i$$

where *log w* denotes the natural logarithm of monthly wage,[11] *age* denotes the age, and ε is a random iid disturbance term that reflects unobserved characteristics. To avoid multicollinearity, age is centred[12] before computing the quadratic term (Marquardt, 1980).

The results of the estimations are reported in the appendix. The results show, that age has a diminishing effect on the wage. Due to the parabolic shape, the regression coefficients of show the expected signs. Whereas the coefficient β_1 is positive, the coefficient β_2 is negative. The coefficient β_2.is significant for the education levels ISCED 3-4 and ISCED 5+, but not for the education level ISCED 0-2, which

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[11] Since wages tend to be lognormal, the wages are included in the estimation equation in lograrithimized form in order to reduce the problem of heteroskedasticity.

[12] Age is centered by Age=((age-40) * (age-40) / 10).

corresponds to the fact, that the wage profile of this education level is rather flat than concave. This implies, that the relationship between wage and age is log-linear.

Graph 2 contrasts estimated and actual wage profiles by gender and educational level. The predicted values are close to the observed data values. The estimated coefficients are used to simulate the wage profiles over all ages from 21 to 65 for the six gender-education groups.

Graph 2: Estimated and actual wage profiles of full time employees, by gender and education
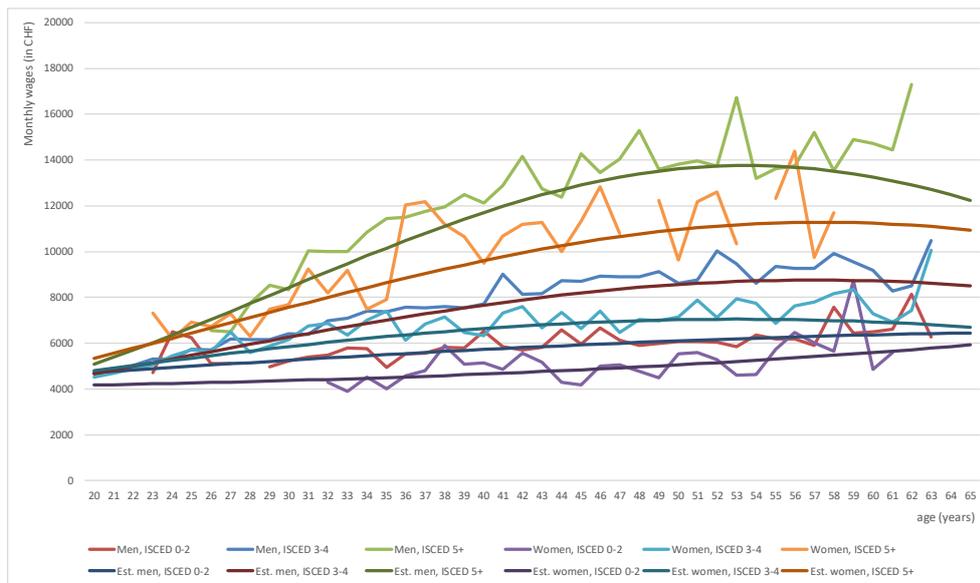
Source: 2015 Census and 2016 wage statistics; Amt für Statistik (2019b).

However, it would be interesting to analyse the wage profiles in more detail in the context of this project. First, it would be interesting to estimate the wage profile by quantile regression, as heteroscedasticity may play a role. A hint for this is given by the plot of the residual vs. fitted values (see Annex), who shows a lack of fit for higher ages. Second, the U-shaped pattern of wage profiles could be caused by a self-selection effect. For example, workers with relatively high wages may be more likely to take early retirement. This would lead to the observed average wage falling with age (e.g. Casanova, 2018).

2.3 The setup of the MSM

The MSM comprises several modules for calculating pension income from the first and second pillar. An extension to model the third pillar is planned.

The starting point for the simulation is the uprated wage profile. The uprated wage profile is an inflation-adjusted update of the wage profile, assuming that the person in question was born in 2000. Since no separate wage index is determined for Liechtenstein, the wage profile is uprated by the Swiss wage index (BFS, 2019b). According to this index, the wages in Switzerland increased in the last twenty years

(1998-2018) by an average of 1.1% in nominal terms. Hence, it is assumed, that the nominal wages will follow this trend in future times[13] and increase by 1.1% in nominal terms.[14]

Graph 3: Uprated wage profiles of full-time employees, by gender and educational level
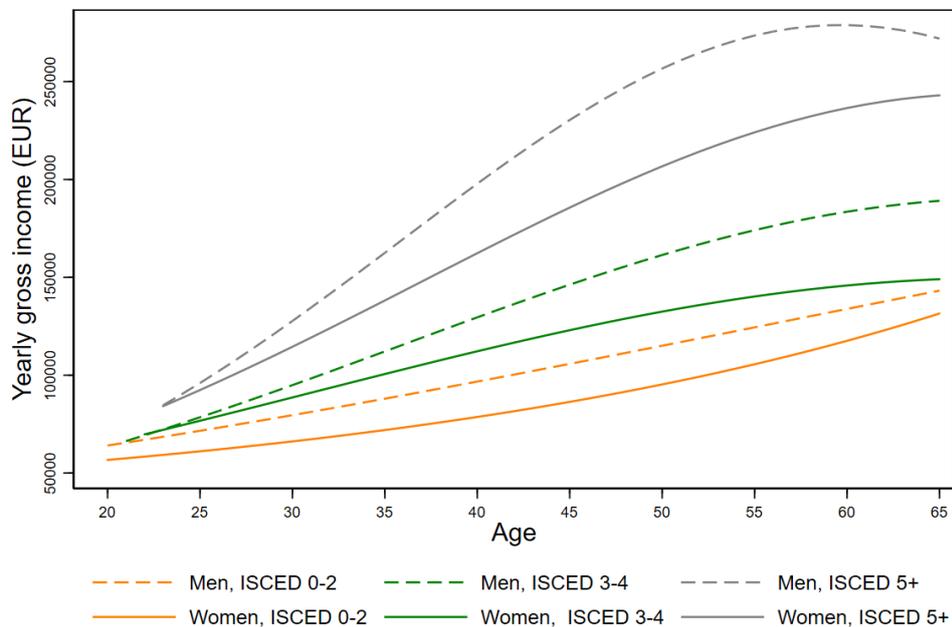
Source: 2015 Census and 2016 wage statistics, own calculations.

Furthermore, an annual inflation rate of 0.5% was assumed in the model. This corresponds to the average annual inflation over the last 20 years according to the Swiss National Consumer Price Index (BFS, 2019b). The inflation rate is used to uprate the table, which is applied to convert the relevant average annual income to the pension income. As the childcare and care credits are linked to the conversion table, they are uprated as well. Income credits are also uprated by the inflation rate. As the inflation rate is smaller than the nominal growth rate of wages, the care credits will increase at a lower rate than the wages. Hence, the compensational effect of care credits will be lower in future times. Thus, the care credit simulated at age 54 for the care of relatives (i.e. in 2054) has a relatively lower compensatory effect than the childcare credit in the case of maternity, which is assumed at age 30 (i.e. in 2030).

However, in the simulations, the revaluation factor that takes into account wage and price developments was not changed, as this is a parameter determined by the government and was therefore left unchanged as a policy variable. In the next WP, however, the political parameters will also be varied, and thus also the revaluation factor. A sensitivity analysis of the impact of the revaluation factor is important for two reasons. First, the revaluation factor is a powerful political adjustment screw, as it determines in the

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[13] In the model, growth rates are assumed to be constant over time for all levels of education. This could be varied in a further step.

[14] This assumption differs from the projections of average wages by the Aging Working Group of the Economic Policy Committee of the European Council (European Commission, 2018), which have been applied in the other country reports of the MIGAPE consortium.

form of a multiplier the relevant income. Second, the revaluation factor of 2.1 appears too high given the relatively low growth rates of the past twenty years.

Graph 4 illustrates the difference between the estimated actual wage profiles (solid curves) and the simulated uprated wage profiles (dashed curves). Since inflation and growth have an exponential effect, the function flattens out more than the original curve by increasing age, and the curve of the simulated wage profile lies above the estimated wage profile. This effect is more pronounced the higher the assumed nominal wage growth rates are. This effect is illustrated by

Graph 13 in the appendix, which shows the same actual and uprated wage profiles, however with a nominal wage growth rate of 2.1%.

When interpreting the results, the relationship between nominal growth rages of wages and the extend of wage penalty must be taken into account. If a higher growth rate is assumed, the wage curve rises more steeply, which in turn results in a higher wage penalty. Thus, the impact of an interruption on pension income would be greater, if a higher growth rate would have been assumed.

Graph 4: Real and uprated wage profiles of full-time employees, by educational level
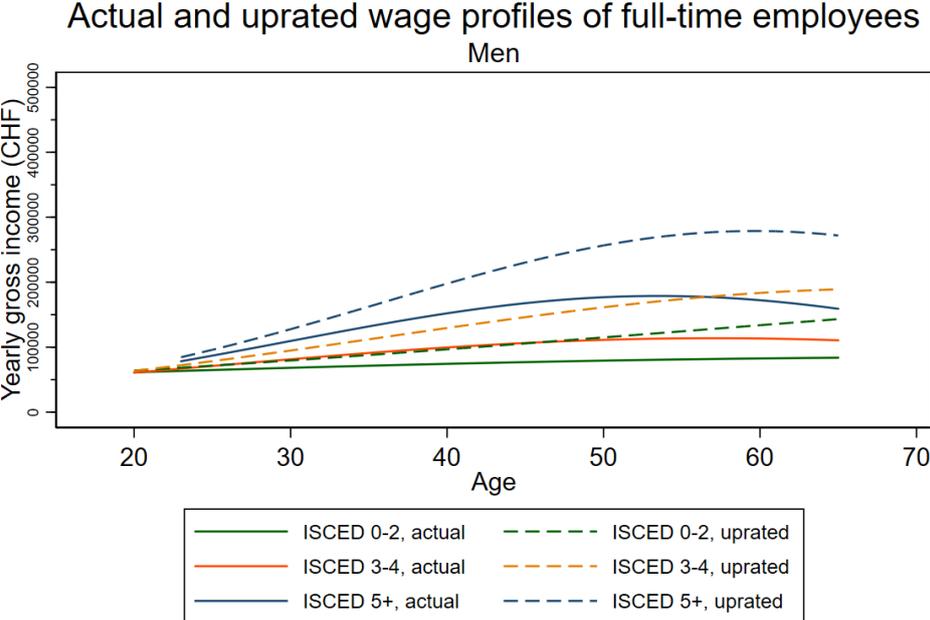
Parameter: Nominal wage growth rate: 0.011.

Source: 2015 Census and 2016 wage statistics, own calculations.

Table 1 reports the average actual and uprated lifetime income from employment by gender and educational level. If a nominal wage growth rate of 1.1% is assumed, the average uprated lifetime income is about 40% higher than the actual average lifetime income. Since growth is exponential, incomes rise significantly over the simulated period, which must be taken into account when interpreting simulated earned income and pension income.

Table 1: Average actual and uprated lifetime income, by gender and educational level

	Education		
Wage profile	Low	Med	High
Men – actual	74640	96970	147937
Women – actual	63015	83353	124927
Men – uprated	102103	134003	207756
Women – uprated	86394	114031	175013

Parameter:
The wage was uprated by a nominal wage growth rate of 1.1%. Full-time employee without interruption.

In a next step, the first pillar is simulated. The first pillar is a state-run pay-as-you go system. The pension income is determined by the two factors "relevant average annual income" and "creditable contribution years".

Figure 2 provides an overview of the calculation of first pillar pension income. In a first step, the total relevant income is determined, which comprises earned income as well as contribution credits and splitting income. In a second step, the total relevant income is converted to an annual average income and revaluated in order to maintain the purchase power of pensioners. In a third step, the relevant average lifetime income is converted to pension income. The conversion is carried out here using different pension scales, depending on the number of contribution years. This means that if the average income is the same, but the number of contribution years is lower, the pension income will be lower. The individual steps are described in detail below.

Figure 2: Conversion of earned income and credits to pension income
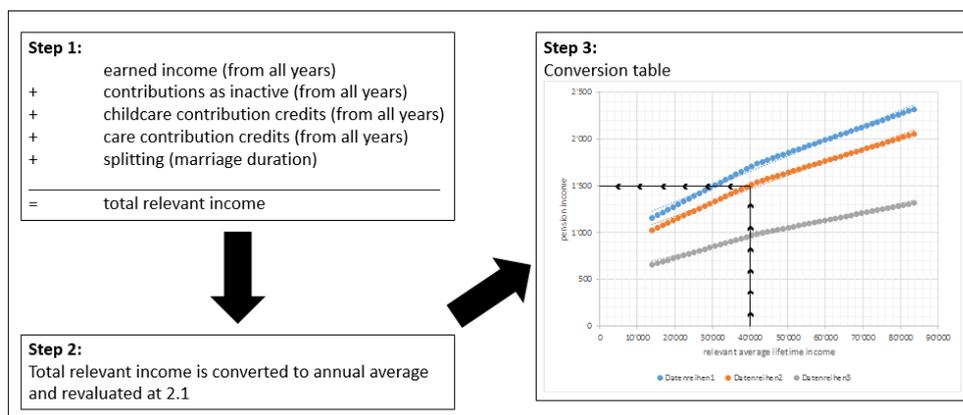
In a first step, contributions to the first pillar are derived. As the pension income is derived from the average relevant life income, the first task is to determine the relevant income. The relevant income is the sum of earned income, contributions paid as inactive (unemployed), childcare credits, care credits and, in case of divorce, splitting related income (or payment to spouse). Since the wage profiles are based on the nominal wage (which takes nominal wage increases into account), contributions as inactive

persons and the crediting of caring periods are also uprated, however by the inflation rate. This ensures that all contributions, both earned income and credited periods, are adjusted. [15]

In addition, in the case of unemployment (parenthood, nursing care, unemployment), an associated wage penalty is simulated. For the sake of simplicity, it is assumed that a person will receive the same wage level when re-entering the labour market as before the interruption. The wage increase rates are assumed to correspond to the wage increase of a comparable person. Thus the simulated wage curves run parallel in the event of an interruption. Additional information concerning the simulation of the wage penalty are provided by the equivalent report for Belgium (Dekkers & van den Bosch, 2020).

Graph 5 illustrates pension assessment bases in the case of interruptions in employment. The brown solid curve illustrates the impact of two phases of unemployment, the first at the age of 30-35, and the second at the age of 55-60. After resumption of employment, the wage curves run parallel to the case without spells of unemployment (dotted curve), but at lower levels. Since the daily allowances of the unemployment insurance are regarded as wages in the case of unemployment, this results in both an obligation to contribute and a prerequisite for benefits. This is illustrated in Graph 5, whereas in case of unemployment (brown solid curve) the wage curve drops down towards 80% of the last labor market income. If unemployment lasts longer than one year (as shown by the solid brown curve) the minimum contributions as inactive persons paid to the OASI. Graph 5 also illustrates pension assessment bases in the case of part-time work (PT), as well as the impact of childcare credits and care credits (orange solid line). The dotted line reflects the base scenario without spells of unemployment and caregiving.

In order to determine the average relevant life income, in a second step the average income is calculated and revaluated by the factor 2.1. The revaluation factor is set by the government and captures average increase in real wages.

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[15] Section 1.1.1 describes in detail how care credits are linked to the pension income.

Graph 5: Simulated pension assessment bases

Source: Own simulations, 2019.
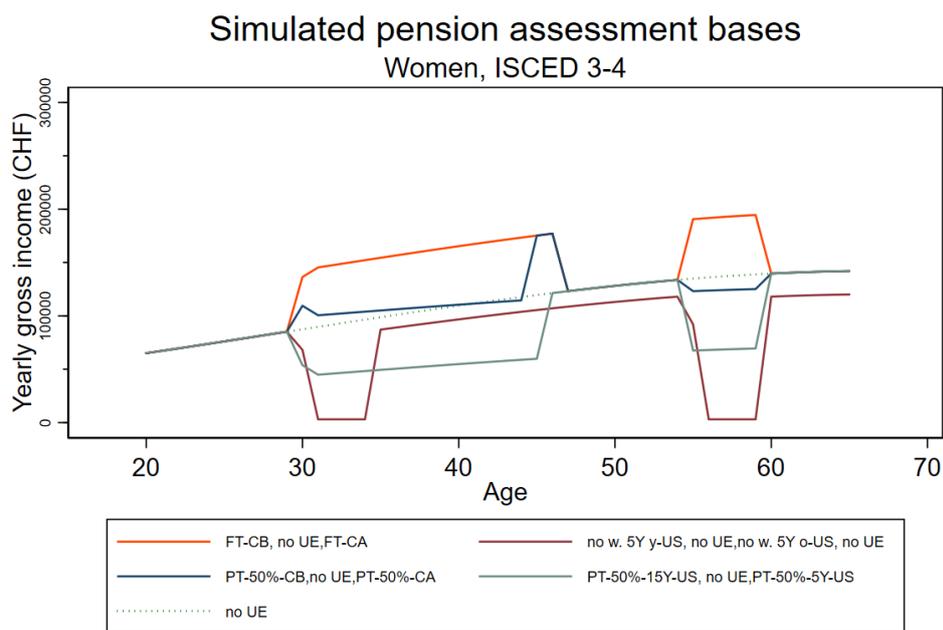
In a third step the average relevant life income is converted into pension income. The maximum pension from the first pillar (CHF 2,320 per month) is twice the minimum pension (CHF 1,160 per month). The minimum pension of CHF 1,160[16] was assigned by the legislator in the revision of the AHV Act of 12 May 2016 to a level of 103.4 points (basis: December 2015 = 100) of the consumer price index (basis: December 2015 = 100).[17] This means that if the consumer price index has exactly this level of 103.4 points, the minimum pension of CHF 1,160 is considered to be exactly adjusted to inflation. The decision on a pension increase is made by the government, but a pension increase[18] must be made at the latest when the index reaches 103.4 points (i.e. when the index stands at 106.5 points) and a 3.0% increase is reached.[19] Thus, both lifetime earnings and pensions in payment are indexed.

Figure 3 illustrates the relationship between pension income (ordinate) and relevant average lifetime income (abscissa) depending on the contribution years. The blue curve shows the relationship between average income and pension income without missing contribution years. The grey curve, on the other hand, shows pension income as a function of average income with 25 contribution years. The orange curve shows the pension income in the case of early retirement. On average, a missing contribution year

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[16] In Switzerland, the minimum (maximum) level correspond to about 20.3 (40.6) percent of average earnings and is indexed to the average of wage and price inflation (so-called Swiss indexation) (Queisser & Vittas, 2000).

