

Pension Projections of the Czech Republic

January 2021

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of the Czech Republic

Czech Republic's Country Fiche
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Country fiche of the Czech Republic describes long-term pension projections prepared in cooperation with European Commission and Working Group on Ageing and Sustainability as a working group of Economic Policy Committee. The fiche is part of Ageing Report 2021.

All calculations are based on data of 2019.

1 Czech Pension System

The first section of the fiche concerns the facts about pension system in the Czech Republic. It consists of three parts. In the first one all the pension pillars are described, in the second part we provide an overview of recent reforms incorporated in the projections and finally in the third part we state some “constant policy assumptions” which are taken and should make the projections transparent.

1.1 Description of the System

The Czech pension system consists of two pillars – main mandatory state pay-as-you-go system and voluntary private fully funded system. There is no occupational pension scheme.

1.1.1 Mandatory Pay-as-you-go System

The first pillar is a mandatory basic pension insurance scheme, based on the pay-as-you-go financing and defined benefits. It covers all economically active persons and applies identically to all economic sectors with the exception for miners who have lower retirement age. Besides so-called armed forces (e.g. soldiers, policemen, fire fighters) that are administered by the respective ministries in charge, all other sectors are managed by Czech Social Security Administration.

The basic pension insurance covers the whole population (except the ones in the period of education) regardless of the actual economic activity of a person. A wide range of so-called non-contributory periods allows gaining pension entitlement at the time of person’s non-activity in the labour market (one does not have any income from which the contribution is derived). Thus the system does not exclude (at least, not to the full extent) those, whose career has been interrupted for many reasons (unemployment, childcare period etc.) Besides the solidarity of economically active persons with non-active ones, there is another type of solidarity within a generation – income solidarity.

Income solidarity is achieved through the formula used to calculate pension benefits. It leads to higher replacement rates for lower-income persons compared to those with higher income through the reduction thresholds. The personal assessment base (which is understood as a pensionable earning in the projections) is determined by the income and the income is divided by reduction thresholds to several reduction brackets. The lowest part (up to 1st bracket) is taken whole and each other part of the income only by decreasing percentage. Actual values are valid from 2015 onwards: the lowest part (for pensionable earnings up to 44% of average wage) 100%, the second lowest part (for pensionable earnings from 44% of average wage up to 400% of average wage) 26% and 0% above 400% of average wage. It is equivalent to sharp progressive taxation.

The pension insurance contributions (as a part of the total social security contributions) form the revenue side of this scheme. The contribution is calculated by multiplying the assessment base by a contributory rate. The assessment base for employees consists of all the benefits paid by employer to the employee which are also subject to personal income tax. There is, however, an upper limit set amounting to 48 times the average monthly wage per calendar year. This limit is valid for employees as well as for self-employed persons and is equivalent to the second reduction bracket (see previous paragraph). The contributory rate for pension insurance is 28%, which is paid partly by employee (6.5%) and partly by employer (21.5%).

Self-employed persons have their own assessment base amounting to 50% of the difference between incomes and expenses. Minimum base is, however, 25% of the average gross monthly wage in the national economy (or 10% for the secondary activity). Maximum base is the same as for employees. The contributory rate for self-employed persons is 28%.

The state pension system covers three main benefits – old-age pension, disability pension and survivor’s pensions. To be entitled to an **old age pension** a person has to reach an insurance period of at least 35 years and a retirement age specified by a law; or at least 20 years of insurance and the age 5 years higher than is the statutory retirement age. Non-contributory periods are also included in the insurance period. If the non-contributory periods are excluded, the minimum insurance period is 30 or 15 year respectively. Statutory retirement age is specified with regard to person’s date of birth and children raised (just in case of women) until it reaches 65 for all persons regardless the number of children brought up. However, every 5 years the Government is to be provided by the Report on Pension System assessing changes in demography and life expectancy. If there is a significant change in life expectancy, the Government decides on rising the statutory retirement age in the way assuring that 25% (+/- 1 p.p.) of life is spent in retirement. To be more specific, for each generation life expectancy can be calculated for every age (e.g. what is life expectancy of generation born in 1980 when the people from this generation are 30 or 40 etc.). This life expectancy is always com-

pared to the age (number of years lived so far) and when there is this ratio 25, the “correct” retirement age is given. Changes in retirement age will concern just the people at the ages of 25 up to 54.

A person is allowed to retire up to 3 years prior the statutory retirement age under the condition the statutory retirement age is lower than 63 years. This period of 3 years will gradually lengthen up to 5 years prior the statutory retirement age if the condition of insurance period is fulfilled. However, in the latter case the statutory retirement age must be at least 63 years and actual age of the person higher than 60 years. This means that only a person with statutory retirement age at (least) 65 years may retire 5 years earlier. In such case of earlier retirement the person is excluded from the right to receive a proper (full) old-age pension and thus obtains permanently reduced early old age pension. Retirement in ages higher than the statutory retirement age is awarded by additional bonuses.

