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Actuarial Neutrality and Financial Incentives for Early Retirement in the Austrian Pension System

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Abstract

This paper takes a closer look at the existing early retirement schemes in Austria and analyses whether early retirement imposes a financial burden on the pension system (actuarial neutrality). Additionally, we compute incentive-neutral deductions for early retirement. These deductions reflect the view of the individual, who faces option of retiring earlier or working another year. Incentive neutral deductions would imply that an individual is indifferent between both. Our results highlight substantial differences between both measures. While the current deduction rate of 5.1% in the Austrian age corridor is, on average, close to actuarial neutrality, it is lower than the incentive-neutral deductions. This indicates that there are financial incentives for early retirement, which may arise due to the Austrian tax system. Additionally, we show that both actuarial and incentive neutrality differ substantially across socio-economic characteristics, such as gender, wages and (early) retirement age.

Keywords

Pension System, Actuarial Neutrality, Incentive Neutrality, Deductions, Early Retirement

I. Introduction

Austria is among the countries with the lowest effective and statutory retirement ages among OECD member states, as highlighted by the OECD (2013). The pension system in Austria is, as in most developed countries, significantly affected by low fertility rates and increasing life expectancy, which in turn increase the number of pensioners and decrease the size of the workforce. In light of the generosity of the Austrian pension system, the effective retirement age has significantly decreased over the last three decades of the previous century (see Figure 1). This negative trend has been compensated by the pension reforms of 2003 and 2004, which led to a reduction in pension benefits compared to the former system and a reduction in early retirement possibilities. Nevertheless, the notional defined benefit (NDB) system, based on the 45/65/80 pension formula, still indicates

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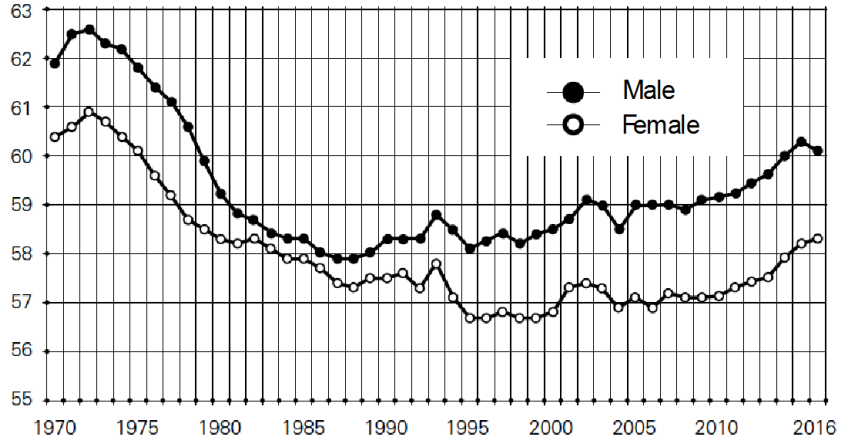
a generous replacement rate: a person retiring at the official retirement age of 65 and after 45 years of contributions to the system is entitled to a pension benefit of 80% of his or her lifetime income (unaffected by increasing life expectancy).

Figure 1: Average pension age in Austria (including rehabilitation)



Source: Main Association of Austrian Social Security Organizations

Since the major pension reforms of 2003 and 2004, the Austrian pension system has taken lifetime earnings into account. Even though this has lowered the expected financial burden on the pension system, there is an ongoing discussion about the sustainability of the Austrian pension system, given the demographic changes. The ageing of society and the ongoing retirement of the baby-boom generation will impose an additional burden in the system in the near future. New long-term projections by the European Commission expect that the expenditures on pension in Austria will increase from 13.8% in 2016 to 14.9% in 2040. Additionally, health care and long-term care expenditures are expected to rise. This signals that – without reforms – the demographic change will necessitate additional government revenues to finance the needs of the elderly population.

Early retirement could significantly influence the financial sustainability of the pension system. The aim of this paper is to take a closer look at the existing early retirement schemes in Austria and analyse whether early retirement imposes a financial burden on the pension system (actuarial neutrality). This has important policy implications. If the early retirement schemes are actuarially neutral, an increase in the effective retirement age will not influence the financial sustainability of the pension system in the long run.

Additionally, we calculate incentive-neutral deductions for early retirement. These deductions reflect the view of the individual who faces the retirement situation. To the best of our knowledge, there is no paper that has investigated the difference between actuarially neutral adjustments based on gross pension and individual incentive neutrality based on net pension entitlements. Our results show that these incentive-neutral deductions are higher than the actuarially neutral ones, indicating that there are substantial incentives in

the Austrian system, mainly due to the tax system. Our paper additionally contributes to the ongoing discussion by interrogating how those actuarially neutral deductions differ in terms gender, income groups and the time of the retirement decision. This allows us to conclude which groups profit more from early retirement.
The paper is structured as follows. Section II introduces the concepts of actuarial fairness, actuarial neutrality and incentive neutrality. Section III provides a short overview of the Austrian pension system. In Section IV, the model used to calculate actuarial and incentive neutrality is presented. Section V highlights the results of the model, while Section VI concludes the paper.

II. Actuarial fairness, actuarial neutrality and incentive neutrality

Policymakers and economists distinguish between different actuarial designs within a pension system. Following Börsch-Supan (2004) and Queisser and Whitehouse (2006), we differentiate between three key concepts: actuarial fairness, actuarial neutrality and individual incentive neutrality. Contrary to actuarial fairness, actuarial neutrality and individual incentive neutrality concern the pension decision at a given time point. Actuarial neutrality is a concept that is strictly related to the pension system. The system is actuarially neutral if its budget is not affected by individuals' retirement decision. Although the pension system might be indifferent towards an individuals' decisions (no effect on financial stability), they may still not be indifferent towards retiring or working an additional year. Hence, financial incentives (level of interest rate, the tax system, preferences) play a crucial role in the individual's retirement decision.