[17] The relevant legal provisions can be found in: Art. 68 para. 3bis AHVG, Art. 77 para. 1 and 2 AHVG (in the version of LGBl. 2016 No. 230 valid from 01 January 2017).

[18] If the consumer price index is lower, the pension will not be reduced.

[19] The index level is determined by the arithmetic mean of the monthly index levels from January to June.

usually leads to a pension reduction of about 2.3%. In the MSM, the minimum pension income of thr conversion table is indexed by the consumer price index.

Figure 3: Conversion of relevant average lifetime income into pension income
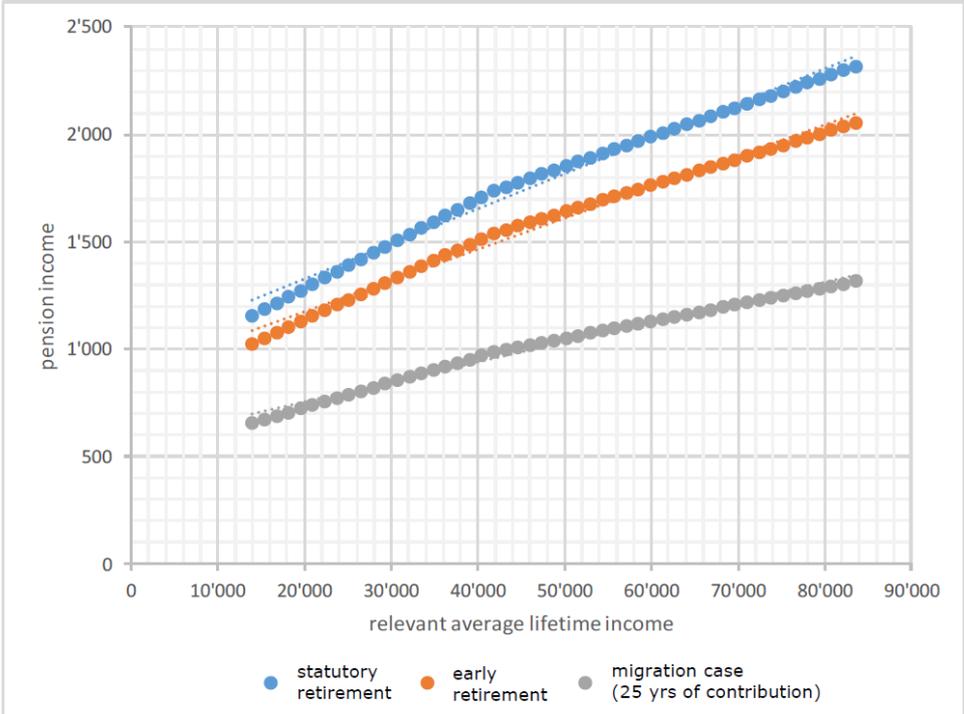
The second pillar is simulated in the next step.[20] The Liechtenstein second pillar has defined contribution (DC) structure, which is financed by employer and employee contributions. The compulsory contributions are simulated on the basis of wage profiles in accordance with legal requirements (BPVG, Act on Company Pension Insurance). Voluntary contribution payments are not taken into account. To determine the second pillar pension payments, the annual contributions are summed up and converted into an annuity, whereby it is assumed, that the contributions bear interest at 2% per year. Since the BFS (2019) has estimated the average number of further years of life to be expected in 2018 for 65 at 19.9 (women 22.7) years a further life expectancy at the age of 65 of 25 years was assumed in the model for the year 2065.[21]

At present, the third pillar (private savings) is not yet included in the MSM. However, it is planned to simulate the third pillar as well.

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[20] A detailed description of the second pillar is given in section 1.1.2.
[21] Life expectancy at age 65 is expected to continue to increase in coming decades.

2.4 Definition of the scenarios

Pension income is determined by a variety of personal circumstances (gender, education level, spells of unemployment) and personal choices (labor market participation). In order to analyze the impact of these factors on pension income, we distinguish situations whether the period out of work or part time work gives rise to pension credits (e.g. childcare and care credits) and situations where it does not. Furthermore, we take into account the impact of periods of unemployment and of full work interruption on the wage profiles. Since, when a person returns to work after an interruption, he/she does not earn the same wage as an otherwise similar individual who worked continuously.

In order to systematically analyze the different combinations of circumstances and options, a basic scenario is compared to a setting with different combinations of circumstances and options. This allows the influence of different options and circumstances to be quantified.

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

-Gender:

a. Female

b. Male

-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 at age of choice 30, and at ages 49, 50, 51 for the case at age of choice 54.

Note that although each education level comes with its own age of entrance of the labour market, everybody from the age of 21 has a general obligation to contribute to the OASI. Thus, across all education levels, the contributions are modelled from the age of 21.

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 6 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, including the wage penalty, and

v) ceasing to work for 6 years, excluding the wage penalty.

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 Liechtenstein, 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. 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.

3 Overall results

In order to analyze gender differences in pension income, various combinations of personal circumstances and choices (so-called scenarios) are compared. In order to present the scenarios in a clear and interpretable manner, we focus on the impact of certain choices (e.g. labor market participation), given circumstances (gender, education level, spells of unemployment). In doing so, the results illustrate the impact of the choices that are modelled on the later pension, while the variant sets show to what extent these findings are sensitive to the circumstances.

In addition to the sensitivity analysis, the influence of the legal framework on pension income can be shown by comparing the scenarios. First, the mitigating impact of care credits is illustrated by the comparison of the scenario without and with care benefits. Second, illustrate the unemployment and age of retirement variants how the impact of the various options changes when the career is less than full. Third, the comparison of the pension income across gender shows, how results change when the wages of the model persons are different.

In the following, the results are compared to 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 childcare benefits.

– 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.

Within each reference set we use the scenario with no work interruption as the base scenario, which is contrasted to various labor market participation decisions (part time work, full-time interruption) across all education levels. Furthermore, the option of full-time interruption is modelled with and without wage penalty (for the part time options, the wage penalty is not relevant, see above).

Furthermore, the reference set is contrasted with variants sets. As 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, the illustrated the impact of single dimensions on pension income.

The results of the simulations are shown both in absolute values (pension amounts) and in percentage differences compared to the base scenario. In order to make the results comparable, the pension income was converted at an exchange rate of 1 Swiss Franc =0.91 EUR. Consequently, all tables below report pension income in EUR.

Graph 6 shows the box plot of the simulated pension income of woman for all choices made at the age at 30 (working full-time, working part time 80,50 and 20%, or not working for years (with and without wage penalty) for all variants (being eligible for childcare credits, experiencing an unemployment spell,

impact of early retirement and the impact of gender). Hence, the distribution of observations could not be interpreted as one would do in case of sample data of actual individuals. It merely represents the distribution resulting from the analyzed combinations of choices and circumstances. Thus, only a relative strength of the effect can be read from the distributions.

When interpreting the results, it must be kept in mind, that the pension income is driven by the assumed nominal growth rates and the interest rate. The nominal growth rate of wages is determined according to the Swiss wage index (BFS, 2019b), with regard to second pillar pension income it is assumed that the annual contributions bear interest at 2% per year. If higher rates would have been assumed, as e.g. by the Aging Working Group of the Economic Policy Committee of the European Council (European Commission, 2018), the simulated pension income would be higher.

Graph 6 illustrates that first pillar compensation instruments compensate for reduced contribution payments due to part-time work and career breaks. Thus, despite an interruption in employment of 6 years, the maximum pension income from first pillar can be achieved with the assumptions made. In contrast, the second pillar presents a more differentiated picture. Since the second pillar does not include any compensation mechanisms, reductions in contributions due to part-time work or interruptions in employment lead to lower pension income. The variation is illustrated by the boxes, whereby the lower and upper end of the box equal the 25th and 75th percentile, while the line in the middle shows the 50th percentile or median. The sharpest fall in pension income is due to a career break, with the wage penalty having a strong influence.

Graph 6: Distribution of pensions by choice made at the of age at 30
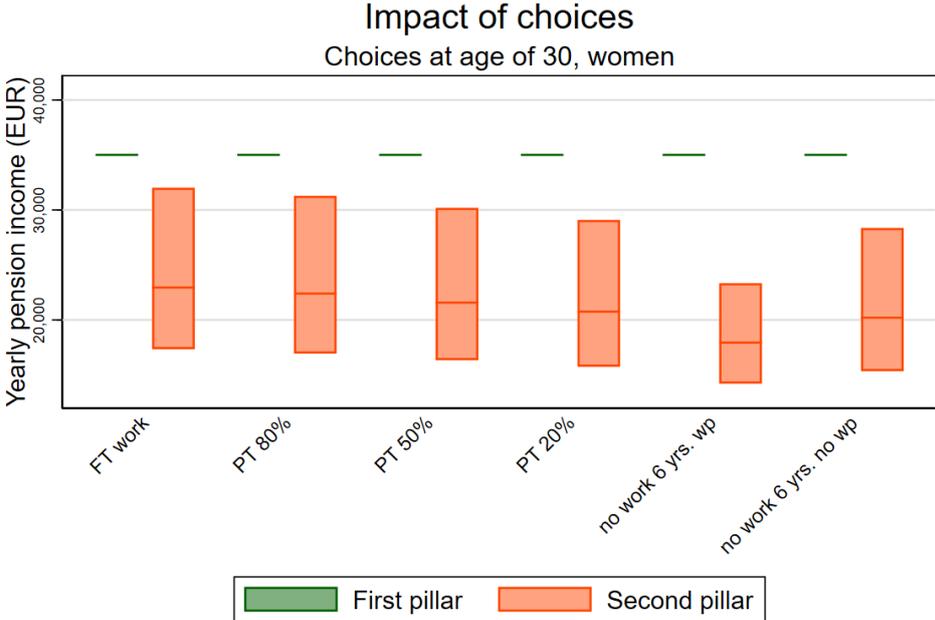
Source: 2015 Census and 2016 wage statistics.

Graph 7 compares the impact when a choice is made at age of 30 to the situation when a comparable choice is made at the age of 54. In general, the equivalent scenarios lead to a comparable decline in pension income. However, the pension losses as a result of a career break are less severe if it occurs at a later date (at the age of 54). This is due to the fact that the associated wage penalty has a shorter period of effect than if the career break occurred earlier and affected the entire career path.

Graph 7: Distribution of pensions by choice made at the of age at 30

Source: 2015 Census and 2016 wage statistics.
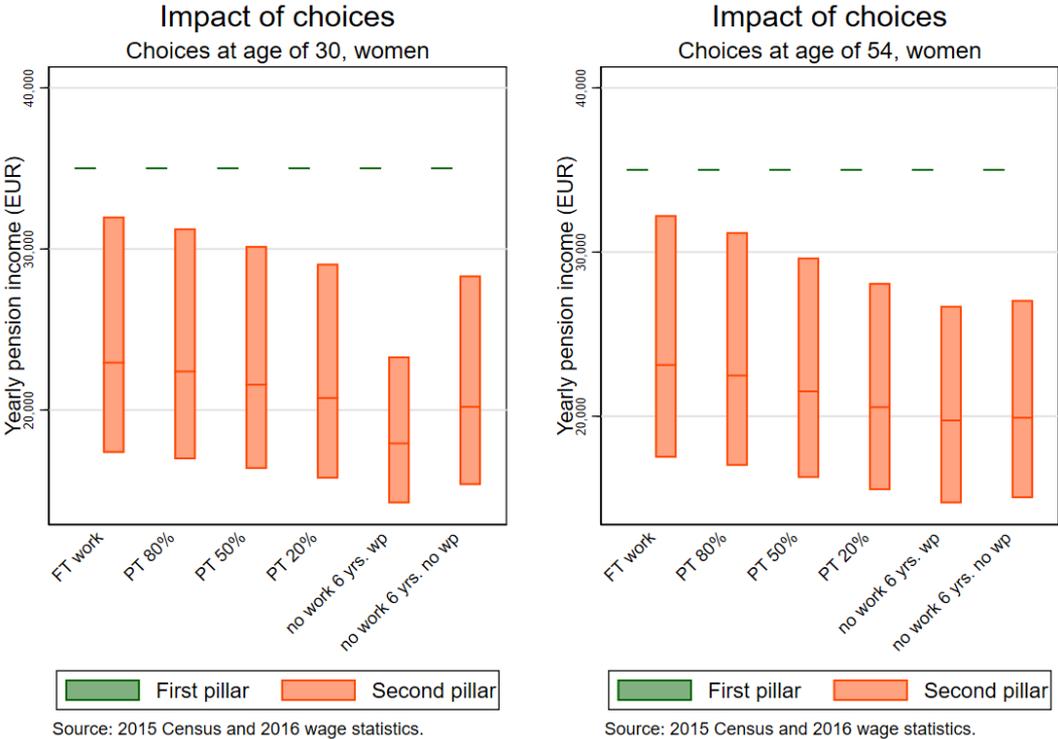
Graph 8 illustrates the impact of choices at age of 30 by level of education. In general, the higher the level of education and thus the higher the lifetime income, the higher the pension income. However, interruptions in employment with a higher level of education lead to comparatively greater losses in pension income. This is caused by the wage penalty, which is higher as the level of education increases. With a low level of educational attainment, which is accompanied by a comparatively flat wage curve, the relative impact of the wage penalty on pension income is smaller.

Graph 8: Impact of choices at age of 30, by educational attainment level

Impact of choices
Choices at age of 30, women

Source: 2015 Census and 2016 wage statistics.
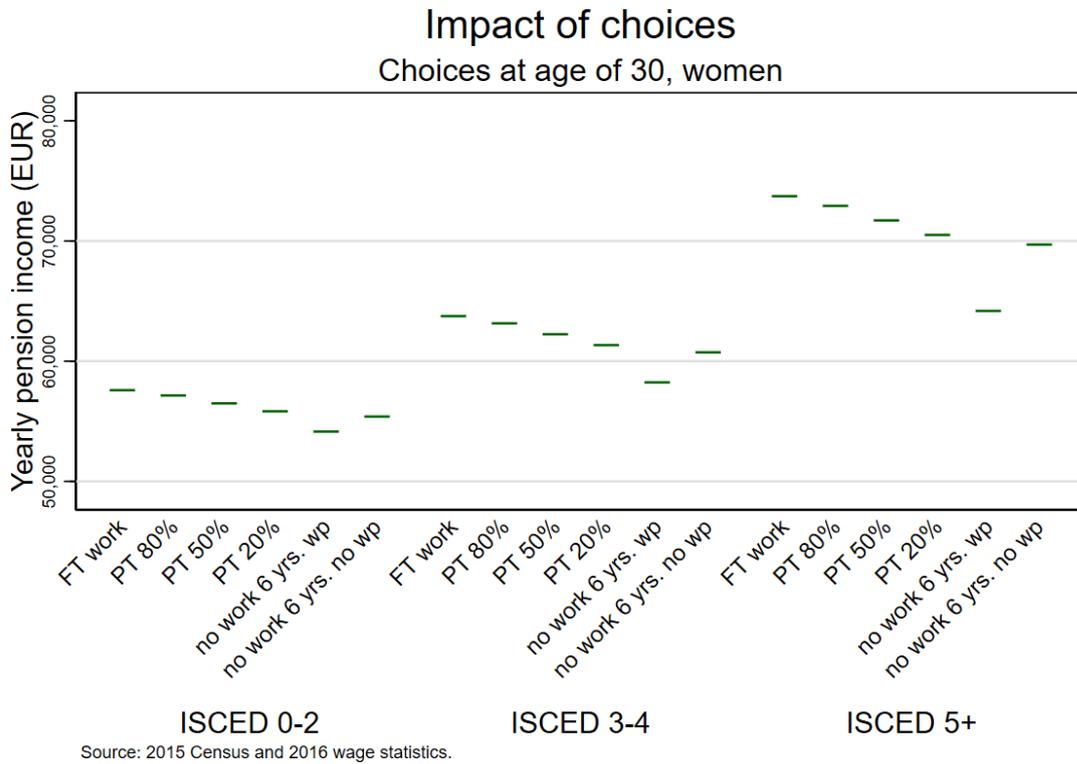
Graph 9 depicts the impact of choices at age of 30 by gender. As the wages of men are higher than those of women, the pension income of men is also higher.

Graph 9: Impact of choices at age of 30, by gender

Impact of choices
Choices at age of 30

Source: 2015 Census and 2016 wage statistics.
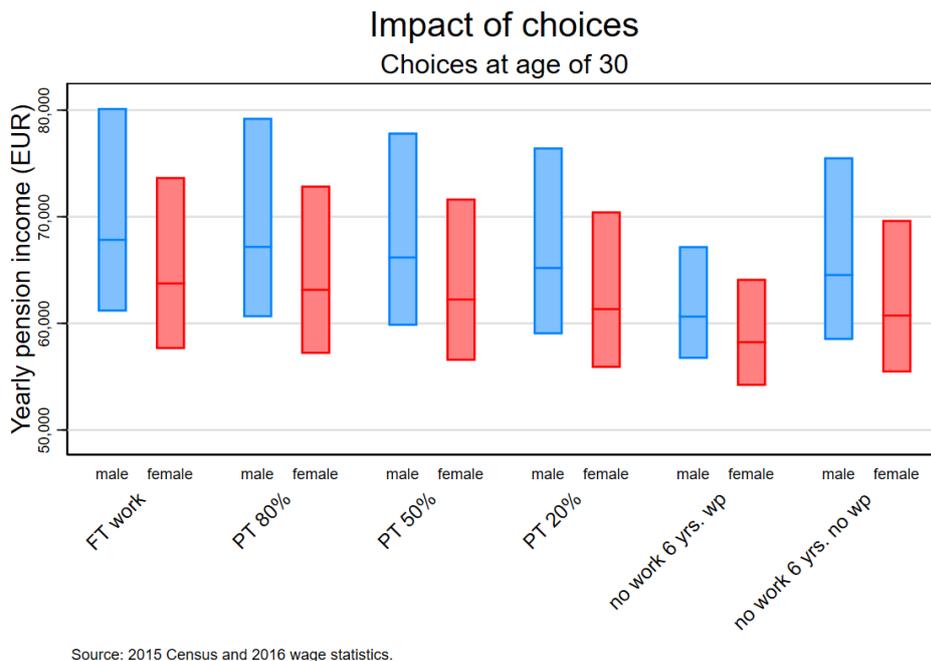
A more detailed insight is provided by Graph 10, which shows the impact of choices at age of 30 by gender and educational level. As the wage curve rises more sharply for men than for women, men's pension incomes fall comparatively more sharply if the labour supply is reduced. This effect is the more pronounced the higher the educational level is.