Table 1.1: Qualifying Conditions for Retirement

		2019	2030	2040	2050	2060	2070
Qualifying condition for retiring with a full pension	Statutory retirement age - men	63.5	65.0	65.0	65.0	65.0	65.0
	Statutory retirement age - women	61.2	65.0	65.0	65.0	65.0	65.0
	Contributory period - men ¹	35.0	35.0	35.0	35.0	35.0	35.0
	Minimum Retirement age - men	63.5	65.0	65.0	65.0	65.0	65.0
	Contributory period - women ¹	35.0	35.0	35.0	35.0	35.0	35.0
	Retirement age - women	61.2	65.0	65.0	65.0	65.0	65.0
Qualifying condition for retirement WITHOUT a full pension	Early retirement age - men	60.0	60.0	60.0	60.0	60.0	60.0
	Early retirement age - women	58.2	60.0	60.0	60.0	60.0	60.0
	Penalty in case of earliest retirement age - men ²	18.9%	27.9%	27.9%	27.9%	27.9%	27.9%
	Penalty in case of earliest retirement age - women ²	15.9%	27.9%	27.9%	27.9%	27.9%	27.9%
	Bonus in case of late retirement ³	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
	Minimum contributory period - men ¹	35.0	35.0	35.0	35.0	35.0	35.0
	Minimum contributory period - women ¹	35.0	35.0	35.0	35.0	35.0	35.0
	Minimum residence period - men	:	:	:	:	:	:
Minimum residence period - women	:	:	:	:	:	:	

¹⁾ There is also an option to receive full pension while having less than required contributory period. He/she must have at least 20 years contributory period and 5-years higher retirement age.

²⁾ Penalties in case of earliest retirement may differ in case of men and women because of different statutory retirement age and different possibility of early retirement, which is gradually extending from 3 up to 5 years. Penalties apply to earnings related component only leaving flat rate component unchanged.

³⁾ Bonuses apply to persons qualified to receive full pension and work beyond their statutory retirement age. Bonuses illustrated in the table are cumulated to yearly value and apply to persons who continue working without drawing pension benefit.

Source: Pension Insurance Act (No. 155/1995), calculations of the MoF.

Disability pensions are received by persons whose ability to work is reduced by at least 35% and are divided into three ranges: (i) First degree of disability – when a person has experienced a decline in his/her working capacity of at least 35% but not more than 49%; (ii) second degree of disability – a decline of at least 50% but not more than 69%; (iii) third degree of disability – a decline of at least 70%. The required insurance period is at least 5 years¹ (it is derived from the ten year period prior to the occurrence of disability).

Disability pension belongs to a person until his/her working ability improves, or until he/she reaches old-age retirement age but 65 years of age at the latest; subsequently a person is transferred from the disability pension scheme to the old age pension scheme.

Survivor’s pensions are paid out to a widow/widower or an orphan (dependent child) if a deceased person has met eligibility conditions for the old age or disability pension or he/she died due to job-relating injury. After one year of receiving the survivor’s pension, the widow/widower must meet other conditions stipulated by the law, otherwise the entitlement lapses (the entitlement continues when the widow/widower cares for a dependent child or disabled child, parents or relatives aged 80 and higher; or when a widow/widower is disabled in the third degree of disability or retired; or he/she has reached the age, which is 4 years lower than statutory retirement age of men of the same year of birth). The entitlement is also renewed when at least one of these conditions is met within 2 years from the last enti-

¹ This applies for persons above the age of 28. Younger people are required to reach shorter insurance period.

tlement termination. Orphan's entitlement to survivor's pension lasts while he/she is dependent. If the adoption is made by only one person, the orphan loses that part of the pension after the person now replaced (i.e. if an orphan is adopted only by a woman, the orphan loses pension on behalf of absent mother).

Pension calculations

The basic act that determines calculation of pension benefits is the Pension Insurance Act (No. 155/1995). Pensions² consist of two main parts:

Flat rate component is the same for all pensions regardless of the insurance period acquired (though, above the minimum one) and earnings achieved. The flat rate amounts to 10% of average monthly wage per month for all kinds of pensions. Thus every time the average wage changes, the flat rate changes hereby automatically.

Earnings related component is derived from the insurance period and earnings achieved. It is calculated as a percentage of personal assessment base, which takes into consideration person's income from the nineteenth year of his/her life to his retirement age (this means that earnings during virtually whole career are taken into account); however the earnings from the years before 1986 are not taken into account.

Minimum amount of a pension is set by both the flat rate component (which is the same for everyone) and the minimum earnings related component. Another instrument that also prevents people from the poverty is the institute of the subsistence level.³ Both these instruments are set by the government and are revaluated on irregular basis. There is not any special minimum pension scheme besides this one inbuilt in all pension types.