- *Actuarial fairness* contrasts the contributions paid and benefits received over an individual's whole working life and retirement, respectively. In an actuarially fair pension system, there is no redistribution towards and away from an individual, while lifetime pension entitlements equal lifetime contributions.
- *Actuarial neutrality* is a marginal concept that computes the effect of an extension to working life by an additional year. In an actuarially neutral pension system, the pension wealth of individuals retiring at different ages is the same, i.e., from the perspective of the pension system, the pension wealth for retiring one year later equals the pension wealth for retiring today adjusted with the pension entitlement earned during that year.
- *Individual incentive neutrality* is also a marginal concept that studies the retirement decision from the perspective of an individual. In an incentive-neutral pension system, individuals with different ages and contribution histories should be indifferent towards retiring or working an additional year when facing the retirement decision. The idea of incentive-neutral deductions from a theoretical point of view has been discussed in Börsch-Supan (2004), who stated that it lies in the eye of the beholder, whose deductions are the "right" ones.

Actuarial fairness is based on the concept of fairness over the whole lifespan. The idea is that an individual accumulates pension wealth with his or her own contributions. Pension entitlement is then based on one's contributions to the system and the expected

duration of the pension claim. This means that the person expects, at the beginning of the contributions, to receive the same amount of the cumulated pension as the payout as he or she has contributed over his or her working lifetime. This requirement is not met by the Austrian pension system. In Austria, everyone with the same income history receives the same pension benefit despite the fact that the statistical duration of receiving the benefit varies significantly across age groups due to an increase in life expectancy. To overcome this problem, it will be necessary to adapt the pension formula to the statistical increase in longevity. According to Christl and Kucsera (2015) or Knell (2013), a yearly increase in the statutory retirement age of two months could overcome this problem concerning the unequal treatment of different cohorts.

As the Austrian pension system is not automatically adjusted to changes in life expectancy, it cannot be actuarially fair. To ensure that the system becomes and stays actuarially fair, the pension formula needs to be adapted each year. Knell (2013) shows that an adoption of a pension formula that implies an increase in the retirement age could mimic a notional defined contribution (NDC) within the Austrian pension system, therefore leading to actuarial fairness.

In our paper, we focus on the actuarial neutrality and individual incentive neutrality of the pension corridor in the Austrian pension system (the so called Korridor-Pension). This early retirement scheme allows a retirement between 62 and 68 years with at least 40 years of insurance contributions. Since most of the other early retirement schemes will be abolished within the coming years, the pension corridor will gain more importance in the retirement decision of individuals. Therefore, two points are of interest: first, whether the deductions are actuarially neutral, meaning that the pension system budget is not affected by individuals' retirement decision; second, whether actual deductions provide individuals with incentives to retire or remain in the workforce.

Early retirement should not impose an additional burden on the pension system and simultaneously guarantee equal treatment for individuals and age cohorts. In this paper, we investigate the actuarial and individual incentive neutrality of the pension system in Austria. We focus on the age corridor ("Korridorpension"), which allows for early retirement. The earliest legal age for age corridor entitlement is 62 years. For every year of early retirement before the age of 65, the gross pension benefit is reduced by 4.2% (5.1% from 2017). Previous research has focused mainly on actuarially neutral deductions for pension benefits in the Austrian pension system (see, e.g., Brunner et al. (2010) or Queisser and Whitehouse (2006)), which is important for a balanced pension system. Annual deductions, based on this measure, guarantee that early retirement does not affect the financial stability of the system. If the actuarially neutral deduction is above (below) the official level, early retirement imposes a financial burden (advantage) on the pension system.

Even if actuarial neutrality is achieved, people may prefer to choose early retirement because the money they receive is not the money the pension system pays out (taxation). Hence, in this paper, we additionally study the effect of taxation on pension retirement. If taxation is taken into account, deductions calculated for net pension entitlements reflect the level at which insured individuals are indifferent towards retiring or working an additional

year. If this deduction is above (below) the official level, people have more (fewer) financial incentives to retire, since longer working would result in a financial loss (benefit) for them. To the best of our knowledge, there is no paper that investigates the difference between actuarially neutral adjustments based on gross pension and individual incentive neutrality based on net pension entitlements. Higher and more progressive taxation leads to proportionally fewer earnings for each additional year of work, in turn increasing the incentive to retire. Therefore, a higher and more progressive tax system might increase the difference between the two measures. Therefore, the tax system in Austria could contribute to the low effective retirement age.

III. The Austrian pension and tax systems

For our analysis, both the pension system itself and the tax system play a crucial role. For the calculation of actuarial neutrality, we need to calculate the present value of gross pension entitlements. Detailed information on the pension system is needed for this purpose. For incentive neutrality, we must calculate net pension entitlements. Therefore, we need to know more about the tax system. Both the Austrian pension and the Austrian tax systems are described in this section.

The Austrian pension system

In this subsection, we seek to provide an overview of the legal framework for the current Austrian pension system. In a second step, we will place the Austrian pension system in an international framework in order to see how and in what ways the system differs from pension systems in other countries.

The legal framework

The Austrian pension system is based on the General Social Security Act (Allgemeines Sozialversicherungsgesetz) and covers most participants in the labour market.[3] The public pension system is financed in three parts: contributions of the workforce, supplementary transfers[4] and a state subsidy, which currently makes up approximately a quarter of the overall yearly expenditure.

In Austria, the contribution rate to the pension system is 22.8% of employees' gross earnings. The contribution rate is split between 10.25% paid by the employee and 12.55% paid by the employer. The contribution is paid up to an upper threshold of 5,130 EUR in terms of gross salary; for earnings above this threshold, no social security contribution is paid. The contribution rate has been stable over the last three decades, while the upper threshold earnings for full contribution have increased approximately in line with average wage growth.[5]

[3] There is still an ongoing harmonization of the pension system for public employees. Until 2003, final income was considered as the basis for the pension calculation of a public employee. Since 2003, the period for the calculation of the pension base has increased gradually. In 2028, the pension base will be computed based on the average income of the last 40 years.

[4] For example, the Public Employment Service Austria (AMS) pays the contributions for the unemployed.

[5] See Hofer and Koman (2006).

The overall system is a notional defined benefit (NDB) system, which is based on the 45/65/80 pension formula. The formula states that, after 45 years of insurance and at the retirement age of 65, the Austrian pension system guarantees a pension entitlement corresponding to 80% of average lifetime income. This formula results in an accrual rate of 1.78% every year (80/45) into the pension account. Past contributions are adjusted by the growth rate of the average contribution base and pensions by the inflation rate.