Graph 10: Impact of choices at age of 30, by gender and educational level
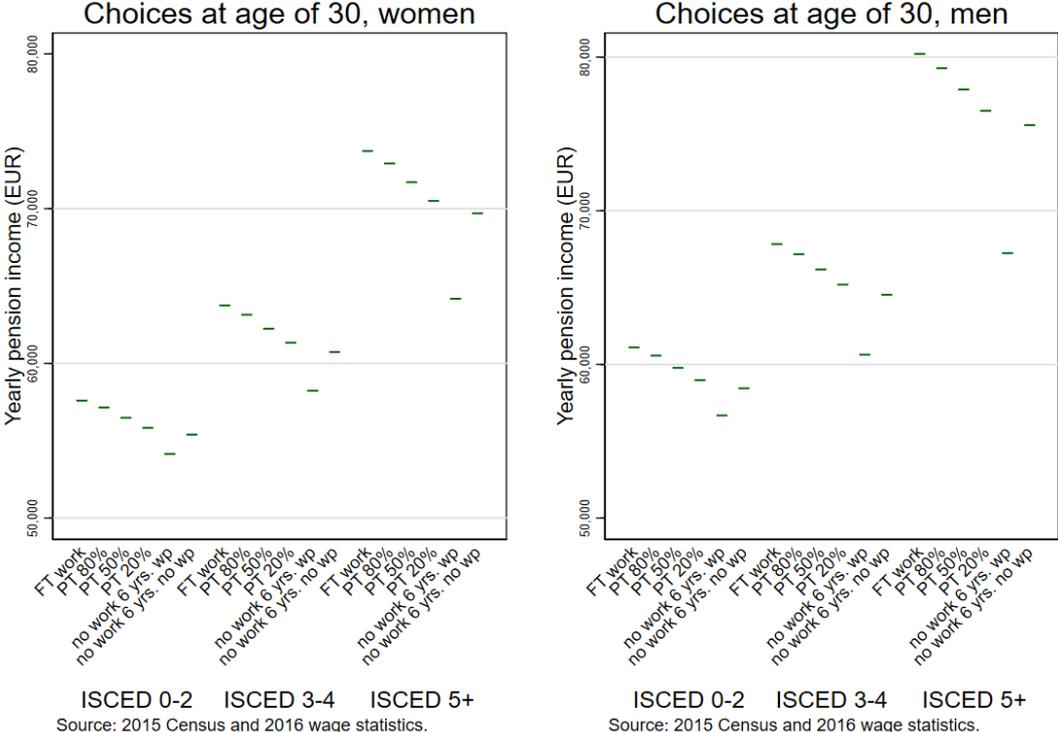
As the pension gap is determined by the employment history as well as the design of the pension system, the subsequent sections report detailed results about the impact of the employment history (length of employment history and work intensity, as well as remuneration) and the design of the pension systems (career break compensation, pension indexation and retirement at different ages). In order to compare the impacts at different ages (choices at the age of 30 due to children and choices at the age of 54 due to care), two reference sets are analyzed and compared to each other.

4   Analyzing the impact of childcare on pension income

The first reference case analyses the choices of a 30-year-old woman who chooses a certain level of employment due to care for a child. Through the child she is entitled to the crediting of child-raising credits (the case without child care credit is simulated in variant set 1). She has not experienced an unemployment spell (this is simulated in variant set 2), and will not retire early (this is simulated in variant 3). Variant set 4 will analyze the impact of the gender, as the wage profiles by age differ across gender.

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" (or between-table) 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.

4.1 Reference set

The first reference set presents the estimated pension amounts of a woman. In this reference set is assumed that a 30-year-old woman decides on a certain extend of work on the basis of bringing up children. The base scenario in this reference set is, that the women continues full-time work without interruption and that she is eligible for child care credit.[22] The next three scenarios show the influence of different working hours (between 80%, 50% and 20% part-time). The last two scenario illustrate the impact of periods of inactivity (for six years). In doing so, we are taking into account wage scarring pertaining to periods of inactivity. In order to assess the impact of the wage penalty, we simulate the pension income without wage penalty and with wage penalty.

Table 2 presents the total of simulated pension amounts of the first and second pillar for the reference set. One should realize 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.[23] Hence, their value lies not so much in the amounts but in the comparison between scenarios.

In general, a higher earned income, which is associated with a higher educational attainment level, leads to higher pension income. However, the spread between the variants is smaller at a lower level of education than at a higher level of education, which is due to the redistribution elements within the first

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[22] For the sake of simplicity is assumed, that the child care credit is not split up between the parents. Hence the women is eligible for the full child care credit.

[23] Table 1 illustrates the effect of uprating on average lifetime income from employment.

pillar.[24] The conversion factor of 2.1 has a strong compensatory effect on the first pillar, with the result that the maximum pension from the first pillar (which amounts in the simulation up to CHF 35,009) can be reached if life income is comparatively low (low educational attainment level, interruption of employment with wage penalty).

Table 2: Reference set; choice at age 30: pension amounts (Total of first and second pillar pension income)

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	52351	57951	67023
PT 80% 6 years	51952	57404	66290
PT 50% 6 years	51353	56582	65192
PT 20% 6 years	50754	55760	64094
No work 6 years (no wage penalty)	50355	55213	63362
No work 6 years (wage penalty)	49220	52941	58343

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

Table 3 shows the simulated pension amounts relative to the base scenario within the reference set. As a rule of thumb, it can be said that a reduction of 20% in working hours over a period of six years leads to an approximate reduction of 1% - 1.5% in pension income. However, in the case of a full interruption scenario, the decline is much greater. With wage penalty, the decline is stronger, the higher the wage increase over the lifetime. In the case of high educational attainment level, the effect of the wage penalty is about 13 pp, of a low educational attainment level the effect is about 6 pp.

Table 3: Reference set; choice at age 30: pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	99.24	99.05	98.91
PT 50% 6 years	98.09	97.64	97.27
PT 20% 6 years	96.95	96.22	95.63
No work 6 years (no wage penalty)	96.19	95.27	94.54
No work 6 years (wage penalty)	94.02	91.35	87.05

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

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[24] Detailed results for the first and second pillar are shown and discussed in the appendix, section 10.1.

4.2 Variant set 1: About the role of parenthood pension-related policies

In order to analyse the impact of the pension credits, it is now assumed that no parental leave credit is granted, but that a reduction in working hours or interruption of employment does occur. Hence, the compensation effects of the childcare credits are omitted. Table 4 presents the pension amount as percentage of pension for the base scenario. Since the underlying revaluation factor of 2.1 means that the maximum pension is reached in all constellations and no child-raising periods are taken into account under the second pillar, the results are identical with table Table 3.

Table 4: Variant set 1 (no time credit): pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	99.24	99.05	98.91
PT 50% 6 years	98.09	97.64	97.27
PT 20% 6 years	96.95	96.22	95.63
No work 6 years (no wage penalty)	96.19	95.27	94.54
No work 6 years (wage penalty)	94.02	91.35	87.05

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

Table 5 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 above stated, compensates the assumed revaluation factor of 2.1. gaps in employment income without the need to take into account childcare credits. However, if a lower revaluation factor were to be applied, this would lead to lower pension income under the first pillar and the compensatory effect of the care credits would become visible. In the next part of this research project will address this issue and analyse the interplay between the revaluation factor and care credits.

Table 5: Variant set 1 (no time credit): pension amount as percentage of pension for the same option in the reference scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	100.00	100.00	100.00
PT 50% 6 years	100.00	100.00	100.00
PT 20% 6 years	100.00	100.00	100.00
No work 6 years (no wage penalty)	100.00	100.00	100.00
No work 6 years (wage penalty)	100.00	100.00	100.00

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

4.3 Variant set 2: Experiencing an unemployment spell

Unemployment affects pension income in two ways. First, unemployment leads to an immediate income loss and, and over the course of working life, to lower earned income due to the wage penalty. Both effects lead to a lower pension income. Second, periods of unemployment are associated with reduced (in case of first pillar pensions) or no contributions to pension funds (in case of second pillar), which also leads to a reduction in pension income.

In order to analyse the effect of unemployment, a three-year unemployment spell that starts at age of 26 is simulated. In doing so, it is assumed, that the cases are entitled to an unemployment benefit, at least until the – possible - exhaustion this benefit. According to the ALVG, persons elder than 25 years receive an allowance of 80% of the insured earnings for a maximum of 260 daily allowances. As daily allowances are regarded as wages and handled accordingly for insurance obligation, losses in the pension career of the first pillar are avoided. [25] If no more unemployment benefit is granted after the 280-day period, the minimum contributions are paid to the first pillar, so that there are no first-pillar contribution gaps during this period.

Table 6 largely reproduces the results of Table 3 of the reference set. Working part time reduces pension income. This effect is stronger the more the working time is reduced, and strongest in the case of a full interruption scenario with wage penalty.

Table 6: Variant set 2 (unemployment): pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	99.25	99.09	98.96
PT 50% 6 years	98.12	97.72	97.40
PT 20% 6 years	96.99	96.35	95.85
No work 6 years (no wage penalty)	96.24	95.44	94.81
No work 6 years (wage penalty)	94.10	91.66	87.69

Reference set:
Woman, age at interruption 30, reason for interruption childbirth, three year unemployment spell (start at age 26), retirement at statutory retirement age.

Table 7 shows the impact of the unemployment spell, as it 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. An unemployment spell results in a decrease of the retirement benefits between 3 pp and 7 pp for the lowest and highest educational attainment level. The losses in pension income result from the lower income from the second pillar. Under the first pillar, the compensation mechanisms (payment of contributions by the unemployment fund in the event of unemployment, revaluation factor,

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[25] A detailed description is provided in section 1.2.

crediting of child-raising periods) mitigate for the loss of earned income so that no pension losses result. However, the second pillar does not include such compensation mechanisms, so that pension income is lower in the event of unemployment.[26]

Table 7: 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)	96.75	94.87	92.19
PT 80% 6 years	96.76	94.91	92.24
PT 50% 6 years	96.78	94.96	92.31
PT 20% 6 years	96.79	95.01	92.39
No work 6 years (no wage penalty)	96.81	95.04	92.45
No work 6 years (wage penalty)	96.84	95.19	92.86

Reference set:
Woman, age at interruption 30, reason for interruption childbirth, three year unemployment spell (start at age 26), retirement at statutory retirement age.

4.4 Variant set 3: The impact of early retirement

Early retirement has the general effect that the contribution period is shortened and thus comparatively fewer contributions are made to the first and second pillar. In addition, system-specific reductions are made for the first and second pillar in the event of early retirement. In the case of the first pillar, a different conversion table is applied, with the result that pension income is reduced by about 1/44 (2.3 pp) for each missing contribution year. Since this reduction is made by the conversion table, an income which would have led to the maximum pension in the case of a full working life has a pension income below the maximum pension in the case of early retirement (see Figure 3). In the second pillar pension system, early retirement results in a lower conversion rate, which in turn results in lower pension income.

Within the framework of the flexible retirement age, women and men can choose to draw their retirement pension irrespective of their spouse, from the age of 60. In this scenario an early retirement two years before the statutory retirement age (SRA-2) is simulated, which is at the age of 63 (42 contribution years).

The results of Table 8 are similar to those of Table 3. Part time work has a relatively small effect on pension income, whereas a full interruption with a wage penalty has more severe consequences for those with medium or higher education. This result is due to the fact that the decline in pension income from early retirement under the first and second pillar is almost linear.[27]

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[26] Section 10.2 provides separate results for first and second pillar pension income.
[27] Section 10.3 provides separate results for first and second pillar pension income.

Table 8: Variant set 3 (early retirement): pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	99.23	99.05	98.89
PT 50% 6 years	98.09	97.62	97.23
PT 20% 6 years	96.94	96.20	95.56
No work 6 years (no wage penalty)	96.17	95.24	94.45
No work 6 years (wage penalty)	94.16	91.55	87.36

Reference set:
Woman, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

Table 9 illustrates this linear effect. Early retirement thus leads to an overall reduction around 7 pp across educational attainment levels and employment rates. However, the pension losses in the second pillar are comparatively greater than in the first pillar.[28]

Table 9: 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)	93.30	93.13	92.32
PT 80% 6 years	93.29	93.13	92.30
PT 50% 6 years	93.29	93.12	92.28
PT 20% 6 years	93.28	93.11	92.26
No work 6 years (no wage penalty)	93.28	93.10	92.24
No work 6 years (wage penalty)	93.43	93.33	92.65

Reference set:
Woman, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

4.5 Variant set 4: Analyzing the impact of gender on pension income

Differences in pension income between men and women are due to differences in wage profiles, in addition to interruptions in working life or part time work, which are associated with caring for relatives and which are mainly provided by women. In this section we now analyse what pension income would be like if there were no difference in wage profiles between men and women, taking interruptions and different working times into account.

The wage profiles of men and women in Liechtenstein differ in two aspects: First, men's wages are higher. In the case of an uninterrupted career, the difference in average simulated earnings over the

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[28] Section 10.3 provides separate results for first and second pillar pension income.

course of a full-time career amounts to approximately 18% across all educational attainment levels (see Table 10). This finding is in line with the ratio of median wage between men and women of 1.18 (Amt für Statistik, 2019b). Second, the wages of men increase more strongly than those of women in the course of their working lives. As a result, the wage penalty for men is relatively higher and the relative wage loss at the end of the career is greater when working hours are reduced (see Graph 3).

Table 10: Average simulated gross earnings by gender and educational attainment level

	Education		
Option	Low	Medium	High
Men	102103	134003	207756
Women	86394	114031	175013
Men / Women (%)	118	118	119

As the pension legislation in Liechtenstein has no gender-specific rules, the impact of the various choices with respect to the base set as reported in Table 11, is similar to those results for the female reference set in Table 3. However, a slight difference can be seen in the case of an employment interruption when earnings penalty is effective. In this case, pension income falls more sharply if the higher and more rapidly rising wage profile of men is taken as a basis. E.g in the case with a high educational attainment level pension income reaches around 84% of the base scenario. With a lower female wage curve, the pension income reaches 87% of the comparable base scenario (Table 3.).

Table 11: Variant set 4 (men): pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	99.13	99.03	98.85
PT 50% 6 years	97.82	97.57	97.11
PT 20% 6 years	96.51	96.11	95.38
No work 6 years (no wage penalty)	95.64	95.14	94.23
No work 6 years (wage penalty)	92.75	89.39	83.84

Reference set:
Man, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

The differences in life income between men and women are also reflected in pension income (Table 12). Here, in all constellations, the pension income of men exceeds those of women, with the difference varying between 6 and 8 percentage points for the lowest and highest levels of education. Thus the gender gap in pension income is smaller than the gap in simulated earned income, which is about18pp (Table 10). This difference is due to the compensatory effect of the first pillar. This can also be seen in Table 12, as the differences are greater for the more highly educated, which is due to the greater importance of second pillar pension income.

Table 12: Variant set 4 (men): Reference set for men: pension amount as percentage of pension for the equivalent scenario for women

| | Education | | |
Option	Low	Medium	High
Base (FT work, no interruption)	106.12	106.41	108.79
PT 80% 6 years	106.00	106.38	108.72
PT 50% 6 years	105.82	106.33	108.62
PT 20% 6 years	105.64	106.29	108.51
No work 6 years (no wage penalty)	105.51	106.26	108.44
No work 6 years (wage penalty)	104.68	104.12	104.78

Reference set:
Man, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

5   Analyzing the impact of elderly care on pension income

The second reference case analyses the choices of a 54-year-old woman who chooses a certain level of employment due to care for a relative. Through the care obligation she is entitled to the crediting of a care credit (the case without care credit is simulated in variant set 1). She has not experienced an unemployment spell (this is simulated in variant set 2), and will not retire early (this is simulated in variant 3). Variant set 4 will analyze the impact of the gender, as the wage profiles by age differ across gender.

As in the first reference case, for each of these reference sets and variants, three standard tables are reported. 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" (or between-table) 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 standard 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. The table illustrates the impact of having the choice or event happening later instead earlier in life, hence the effect of the "age of choice" on pension income.

As there are many parallels between the two reference cases, the results are generally discussed only briefly, unless they differ from the results presented in the earlier tables. Therefore, many of the

arguments and conclusions from the previous section are not repeated. In addition, the discussion will of course include the fourth table of each scenario, showing the effects of the choice or event that occur later rather than earlier in life.

In addition to the parallels that exist between the two reference cases, there are also regulatory and economic differences. With regard to the regulatory differences, it should be noted that child care credits are granted over a period of 16 years. They therefore outlast the periods with interruptions in employment that were simulated (a maximum interruption of employment of six years was simulated). In the case of care, it is assumed that nursing is carried out over a period of six years, which coincides with the period of the maximum interruption of employment. Furthermore, in accordance with the legal provisions, the simulation model assumes that pension income and the associated care credits increase with the inflation rate, but wages increase with the nominal rate of wage growth. Since the predicted rate of wage growth exceeds the expected rate of inflation, this leads to a drifting apart of pensions and wages with increasing time. Thus, in the further future (at the reference case of age 54), care credits will be relatively lower than care credits in the near future (at the reference case of age 30). However, as the average pension base over the employment phase is multiplied by the revaluation factor, which is currently comparatively high (factor 2.1), contribution gaps to the first pillar fully compensated and thus do not lead to pension losses.

Economic differences exist in two aspects: First, since income at the end of working life is higher than at the beginning of the career due to wage growth, the relative loss of earnings is higher when a career is more advanced. However, the wage curve is flatter, which leads to a lower wage penalty in the event of a career break. Second, the effect of the wage penalty is less pronounced in the case of a later interruption of employment, since the wage penalty at age of 54 is effective only for five years (65-60), whereas the wage penalty at age of 30 affects 30 years (65-35). As the wage curve is more concave, the higher the educational attainment level, this effect is more pronounced for those with high education.

5.1 Reference set

Table 13 reports the simulated pension income of the first and second pillar. As in the first reference set a higher earned income, which is associated with a higher educational attainment level, leads to higher pension income.

Table 13 shows the simulated pension amounts relative to the base scenario within the reference set. As with the first reference set, the differences in pension income are due to the differences in the second pillar, as the compensation mechanisms of the first pillar compensate for the loss of contributions.[29]

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[29] Detailed results for the first and second pillar are provided in the appendix, section 11.

Table 13: Reference set; choice at age 54: pension amounts (Total of first and second pillar pension income)

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	52486	58133	67257
PT 80% 6 years	51992	57489	66224
PT 50% 6 years	51251	56524	64675
PT 20% 6 years	50510	55560	63126
No work 6 years (no wage penalty)	50016	54916	62093
No work 6 years (wage penalty)	49705	54755	61732

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Since wages are higher towards the end of the career, a reduction in working hours leads to a comparatively greater decline in pension income. This effect is all the stronger the higher the level of education and the more extensive the reduction in working hours (Table 14).