Earnings related component of **old age pension** amounts to 1.5% of person's assessment base for every completed year of acquired insurance period. Minimum earnings related component is now 770 CZK per month (approx. 30 EUR); maximum amount is not determined.⁴ Bonus for longer career is 1.5% of person's assessment base for every additional completed 90 calendar days.⁵ Early retirements are subject to penalization, which is 0.9% of person's assessment base for every period of 90 calendar days before the statutory retirement age up to 360 days, 1.2% from 361st day to 720th day and 1.5% from the 721st day. But resulting earnings related component must not be lower than 770 CZK.

Disability pension's earnings related component is 0.5% for the first degree, 0.75% for the second degree or 1.5% for the third degree of their assessment base for every completed year of acquired insurance period. This period makes the difference in case of disability pensions. If a person becomes disabled after he/she reaches the necessary insurance period, it is presumed, that a disabled person has already reached the retirement age (added imaginary insurance period as he/she would work till retirement age).⁶ In case the conditions of insurance period are not met to the full extent, the imaginary insurance period is correspondingly shorter. If a person becomes disabled before his/her age of 18, earnings related component amounts to 45% of general assessment base.

In case of **widow's/widower's pensions**, the earnings related component amounts to 50% of earnings related component of a spouse's old age or disability pension of the 3rd degree at the time he/she died.

Calculation of earnings related component for **orphan's pensions** is the same as in case of the widow's/widower's pension, but here the rate of 40% is applied instead.

In case of widow's/widower's or orphan's pension in concurrence with old-age/disability pension⁷ the earnings related component consists of full earnings related component of the higher pension (be it old-age/disability pension or survivor's pension) and 50% of earnings related component of the lower pension.

Pension indexation

Pension indexation proceeds on a regular basis (every January). Indexation represents an inflation growth (measured by the aggregate consumer price index or pensioner cost of living index, whichever is higher) plus a half of the growth in real average wage.⁸ The indexation must firstly guarantee that the flat rate will be 10% of gross average wage and the earnings-related component will be adjusted to fulfil the condition of indexation formula. If the inflation rate ex-

² Pensions include old age pension, disability pensions and also survivor's pensions.

³ A person whose income is lower than the subsistence level has a claim for social support benefits.

⁴ However maximal value is implicitly bounded by ceilings on personal assessment base, amounting to four-times average wage, from which a pension is calculated.

⁵ Alternatively 1,5% for every additional completed 180 days if the person draws only half of old-age pension or 0,4% for every additional completed 360 days if the person draws whole old-age pension.

⁶ For this period of inactivity is used a general assessment base, which is determined by the government upon an average gross income.

⁷ In case of pensions in concurrence, a recipient receives flat rate component for one of the two pensions only.

⁸ Official statistic of Czech Statistical Office is used.

ceeds 5%, there is special adjustment of pension benefits added. This can occur any time of year. Moreover, if the indexation of pensions according to standard formula is lower than 2.7%, the Government may decide about higher rate but not more than 2.7%.

Pension taxation

Pension benefits are not taxed in absolute majority of cases. This is due to relatively high threshold up to which income of pensioners is tax exempt. Only pension benefits exceeding 3 times minimum wage⁹ are subject to 15% Personal Income Tax (but there is still applicable tax deduction pushing the effective minimum taxable amount significantly higher). Currently only a negligible number of pensioners (not even 1% of them) pays taxes. Moreover, such negligible personal income tax revenue is a source of the state budget and not of the social security system itself. For these reasons tax calculations are not part of projection exercise.

1.1.2 Voluntary fully funded private system

This pillar (known as the third pillar) is voluntary, supplementary, fully funded and state-subsidized pension scheme based on defined contribution. It also includes life insurance as a product of commercial insurance companies. Compared to the 1st pillar and with respect to pension sustainability and adequacy, the 3rd pillar plays rather minor role.

Besides the state subsidy, any employer can support his employees with additional contribution to employee's fund. Both, employer's and employee's contributions are subject to additional tax allowances.

Moreover, a so-called preretirement scheme was established in 2013, which enables those subscribing to an additional insurance pension (the 3rd pillar) to already draw funds 5 years before reaching the statutory retirement age without imposing any sanctions. However, preretirement is conditional upon having a minimum amount of accumulated funds in the private 3rd pillar so as to provide a monthly pension amounting to at least 30% of the average wage. The old-age pension will not be subsequently reduced for the years when the pre-pension is drawn. The possibility to draw preretirement was only used by 4,455 persons before the end of 2019. As to the sustainability of the pension system, the impact of this measure is negligible.

1.2 Recent Reforms and Other Measures

In the last 20 years the pension system has undergone some parametrical changes of pay-as-you-go system. In June 2017 the legislation brought up the ceiling on retirement age of 65 years. Shifts in life expectancy are, however, still to be taken into account. Ministry of Labour and Social Affairs, based on the Czech Statistical Office data, is to prepare every 5 years the report which will compare life expectancy development and statutory retirement age. The aim is that every generation should spend a quarter of its life in retirement. The first report is was prepared in 2019. Despite the increasing gap between the life expectancy and the retirement age indicating that the latter should be raised at least for the generation born in 1980 and younger, the Government decided the retirement age to be still capped on unified level of 65 years. Nevertheless, the last projections in 2017 included the strict cap on the retirement age, thus being in line with the current situation.