The statutory retirement age for the pension in Austria is 60 years for women and 65 for men. The Austrian pension system offers various ways to retire before the statutory retirement age. Many of them will be eliminated or amended within the next few years. Early retirement is most commonly used through the age corridor ("Korridorpension") and the heavy labour pension ("Schwerarbeiterpension"). In 2016, 65,200 people (excluding invalidity pension recipients) retired in Austria according to the Federal Ministry of Labour, Social Affairs and Consumer Protection (BMASK). Approximately 57% retired at or after the official retirement age of 65 for men and 60 for women, while 18% (11,747) used the heavy labour pension and more than 11% (7,426) used the age corridor to retire before the official retirement age. Additionally, 16,776 people were eligible for an invalidity pension. The age corridor scheme is attainable only for individuals aged between 62 and 68 years with at least 40 years of insurance contributions. The deduction for every year of early retirement is 5.1% of the gross pension earnings. The annual supplements for working longer than the statutory retirement age are also 5.1% per year up to an upper threshold of 91.76% for the initial pension. The heavy labour pension allows for a person with 45 years of contributions to retire at the age of 60, if at least 10 years of the contributions made in the last 20 years stem from work in heavy labour. The annual deduction in this case is 1.8%. Since the statutory retirement age of women is still 60 and will increase incrementally in the period between 2024 and 2032 to 65 years, both the corridor pension and the heavy labour pension will be not attainable for women before 2028 and 2024, respectively.

An international comparison of the Austrian pension system

When making an international comparison with the different pension systems (see Table 1), the Austrian NDB scheme has a high accrual rate of 1.78% per year compared to other countries. Additionally, Austria is one of the few countries where the earnings measure of the system still does not match the average lifetime average. The valorization of the pension account is, similar to other countries, based on wage growth, while pensions are typically uprated by inflation (even though, in recent years, there has been discretionary uprating depending on the level of the pension). The Austrian pension system has no automatic link to life expectancy, implying that increases in life expectancy increase the financial burden on the pension system.

All those factors discussed above already show that the Austrian pension system is highly dependent on demographic changes. The Austrian state is, by law, obliged to close the gap between contributions paid into the pension system by the working population and pensions paid out to pensioners. Therefore, demographic changes automatically influence the expenditure of the central government in Austria and are therefore highly relevant.

Additionally, the costs of the pension system in Austria (measured as a percentage of GDP) are among the highest within the European Union and estimated to increase further in the coming years.

Table 1: An international comparison of the Austrian Pension System

Country	Type	Accrual rate (in %)	Earnings Measure	Valorization	Indexation	Link to life exp.
Austria	DB	1.78	28–40	w	d	
Belgium	DB	1.33	L	p	p	
Denmark	DC					x
Finland	DB	1.5	L	80w/20p	20w/80p	x
France	DB/points	1.12	b25/L	p/p	p/p	x
Germany	Points	1.00	L	w [c]	w [c]	x
Italy	NDC	1.46	L	GDP	p	x
Netherlands	DB	1.85	L	w [c]	w [c]	x
Norway	NDC	0.94	L	w	w – 0.75	x
Portugal	DB	2.3–2 [w]	L	25w/75p	p/GDP	
Spain	DB	1.82 [y]	f25	p	0.25% to p + 0.5%	x
Sweden	NDC	0.95 [w]	L	w	w-1.6 [c]	x

Source: OECD, Pension at a Glance 2017 and EC 2018 Ageing Report

Remark: Parameters are for 2016, but include all legislated changes that will take effect in the future: for example, some countries are extending the period of earnings covered for calculating benefits. Empty cells indicate that the parameter is not relevant.
[a] = varies with age; b = number of best years; [c] = valorization/indexation conditional on financial sustainability; d = discretionary indexation; DB = defined benefit; DC = defined contribution; f = number of final years; fr = fixed rate valorization; GDP = growth of gross domestic product; L = lifetime average; NDC = non-financial accounts; p = valorization/indexation with prices; w = valorization/indexation with average earnings; [w] = varies with earnings; [y] = varies with years of service.
Austria: Valorization assumed to move to earnings as the averaging period for the earnings measure is extended. Italy: Indexation is fully linked to prices for low pensions and 75% of prices for higher pensions. Portugal: Indexation will be higher, relative to prices for low pensions and vice versa. The higher the GDP growth, the more generous the indexation.

Measures to limit the costs of the pension system are constantly being discussed. This includes an increase in the statutory retirement age as well as an increase in the effective retirement age. But an increase in the effective retirement age will only reduce expenditure if the deductions for early retirement are higher than actuarial neutrality. There are several papers that analyse the actuarial neutrality of early retirement regimes. Freudenberg et al. (2018) calculate these actuarially neutral deductions for several European countries

and show that, in most of the 19 analysed countries, early retirement schemes are not actuarially neutral, indicating that not only are financial incentives high for retiring early, but also that early retirement influences the budget of the pension systems significantly in several European countries. Table 2 gives an overview of their results.

Table 2: Neutral and official deduction rates for one year of early retirement (in %)

	Actuarial neutral	Official	Difference
Austria	5.3	5.1 (4.2)	0.2 (1.1)
Belgium	5.5	0.0	5.5
Czech Republic	6.4	3.6	2.8
Slovenia	5.8	3.6	−2.2
Germany	4.9	3.6	1.3
Finland	1.5	0.0	1.5
France	5.0	5.0	0.0
Portugal	4.7	4.8	−0.1
Spain	3.3	8.0	−4.7
Slovakia	4.3	6.0	−1.7

Source: Freudenberg et al. (2018)
Remark: The Austrian deduction changed to 5.1% in 2017.

We can also see that Austria is one of the countries where, since 2017, actuarial neutrality and actual deductions are close to each other.