Table 14: Reference set; choice at age 54: pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	99.06	98.89	98.46
PT 50% 6 years	97.65	97.23	96.16
PT 20% 6 years	96.24	95.57	93.86
No work 6 years (no wage penalty)	95.30	94.47	92.32
No work 6 years (wage penalty)	94.70	94.19	91.79

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 15 shows the effect of "age of choice" on pension income, by comparing the results of Table 13 with those of Table 2. Hence, Table 15 reports the difference in pension income, if a choice is made at younger ages (30) with a comparable choice at age of 54. Here, too, it can be seen that a reduction in working hours towards the end of the career leads to greater losses in pension income due to the comparatively higher salaries. However, the effect of the wage penalty is less pronounced in the case of a later interruption of employment, since the wage penalty at age of 54 is effective only for five years (65-60), whereas the wage penalty at age of 30 affects 30 years (65-35). As the wage curve is more concave, the higher the educational attainment level, this effect is more pronounced for those with high education.

Table 15: Reference set; choice at 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)	100.26	100.31	100.35
PT 80% 6 years	100.08	100.15	99.90
PT 50% 6 years	99.80	99.90	99.21
PT 20% 6 years	99.52	99.64	98.49
No work 6 years (no wage penalty)	99.33	99.46	98.00
No work 6 years (wage penalty)	100.98	103.43	105.81

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty
unless otherwise mentioned, retirement at statutory retirement age.

When interpreting this type of table, however, it must be borne in mind that the child care credits are granted over a period of 16 years - irrespective of the level of employment - but the care credits are only granted for the duration of care, which in the simulations corresponds to the duration of interruptions or reductions in employment.

5.2 Variant set 1: About the role of elderly care policies on pension income

In order to analyse the impact of the pension credits, it is now assumed that no care contribution credit is granted, but that a reduction in working hours or interruption of employment does occur. Hence, the compensation effects of the care contribution credits are omitted.

Table 16 presents the pension amount as percentage of pension for the base scenario. Since the underlying revaluation factor of 2.1 means that the maximum pension is reached in all constellations and no care periods are taken into account under the second pillar, the results are identical with those of Table 14.

Table 16: Variant set 1 (no time credit; choice at age 54): pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	99.06	98.89	98.46
PT 50% 6 years	97.65	97.23	96.16
PT 20% 6 years	96.24	95.57	93.86
No work 6 years (no wage penalty)	95.30	94.47	92.32
No work 6 years (wage penalty)	94.70	94.19	91.79

Reference set:
Woman, age at interruption 54, no pension credit for work interruptions, no unemployment, no wage penalty
unless otherwise mentioned, retirement at statutory retirement age.

Table 17 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 care credit. As above stated, compensates the assumed revaluation factor of 2.1 gaps in employment income without the need to take into account care credits. However, if a lower revaluation factor were to be applied, this would lead to lower pension income under the first pillar and the compensatory effect of the care credits would become visible.

Table 17: Variant set 1 (no time credit; choice at 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)	100.00	100.00	100.00
PT 80% 6 years	100.00	100.00	100.00
PT 50% 6 years	100.00	100.00	100.00
PT 20% 6 years	100.00	100.00	100.00
No work 6 years (no wage penalty)	100.00	100.00	100.00
No work 6 years (wage penalty)	100.00	100.00	100.00

Reference set:
Woman, age at interruption 54, no pension credit for work interruptions, no unemployment, no wage penalty
unless otherwise mentioned, retirement at statutory retirement age.

Table 18 shows the ratio of the scenario's making the choice at age 54 with those of making the choice at age of 30. Hence the table illustrates the impact of having the choice or event happening later instead earlier in life. As the loss of care credits does not affect first pillar pension income due to the high revaluation factor, the results of table Table 18 are identical to Table 15.

Table 18: Variant set 1 (no time credit; choice at age 54): pension amount as percentage of pension for the equivalent scenario when age of choice is 30

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.26	100.31	100.35
PT 80% 6 years	100.08	100.15	99.90
PT 50% 6 years	99.80	99.90	99.21
PT 20% 6 years	99.52	99.64	98.49
No work 6 years (no wage penalty)	99.33	99.46	98.00
No work 6 years (wage penalty)	100.98	103.43	105.81

Reference set:
Woman, age at interruption 54, no pension credit for work interruptions, no unemployment, no wage penalty
unless otherwise mentioned, retirement at statutory retirement age.

5.3 Variant set 2: Experiencing an unemployment spell

In order to analyse the effect of unemployment, a three-year unemployment spell that starts at age of 49 is simulated. This is in contrast to variant set 2 at age of 30, where it is assumed, that unemployment lasts from age 26 to 28.

In doing so, it is assumed, that the cases are entitled to an unemployment benefit, at least until the – possible - exhaustion this benefit. According to the ALVG, persons younger than 50 years receive an allowance of 80% of the insured earnings for a maximum of 260 daily allowances. As daily allowances are regarded as wages and handled accordingly for insurance obligation, losses in the pension career of the first pillar are avoided. 25 If no more unemployment benefit is granted after the 280-day period, the minimum contributions are paid to the first pillar, so that there are no first-pillar contribution gaps during this period.

Graph 11 shows the simulated wage profiles of both variants with unemployment with an age of choice at 30 and 54. With regard to wage penalty two effects impact the wage curve: First, the wage penalty increases, if two subsequent interruptions occur. Second, if the interruption comes early in career (as in the case of variant set 2 with age of choice at 30), the effect of the wage penalty is more pronounced, as it is effective for 30 years (65-35). If the interruption occurs in the later career, the wage penalty affects only five years (65-60), and has a smaller impact on the lifetime income.

Graph 11: Comparing variant set 2 (unemployment) at the choice of age at 30 and 54
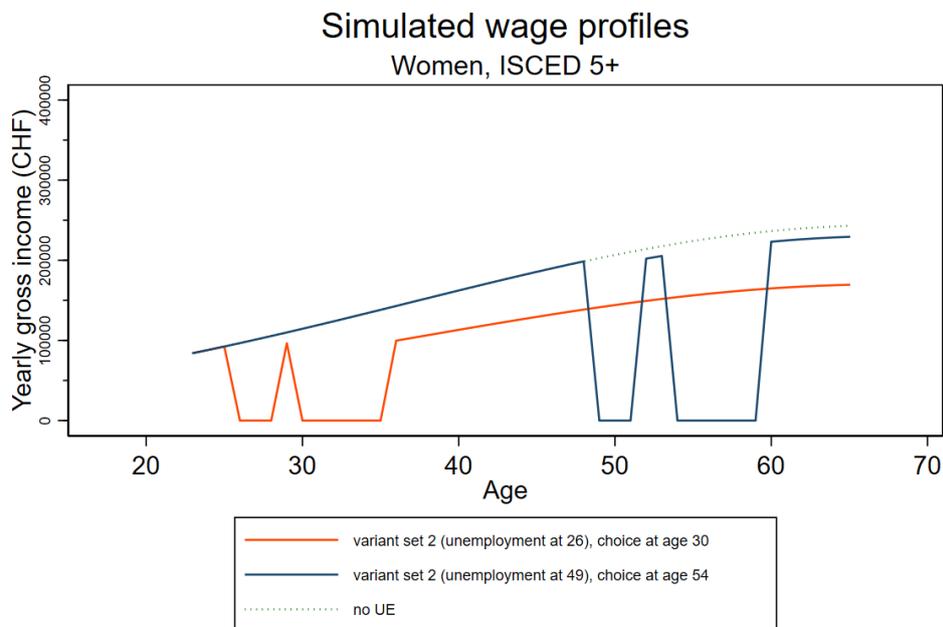

Source: Own calculations.

However, the effects on pension income are more complex. Graph 12 shows the pension assessment base of the first pillar. The crediting of child-care for a period of 16 years compensates for part of the

wage penalty. However, the loss of the pension assessment is greater if the interruption happens in the early career, since the early onset of the penalty is effective over the entire working life. However, as the average pension base over the employment phase is multiplied by the revaluation factor, which is currently comparatively high (factor 2.1), the wage penalty is fully compensated with regard to first pillar pension income.

Graph 12: First pillar pension assessment base of variant set 2 (unemployment) at the choice of age at 30 and 54
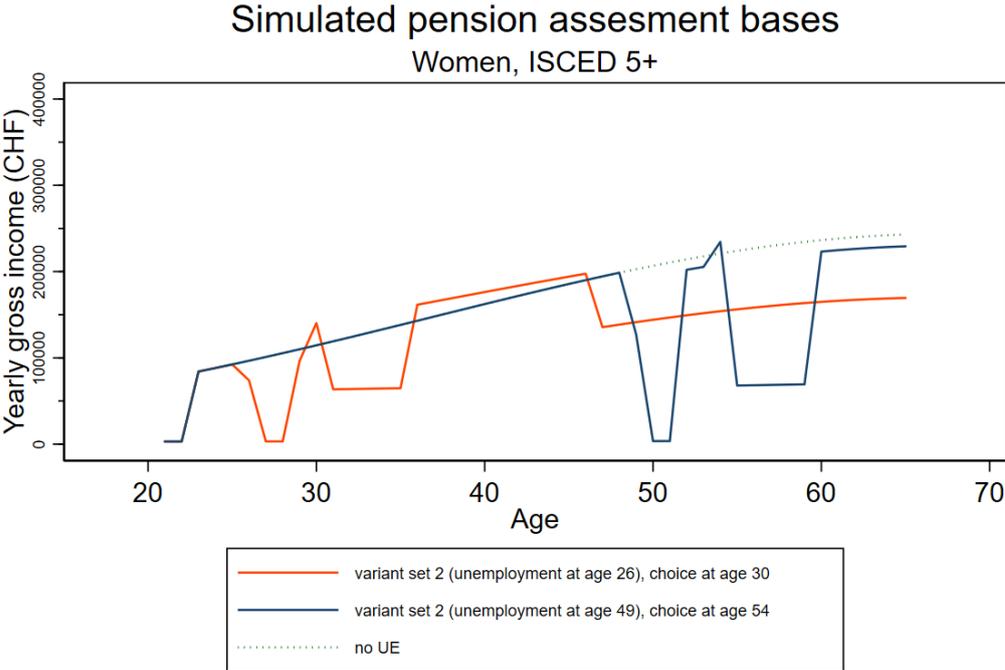
Source: Own calculations.

Although the wage penalty does not affect first-pillar pension income, it does affect second-pillar pensions, which is illustrated in Table 19.

Table 19: Variant set 2 (unemployment; choice at age 54): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	99.07	98.93	98.54
PT 50% 6 years	97.68	97.33	96.35
PT 20% 6 years	96.29	95.73	94.16
No work 6 years (no wage penalty)	95.36	94.66	92.70
No work 6 years (wage penalty)	94.78	94.40	92.19

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Since the wage penalty is stronger for higher incomes, the pension losses increase with the educational attainment level. Hence, an unemployment spell results in a decrease of the retirement benefits between 4 pp and 8 pp for the lowest and highest educational attainment level (Table 20).

Table 20: Variant set 2 (unemployment; choice at 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)	96.75	94.86	92.17
PT 80% 6 years	96.76	94.90	92.24
PT 50% 6 years	96.78	94.96	92.35
PT 20% 6 years	96.80	95.02	92.47
No work 6 years (no wage penalty)	96.82	95.06	92.55
No work 6 years (wage penalty)	96.82	95.07	92.58

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 21 illustrates the effect of the "age of choice" on pension income, which is similar to the results in the reference case (Table 15). A reduction in working hours towards the end of the career leads to greater losses in pension income due to the comparatively higher salaries. However, the effect of the wage penalty is less pronounced in the case of a later interruption of employment, since the wage penalty at age of 54 is effective only for five years (65-60), whereas the wage penalty at age of 30 affects 30 years (65-35) (see Graph 11). As the wage curve is more concave, the higher the educational attainment level, this effect is more pronounced for those with high educational attainment levels.

Table 21: Variant set 2 (unemployment; choice at age 54): pension amount as percentage of pension for the equivalent scenario when age of choice is 30

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.25	100.30	100.33
PT 80% 6 years	100.08	100.14	99.90
PT 50% 6 years	99.80	99.90	99.25
PT 20% 6 years	99.53	99.65	98.57
No work 6 years (no wage penalty)	99.34	99.48	98.10
No work 6 years (wage penalty)	100.97	103.29	105.48

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

5.4 Variant set 3: The impact of early retirement

In this scenario an early retirement two years before the statutory retirement age (SRA-2) is simulated, which is at the age of 63 (42 contribution years), as it was defined in section 4.4.

The results of Table 22 are similar to those of Table 8. Part time work (80% or 50%) has a relatively small impact on the pension income. Full interruption has more severe consequences especially for those with medium or high educational attainment levels. In comparison to variant set 3 of the first reference set (Table 8) is the effect of the wage penalty is less pronounced in the case of a later interruption of employment, however more pronounced for those with high education.

Table 22: Variant set 3 (early retirement, choice at age 54): pension amount as percentage of pension for base scenario

| | Education | | |
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	99.05	98.89	98.44
PT 50% 6 years	97.64	97.22	96.10
PT 20% 6 years	96.22	95.55	93.76
No work 6 years (no wage penalty)	95.27	94.43	92.21
No work 6 years (wage penalty)	94.88	94.24	91.84

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty
unless otherwise mentioned, early retirement.

Like in variant set 3 with choice at age 30, the decline in pension income from early retirement is almost linear (Table 23). Early retirement thus leads to a reduction around 7 pp across all education attainment levels.

Table 23: Variant set 3 (early retirement, choice at 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)	93.30	93.13	92.33
PT 80% 6 years	93.29	93.13	92.30
PT 50% 6 years	93.29	93.12	92.27
PT 20% 6 years	93.28	93.11	92.23
No work 6 years (no wage penalty)	93.28	93.10	92.21
No work 6 years (wage penalty)	93.47	93.19	92.38

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

The effect of the "age of choice" on pension income is illustrated in Table 24, which is similar to the results in the reference case (Table 15). Here, too, the opposing effects of comparatively higher wage losses towards the end of the career and the lower effect of the wage penalty are evident.

Table 24: Variant set 4 (early retirement; choice at age 54): pension amount as percentage of pension for the equivalent scenario when age of choice is 30

| | Education | | |
Option	Low	Medium	High
Base (FT work, no interruption)	100.26	100.31	100.35
PT 80% 6 years	100.08	100.15	99.90
PT 50% 6 years	99.80	99.90	99.19
PT 20% 6 years	99.52	99.64	98.47
No work 6 years (no wage penalty)	99.32	99.46	97.97
No work 6 years (wage penalty)	101.03	103.27	105.50

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

5.5 Variant set 4: Analysing the impact of gender on pension income

The wage profiles of men and women in Liechtenstein differ in two aspects: First, men's wages are higher.[30] Second, the wages of men increase more strongly than those of women in the course of their working lives. As a result, the wage penalty for men is relatively higher and the relative wage loss at the end of the career is greater when working hours are reduced (see Graph 4).

Table 25 shows the impact of the various choices on pension income. The results are similar to those reported in Table 14, however, the impact of the wage penalty on pension income is slightly stronger.

Table 25: Variant set 4 (men, choice at age 54): pension amount as percentage of pension for base scenario

| | Education | | |
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	98.97	98.70	98.29
PT 50% 6 years	97.41	96.76	95.73
PT 20% 6 years	95.86	94.81	93.17
No work 6 years (no wage penalty)	94.83	93.52	91.47
No work 6 years (wage penalty)	94.38	93.08	91.16

Reference set:
Man, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

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[30] The median wage of men is 18 pp higher than that of women (Amt für Statistik, 2019b).

The differences in life income between men and women are also reflected in pension income (Table 26). Here, in all constellations, the pension income of men exceeds those of women, with the difference varying between 6 and 8 percentage points for the lowest and highest levels of education. Thus the gender gap in pension income is smaller than the gap in simulated earned income. These are around 18pp (see Table 10). This difference is due to the compensatory effect of the first pillar. This can also be seen in table Table 26, as the differences are greater for the more highly educated, which is due to the greater importance of second pillar pension income.

Table 26: Variant set 4 (men, choice at 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)	106.16	106.41	108.80
PT 80% 6 years	106.06	106.21	108.61
PT 50% 6 years	105.90	105.89	108.32
PT 20% 6 years	105.74	105.57	108.01
No work 6 years (no wage penalty)	105.64	105.34	107.79
No work 6 years (wage penalty)	105.80	105.16	108.06

Reference set:
Man, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

The effect of the "age of choice" on pension income is illustrated in Table 27. Although results are similar to the results of the reference case (Table 15), Here, too, the opposing effects of comparatively higher wage losses towards the end of the career and the lower effect of the wage penalty are evident. However, Table 27 illustrates also the different impact of the wage penalty across gender. Due to the more pronounced curvature of the wage profiles, the wage penalty is stronger. E.g for a high educational attainment level, the effect of the wage penalty for men is about 12 pp (109.13-97.42), those of women 8 pp (105.81-98) (Table 15).

Table 27: Variant set 4 (early retirement; choice at age 54): pension amount as percentage of pension for the equivalent scenario when age of choice is 30

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.29	100.31	100.36
PT 80% 6 years	100.13	99.99	99.80
PT 50% 6 years	99.88	99.48	98.93
PT 20% 6 years	99.62	98.96	98.03
No work 6 years (no wage penalty)	99.44	98.61	97.42
No work 6 years (wage penalty)	102.06	104.45	109.13

Reference set:
Man, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

6 Conclusions

This study analyzes gender-specific differences in pension income. Since pension income is determined by a variety of personal circumstances (gender, educational attainment level, spells of unemployment) and personal choices (labour market participation), the influence of these factors on pension income is analyzed. As labor supply at the extensive and intensive margins is influenced by care obligations, the focus of the analysis is laid on the impact of bringing up children and caring for relatives on pension income.

In order to analyse the impact of personal circumstances and choices on pension income, different combinations of personal circumstances and decisions (so-called scenarios) are compared. In doing so, the results illustrate the impact of the choices on the later pension, while the variant sets show to what extent these findings are sensitive to the circumstances. The pension outcomes are calculated by using standard simulations, based on earnings profiles, and the regulatory framework of the current pension systems. Although this approach makes it possible to analyze the influence of personal circumstances and choices, the generalizability of the results is limited by limited by the number and definitions of the scenarios that are simulated. Hence, the distribution of observations could not be interpreted as one would do in case of sample data of actual individuals. It merely represents the distribution resulting from the analyzed combinations of choices and circumstances. Thus, only the relative strength of the effects can be concluded from the results. Another limitation is that the simulations reach far into the future, which requires implicit assumptions about future developments. When interpreting the results, therefore, it must be borne in mind that the results depend heavily on the assumptions made and assume that the current legal provisions will not be changed over the forecast period. This will be taken into account in WP3 by considering the influence of assumptions as well as possible reform scenarios. Finally, the simulations are limited in that the third pillar is not included. Furthermore, the household context is also ignored.