On 17 February 2016, the Government approved a change in the pension indexation, which has partly restored discretion of the Government. Only if an increase in the average pension does not reach 2.7%, the Government is authorised to increase the percentage assessment of pensions by a Government Regulation up to the value corresponding to an overall indexation of 2.7%. Another measure changing the pension indexation system was added to be effective since 2018 at the recommendation of the Expert Committee on Pension Reform. The standard indexation formula has been changed to a sum of growth of either the consumer price index, or the pensioner cost of living index, whichever is higher, and one half of real wage growth. Approved in 2018, another two changes have taken the effect since January 2019. First, the flat-rate component of pension benefits has been raised by 1 percentage point from 9% to 10% of average wage (without any modification in earnings-related component). The second change tops up the indexation for people aged 85 (and more in the first year) by lump-sum rate 1 000 CZK per month (approx. 37 EUR, not indexed). Finally, in December 2020 all pensioners should be granted by one-off amount of 5 000 CZK, which, however, does not affect the level of pensions in the future years.

1.3 Constant Policy Assumptions

Indexation: As described in the previous section, current rule includes the choice between indices of consumer prices and pensioner costs of living. It is a question how these two will evolve and it is true that in the past, the pensioner

⁹ Minimum gross wage is set from 1st January 2020 to be 175,200 CZK per year (approx. 6,825 EUR).

costs of living index was mostly higher in the Czech Republic. However, rather the opposite is true for recent past, from 2014 consumer price index revealed to be higher except in 2020 when the pensioner costs of living index has been used for 2021 indexation. Moreover, data from remote past are “biased” by periods of deregulation that cannot be reflected in the future. Above all, consumer price index is well anchored via inflation expectations as the Czech National Bank has been targeting inflation since 1998 with inflation target of 2% starting from January 2010. No such definition of price level development and expectations are clear for pensioner costs of living index. From this perspective and for the sake of transparency we take the two indices to be equal in the future.

Early retirement versus pre-retirement: Despite the fact that the pre-retirement scheme is still scarcely drawn, we assume increasing popularity as this is financially more advantageous than early retirement scheme. On the other hand, pre-retirement scheme requires quite high capital savings. Therefore we assume that people 5 years prior to statutory retirement age uncovered by any social security benefit will draw upon these schemes less than in 100%. This is reflected in the lower coverage in particular age cohorts.

Wage profiles: Observed wage profile across the ages from 15 to 65+ shows relatively high inertia, despite constantly decreasing wage relative to the average wage in higher ages. One cannot assume this will last forever. It seems very much reasonable to assume constant wage profile in the future. We adopt, as in previous rounds of projections, the shift in the age specific wage profile from 2019 onwards with respect to postponement of retirement age and thus constant relationships to average wage. This means that the average gross wage at retirement grows exactly in the same pace as the average wage given by the AWG assumptions and is approximately by 0.8% lower than economy wide average wage.

Age specific profiles of disability rates and probabilities to retire: In order to meet commonly agreed assumptions (mainly in terms of inactive population coverage), there are some model adjustments, which aim at harming constant policy assumption to the lowest possible extent. For detailed explanation, see Annex B.

The retirement age: The Czech law includes the mechanism checking the link between statutory retirement age and life expectancy (see Section 1.1.1). The mechanism, however, provides the Government just with the option to forward a proposal for the retirement age modification to the Parliament. The first revision round took place in 2019 and the Government decided to keep the retirement age unchanged. Thus, it is a still valid assumption that the retirement age reaches the level of 65 years for men and women in the 2030s and remains at this level thereafter.