The Austrian tax system

The pension benefits in the Austrian tax system are taxed in the same way as labour income. Since social security contributions are tax-deductible items, the taxable base for pensions is the gross income reduced by social security contributions. As pensioners are not paying pension and unemployment contributions, their tax base for the same income is hence higher. This results in a higher tax burden and an average tax rate.
In general, Austrian income tax is charged at progressive rates. The first 11,000 EUR of income are tax-free; afterwards, the tax rate increases in steps, as highlighted in Table 3.
As the tax system itself is complex, we focus on standard taxation mechanisms for a single pensioner household, hence neglecting several allowances and tax credits for childcare, single earners or other family-specific tax relief. Only general lump sum allowances for pensioners, such as the “Sonderausgabenpauschale” and the “Pensionistenabsetzbetrag”, are included in our calculations.

Table 3: Income tax rates in Austria

Tax base	Tax rate
0 EUR – 11,000 EUR	0%
11,000 EUR – 18,000 EUR	25%
18,000 EUR – 31,000 EUR	35%
31,000 EUR – 60,000 EUR	42%
60,000 EUR – 90,000 EUR	48%
90,000 EUR – 1,000,000 EUR	50%
>1,000,000 EUR	55%

Remark: The tax system changed in recent years due to a tax reform. See e.g. Christl et al. (2018). The difference between pension income and labour income however remained.

The "Sonderausgabenpauschale" is a general lump sum allowance for housing or life insurance and accounts for 60 EUR per year. The "Pensionistenabsetzbetrag" is a benefit for pensioners with a taxable base (gross pension minus social security contributions) below 17,000 EUR and reduces the tax burden by 400 EUR per year. For incomes above this threshold and up to 25,000 EUR, this benefit is reduced stepwise to zero.[6]
The prevalence of exceptions in the Austrian tax system might result in minor deviations in our calculations from the actual net income of pensioners in our paper. However, any such deviations should be negligibly small. For a detailed overview of the taxation of pensions in Austria, see Austrian Federal Pension Fund (2016).

IV. Model and data

The model

In the literature, there are two main approaches to calculate actuarially neutral deductions. These approaches capture the changes in pension benefits at the margin. Following Duval (2003), the first approach defines actuarial neutrality when the foregone pensions and paid contributions are offset by higher future pension payments. Based on the definition by Queisser and Whitehouse (2006), actuarial neutrality is achieved if the present value of accrued pension benefits for working an additional year is the same as in the year before. Hence, the main difference between the two definitions is that the contributions paid and the higher future pension payments are not considered in the second approach. Our model is the combination of the two approaches. Unlike Stock and Wise (1990), who use the option value model approach[7], in order to compare actuarial and individual incentive neutrality, we follow Börsch-Suppan (2004). Contrary to Queisser and Whitehouse (2006), the contributions and the additionally earned benefits during the extra years of working

[6] Under specific circumstances, this tax reduction can be increased to 764 EUR, depending on marital status, income of the partner and no claim for the "Alleinverdienerabsetzbetrag". This is not included in our calculation.
[7] The advantage of this approach is that the disutility of labour and current wages are taken into account. Nevertheless, the approach necessitates assumptions about the utility function.

are directly taken into account in the computation of pension wealth. This is in line with Brunner et al. (2010), who, in the calculation of pension wealth, deduct the lost contributions due to earlier retirement.

Let $PW_{x|y}$ denote the pension wealth at time x, which is conditional on retiring at time y. A pension wealth, which is the stock of lifetime pension capital, can be computed as a stream of benefits until the death of the insured person. Pension wealth at time t is calculated as the pension entitlement at time t, P_t, multiplied by the annuity factor, A_t:

$$PW_{t|t} = P_t * A_t. \tag{1}$$

The annuity factor represents the present value of a yearly stream of a unit pension. This takes into account the duration of the pension disbursal (age of retirement, mortality rate) and the yearly pension adjustment, usually chosen as the inflation level or average earnings growth). Hence, the annuity factor can be expressed as:

$$A_t = \sum_{i=R}^{T} PVPF_i. \tag{2}$$

where $PVPF$ is the present value of the unit pension flow of a person aged R with a maximum lifespan of T, retiring at time t. Let the future income be discounted at the rate of z and the yearly real adjustment rate of the pension entitlement be u.[8] As the present value of the pension flow is conditional on being alive to receive the benefit, the annuity factor also depends on the survival function, s. Thus, Equation 3 can be rewritten as:

$$A_t = \sum_{i=R}^{T} s_i (1+z)^{-i} (1+u)^i. \tag{3}$$

If the individual decides to work an additional year, the calculation of the pension wealth drawn at time $t+1$ and measured at time t requires discounting back the pension wealth $PW_{t+1|t+1}$ (drawn at time $t+1$, measured at time $t+1$), as well as controlling for the probability of death during that year:

$$PW_{t|t+1} = PW_{t+1|t+1} * \frac{s_t}{(1+z)} = \frac{P_{t+1} * A_{t+1} * s_t}{(1+z)}. \tag{4}$$

The actuarial neutrality condition requires that $PW_{t|t} = PW_{t|t+1}$. Substituting equation (1) with (4) yields:

$$P_t * A_t = \frac{P_{t+1} * A_{t+1} * s_t}{(1+z)} - 1. \tag{5}$$

An additional year in the labour force increases the pension of the individual in two ways. First, in the course of pension contributions, the person earns additional pension

[8] Note that, if the pensions are adjusted by the inflation rate, u will be zero.

entitlements. The flow of pension benefits in year $t + 1$ should hence be greater than the adjusted pension benefit earned in year t, yielding $P^*_{t+1} > P_t * (1 + u)$. Second, via the additional year in the labour force, the individual earns the actuarially neutral bonus rate, α_t, for deferring retirement at age t by one year, which equates to a certain proportion of his or her pension benefits. This leads to $P_{t+1} = P^*_{t+1} * (1 + \alpha)$. After substitution and rearrangement, Equation (5) can be rewritten as:

$$\alpha = \frac{P_t * A_t * (1 + z)}{P^*_{t+1} * A_{t+1} * s_t}. \tag{6}$$

The pension benefit in Equation (6) can be computed by either using the net or gross pension entitlement. The pension wealth computed by the gross pension entitlement represents the financial perspective of the pension system (actuarial neutrality), while the pension wealth based on the net benefit allows us to analyse the financial perspective of an individual (individual incentive neutrality) by taking taxation into account. As the average tax rate for a pensioner is higher in comparison to a worker, an additional year in employment leads to higher pension benefits, which are however taxed more heavily in the future. For simplicity, in our analysis, we keep the tax system constant over time and do not differentiate between the discount factor for the pension system and for the individual[9].