Keeping these limitations in mind, we propose the following concluding remarks, first on the impact of personal circumstances and second on the impact of choices on pension income. With regard to personal circumstances, a higher educational attainment level is associated with a higher earned lifetime income, which in turn leads to a higher pension income. However, a career break, especially in the case of a higher level of education, leads to a greater decline in pensions, since the steeper rise in the wage curve means that the wage penalty is also greater. Part-time work (which according to the assumptions is not associated with a wage penalty) does not lead to a pension loss under the first pillar, since the crediting of child-raising periods and the comparatively high revaluation factor compensate for the reduced contribution payments. With regard of the strength of the respective choices, an interruption leads to the strongest decline in pension income. The compensatory elements of the first pillar mean that part-time work only leads to comparatively lower pension losses. As a rule of thumb, it can be said that a reduction of 20% in working hours over a period of six years leads to an approximate reduction of 1% - 1.5% in

pension income. However, in the case of a full interruption scenario, the decline is much greater. With wage penalty, the decline is stronger, the higher the wage increase over the lifetime. In the case of high educational attainment level, the effect of the wage penalty is about 13 pp, of a low educational attainment level the effect is about 6 pp..

As differences in pension income between men and women are mainly driven by differences in wage profiles and due to care related interruptions in working life or part time work, both effects are disentangled in the analysis. With regard to wage profiles, two aspects are crucial: the relative level of wages, and the increase in wages over the life course. First, men's wages are higher than those of women. In the case of an uninterrupted career, the difference in average simulated earnings over the course of a full-time career amounts to approximately 18% across all educational attainment levels. Second, the wages of men increase more strongly than those of women in the course of their working lives. As a result, the wage penalty for men is relatively higher and the relative wage loss and hence the decline in pension income is higher compared to woman. However, the simulated pension income of men exceeds those of women for all scenario, whereby the differences in pension income are smaller than in life income, which is due to the balancing effect of the first pillar.

When the temporal influence of decisions is examined, i.e. the difference between whether a career break occurs at a younger age or later in working life, two opposing effects occur. A reduction in working hours towards the end of the career leads to greater losses in pension income due to the comparatively higher salaries. However, the effect of the wage penalty is less pronounced in the case of a later interruption of employment, since the wage penalty at age of 54 is effective only for five years (65-60), whereas the wage penalty at age of 30 affects 30 years (65-35). As the wage curve is more concave, the higher the educational attainment level, this effect is more pronounced for those with high educational attainment levels.

If one finally compares all simulated effects, the following conclusion can be drawn: The largest reduction in pension income is due to career breaks, whereby the associated wage penalty, which is effective over the entire working life, leads to a significant lower pension income. Another large part of the differences in pension income in the simulated cases is due to the gender pay gap. Unemployment and early retirement are additional factors that lead to lower pension income, but the effect is less than those mentioned above. A comparatively small influence is also exerted by temporary part-time work This is mainly due to the care-related pension credits, although also the revaluation factor plays a role for those with low wages.

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8 Appendices

7.1. Institutional background: Additional resources

Table 28: Conversion Table

Skala 44		Monatliche Vollrenten								Beträge in CHF
Bestimmungsgrösse Massgebendes durchschnittliches Jahreseinkommen bis	Alters- und Invalidenrente 1/1	Alters- und Invalidenrente für Witwen/Witwer	Waisenrente 40%	Kinderrente 40%	Invalidenrente		Kinderrente 40%		Verwitwetenrente 80%
					1/2	1/4	1/2	1/4	
13'920	1'160	1'392	464	464	580	290	232	116	928
15'312	1'190	1'428	476	464	595	298	232	116	952
16'704	1'220	1'464	488	464	610	305	232	116	976
18'096	1'250	1'500	500	464	625	313	232	116	1'000
19'488	1'281	1'537	512	464	641	320	232	116	1'025
20'880	1'311	1'573	524	464	656	328	232	116	1'049
22'272	1'341	1'609	536	464	671	335	232	116	1'073
23'664	1'371	1'645	548	464	686	343	232	116	1'097
25'056	1'401	1'681	560	464	701	350	232	116	1'121
26'448	1'431	1'717	572	464	716	358	232	116	1'145
27'840	1'462	1'754	585	464	731	366	232	116	1'170
29'232	1'492	1'790	597	464	746	373	232	116	1'194
30'624	1'522	1'826	609	464	761	381	232	116	1'218
32'016	1'552	1'862	621	464	776	388	232	116	1'242
33'408	1'582	1'898	633	464	791	396	232	116	1'266
34'800	1'612	1'934	645	464	806	403	232	116	1'290
36'192	1'643	1'972	657	464	822	411	232	116	1'314
37'584	1'673	2'008	669	464	837	418	232	116	1'338
38'976	1'703	2'044	681	464	852	426	232	116	1'362
40'368	1'733	2'080	693	464	867	433	232	116	1'386
41'760	1'763	2'116	705	464	882	441	232	116	1'410
43'152	1'782	2'138	713	464	891	446	232	116	1'426
44'544	1'800	2'160	720	464	900	450	232	116	1'440
45'936	1'819	2'183	728	464	910	455	232	116	1'455
47'328	1'837	2'204	735	464	919	459	232	116	1'470
48'720	1'856	2'227	742	464	928	464	232	116	1'485
50'112	1'875	2'250	750	464	938	469	232	116	1'500
51'504	1'893	2'272	757	464	947	473	232	116	1'514
52'896	1'912	2'294	765	464	956	478	232	116	1'530
54'288	1'930	2'316	772	464	965	483	232	116	1'544
55'680	1'949	2'320	780	464	975	487	232	116	1'559
57'072	1'967	2'320	787	464	984	492	232	116	1'574
58'464	1'986	2'320	794	464	993	497	232	116	1'589
59'856	2'004	2'320	802	464	1'002	501	232	116	1'603
61'248	2'023	2'320	809	464	1'012	506	232	116	1'618
62'640	2'042	2'320	817	464	1'021	511	232	116	1'634
64'032	2'060	2'320	824	464	1'030	515	232	116	1'648
65'424	2'079	2'320	832	464	1'040	520	232	116	1'663
66'816	2'097	2'320	839	464	1'049	524	232	116	1'678
68'208	2'116	2'320	846	464	1'058	529	232	116	1'693
69'600	2'134	2'320	854	464	1'067	534	232	116	1'707
70'992	2'153	2'320	861	464	1'077	538	232	116	1'722
72'384	2'172	2'320	869	464	1'086	543	232	116	1'738
73'776	2'190	2'320	876	464	1'095	548	232	116	1'752
75'168	2'209	2'320	884	464	1'105	552	232	116	1'767
76'560	2'227	2'320	891	464	1'114	557	232	116	1'782
77'952	2'246	2'320	898	464	1'123	562	232	116	1'797
79'344	2'264	2'320	906	464	1'132	566	232	116	1'811
80'736	2'283	2'320	913	464	1'142	571	232	116	1'826
82'128	2'301	2'320	920	464	1'151	575	232	116	1'841
83'520 und mehr	2'320	2'320	928	464	1'160	580	232	116	1'856

(gültig ab 01.01.2018)

- Skala 44 -

7.2 The Liechtenstein Educational System

Figure 4 provides an overview of the ISCED levels in the Liechtenstein educational system.

Figure 4: Overview of the ISCED level

18 y. – 21 y. Study	18 y. – 21 y. higher education	ISCED 6 / ISCED 5
15 y. – 18 y. Secondary school II	15 y. – 18 y. Apprenticeship	ISCED 3 / ISCED 4
11 y. – 15 y. Secondary school I		ISCED 2
6 y. – 11 y. Primary school		ISCED 1
4 y. – 6 y. Kindergarten		ISCED 0

ISCED Level 0 includes two different levels. One level deals with children under the age of three. The focus is on language acquisition and the development of movement skills. The second level deals with children between the age of 3 and 6. At this level the children attend the kindergarten. The last two years of the kindergarten (between the age of 4 and 6) are obligatory. ISCED Level 1 includes an obligatory school visit. Children between the age of 6 and 11 have to visit the primary school. The children learn the basics of writing, reading and arithmetic. ISCED Level 2 also includes an obligatory school visit. School attendance at the Secondary School I takes place between the ages of 11 and 15. The Educational programmes are mainly subject-oriented. After successful completion of the ISCED 2 level you can decide whether to continue on the ISCED 3 level or on the ISCED 4 level.

ISCED 3 Level takes place between the age of 15 and 18 years. If a person decided to go further with ISCED 3 Level, he or she goes to Secondary school II. If one successfully completes the Secondary School II one receives at the end Matura. ISCED 3 would be the most "classic" way. ISCED 4 level is for all those who decide against the classic Matura and thus against ISCED 3. ISCED 4 can also be completed between the ages of 15 and 18. At the end of ISCED 4 one either has a completed vocational training or a vocational baccalaureate.

ISCED 5 level ISCED 5 Level provides vocational training in knowledge, skills and competences. As a rule, they are practice-oriented, profession-specific and prepare the participants for entering the labour market. In order to complete ISCED 5, you must have successfully completed ISCED 3 or ISCED 4 with admission to higher education. Those who are on ISCED 5 level are usually between 18 and 21 years old. ISCED 6 level provides advanced academic and/or vocational knowledge. Often there is a Bachelor's degree at the end of this level. Similar to the ISCED 5 level are those who are on the ISCED 6 level usually between 18 and 21 years old.

7.3 Methodology

7.3.1 Estimation of the wage profiles: Econometric results

Results for the wage profile, Men (ISCED 0-2)

Residuals:

Min	1Q	Median	3Q	Max
-0.74929	-0.12141	-0.00461	0.10856	1.16992

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	8.3531812	0.0371348	224.942	< 2e-16	***
ALTER	0.0074811	0.0009017	8.297	5.87e-16	***
ALTER2	-0.0010940	0.0006905	-1.584	0.114	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2069 on 671 degrees of freedom
  (150 observations deleted due to missingness)
Multiple R-squared: 0.1038,   Adjusted R-squared: 0.1011
F-statistic: 38.86 on 2 and 671 DF, p-value: < 2.2e-16

54
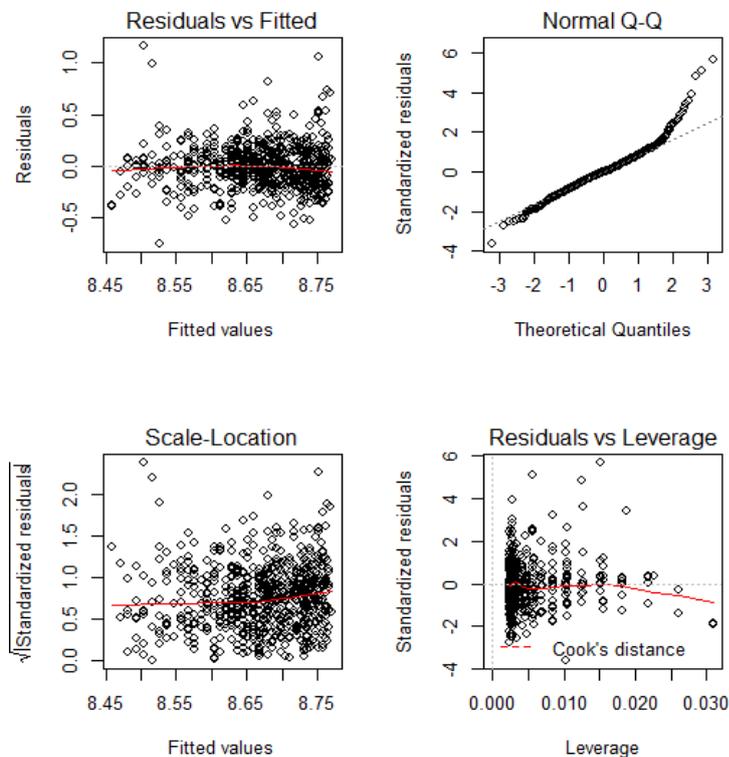
Results for the wage profile, Men (ISCED 3-4)

Residuals:
```
    Min      1Q   Median     3Q     Max
-1.1972 -0.1766 -0.0226  0.1434  1.2210
```

Coefficients:
```
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 8.3202118  0.0198898  418.32   <2e-16 ***
ALTER       0.0156043  0.0004637   33.65   <2e-16 ***
ALTER2     -0.0045673  0.0004216  -10.83   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Residual standard error: 0.2989 on 3173 degrees of freedom
  (150 observations deleted due to missingness)
Multiple R-squared: 0.2705,   Adjusted R-squared: 0.2701
F-statistic: 588.4 on 2 and
3173 DF, p-value: < 2.2e-
16
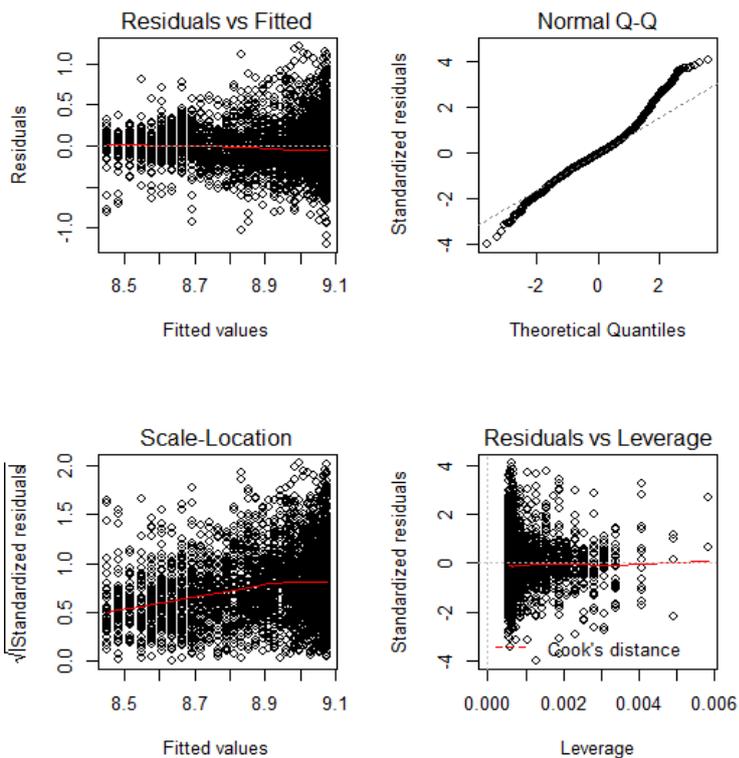
Results for the wage profile, Men (ISCED 5+)

Residuals:
```
    Min      1Q   Median      3Q      Max
-1.44203 -0.20049 -0.01792  0.18484  1.08192
```

Coefficients:
```
            Estimate Std. Error t value Pr(>|t|)
(Intercept)  8.409347   0.049151 171.092  < 2e-16 ***
ALTER        0.023959   0.001235  19.398  < 2e-16 ***
ALTER2      -0.008867   0.001082  -8.192 6.67e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Residual standard error: 0.3374 on 1168 degrees of freedom
  (150 observations deleted due to missingness)
Multiple R-squared: 0.2469,   Adjusted R-squared: 0.2456
F-statistic: 191.5 on 2 and
1168 DF, p-value: < 2.2e-
16
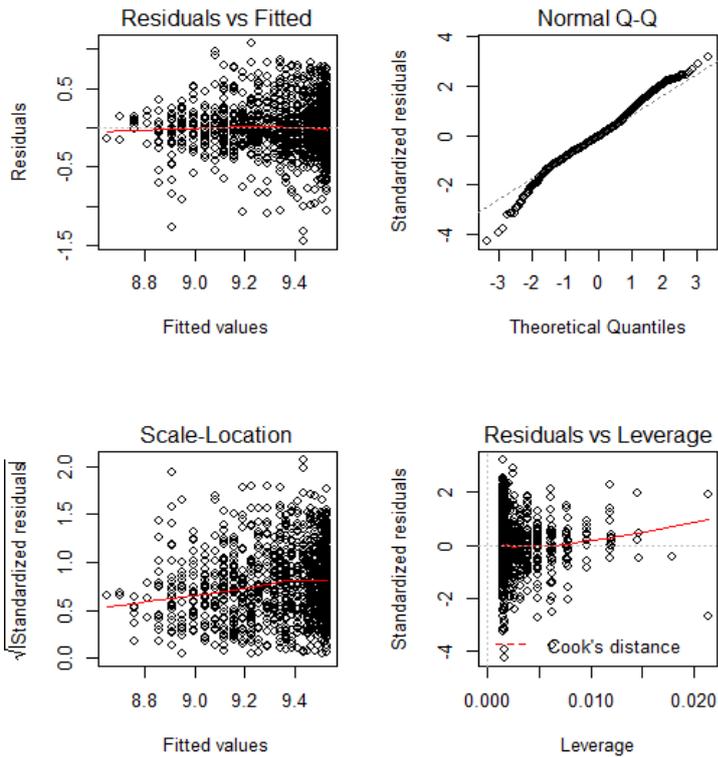
Results for the wage profile, Women (ISCED 0-2)

Residuals:

Min	1Q	Median	3Q	Max
-0.61117	-0.17597	0.00034	0.13931	1.36716

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	8.1541519	0.0673722	121.031	< 2e-16	***
ALTER	0.0072832	0.0016317	4.464	1.13e-05	***
ALTER2	0.0009329	0.0012652	0.737	0.461	