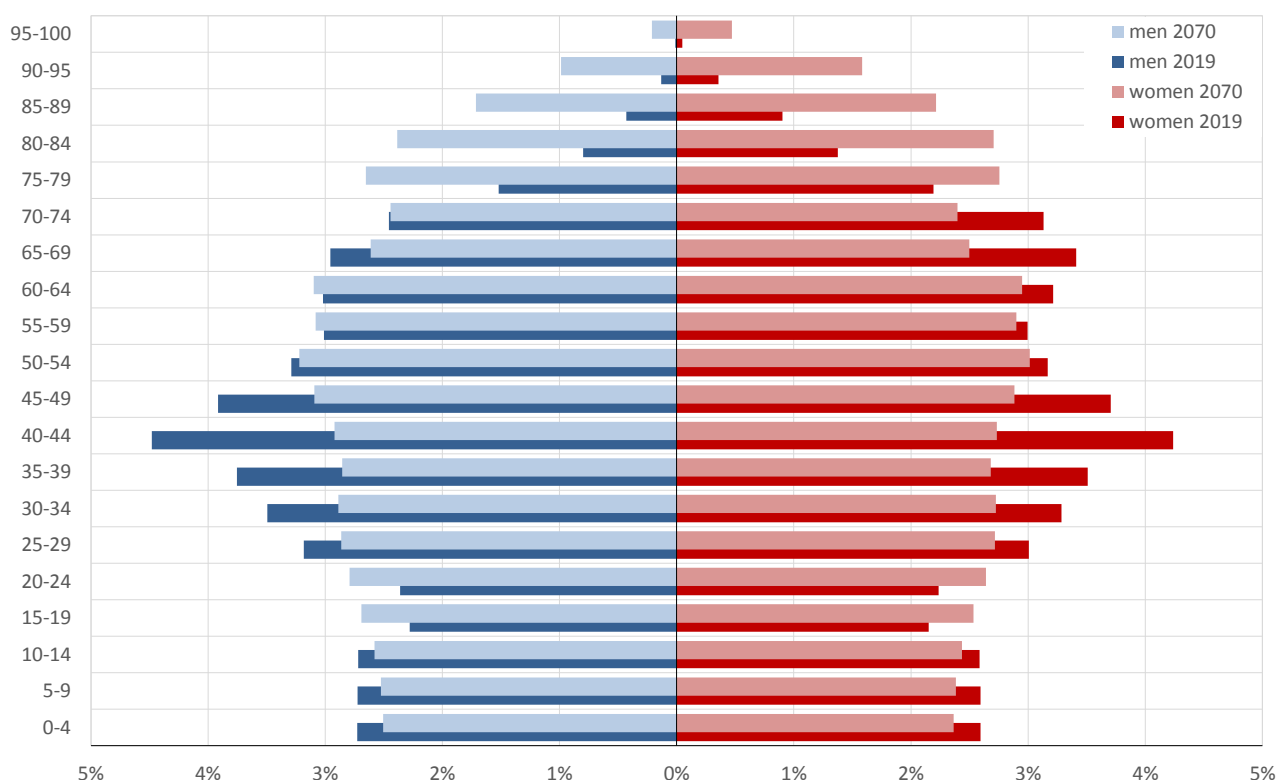
2 Demographic and Labour Forces Projections

This section illustrates key assumptions about demographic and labour force projections. Exogenous to the pension projection model, the demography is provided by EUROSTAT and both labour force projections as well as macroeconomic assumptions are result of Cohort Simulation Model (CSM). We fully employ all these assumptions in the pension model.

2.1 Demographic Development

The Czech population is relatively young, with a great majority of people in productive ages. This is mainly due to baby boom generations born in 1970s. Therefore, currently quite a lot of children are born in absolute terms. However, the reproduction itself does not seem to be sufficient enough to fully compensate the number of active population at later stage. Thus, the age pyramid is expected to somehow flatten during the next 50 years.

Figure 2.1: Age Pyramid, Comparison between 2019 and 2070



Source: Eurostat.

The Eurostat projects the number of population to decrease in the long horizon. It reaches its peak in 2025; the old-age dependency ratio comparing elderly (65+) with active population (20–64) almost doubles over projection horizon, reaching approximately 54% in 2070. This is not only due to continuous decrease in the number of active population but also because of increase in longevity – share of population 80+ over 65+ raises from 20.7% to 45.0% – as life expectancy at birth increases by 8.3 p.p. for men and 6.9 p.p. for women. Survivor rates in the population improve over time.

Table 2.1: Main Demographic Variables

	2019	2030	2040	2050	2060	2070	Peak value	Peak year	change 2019-2070
Population <i>thousands</i>	10 672	10 756	10 619	10 526	10 405	10 204	10 789	2025	-468
Population growth rate	0.4	-0.1	-0.1	-0.1	-0.2	-0.2	0.4	2019	-0.6
Old-age dependency ratio (pop 65+/pop 20-64)	33.0	38.6	45.2	54.8	59.2	53.7	59.4	2059	20.6
Old-age dependency ratio (pop 75+/pop 20-74)	10.9	16.9	18.5	22.6	28.3	29.0	29.4	2067	18.1
Ageing of the aged (pop 80+/pop 65+)	20.7	29.6	31.8	30.7	40.1	45.0	45.0	2070	24.3
Men - Life expectancy at birth	76.5	78.4	80.2	81.8	83.4	84.8	84.8	2070	8.3
Women - Life expectancy at birth	82.3	83.9	85.4	86.7	88.0	89.2	89.2	2070	6.9
Men - Life expectancy at 65	16.5	17.8	19.1	20.3	21.4	22.5	22.5	2070	6.0
Women - Life expectancy at 65	20.0	21.3	22.5	23.6	24.7	25.7	25.7	2070	5.7
Men - Survivor rate at 65+	83.3	86.2	88.4	90.3	91.8	93.1	93.1	2070	9.8
Women - Survivor rate at 65+	91.9	93.2	94.2	95.1	95.8	96.4	96.4	2070	4.5
Men - Survivor rate at 80+	49.0	56.1	62.0	67.4	72.1	76.2	76.2	2070	27.2
Women - Survivor rate at 80+	69.7	74.6	78.5	81.9	84.8	87.2	87.2	2070	17.6
Net migration	44.2	16.3	16.6	17.5	18.0	18.2	44.2	2019	-26.0
Net migration over population change	1.1	-1.5	-1.3	-2.2	-1.0	-1.0	29.4	2019	-2.0

Source: Eurostat, European Commission.