Data and parametrization

Similar to life insurance, survival probabilities play a key role in the calculation of pension insurance. The data are based on the mortality tables of Statistics Austria for 2017. Since general (unisex) deductions are of interest to policymakers, for the calculation of actuarially neutral deductions, we use unisex survival probabilities. As a robustness check, we analyse the effects of different survival probabilities on actuarially neutral adjustments and take into account the difference in the probability of death between women and men.

According to our model, actuarial neutrality depends crucially on the following three factors: riskless interest rate, already collected pension entitlement and total earnings in the additional year of employment. First, the riskless interest rate influences the annuity factor. A higher riskless interest rate will demand higher deductions because consuming now is valued higher than consuming later. Second, an additionally earned wage for another year of work influences future pension payments. Third, the already collected pension benefits influence the pension payments and therefore the pension wealth. Other minor factors, such as the level of the valorization of the pension account or the accrual rate, might influence the actuarially neutral deductions. For both of these factors, higher values lead to a higher pension wealth.

The appropriate riskless rate is usually chosen as the long-term government bond interest rate.[10] The main justification for this choice is that the government pension payouts have

[9] In general, the discount rate of individuals may differ, meaning that the individual discount rate is not easy to calibrate. For simplicity, we set the individual and the pension system discount rates at the same value.

[10] The possibility of a default by government is supposed to be close to zero and can hence be neglected.

the same default risk as government long-term bonds.[11] Therefore, we follow Brunner et al. (2010) and choose a 1.5% riskless rate in our baseline scenario.
For the analysis, we distinguish between three different pension account levels at the age of 65 (gross) for individuals deciding between working one extra year or retiring:

* Low-pension account level: 15,000 EUR
* Medium-pension account level: 30,000 EUR
* High-pension account level: 45,000 EUR

Additionally, we take into account the effects of different wages for individuals aged over 60, as earned during that year:

* Low earnings: 18,000 EUR
* Medium earnings: 40,000 EUR
* High earnings: 50,000 EUR

The data are taken form Statistics Austria, with low and medium earnings reflecting approximately the first quantile and the median (gross) yearly earnings for individuals aged over 60 in Austria, respectively. We consider 50,000 EUR as high earnings. For the baseline scenario, we choose the medium-pension account level and medium earnings.
The valorization of the pension account will be chosen close to reality. Since 2002, the real increase in the pension account equalled, on average, 0.4% per year, according to BMASK. This value will be chosen as the parameter of the baseline scenario.

V. Empirical findings

Actuarial neutrality based on gross pension entitlement

As presented earlier, the actuarially neutral adjustments based on gross entitlements represent the financial perspective of the pension system. In the case of actuarially neutral adjustments, the pension system is indifferent towards retiring or working an additional year. An actuarially neutral adjustment rate above the official level means that early retirement would impose a financial burden on the pension system. The results for actuarially neutral deductions at the retirement age of 64 for different wage levels and pension account levels are shown in Table 4. The results for the retirement ages of 62 and 63 are listed in Table A in the Appendix.
The results in Table 4 show that, at the age of 64 years, the actuarially neutral deduction for a medium-income earner and medium-pension account owner is 4.76% per year. This result is close to the actual deductions of the Austrian pension system of 5.1%.

[11] For other rationales for the choice of the long-term government bond interest rate, see e.g. Queisser and Whitehouse (2006).

Table 4: Actuarially neutral deductions at age 64 (in %)

Age	Wage	Pension account					
		(Low)		(Medium)		(High)	
64	Low	5.25%	(± 0.15%)	7.12%	(± 0.23%)	7.76%	(± 0.24%)
	Medium	0.50%	(± 0.14%)	4.76%	(± 0.19%)	6.18%	(± 0.22%)
	High	−1.37%	(± 0.13%)	3.86%	(± 0.20%)	5.56%	(± 0.24%)

Remark: The values in brackets are the differences based on the assumption that the mortality rate changes, according to a 10-year increase or decrease in the mortality tables.

The actuarially neutral deductions increase in line with the level of the pension account. The neutral deduction for a medium-income earner at the age of 64 years with a low-pension account balance will equal 0.50%; when it is at a high level, the deduction reaches 6.18%. Additionally, increasing income leads to decreasing actuarially neutral deductions. These results are, on average, consistent with the findings of Freudenberg et al. (2018), who calculated an actuarially neutral rate of 5.3%.

For a person with a medium-pension account level and a medium wage, but a retirement age of 63 years, the yearly deduction is lower, namely, 4.35% (see Table A in the Appendix). The reason for this increase is that, because of the increased mortality rate in relation to an individual's age, the probability of a shorter pension payment period increases. Hence, the pension system has a higher incentive to avoid an additional year of pension payment. We find that the annual actuarially neutral adjustments depend on the age of the individual. The closer the individual is to the official retirement age, the higher the annual actuarially neutral adjustments, and therefore the capacity of the financial advantage of the system to avoid early retirement. This result is in line with Brunner et al. (2010) and Gasche and Kluth (2012) and stems from a shorter pension payment period.

The range of obtained results are consistent with those of Queisser and Whitehouse (2006). The authors find that the actuarially neutral adjustments of the benefits for people retiring earlier at the age of 64 years, rather than the official retirement age of 65 years, is around 7–8% for OECD countries. One should note that this reduction is calculated for average mortality rates of 2002. However, the expected life expectancy in Austria is currently above this level, which indicates that this value should be considered rather as an upper bound for actuarially neutral deductions. Moreover, using a higher interest rate in the model leads to higher neutral deductions. Both issues will be discussed later.

Individual incentive neutrality based on net pension entitlement

For the calculation of financial incentives for early retirement within the Austrian pension corridor, we take taxation into account. Individual incentive-neutral deductions are reached when the individual is indifferent towards working an additional year or retiring with a reduced net pension entitlement level. If the neutral deductions are above the official level, people have more financial incentive to retire. Hence, a lower adjustment than the neutral one reflects a financial incentive to retire.