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2616 on 309 degrees of freedom
  (150 observations deleted due to missingness)
Multiple R-squared: 0.09222,   Adjusted R-squared: 0.08634
F-statistic: 15.7 on 2 and
309 DF, p-value: 3.222e-
07
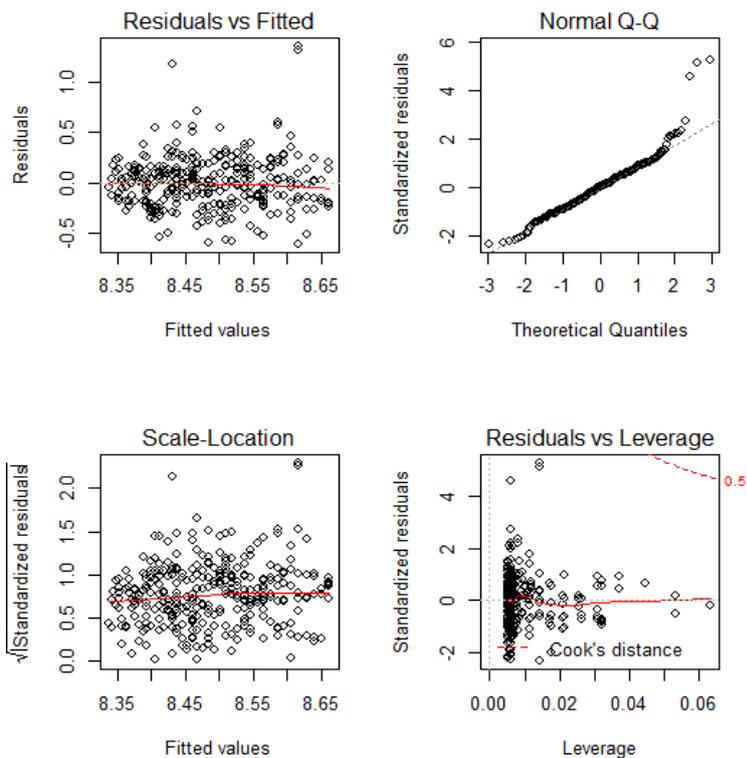
Results for the wage profile, Women (ISCED 3-4)

Residuals:

Min	1Q	Median	3Q	Max
-1.17728	-0.14577	0.00376	0.16472	1.37242

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	8.4344294	0.0271802	310.315	< 2e-16	***
ALTER	0.0091574	0.0006119	14.965	< 2e-16	***
ALTER2	-0.0034976	0.0006012	-5.818	7.23e-09	***

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2882 on 1537 degrees of freedom
  (150 observations deleted due to missingness)
Multiple R-squared: 0.1593,   Adjusted R-squared: 0.1582
F-statistic: 145.6 on 2 and 1537 DF, p-value: < 2.2e-16
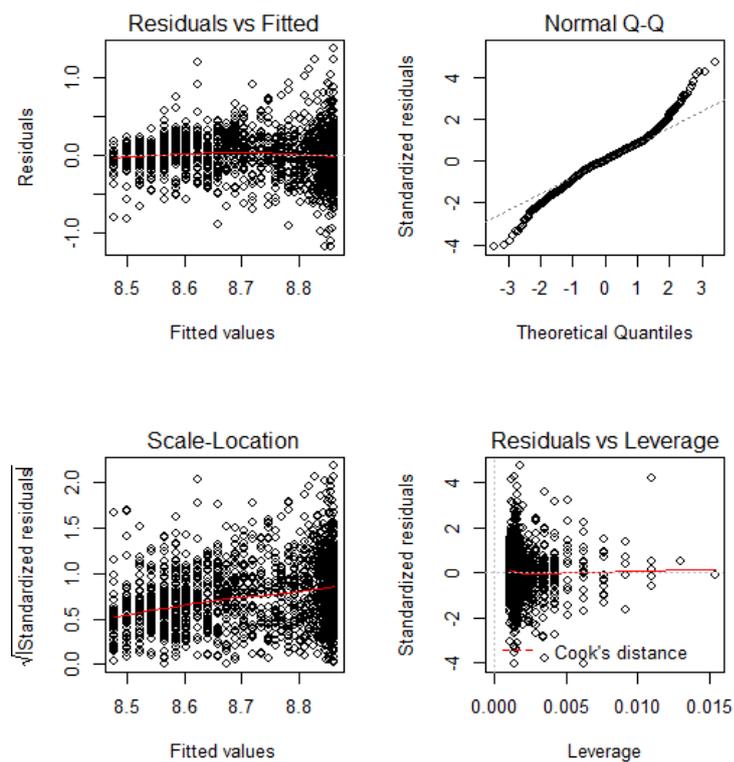
Results for the wage profile, Women (ISCED 5+)

Residuals:

Min	1Q	Median	3Q	Max
-1.37740	-0.15293	0.02159	0.15381	1.12483

Coefficients:

	Estimate	Std. Error	t value	Pr(>|t|)	
(Intercept)	8.426628	0.067084	125.612	<2e-16	***
ALTER	0.018581	0.001662	11.179	<2e-16	***
ALTER2	-0.005354	0.001704	-3.141	0.0018	**

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3515 on 416 degrees of freedom
  (150 observations deleted due to missingness)
Multiple R-squared: 0.2431,   Adjusted R-squared: 0.2394
F-statistic: 66.79 on 2 and
416 DF, p-value: < 2.2e-
16
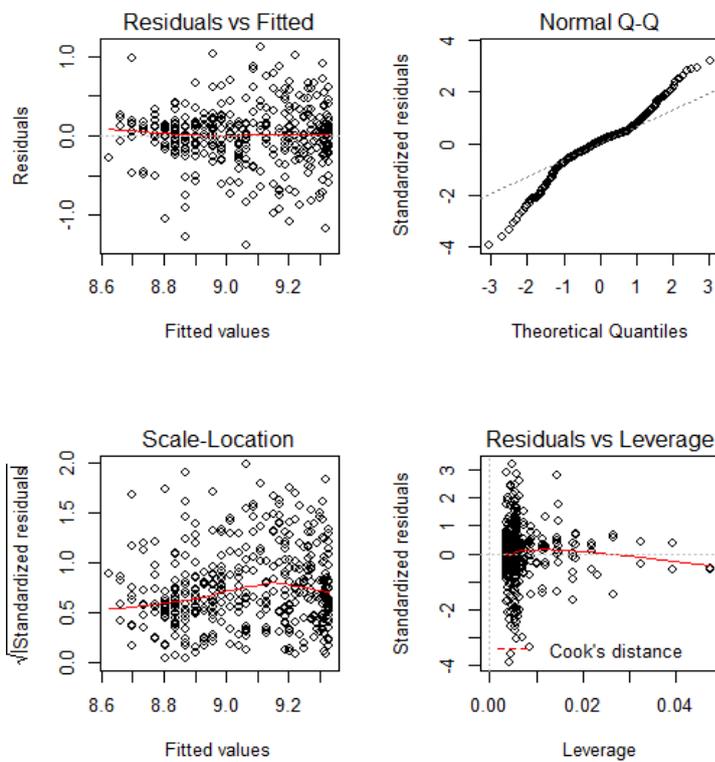
7.3.2 Actual and uprated wage profiles

Graph 13: Real and uprated wage profiles of full-time employees, growth rate 2.1%.

Real and uprated wage profiles of full-time employees
Men

Source: Own calculations, 2019. Parameter: Nominal wage growth rate: 0.021.
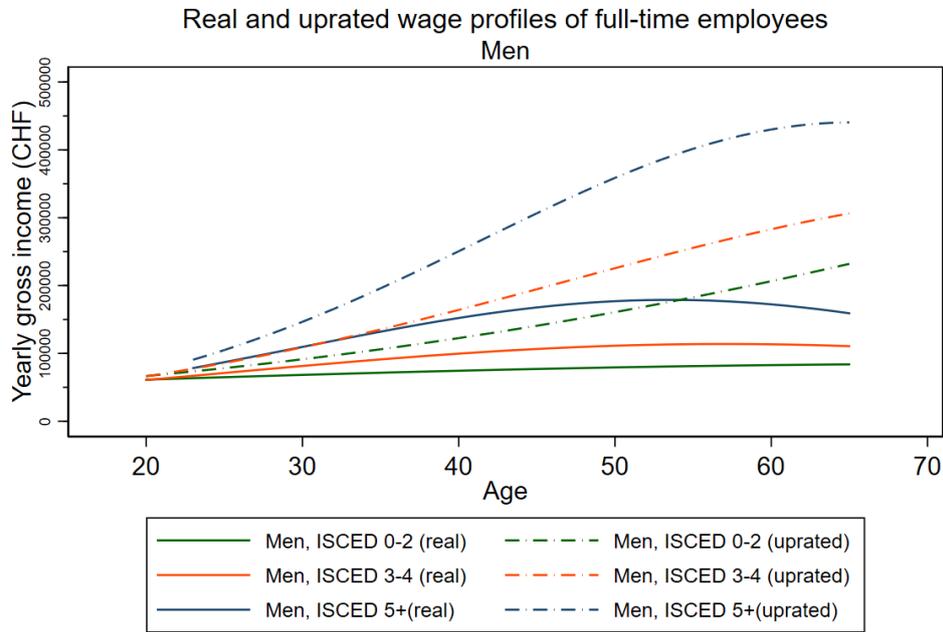
Source: 2015 Census and 2016 wage statistics, own calculations.

9   Results for men

9.1   Analyzing the impact of childcare on pension income

9.1.1   Reference set

The reference set presents the estimated pension amounts of a man, and it is identical to the reference set for women. In this reference set is assumed that a 30-year-old man decides on a certain extend of work on the basis of bringing up children. The base scenario in this reference set is, that the man continues full-time work without interruption and that he is eligible for child care credit. The next three scenarios show the influence of different working hours (between 80%, 50% and 20% part-time). The last two scenario illustrate the impact of periods of inactivity (for six years). In doing so, we are taking into account wage scarring pertaining to periods of inactivity. In order to assess the impact of the wage penalty, we simulate the pension income without wage penalty and with wage penalty.

Table 29 presents the total of simulated pension amounts of the first and second pillar for the reference set. One should realize 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.

Table 29: Reference set: pension amounts (Total of first and second pillar pension income)

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	55554	61666	72915
PT 80% 6 years	55070	61066	72074
PT 50% 6 years	54343	60166	70811
PT 20% 6 years	53616	59267	69548
No work 6 years (no wage penalty)	53132	58667	68707
No work 6 years (wage penalty)	51526	55125	61130

Reference set:
Man, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless
otherwise mentioned, retirement at statutory retirement age.

Table 30 shows the simulated pension amounts relative to the base scenario within the reference set. As a rule of thumb, it can be said that a reduction of 20% in working hours over a period of six years leads to an approximate reduction of 1% - 1.2% in pension income. However, in the case of a full interruption scenario, the decline is much greater. With wage penalty, the decline is stronger, the higher the wage increase over the lifetime. In the case of high educational attainment level, the effect of the wage penalty is about 16 pp, of a low educational attainment level the effect is about 8 pp.

Table 30: Reference set: pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100,00	100,00	100,00
PT 80% 6 years	99,13	99,03	98,85
PT 50% 6 years	97,82	97,57	97,11
PT 20% 6 years	96,51	96,11	95,38
No work 6 years (no wage penalty)	95,64	95,14	94,23
No work 6 years (wage penalty)	92,75	89,39	83,84

Reference set:
Man, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

9.1.2 Variant set 1: About the role of parenthood pension-related policies

In order to analyse the impact of the pension credits, it is now assumed that no parental leave credit is granted, but that a reduction in working hours or interruption of employment does occur. Hence, the compensation effects of the childcare credits are omitted.

Table 31 presents the pension amount as percentage of pension for the base scenario. As in the case of women, in the case of men the underlying revaluation factor of 2.1 means that the maximum pension is reached in all constellations and no child- raising periods are taken into account under the second pillar, the results are identical with table Table 30.

Table 31: Variant set 1 (no time credit): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100,00	100,00	100,00
PT 80% 6 years	99,13	99,03	98,85
PT 50% 6 years	97,82	97,57	97,11
PT 20% 6 years	96,51	96,11	95,38
No work 6 years (no wage penalty)	95,64	95,14	94,23
No work 6 years (wage penalty)	92,75	89,39	83,84

Reference set:
Man, age at interruption 30, no pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 32 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 above stated, compensates the assumed revaluation factor of 2.1. gaps in employment income without the need to take into account childcare credits. However, if a lower revaluation factor were to be applied, this would lead to lower pension income under the first pillar and the compensatory effect of the care credits would become visible.

Table 32: Variant set 1 (no time credit): pension amount as percentage of pension for the same option in the reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100,00	100,00	100,00
PT 80% 6 years	100,00	100,00	100,00
PT 50% 6 years	100,00	100,00	100,00
PT 20% 6 years	100,00	100,00	100,00
No work 6 years (no wage penalty)	100,00	100,00	100,00
No work 6 years (wage penalty)	100,00	100,00	100,00

Reference set:
Man, age at interruption 30, no pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

9.1.3 Variant set 2: Experiencing an unemployment spell

In order to analyse the effect of unemployment, a three-year unemployment spell that starts at age of 26 is simulated. In doing so, it is assumed, that the cases are entitled to an unemployment benefit, at least until the – possible - exhaustion of this benefit. According to the ALVG, persons elder than 25 years receive an allowance of 80% of the insured earnings for a maximum of 260 daily allowances. As daily allowances are regarded as wages and handled accordingly for insurance obligation, losses in the pension career of the first pillar are avoided. If no more unemployment benefit is granted after the 280-day period, the minimum contributions are paid to the first pillar, so that there are no first-pillar contribution gaps during this period.

Table 33 largely reproduces the results of Table 30 of the reference set. Working part time reduces pension income. This effect is stronger the more the working time is reduced, and strongest in the case of a full interruption scenario with wage penalty.

Table 33: Variant set 2 (unemployment): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100,00	100,00	100,00
PT 80% 6 years	99,15	99,08	98,92
PT 50% 6 years	97,87	97,69	97,31
PT 20% 6 years	96,59	96,30	95,69
No work 6 years (no wage penalty)	95,73	95,38	94,62
No work 6 years (wage penalty)	92,91	89,92	84,93

Reference set:
Man, age at interruption 30, reason for interruption childbirth, three year unemployment spell (start at age 26), retirement at statutory retirement age.

Table 34 shows the impact of the unemployment spell, as it 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. An unemployment spell results in a decrease of the retirement benefits between 4 pp and 11 pp for the lowest and highest educational attainment level. The losses in pension income result from the lower income from the second pillar. The second pillar does not include compensation mechanisms.

Table 34: Variant set 2 (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)	95,88	93,65	89,87
PT 80% 6 years	95,90	93,70	89,94
PT 50% 6 years	95,92	93,77	90,05
PT 20% 6 years	95,95	93,84	90,16
No work 6 years (no wage penalty)	95,97	93,89	90,24
No work 6 years (wage penalty)	96,04	94,21	91,04

Reference set:
Man, age at interruption 30, reason for interruption childbirth, three year unemployment spell (start at age 26),
retirement at statutory retirement age.

9.1.4 Variant set 3: The impact of early retirement

The results of Table 35 are similar to those of Table 30 (reference set). Part time work (especially 80% or 50%) has a relatively small effect on the pension income, whereas a full interruption with a wage penalty has more severe consequences especially for those with higher education. This result is due to the fact that the decline in pension income from early retirement under the first and second pillar is almost linear. This applies to both women and men.

Table 35: Variant set 3 (early retirement): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100,00	100,00	100,00
PT 80% 6 years	99,12	99,02	98,83
PT 50% 6 years	97,81	97,54	97,07
PT 20% 6 years	96,49	96,07	95,30
No work 6 years (no wage penalty)	95,61	95,09	94,13
No work 6 years (wage penalty)	92,91	89,67	84,23

Reference set:
Man, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless
otherwise mentioned, early retirement.

Table 36 illustrates this linear effect. Early retirement thus leads to an overall reduction around 8 pp across educational attainment levels and employment rates. However, the pension losses in the second pillar are comparatively greater than in the first pillar

Table 36: Variant set 3 (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)	93,18	92,76	92,17
PT 80% 6 years	93,18	92,75	92,15
PT 50% 6 years	93,17	92,73	92,12
PT 20% 6 years	93,16	92,72	92,09
No work 6 years (no wage penalty)	93,16	92,71	92,07
No work 6 years (wage penalty)	93,34	93,04	92,59

Reference set:
Man, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

9.2 Analyzing the impact of care on pension income

The fourth reference case analyses the choices of a 54-year-old man who chooses a certain level of employment due to care for a relative. Through the care obligation he is entitled to the crediting of a care credit (the case without care credit is simulated in variant set 1). He has not experienced an unemployment spell (this is simulated in variant set 2) and will not retire early (this is simulated in variant 3). As in the first reference case for men and in the reference cases for women, for each of these reference sets and variants, three standard tables are reported. Contrary to the child-care sections, there is a fourth and final standard 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. The table illustrates the impact of having the choice or event happening later instead earlier in life, hence the effect of the "age of choice" on pension income.

As there are many parallels between four reference cases (women and men), the results are generally discussed only briefly, unless they differ from the results presented in the earlier tables. Therefore, many of the arguments and conclusions from the previous section are not repeated.

9.2.1 Reference set

Table 37 reports the simulated pension income of the first and second pillar. As in the other reference sets, a higher earned income, which is associated with a higher educational attainment level, leads to higher pension income.

Table 37: Reference set; choice at age 54: pension amounts (Total of first and second pillar pension income)

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	55717	61860	73176
PT 80% 6 years	55141	61058	71928
PT 50% 6 years	54276	59855	70054
PT 20% 6 years	53412	58652	68181
No work 6 years (no wage penalty)	52836	57850	66932
No work 6 years (wage penalty)	52587	57580	66710

Reference set:
Man, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 37 shows the simulated pension amounts relative to the base scenario within the reference set. As with the first reference set, the differences in pension income are due to the differences in the second pillar, as the compensation mechanisms of the first pillar compensate for the loss of contributions. Since wages are higher towards the end of the career, a reduction in working hours leads to a comparatively greater decline in pension income. This effect is all the stronger the higher the level of education and the more extensive the reduction in working hours (Table 38).

Table 38: Reference set; choice at age 54: pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100,00	100,00	100,00
PT 80% 6 years	98,97	98,70	98,29
PT 50% 6 years	97,41	96,76	95,73
PT 20% 6 years	95,86	94,81	93,17
No work 6 years (no wage penalty)	94,83	93,52	91,47
No work 6 years (wage penalty)	94,38	93,08	91,16

Reference set:
Man, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 39 shows the effect of "age of choice" on pension income, by comparing the results of Table (above) with those of Table (reference case child). Hence, Table xx reports the difference in pension income, if a choice is made at younger ages (30) with a comparable choice at age of 54. Here, too, it can be seen that a reduction in working hours towards the end of the career leads to greater losses in pension income due to the comparatively higher salaries. However, the effect of the wage penalty is less pronounced in the case of a later interruption of employment, since the wage penalty at age of 54 is effective only for five years (65-60), whereas the wage penalty at age of 30 affects 30 years (65-35). As

the wage curve is more concave, the higher the educational attainment level, this effect is more pronounced for those with high education.