2.2 Labour Force

Labour force projections are result of common CSM model and assumptions made for particular country. Characteristics of labour market situation for older cohorts summarized in Table 2.2 show quite positive development, as participation rates, especially of older workers, slightly increase until 2030, i.e. during the period with continuous postponement of statutory retirement age. Beyond that period where pension age is fixed by assumption, participations remain broadly constant. These rates for cohort 55–64 have increased between 2016 and 2019 already by 8.5 p.p. and are projected to increase by additional 1–2 p.p. Positive effect can be expected also in the case of oldest cohorts on the labour market, where participation of people aged 65–74 is expected to increase by almost 3 p.p.

Table 2.2: Participation Rate, Employment Rate and Share of Workers

	2019	2030	2040	2050	2060	2070	Peak value	Peak year	change 2019-2070
Labour force participation rate 20-64	82.0%	81.7%	80.3%	81.0%	82.0%	81.3%	82.2%	2020	-0.7
Employment rate of workers aged 20-64	80.4%	78.9%	77.5%	78.2%	79.1%	78.5%	80.4%	2019	-1.9
Share of workers aged 20-64 in the labour force 20-64	98.0%	96.5%	96.5%	96.5%	96.5%	96.5%	98.0%	2019	-1.5
Labour force participation rate 20-74	70.2%	70.6%	68.0%	66.6%	68.4%	70.3%	70.8%	2032	0.1
Employment rate of workers aged 20-74	68.8%	68.2%	65.7%	64.4%	66.1%	67.9%	68.8%	2019	-0.9
Share of workers aged 20-74 in the labour force 20-74	98.1%	96.6%	96.6%	96.6%	96.6%	96.6%	98.1%	2019	-1.5
Labour force participation rate 55-64	68.4%	71.0%	69.0%	69.8%	70.8%	70.7%	72.4%	2032	2.3
Employment rate for workers aged 55-64	67.1%	68.5%	66.7%	67.5%	68.5%	68.3%	69.8%	2032	1.3
Share of workers 55-64 in the labour force 55-64	98.0%	96.5%	96.7%	96.7%	96.7%	96.7%	98.0%	2019	-1.3
Labour force participation rate 65-74	10.9%	10.9%	13.6%	11.8%	11.9%	12.5%	13.7%	2041	1.6
Employment rate for workers aged 65-74	10.8%	10.8%	13.4%	11.7%	11.9%	12.4%	13.5%	2041	1.6
Share of workers 65-74 in the labour force 65-74	99.5%	99.2%	99.2%	99.2%	99.2%	99.2%	99.5%	2019	-0.4
Median age of the labour force	42.0	44.0	44.0	42.0	42.0	43.0	45.0	2035	1.0

Source: European Commission.

The magnitude of increase in participation rates is mainly driven by assumptions about effective entry and exit ages to or from the labour market

The reason why “contributory periods” or better say “period covered by insurance” can be higher than average effective working career assumed by CSM is in fact that people can acquire those periods (pension rights) until they start to receive an old-age pension. This can happen even when a person is not active on the labour market. Thus these periods include both, “real” contributory periods when a person pays contributions from his/her income and so-called non-contributory periods (defined by law) when a person does not contribute into the system. However, this period is recognized by the pension system and as such it enters to the “period covered by insurance” and into the pension formula for pension benefits calculation. Moreover, there are also people contributing voluntarily into the system to have pension rights (in case the law does not cover these periods as non-contributory).

Average contributory periods increase in coming years for men by 2 years and for women by 4 years due to additional postponement of retirement age until 2030.¹⁰ The decline in average career years beyond 2030 both, for men and women, is due to cancelling validation of education periods as non-contributory periods.¹¹ This change affects generations enrolled in secondary education after 1995 and / or in tertiary education after 2009. Since then education periods are no longer considered in the pension system for pension benefits calculations.

Table 2.3: Labour Market Entry Age, Exit Age and Expected Duration of Life Spent at Retirement