For simplicity, we assume no changes in the tax system and the absence of a bracket creep.[12] The results for incentive-neutral deductions, based on the net pension entitlement, are summarized in Table 5.

We can see that incentive-neutral deductions for the net pension level are higher than those computed for actuarial neutrality. The reason is that, due to the progressivity of the Austrian tax system, a higher pension entitlement is taxed more heavily, which in turn reduces the incentive to work longer.

Table 5: Incentive-neutral deductions at age 64 (in %)

Age	Wage	Pension account					
		(Low)		(Medium)		(High)	
64	Low	5.40%	(± 0.28%)	9.50%	(± 0.25%)	9.59%	(± 0.26%)
	Medium	1.06%	(± 0.14%)	6.45%	(± 0.18%)	7.58%	(± 0.27%)
	High	−0.64%	(± 0.23%)	5.03%	(± 0.31%)	6.78%	(± 0.21%)

Remark: The values in brackets are the differences based on the assumption that the mortality rate changes, according to a 10-year increase or decrease in the mortality tables.

The individual incentive-neutral deductions for retiring at 64 are 6.45% for a medium-income earner and a medium-pension account level. This is approximately 1.5 percentage points higher than the deductions calculated using gross pension entitlement.

Again, we can see that the individual incentive-neutral adjustment decreases with higher wages. For high wages, the deductions are 5.03%. The reason behind a lower incentive to retire is that higher wages result in higher pension entitlement, which is subject to a higher tax rate. Since lower pension entitlements are taxed at lower rates, this effect is higher for low-pension account levels (differences in the slopes).

Table B in the Appendix shows the results for several retirement ages. Similar to the actuarial ones, the incentive-neutral adjustments also depend on the age of the individual. The closer the individual gets to the official retirement age, the higher the yearly incentive-neutral adjustment; hence, the incentive to retire. The deductions decrease to 5.84% and 5.39% for a retirement age of 63 and 62 years, respectively. These are again respectively around 1.5 percentage points higher than in the case of actuarial neutrality.

Due to the increased mortality rate and lower remaining life expectancy, an individual is no longer compensated by the increased pension entitlement earned during the additional working year. Hence, if the pension decrements are chosen to be constant for each year of early retirement, incentives to work are higher at the beginning of the period of allowance than at the end of this period (for an individual with the same earnings and pension entitlements).

[12] The assumption of a fixed tax system could influence future pension benefits at a specific time, but the overall pension wealth should only be slightly influenced.

Sensitivity

Both the actuarially neutral adjustments and the individual incentive-neutral adjustments are significantly affected by the choice of the underlying model parameters. In this subsection, we discuss the effect of the mortality rate, the valorization of the pension account and the riskless interest rate. As the mortality rate belongs to the key parameters, actuarially neutral deductions depend significantly on the choice of the mortality tables used for the calculations. Since men have a lower life expectancy (higher mortality rates at the same age) than women, the level of the actuarially neutral adjustment is higher for them (higher incentive to retire early under the same conditions). As the Austrian pension system is not automatically adjusted to increasing life expectancy, the actuarially neutral adjustment is also significantly affected by this change.

We investigate the effect of the difference between male and female life expectancies and the effect of increased life expectancy over the last 10 years. We compute the actuarially neutral deductions for a person with an entitlement to a medium pension (30,000 EUR) and a medium income (40,000 EUR) based on male, female and unisex mortality rates and the mortality tables for 2007 and 2017. The results are highlighted in Table 6.

Table 6: Actuarially neutral decrements (in %) according age, sex and mortality table

Sex	Mortality Table 2017			Mortality Table 2007		
	Age			Age		
	62	63	64	62	63	64
Male	4.35%	4.87%	5.29%	4.58%	5.05%	5.55%
Female	3.50%	3.86%	4.24%	3.62%	3.92%	4.30%
Unisex	3.93%	4.35%	4.76%	4.12%	4.51%	4.95%

Since men have higher mortality rates, the annuity factor is lower, resulting in a statistically shorter pension flow. As the life expectancy increases over time, individuals receive a longer pension flow and hence prefer to work longer in order to receive higher pension entitlements.

As already mentioned, both the actuarially neutral and the individual incentive-neutral adjustments decrease with higher wages. Figure 2 presents an overview of the impact of wages on deductions in the case of a medium-pension account level of 30,000 EUR. We can see that the actuarially neutral and incentive-neutral deductions are lower for high-wage earners than for low-wage earners. On the contrary, the higher the current value of the pension account, the higher the incentive-neutral deductions[13]. This implies that using the same deductions for all individuals will lead to the unequal treatment of several groups.

[13] See Table A and B in the Appendix.

Figure 2: The effect of additional earnings on actuarially neutral and incentive-neutral adjustments

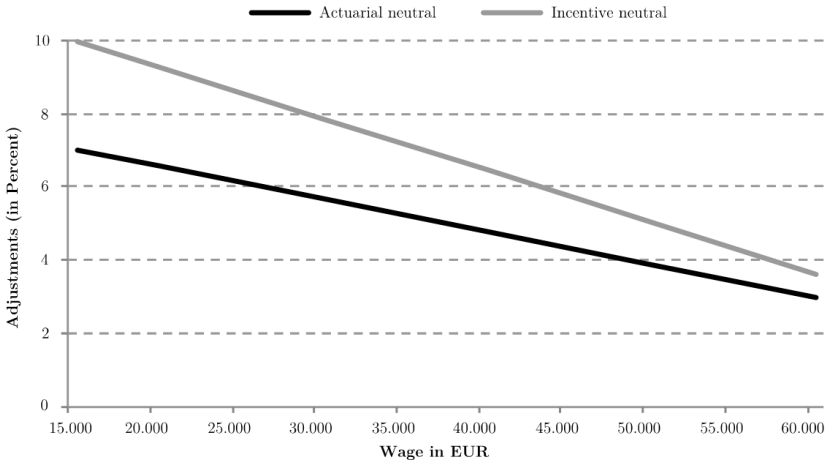
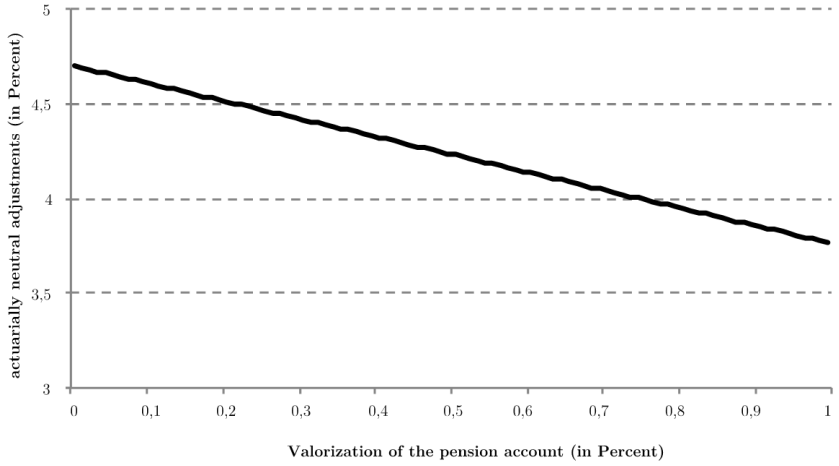