Table 39: Reference set; choice at 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)	100,29	100,31	100,36
PT 80% 6 years	100,13	99,99	99,80
PT 50% 6 years	99,88	99,48	98,93
PT 20% 6 years	99,62	98,96	98,03
No work 6 years (no wage penalty)	99,44	98,61	97,42
No work 6 years (wage penalty)	102,06	104,45	109,13

Reference set:
Man, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

When interpreting this type of table, however, it must be borne in mind that the child care credits are granted over a period of 16 years - irrespective of the level of employment - but the care credits are only granted for the duration of care, which in the simulations corresponds to the duration of interruptions or reductions in employment.

9.2.2   Variant set 1: About the role of elderly care policies on pension income

In order to analyse the impact of the pension credits, it is now assumed that no care contribution credit is granted, but that a reduction in working hours or interruption of employment does occur. Hence, the compensation effects of the care contribution credits are omitted.

Table 40 presents the pension amount as percentage of pension for the base scenario. Since the underlying revaluation factor of 2.1 means that the maximum pension is reached in all constellations and no care periods are taken into account under the second pillar, the results are identical with those of Table 38.

Table 40: Variant set 1 (no time credit; choice at age 54): pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100,00	100,00	100,00
PT 80% 6 years	98,97	98,70	98,29
PT 50% 6 years	97,41	96,76	95,73
PT 20% 6 years	95,86	94,81	93,17
No work 6 years (no wage penalty)	94,83	93,52	91,47
No work 6 years (wage penalty)	94,38	93,08	91,16

Reference set:
Man, age at interruption 54, no pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 41 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 care credit. As above stated, compensates the assumed revaluation factor of 2.1 gaps in employment income without the need to take into account care credits. However, if a lower revaluation factor were to be applied, this would lead to lower pension income under the first pillar and the compensatory effect of the care credits would become visible.

Table 41: Variant set 1 (no time credit; choice at age 54): pension amount as percentage of pension for reference scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100,00	100,00	100,00
PT 80% 6 years	100,00	100,00	100,00
PT 50% 6 years	100,00	100,00	100,00
PT 20% 6 years	100,00	100,00	100,00
No work 6 years (no wage penalty)	100,00	100,00	100,00
No work 6 years (wage penalty)	100,00	100,00	100,00

Reference set:

Man, age at interruption 54, no pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 42 shows the ratio of the scenario's making the choice at age 54 with those of making the choice at age of 30. Hence the table illustrates the impact of having the choice or event happening later instead earlier in life. As the loss of care credits does not affect first pillar pension income due to the high revaluation factor, the results of table Table 42 are identical to Table 41.

Table 42: Variant set 1 (no time credit; choice at age 54): pension amount as percentage of pension for the equivalent scenario when age of choice is 30

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100,29	100,31	100,36
PT 80% 6 years	100,13	99,99	99,80
PT 50% 6 years	99,88	99,48	98,93
PT 20% 6 years	99,62	98,96	98,03
No work 6 years (no wage penalty)	99,44	98,61	97,42
No work 6 years (wage penalty)	102,06	104,45	109,13

Reference set:
Man, age at interruption 54, no pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

9.2.3 Variant set 2: Experiencing an unemployment spell

In order to analyse the effect of unemployment, a three-year unemployment spell that starts at age of 49 is simulated. This is in contrast to variant set 2 at age of 30, where it is assumed, that unemployment lasts from age 26 to 28.

Although the wage penalty does not affect first-pillar pension income, it does affect second-pillar pensions, which is illustrated in Table 43.

Table 43: Variant set 2 (unemployment; choice age 54): pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100,00	100,00	100,00
PT 80% 6 years	98,99	98,77	98,41
PT 50% 6 years	97,47	96,92	96,02
PT 20% 6 years	95,95	95,07	93,63
No work 6 years (no wage penalty)	94,94	93,84	92,04
No work 6 years (wage penalty)	94,50	93,42	91,76

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

Since the wage penalty is stronger for higher incomes, the pension losses increase with the educational attainment level. Hence, an unemployment spell results in a decrease of

the retirement benefits between 5 pp and 11 pp for the lowest and highest educational attainment level Table 44.

Table 44: Variant set 2 (unemployment; 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)	95,87	93,64	89,85
PT 80% 6 years	95,89	93,70	89,95
PT 50% 6 years	95,93	93,79	90,12
PT 20% 6 years	95,96	93,89	90,29
No work 6 years (no wage penalty)	95,98	93,96	90,41
No work 6 years (wage penalty)	96,00	93,98	90,43

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

Table 45 illustrates the effect of the "age of choice" on pension income, which are similar to the results in the reference case (Table xx). A reduction in working hours towards the end of the career leads to greater losses in pension income due to the comparatively higher salaries. However, the effect of the wage penalty is less pronounced in the case of a later interruption of employment, since the wage penalty at age of 54 is effective only for five years (65-60), whereas the wage penalty at age of 30 affects 30 years (65-35) (see Graph 5). As the wage curve is more concave, the higher the educational attainment level, this effect is more pronounced for those with high educational attainment levels.

Table 45: 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	Low	Medium	High
Base (FT work, no interruption)	100,29	100,30	100,33
PT 80% 6 years	100,13	99,99	99,81
PT 50% 6 years	99,88	99,51	99,01
PT 20% 6 years	99,63	99,02	98,17
No work 6 years (no wage penalty)	99,46	98,68	97,60
No work 6 years (wage penalty)	102,01	104,21	108,40

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

9.2.4   Variant set 3: The impact of early retirement

In this scenario an early retirement two years before the statutory retirement age (SRA-2) is simulated, which is at the age of 63 (42 contribution years), as it was defined in section 4.4.

Full interruption has severe consequences especially for those with high educational attainment levels. In comparison to variant set 3 of the first reference set the effect of the wage penalty is less pronounced in the case of a later interruption of employment. If one compares this with Table of Variant set 3, early retirement, women, it can be seen that it the impact of early retirement is stronger for men than for women.

Table 46: Variant set 3 (early retirement, choice at age 54): pension amount as percentage of pension for base scenario

|	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100,00	100,00	100,00
PT 80% 6 years	98,96	98,69	98,26
PT 50% 6 years	97,40	96,73	95,66
PT 20% 6 years	95,84	94,76	93,06
No work 6 years (no wage penalty)	94,80	93,45	91,32
No work 6 years (wage penalty)	94,50	93,15	91,11

Reference set:

Man, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

Like in variant set 3 with choice at age 30 (men), the decline in pension income from early retirement is almost linear (Table 47). Early retirement thus leads to a reduction around 8 pp across all education attainment levels.

Table 47: Variant set 3 (early retirement, choice at 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)	93,18	92,76	92,17
PT 80% 6 years	93,18	92,75	92,15
PT 50% 6 years	93,17	92,73	92,10
PT 20% 6 years	93,16	92,71	92,06
No work 6 years (no wage penalty)	93,15	92,69	92,03
No work 6 years (wage penalty)	93,30	92,83	92,12

Reference set:

Man, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

The effect of the "age of choice" on pension income is illustrated in Table 26, which is similar to the results in the reference case (Table 48). Here, too, the opposing effects of comparatively higher wage losses towards the end of the career and the lower effect of the wage penalty are evident.

Table 48: 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	Low	Medium	High
Base (FT work, no interruption)	100,29	100,32	100,36
PT 80% 6 years	100,13	99,99	99,79
PT 50% 6 years	99,88	99,48	98,91
PT 20% 6 years	99,62	98,95	98,00
No work 6 years (no wage penalty)	99,44	98,59	97,37
No work 6 years (wage penalty)	102,01	104,22	108,57

Reference set:

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

10 Analyzing the impact of childcare on pension income

Table 49 presents the simulated pension amounts of the first pillar for the reference set. First pillar pension income does not show any differences in terms of the extent of employment or the level of education. The crediting of child-raising periods compensates for the loss of earnings caused by reduced or no labor market participation. In addition, the minimum contribution to the first pillar means that no contribution years are lost and therefore there is no loss of pension entitlement despite an interruption of employment. Furthermore, the conversion factor of 2.1 results in a comparatively high pensions assessment base, which in turn compensates for spells with lower income.

Table 49: Reference set: pension amounts (First pillar pension income)

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	35009	35009	35009
PT 80% 6 years	35009	35009	35009
PT 50% 6 years	35009	35009	35009
PT 20% 6 years	35009	35009	35009

No work 6 years (no wage penalty)	35009	35009	35009
No work 6 years (wage penalty)	35009	35009	35009

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

Graph 14 illustrates the simulated pension assessment bases of a women with an education attainment level ISCED 3-4. As the child credit is credited over a period of 16 years, the pension bases increases. In case of full work interruption, compensates the child credit the decline in the pension assessment nearby full. A full compensation is achieved at wages which are related to a low educational attainment level. Pension assessment bases, which are related to wages of a high educational attainment level are not fully compensated. However, the above-average wage levels mean that the maximum pension can be reached in spite of an interruption in employment. In addition, the conversion rate of 2.1 has a strong upward effect. The kink at age 30 is due to maternity leave. During this period, only 80% of the salary is paid, and the contribution to the first pillar is correspondingly lower.

Graph 14: First pillar pension assessment base of the reference set at age of 30
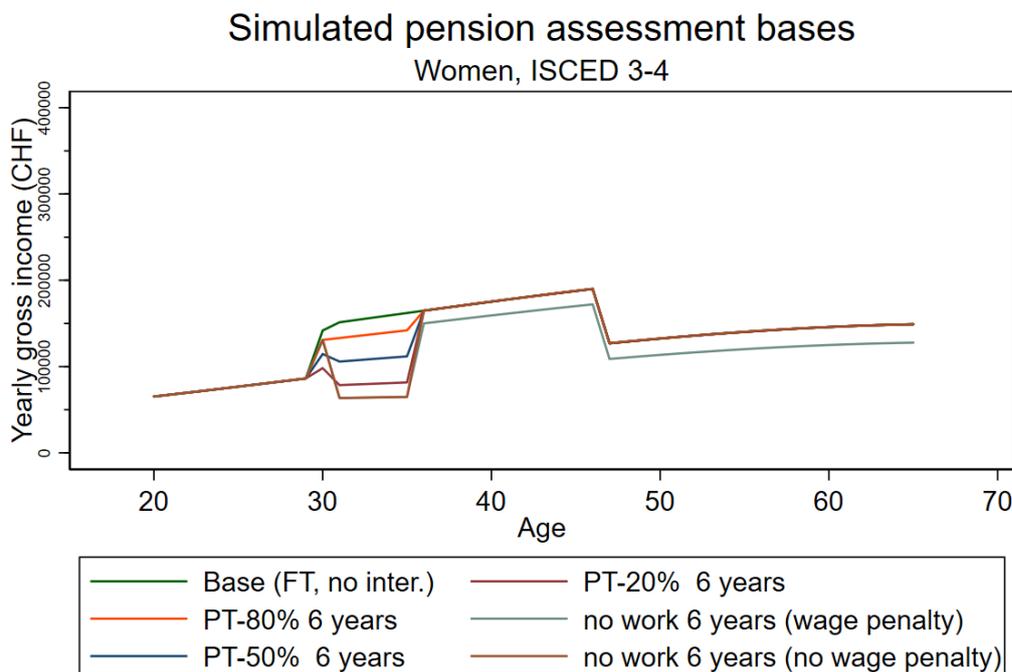
Source: Own simulations.

Table 50 presents the simulated pension amounts of the second pillar. As the second pillar does not include compensation mechanisms such as care credits, continued payment of contributions in the event of unemployment or a corridor on pension income (achieved through redistribution), the different levels of pension income reflect differences in income according to level of education, level of employment and length of employment.

Table 50: Reference set: pension amounts (Second pillar pension income)

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	17342	22943	32014
PT 80% 6 years	16943	22395	31282
PT 50% 6 years	16344	21573	30184
PT 20% 6 years	15746	20752	29085
No work 6 years (no wage penalty)	15347	20204	28353
No work 6 years (wage penalty)	14212	17933	23334

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

Table 51 shows the impact of part time work, which results in a reduction in pension income in the second pillar between -2.3% in the case of 80% PT and -9.2% in the case of 20% PT for six years (in case with a low educational attainment level). As a rule of thumb, it can be said that a reduction of 20% in working hours over a period of six years leads to an approximate reduction of 2% in pension income from the second pillar. However, in the case of a full interruption scenario, the decline is much greater. Without wage penalty, the decline is about 11%, regardless of the level of education.[31] With wage penalty, the decline is much stronger, the higher the wage increase over the lifetime. In the case of high educational attainment level, the effect of the wage penalty is about 16pp, of a low educational attainment level the effect is about 6 pp.

Table 51: Reference set: pension amounts as percentage of pension for base scenario (Second pillar pension income)

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	97.70	97.61	97.71
PT 50% 6 years	94.25	94.03	94.28
PT 20% 6 years	90.80	90.45	90.85
No work 6 years (no wage penalty)	88.49	88.06	88.56
No work 6 years (wage penalty)	81.95	78.16	72.89

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

Table 51 illustrates the impact of the different choices on the simulated pension assessment bases of the second pillar. The wage penalty in the case of a total interruption of work has a stronger economic impact than the interruption of work itself, as it has an impact on the wage income of the rest of working

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[31] If the interruption is later in the career, the impact varies across educational attainment levels. See reference set with choices at age of 54.

life. This effect is stronger the more curved the income profile is (the greater the wage the wage increase over the lifetime). If a higher nominal wage growth would have been assumed in the simulation, the effect of the wage penalty would be much stronger.

Graph 15: Second pillar pension assessment base of the reference set at age of 30
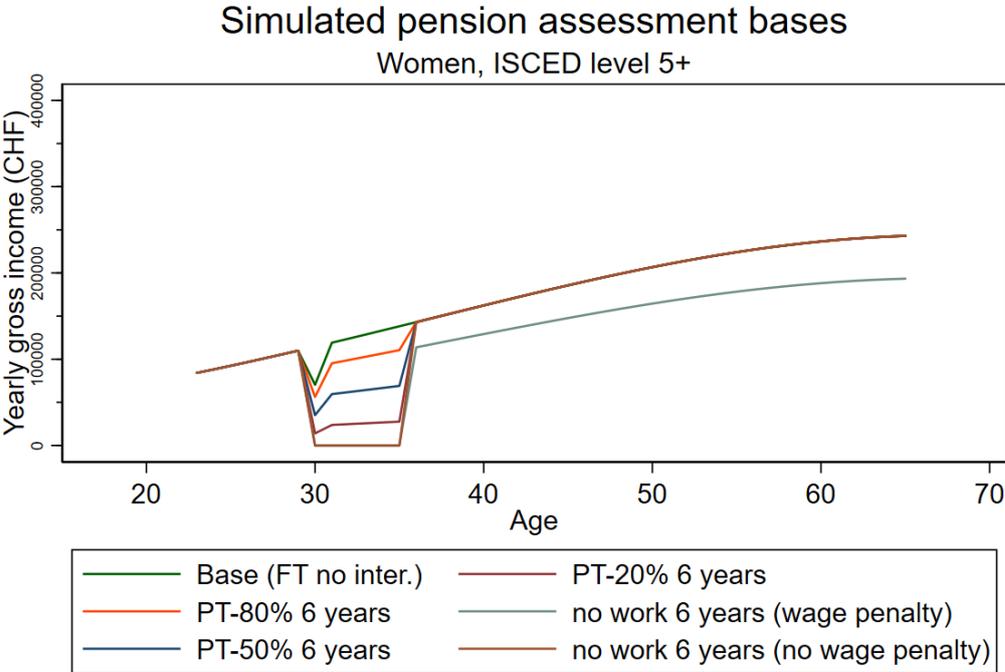
Source: Own simulations.

10.1 Variant set 1: About the role of parenthood pension-related policies

Table 52 presents the simulated pension amounts of the first pillar without childcare credits. Due to the underlying high conversion factor of 2.1 does neither part time work nor full time interruption lead to pension losses. However, if a lower conversion factor were to be applied, part-time work and career breaks would lead to lower first-pillar pensions, at least at lower levels of educational attainment.

Table 52: Variant set 1: pension amounts (First pillar pension income)

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	35009	35009	35009
PT 80% 6 years	35009	35009	35009
PT 50% 6 years	35009	35009	35009
PT 20% 6 years	35009	35009	35009
No work 6 years (no wage penalty)	35009	35009	35009
No work 6 years (wage penalty)	35009	35009	35009

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

Since no childcare credits are granted under the second pillar, pension income does not change either. For this reason, no additional table is provided here.

10.2 Variant set 2: Experiencing an unemployment spell

Table 53: Variant set 2 (unemployment): First pillar pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	100.00	100.00	100.00
PT 50% 6 years	100.00	100.00	100.00
PT 20% 6 years	100.00	100.00	100.00
No work 6 years (no wage penalty)	100.00	100.00	100.00
No work 6 years (wage penalty)	100.00	100.00	100.00

Reference set:
Woman, age at interruption 30, reason for interruption childbirth, three year unemployment spell (start at age 26), retirement at statutory retirement age.

Table 54: Variant set 2 (unemployment): First pillar pension amount as percentage of pension for the same option in the reference scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	100.00	100.00	100.00
PT 50% 6 years	100.00	100.00	100.00
PT 20% 6 years	100.00	100.00	100.00
No work 6 years (no wage penalty)	100.00	100.00	100.00
No work 6 years (wage penalty)	100.00	100.00	100.00

Reference set:
Woman, age at interruption 30, reason for interruption childbirth, three year unemployment spell (start at age 26), retirement at statutory retirement age.

Graph 16 illustrates the combined compensatory effect of the payment of unemployment benefit and the crediting of childcare. Persons elder than 25 years receive an allowance of 80% of the insured earnings for a maximum of 260 daily allowances. Since the daily allowances are handled accordingly for the insurance contribution obligation, the ALV deducts the contribution share from the compensation for wages and salaries and pays it together with the employer's share to be paid by it. This measure helps to avoid losses in the pension career. In the graph this can be seen as a "notch" for one year after the beginning of unemployment. After the 280-day period, the minimum contributions are paid to the first pillar, so that there are no first-pillar contribution gaps during this period. This minimum contribution is depicted by the low pension assessment bases between the ages of 27 and 28. The further course of the curve shows the childcare credits, which are granted for a period of 16 years. It is interesting to note

how both phases of career interruption (due to unemployment and maternity) increase the wage penalty. Since the wage penalty starts early and extends over the entire working life, the wage curve is significantly lower. However, these lower earned incomes are offset by the compensation mechanisms of the first pillar under the assumptions made (in particular the revaluation factor), so that there is no loss of pension income under the first pillar (see Table 54).