Men	2019	2030	2040	2050	2060	2070	Peak value	Peak year	change 2019-2070
Average effective retirement age (administrative data) ¹	62.7						62.7	2019	-62.7
Average labour market exit age (CSM) ²	63.5	64.2	64.2	64.2	64.2	64.2	64.2	2057	0.7
Contributory period	44.9	46.9	46.9	42.9	41.9	41.9	46.9	2030	-3.0
Duration of retirement ³	17.9	18.5	19.8	21.0	22.2	23.3	23.3	2070	5.4
Duration of retirement/ contributory period	40%	39%	42%	49%	53%	56%	56%	2070	0.2
Percentage of adult life spent at retirement ⁴	28.2	28.6	30.0	31.3	32.5	33.5	33.5	2070	5.3
Early/late exit ⁵	1.1	1.5	1.4	1.2	1.1	1.1	1.5	2030	0.0
Women	2019	2030	2040	2050	2060	2070	Peak value	Peak year	change 2019-2070
Average effective retirement age (administrative data) ¹	61.1						61.1	2019	-61.1
Average labour market exit age (CSM) ²	61.4	63.4	63.4	63.4	63.4	63.4	63.4	2030	2.0
Contributory period	43.1	47.1	47.1	43.1	42.1	42.1	47.1	2030	-1.0
Duration of retirement ³	23.5	23.1	24.3	25.5	26.6	27.6	27.6	2070	4.1
Duration of retirement/ contributory period	55%	49%	52%	59%	63%	66%	66%	2070	0.1
Percentage of adult life spent at retirement ⁴	35.1	33.7	34.8	35.9	36.9	37.8	37.8	2070	2.7
Early/late exit ⁵	1.5	1.9	1.7	1.4	1.2	1.2	1.9	2030	-0.3

¹⁾ Duration of retirement is calculated as the difference between the life expectancy at average effective exit age and the average effective exit age itself.

²⁾ The percentage of adult life spent at retirement is calculated as the ratio between the duration of retirement and the life expectancy diminished by 18 years

³⁾ Early/late exit, in the specific year, is the ratio of those who retired and aged less than the statutory retirement age and those who retired and are aged more than the statutory retirement age.

Source: European Commission, MoF.

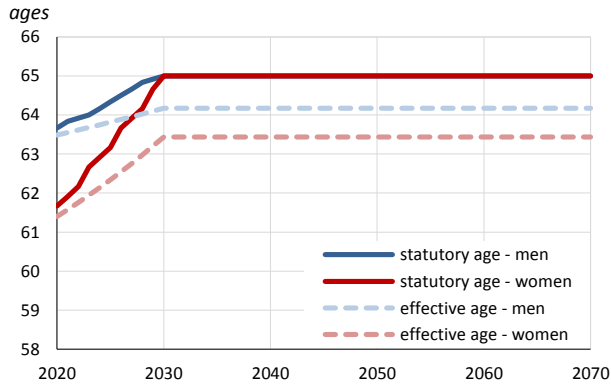
There is, however, one important implication from the evolution of average exit age as a result of CSM on the pension projection. It lies in the difference between this effective age and statutory retirement age recognized by the pension law. Development of the two is showed on Figure 2.2. Recently, the effective exit from the labour market has been close to (and above) the statutory retirement age due to high penalization in case of early retirement. Such relationship is expected to be weakened in the near future, as further increase of retirement age is assumed to be less effective. This assumption opens the gap between the two (Figure 2.3). Moreover, even when the retirement age is unified

¹⁰ Retirement age of women increases up to 65 from currently lower level.

¹¹ In this projection round, we were able to improve modelling of average contributory periods also thanks to outputs of simulation model run by Czech Ministry of Labour and Social Affairs.

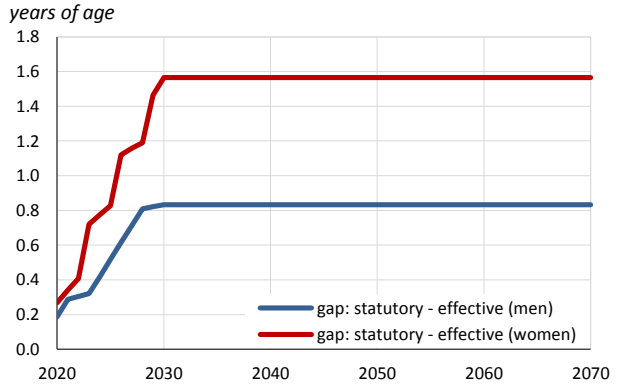
there is constantly different gap for men and women over projection horizon. These gaps pose a pressure on pension system and also touch the question how to understand constant policy setting, because it brings additional number of inactive people, currently not observed in the data. In order to be in line with macroeconomic assumptions, the model is forced to consider these inactive people as early pensioners (beyond probabilities to retire used by pension model and calculated from administrative data) despite the fact they face high permanent penalizations for their “decision”.¹²

Figure 2.2: Statutory Versus Effective Exit Age



Source: Pension Insurance Act (No. 155/1995), MoF.

Figure 2.3: Gap Between Statutory and Effective Age



Source: MoF calculations.

¹² For detailed discussion of differences in assumption between CSM and pension model please see Annex B.

3 Pension Projection Results

This part presents the results of pension model that applies policy settings described in Section 1, while applying the AWG assumptions from Section 2.

3.1 Extent of the Coverage of the Pension Schemes in the Projections

Pension projection focuses on mandatory social security pensions as the most important scheme. It fully covers all type of pensions –old age, disability and survivors’ with respect to current legislation. Special schemes for armed forces are not covered as they are administered by respective ministries. These schemes are of minor importance and do not pose additional pressures on public finances with changes in population structure.¹³

Projections exclude the third pillar, voluntary fully funded private scheme as it plays negligible role. Moreover, detailed data for contribution side are not available and expenditure side is not possible to analyse because benefits have a form of lump sum in majority of cases. Therefore, pension projections fully cover and respect all settings of the pay-as-you-go pillar described in Section 1.1.1 and disregard pillar introduced in Section 1.1.2.