Figure 3 depicts the effect of the valorization of the pension account on actuarially neutral adjustments for the baseline scenario. We find that a higher valorization paid into pension accounts reduces actuarially neutral deductions. This result is not surprising as working longer becomes more attractive.

Figure 3: The effect of the valorization of the pension account on actuarially neutral adjustments



The interest rate is a key parameter in our calculations and the correct choice of this parameter is not obvious. Therefore, we decided to also show the result in the case of different assumptions for the interest rate. Usually, the riskless rate is chosen as the

long-term government bond interest rate. The main justification for this choice is that government pension payouts have the same default risk as government long-term bonds. We follow Brunner et al. (2010) in our choice and choose a 1.5% riskless rate in our baseline scenario.

Table 7 shows the effects of different interest rates, namely, 1%, 1.5% and 2%. A high riskless interest rate reduces the annuity factor, which in turn increases the actuarially neutral adjustment. This is simply due to the fact that money now is more attractive than money in the future.

Table 7: The effect of the riskless interest rate on actuarially neutral decrements for baseline parametrization (in %)

Riskless interest	Age		
Rate	62	63	64
1%	3.58%	3.94%	4.30%
1.5%	3.93%	4.35%	4.76%
2%	4.22%	4.68%	5.14%

Discussion

D'Addio et al. (2010) show that the financial incentive to prolong working life not only depends on changes in gross pension wealth, but also crucially depends on the net pension wealth when the decision to retire is made. The study shows that Austria is among the group of countries with the highest net pension entitlement at the age of 60. Since actuarial fairness is not fulfilled in the Austrian pension system[14], the pension system itself offers an incentive to retire earlier.

We find that current deductions in the Austrian pension corridor are, on average, slightly above neutral deductions. These calculations are especially interesting from the perspective of the pension system. Actuarially neutral deductions imply no additional costs of early retirement for the pension system, since pension wealth is the same for retiring or working an additional year.

Numerous studies have shown the importance of financial incentives for retirement decisions. The incentive to retire is driven by the rules of the social security system, as well as employer-provided pension benefits (see Lumsdaine and Mitchell (1999)). Gruber and Wise (2000) note that there is a strong negative correlation between the generosity of (early) retirement benefits and the employment rate of older workers.

Manoli and Weber (2016) show that there is a relatively low responsiveness of retirement decisions to financial incentives in Austria. They argue that retirement decisions are likely to be affected by factors beyond mere financial incentives from retirement benefits. Lumsdaine and Mitchell (1999) also cite other factors that determine early retirement decisions. Health and disability problems are mostly stated, but family-related reasons also affect retirement decisions (childcare by grandparents and other caregiving issues).

[14] See, e.g., Knell (2005) or Knell (2013).

Another reason for early retirement in the literature is the dependence of the decision on a partner's retirement decision. Spouses often retire within less than one year, independently of the age difference between them. Gustman and Steinmeier (2004), Stancanelli (2012) and Hospido and Zamarro (2014) provide empirical evidence of joint retirement behaviour.

We show that, even if financial incentives are not the only driver of early retirement in Austria, these incentives occur because of the tax system. Since the retirement decision of an individual is more likely to depend on the net pension, the calculation of these individual incentive-neutral deductions for net pension entitlements reveals that the actual deductions are below the neural ones. This implies that the tax system offers an additional financial incentive for earlier retirement.

Additionally, we find that the actuarially neutral deductions fall if life expectancy (survival probability) increases. Hence, even though the actual deduction might be below the actuarially neutral values, this gap will shrink with increasing life expectancy. This implies that a revaluation of the deductions would be necessary to guarantee actuarial neutrality, at least in the long run.

Under the condition that one of the tasks of the pension system is to ensure an adequate income for older people with a minimum pension payment, the discussed actuarial concepts cannot alone be a target of the pension system. The imposition of actuarial neutrality and fairness could hurt low-income workers because early retirement can push them below the poverty threshold. Furthermore, low-income workers may not be able to receive a pension payment above the poverty threshold through their own contributions. This is an important consideration for policymakers, who usually introduce a minimum pension payment to overcome this problem. Nevertheless, if the sustainability cost of the pension system increases on account of inadequate incentives to contribute (actuarial fairness) and retirement incentives (individual incentive neutrality), the taxes and/or contributions that are needed to finance future benefits will increase. This in turn affects the labour supply incentives of younger workers, implying that the disincentives of working will only be reshuffled among the age cohorts.

In the discussion of actuarial neutrality and fairness, one should not forget that both concepts are defined across the population. Since there are significant differences between individual life expectancy (women and people with a high income statistically live longer[15]), this raises the question as to whether it is "unfair" to use average demographic parameters. This question can be raised as well with regard to the Austrian pension corridor. Following Knell (2013), a one-time compensatory payment to an individual account might overcome and reduce the difference between individuals.