Graph 16: First pillar pension assessment base of the reference set at age 30, variant set unemployment.
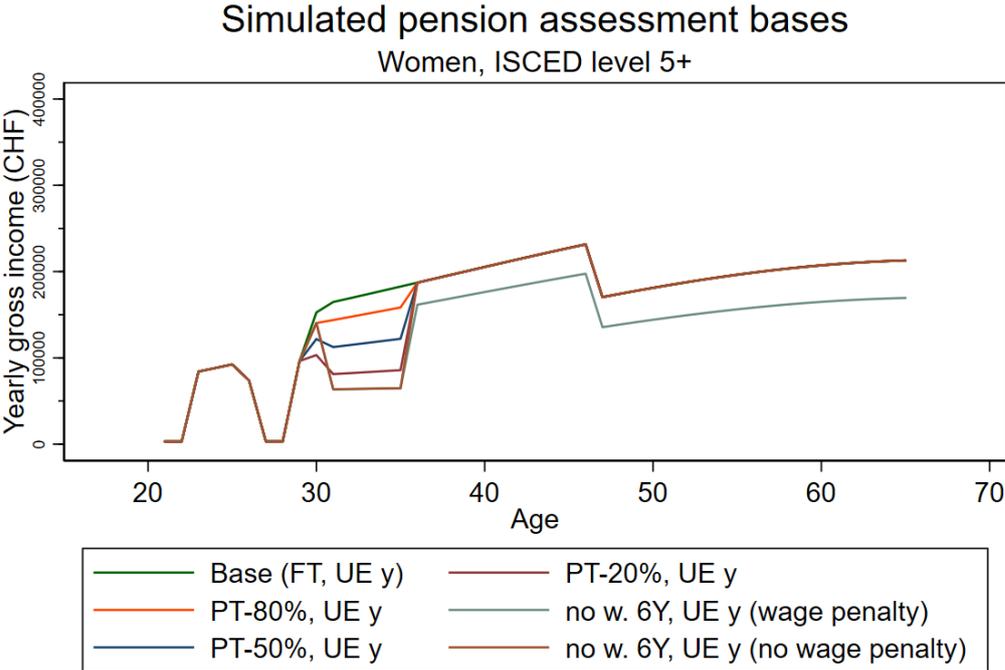
Source: Own simulations.

However, the consequences of this loss of earning become apparent in the case of second pillar pension income. Compared with the reference scenario, pension income falls significantly in the event of two interruptions in employment, as no contributions are paid during these phases. Depending on the educational attainment level, pension income falls between 10pp and 18pp (see Table 56).

Table 55: Variant set 2 (unemployment): Second pillar pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	97.57	97.49	97.60
PT 50% 6 years	93.92	93.73	94.01
PT 20% 6 years	90.26	89.96	90.41
No work 6 years (no wage penalty)	87.83	87.45	88.02

No work 6 years (wage penalty)	80.91	77.04	71.59

Table 56: Variant set 2 (unemployment): Second pillar pension amount as percentage of pension for the same option in the reference scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	90.20	87.05	83.64
PT 80% 6 years	90.07	86.95	83.55
PT 50% 6 years	89.88	86.77	83.40
PT 20% 6 years	89.67	86.58	83.24
No work 6 years (no wage penalty)	89.52	86.45	83.13
No work 6 years (wage penalty)	89.05	85.81	82.16

Graph 17 shows the simulated pension assessment bases of the second pillar. Since no contributions are paid in the event of unemployment and maternity leave, there are gaps in contributions. These lower contribution payments are reinforced in the event of unemployment by the "double" wage penalty.

Graph 17: Second pillar pension assessment base of the reference set at age 30, variant set unemployment.
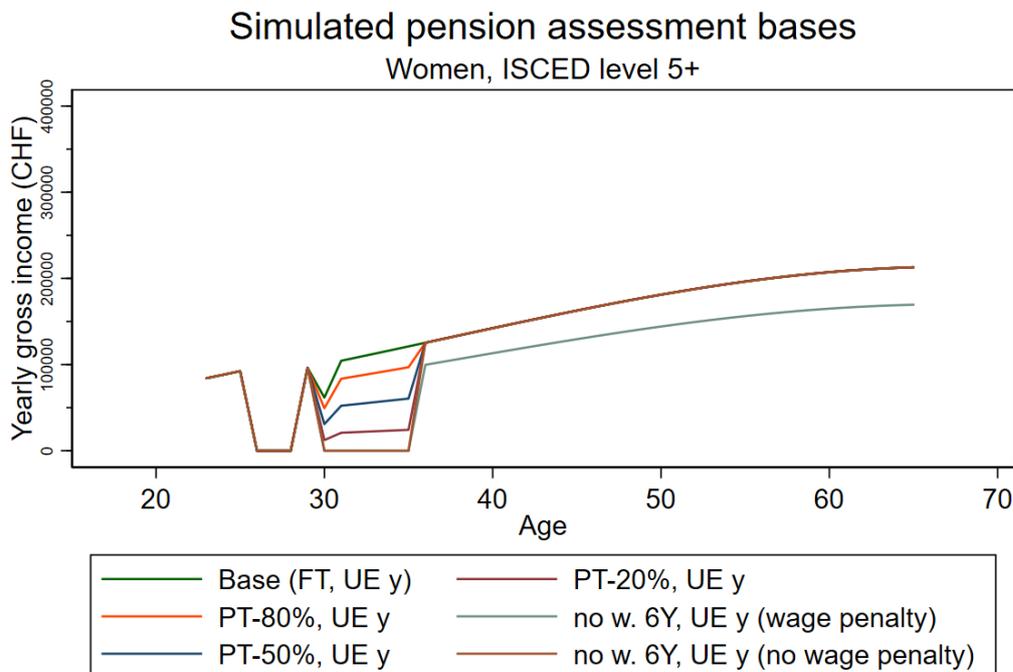
Source: Own simulations.

10.3   Variant set 3: The impact of early retirement

In the event of early retirement, a different conversion table is applied for the first pillar. In the simulated example, the conversion table is applied with 42 years. This results in pensions being reduced evenly. Table 57 shows this even impact of early retirement (SRA-2) on fist pillar pension income as percentage of first pillar pension income for the base scenario.

Table 57: Variant set 3 (early retirement): First pillar pension amount as percentage of pension for base scenario

| | Education | | |
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	100.00	100.00	100.00
PT 50% 6 years	100.00	100.00	100.00
PT 20% 6 years	100.00	100.00	100.00
No work 6 years (no wage penalty)	100.00	100.00	100.00
No work 6 years (wage penalty)	100.00	100.00	100.00

Reference set:
Woman, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

As a rule of thumb, the pension income of the first pillar is reduced by 1/44 for each missing contribution year. If two contribution years are missing, as assumed, this results in a reduction of 2/44, i.e. approximately 4.6 pp, which corresponds to the results of Table 58.

Table 58: Variant set 3 (early retirement): First pillar pension amount as percentage of pension for the same option in the reference scenario

| | Education | | |
Option	Low	Medium	High
Base (FT work, no interruption)	95.45	95.45	95.45
PT 80% 6 years	95.45	95.45	95.45
PT 50% 6 years	95.45	95.45	95.45
PT 20% 6 years	95.45	95.45	95.45
No work 6 years (no wage penalty)	95.45	95.45	95.45
No work 6 years (wage penalty)	95.45	95.45	95.45

Reference set:
Woman, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

In the second pillar pension system, early retirement results in a lower conversion rate, which in turn results in lower pension income. This results in pensions being reduced evenly.

Table 59: Variant set 3 (early retirement): Second pillar pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	97.58	97.50	97.59
PT 50% 6 years	93.94	93.76	93.97
PT 20% 6 years	90.30	90.01	90.35
No work 6 years (no wage penalty)	87.88	87.51	87.94
No work 6 years (wage penalty)	81.49	77.81	72.52

Reference set:
Woman, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

Table 60 shows this even impact of early retirement (SRA-2) on second pillar pension income as percentage of second pillar pension income for the reference scenario.

Table 60: Variant set 3 (early retirement): Second pillar pension amount as percentage of pension for the same option in the reference scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	88.94	89.59	88.89
PT 80% 6 years	88.83	89.49	88.78
PT 50% 6 years	88.65	89.33	88.60
PT 20% 6 years	88.46	89.15	88.41
No work 6 years (no wage penalty)	88.32	89.03	88.27
No work 6 years (wage penalty)	88.45	89.19	88.45

Reference set:
Woman, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, early retirement.

10.4   Variant set 4: Analyzing the impact of gender

Table 61 and Table 62 illustrate the impact of gender specific wage curves on pension income. Due to the ceiling of the maximum pension income do higher earnings not result in higher first pillar pensions (see Table 62). Furthermore shows Table 61, that the pillar pension income does not show any differences in terms of the extent of employment or the level of education due to the crediting of child-raising periods, the minimum contribution to the first pillar in case of interruptions as well as the impact of the conversion factor, which in turn compensates for spells with lower income.

Table 61: Variant set 4 (men): First pillar pension amount as percentage of pension for base scenario

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	100.00	100.00	100.00
PT 50% 6 years	100.00	100.00	100.00
PT 20% 6 years	100.00	100.00	100.00
No work 6 years (no wage penalty)	100.00	100.00	100.00
No work 6 years (wage penalty)	100.00	100.00	100.00

Reference set:
Man, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 62: Variant set 4 (men): Reference set for men: First pillar pension amount as percentage of pension for the equivalent scenario for women

Option	Education		
	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	100.00	100.00	100.00
PT 50% 6 years	100.00	100.00	100.00
PT 20% 6 years	100.00	100.00	100.00
No work 6 years (no wage penalty)	100.00	100.00	100.00
No work 6 years (wage penalty)	100.00	100.00	100.00

Reference set:
Man, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 63 presents the simulated second pillar pension amount as percentage of the base scenario. As the second pillar does not include compensation mechanisms such as care credits, continued payment of contributions in the event of unemployment or a corridor on pension income (achieved through redistribution), the different levels of pension income reflect differences in income according to level of education, level of employment and length of employment.

Furthermore illustrates Table 64 the impact of the differences between the wage curves of women and men on the simulated pension assessment bases of the second pillar. As the wage curve of men is more curved than the income profile women, is the effect of wage penalty on pension income more severe than in the comparable case (see Table 51).

Table 63: Variant set 4 (men): Second pillar pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	97.64	97.75	97.78
PT 50% 6 years	94.10	94.38	94.45
PT 20% 6 years	90.57	91.00	91.12
No work 6 years (no wage penalty)	88.21	88.75	88.90
No work 6 years (wage penalty)	80.39	75.46	68.91

Reference set:
Man, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

A comparison of the second pillar pension income between man and women is given by Table 64. If no wage penalty occurs, show the pension incomes the same gap as the average simulated gross earnings, which amounts to approximately 18% across all educational attainment levels (see Table 10). Table Table 64 thus illustrates how differences in earned income are reflected in pension income in a system without compensation mechanisms.

Table 64: Variant set 4 (men): Reference set for men: Second pillar pension amount as percentage of pension for the equivalent scenario for women

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	118.47	116.19	118.41
PT 80% 6 years	118.41	116.35	118.49
PT 50% 6 years	118.29	116.61	118.62
PT 20% 6 years	118.18	116.90	118.75
No work 6 years (no wage penalty)	118.09	117.10	118.85
No work 6 years (wage penalty)	116.23	112.18	111.94

Reference set:
Man, age at interruption 30, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

11 Analyzing the impact of elderly care on pension income

Table 52 presents the simulated pension amounts of the first pillar for the reference set. First pillar pension income does not show any differences in terms of the extent of employment or the level of education, since spells with lower income are compensated by the system.

Table 65: Reference set; choice at age 54: pension amounts (First pillar pension income)

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	35009	35009	35009
PT 80% 6 years	35009	35009	35009
PT 50% 6 years	35009	35009	35009
PT 20% 6 years	35009	35009	35009
No work 6 years (no wage penalty)	35009	35009	35009
No work 6 years (wage penalty)	35009	35009	35009

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty
unless otherwise mentioned, retirement at statutory retirement age.

Graph 18 illustrates the simulated pension assessment bases of a women with an education attainment level ISCED 5+. The care credit compensates nearby a loss of earnings with a reduction towards 50 % PT.

Graph 18: First pillar pension assessment base of the reference set at age of 54
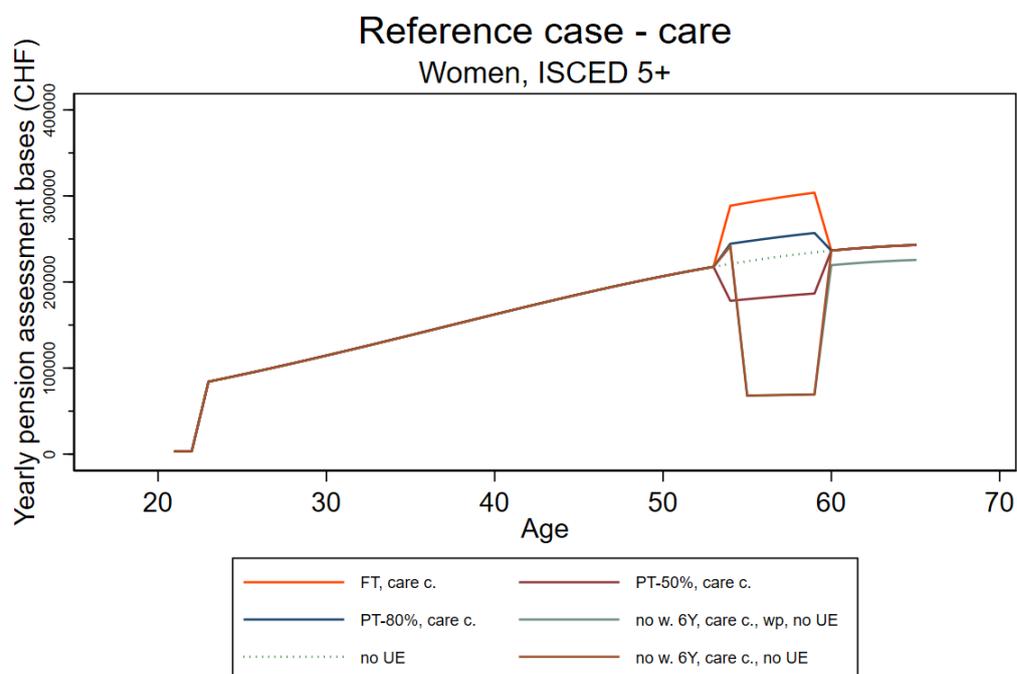
Source: Own calculations.

Table 66: Reference set; choice at age 54: First pillar pension amount as percentage of pension for base scenario

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	100.00	100.00	100.00
PT 50% 6 years	100.00	100.00	100.00
PT 20% 6 years	100.00	100.00	100.00
No work 6 years (no wage penalty)	100.00	100.00	100.00
No work 6 years (wage penalty)	100.00	100.00	100.00

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 67: Reference set; choice at age 54: First pillar 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	100.00	100.00	100.00
PT 50% 6 years	100.00	100.00	100.00
PT 20% 6 years	100.00	100.00	100.00
No work 6 years (no wage penalty)	100.00	100.00	100.00
No work 6 years (wage penalty)	100.00	100.00	100.00

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Table 68 presents the simulated pension amounts of the second pillar. As the second pillar does not include compensation mechanisms such as care credits, continued payment of contributions in the event of unemployment or a corridor on pension income (achieved through redistribution), the different levels of pension income reflect differences in income according to level of education, level of employment and length of employment.

Table 68: Reference set; choice at age 54: pension amounts (Second pillar pension income)

	Education		
Option	Low	Medium	High
Base (FT work, no interruption)	17477	23124	32248
PT 80% 6 years	16983	22481	31215
PT 50% 6 years	16243	21516	29666
PT 20% 6 years	15502	20551	28117
No work 6 years (no wage penalty)	15008	19908	27084
No work 6 years (wage penalty)	14697	19747	26724

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty unless otherwise mentioned, retirement at statutory retirement age.

Since wages are higher towards the end of the career, a reduction in working hours leads to a comparatively greater decline in pension income. This effect is the stronger the higher the level of education and the more extensive the reduction in working hours (Table 69).

Table 69: Reference set; choice at age 54: Second pillar pension amount as percentage of pension for base scenario

| | Education | | |
Option	Low	Medium	High
Base (FT work, no interruption)	100.00	100.00	100.00
PT 80% 6 years	97.17	97.22	96.80
PT 50% 6 years	92.94	93.05	91.99
PT 20% 6 years	88.70	88.87	87.19
No work 6 years (no wage penalty)	85.87	86.09	83.99
No work 6 years (wage penalty)	84.09	85.40	82.87

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty
unless otherwise mentioned, retirement at statutory retirement age.

Table 70 shows the results of a comparison of table Table 68 with the results of Table 50, which contains the simulated retirement benefits if one faces the same choices at the age of 30. The effect of the wage penalty is less pronounced in the case of a later interruption of employment, since the wage penalty at age of 54 is effective only for five years (65-60), whereas the wage penalty at age of 30 affects 30 years (65-35). As the wage curve is more concave, the higher the educational attainment level, this effect is more pronounced for those with high education.

Table 70: Reference set; choice at age 54: Second pillar 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)	100.78	100.79	100.73
PT 80% 6 years	100.24	100.38	99.79
PT 50% 6 years	99.38	99.73	98.29
PT 20% 6 years	98.45	99.03	96.67
No work 6 years (no wage penalty)	97.79	98.53	95.52
No work 6 years (wage penalty)	103.41	110.12	114.52

Reference set:
Woman, age at interruption 54, pension credit for work interruptions, no unemployment, no wage penalty
unless otherwise mentioned, retirement at statutory retirement age.

List of Abbreviations

AHV – Alters- und Hinterbliebenenversicherung (same as OASI)

AHVG - Alters- und Hinterbliebenenversicherung Gesetz

ALV – Arbeitslosenversicherung / Unemployment Insurance

ALVG – Arbeitslosenversicherung Gesetz / Unemployment Insurance Law

BPVG - Betriebliches Personalvorsorge Gesetz / Company Pension Law

BV – Pension provision?

CHF – Swiss Franc

DC – Defined Contribution

DI – Invalidity Insurance

EheG – Ehegatten Gesetz?

EUROMOND – a static model?

FAK – Family Allowance

GWR – Gebäude- und Wohnregister / Building and residential registers

ISCED - International Standard Classification of Education

OASI – Old Age and Survivors' Insurance

MIGAPE - Mind the Gap in Pensions

MiLiPE – Microsimulation Model of the Liechtenstein Pension System

MSM – Microsimulation Model

PAYG – pay-as-you-go

PT – Part-Time

SB – Supplementary Benefits

SRA – Statutory Retirement Age

UI – Unemployment Insurnace

ZPR – Zentral Pensionsregister / Central Pension Register

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