VI. Conclusion

The goal of this paper was to investigate the actuarial neutrality and the financial incentive neutrality for early retirement (age corridor) in the Austrian pension system. Our results contribute to the discussion about the choice of an actuarially neutral adjustment of

[15] See, e.g., Von Gaudecker et al. (2007) and Waldron (2007).

pension levels for individuals retiring earlier than the statutory retirement age of 65 years. In contrast to previous research, we investigated not only actuarially neutral adjustments, but also incentive-neutral adjustments. The first indicator is more relevant for the financial stability of the pension system, while the second indicator is focused on the individual decision to retire.

We show that the choice of a 5.1% deduction in Austria is, on average, in line with the concept of actuarial neutrality. This has important policy implications for the Austrian pension system. If the retirement scheme is actuarially neutral, an increase in the effective retirement age has no effect on financial stability, i.e., the financial sustainability of the pension system is not influenced by the early retirement decision of an individual. On the other hand, if a pension system is not actuarially neutral, an increase in the effective retirement age reduces the financial burden in the long run.

Since deduction rates for early retirement are close to actuarially neutral ones, our analysis suggests that, if there is a need to reduce pension expenditure in the long run in Austria, increasing the effective retirement age will not be an effective tool. In the short run, an increase in the effective retirement age will lead to more contributions since more people are contributing and fewer people are drawing their pension. This will reduce the financial burden on the system in the near future. Those who postpone retirement will collect more pension entitlements. When they claim their pension at a later time, the pension system will have to pay them a higher pension. This will lead to a higher financial burden at a later time. Due to the concept of actuarial neutrality, the overall effect on the financial side of the pension system will be close to zero.

Having said that, this has important policy implications for Austria. Austria has a very generous pension system. Given the projected demographic changes (retirement of the baby-boomers as well as increasing life expectancy), the long-term projections show a substantial increase of the expenditures for pensions, as well as for health and long-term care. While pension expenditure will increase from 13.8% of GDP in 2016 to 14.9% in 2040, health care expenditure will increase from 7% of GDP to 7.7% in 2040 and expenditure long-term care from 1.9% to 2.6%. Our analysis suggests that to stabilize this increase in pension expenditures, an increase in the effective retirement will not help in the long run. Instead, if policy makers want to stabilize those costs, an increase in the statutory retirement could be an option.

To the best of our knowledge, our paper is the first to investigate the difference between actuarially neutral adjustments based on gross pension and individual incentive neutrality based on net pension entitlements. Higher and more progressive taxation leads to proportionally less earning for each additional year of work, which in turn could increase the incentive to retire. Our analysis shows that actual deductions in the case of the Austrian pension corridor are indeed below the incentive-neutral deduction rate, especially for those people with a low- and middle-income and a medium- or high-pension account level. Even though financial incentives might not be the main reason for early retirement, our analysis suggests that there are financial incentives for early retirement in the pension corridor of the Austrian pension system, which stem from the Austrian tax system.

Additionally, our analysis investigates new redistributional insight into the Austrian pension system. When deductions for early retirement are chosen to be uniform for all socio-economic groups, this leads to some redistribution within the system. Neutral rates increase in line with the level of the pension account. On the other hand, they decrease along with wages. The use of unisex mortality rates leads to a disadvantage for women compared to men due to women's higher life expectancy. Unisex deductions therefore lead to the unequal treatment of men and women within the pension system.

We additionally found that actuarially neutral adjustments and individual incentive-neutral adjustments decrease if the pension account valorizations are higher, life expectancy (survival rate) increases or the riskless interest rate decreases. The deductions increase with retirement age, i.e., when the individual is closer to the statutory retirement age.

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Appendix

Table A: Actuarially neutral deductions (based on gross pension entitlement) at different retirement ages (in %)

Age	Wage	Pension account					
		(Low)		(Medium)		(High)	
62	Low	4.31%	(± 0.21%)	5.84%	(± 0.22%)	6.35%	(± 0.22%)
	Medium	0.29%	(± 0.16%)	3.93%	(± 0.19%)	5.09%	(± 0.21%)
	High	−1.40%	(± 0.11%)	3.15%	(± 0.22%)	4.58%	(± 0.17%)
63	Low	4.74%	(± 0.24%)	6.46%	(± 0.20%)	7.02%	(± 0.20%)
	Medium	0.43%	(± 0.12%)	4.35%	(± 0.16%)	5.62%	(± 0.18%)
	High	−1.36%	(± 0.10%)	3.53%	(± 0.18%)	5.07%	(± 0.18%)
64	Low	5.25%	(± 0.15%)	7.12%	(± 0.23%)	7.76%	(± 0.24%)
	Medium	0.50%	(± 0.14%)	4.76%	(± 0.19%)	6.18%	(± 0.22%)
	High	−1.37%	(± 0.13%)	3.86%	(± 0.20%)	5.56%	(± 0.24%)

Remark: The values in brackets are the differences based on the assumption that the mortality rate changes, according to a 10-year increase or decrease in the mortality tables.

Table B: Incentive-neutral deductions (based on net pension entitlement) at different retirement ages (in %)

Age	Wage	Pension account					
		(Low)		(Medium)		(High)	
62	Low	4.32%	(± 0.06%)	7.82%	(± 0.25%)	7.29%	(± 0.26%)
	Medium	0.60%	(± 0.09%)	5.39%	(± 0.13%)	5.97%	(± 0.16%)
	High	−0.70%	(± 0.20%)	4.32%	(± 0.23%)	5.47%	(± 0.22%)
63	Low	4.62%	(± 0.17%)	8.65%	(± 0.22%)	8.65%	(± 0.13%)
	Medium	0.82%	(± 0.15%)	5.84%	(± 0.20%)	6.93%	(± 0.21%)
	High	−0.56%	(± 0.13%)	4.74%	(± 0.27%)	6.21%	(± 0.14%)
64	Low	5.40%	(± 0.28%)	9.50%	(± 0.25%)	9.59%	(± 0.26%)
	Medium	1.06%	(± 0.14%)	6.45%	(± 0.18%)	7.58%	(± 0.27%)
	High	−0.64%	(± 0.23%)	5.03%	(± 0.31%)	6.78%	(± 0.21%)

Remark: The values in brackets are the differences based on the assumption that the mortality rate changes, according to a 10-year increase or decrease in the mortality tables.