The comparison of the past showing the differences in pensions as a share of GDP in fact does not mean that different data are used for the projection. The difference stems from exclusion of armed forces in AWG projections due to lack of data and due to the fact that these marginal schemes are not financed from general social security system but rather from budgets of respective ministries.

Table 3.1: Eurostat (ESSPROS) vs. Ageing Working Group Definition of Pension Expenditure

% of GDP

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	change 2009-2018
Eurostat total pension expenditure	8.7	8.8	9.2	9.3	9.3	9.0	8.6	8.4	8.3	8.2	-0.5
Eurostat public pension expenditure (A)	8.7	8.8	9.2	9.3	9.3	9.0	8.6	8.4	8.3	8.2	-0.5
Public pension expenditure (AWG: outcome) (B)	8.4	8.4	8.8	8.9	9.0	8.6	8.3	8.1	7.9	7.8	-0.6
Difference Eurostat/AWG: (A)-(B)	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.4	0.3	0.1

Source: Eurostat, European Commission.

3.2 Overview of Projection Results

Social security scheme is the major source of benefits for elderly generation based on pay-as-you-go system. With the population ageing the expenditure pressures will rise to some extent with the old-age pension as the most demanding type of pension. This increase is caused by changes in population structure and longevity, resulting in higher number of pensions over time as illustrated on Figure D.14 in Annex D.

Public pension contributions are paid by working population from their wages that develop in line with GDP over the horizon. We also assume constant contribution rate in line with no policy change assumption. This results in the constant share of contributions on GDP in all projection years.

¹³ Taking all the relevant ministries together, their total expenditures on pensions reach stable ratio of approx. 0.2% of GDP.

Table 3.2: Projected Gross and Net Pension Spending and Contributions*% of GDP*

Expenditure	2019	2030	2040	2050	2060	2070	Peak value	Peak year	change 2019-2070
Gross public pension expenditure	8.0	8.8	9.8	11.4	11.8	10.9	11.9	2057	2.9
Private occupational pensions	:	:	:	:	:	:	:	:	:
Private individual pensions	:	:	:	:	:	:	:	:	:
Mandatory private	:	:	:	:	:	:	:	:	:
Non-mandatory private	:	:	:	:	:	:	:	:	:
Gross total pension expenditure	8.0	8.8	9.8	11.4	11.8	10.9	11.9	2057	2.9
Net public pension expenditure	8.0	8.8	9.8	11.4	11.8	10.9	11.9	2057	2.9
Net total pension expenditure	8.0	8.8	9.8	11.4	11.8	10.9	11.9	2057	2.9
Contributions	2019	2030	2040	2050	2060	2070	Peak value	Peak year	change 2019-2070
Public pension contributions	8.5	8.5	8.5	8.5	8.5	8.5	8.5	2019	0.0
Total pension contributions	8.5	8.5	8.5	8.5	8.5	8.5	8.5	2019	0.0

Source: MoF calculations.

In the light of the most recent population and macroeconomic assumptions, pension expenditures are expected to increase from current 8.0% to 10.9% of GDP in 2070. The greatest part is taken by **old-age pensions** being mostly affected by changes in population structure. However, the increase is somewhat limited, due to the postponement in retirement age, which takes place until 2030. Expenditures, as a share of GDP, are broadly constant in this period, followed by an increase due to longevity together with fixed retirement age and not least by a wave of strong population cohorts entering retirement after 2040. The latter is visible from decrease of expenditure in the last decade of projection horizon together with disappearance of these cohorts from retirement. After the peak in 2057 (amounting to 11.9% of GDP) expenditure decline by 1.0 p. p in one decade landing at 10.9% of GDP in 2070. Thus the overall increase between years 2019 and 2070 is expected to be 2.9 p.p.

Table 3.3: Projected Gross Public Pension Spending by Scheme*% of GDP*

Pension scheme	2019	2030	2040	2050	2060	2070	Peak value	Peak year	change 2019-2070
Total public pensions	8.0	8.8	9.8	11.4	11.8	10.9	11.9	2057	2.9
of which									
Old age and early pensions:	6.7	7.4	8.5	10.1	10.4	9.5	10.5	2057	2.8
Flat component	1.7	1.7	1.9	2.3	2.4	2.3	2.4	2058	0.6
Earnings related	5.0	5.8	6.5	7.8	8.0	7.3	8.1	2057	2.3
Minimum pensions (non-contributory) i.e. minimum income guarantee	:	:	:	:	:	:	:	:	:
Disability pensions	0.8	0.8	0.7	0.7	0.7	0.7	0.9	2020	-0.1
Survivor pensions	0.5	0.6	0.6	0.6	0.7	0.7	0.7	2061	0.2
Other pensions	:	:	:	:	:	:	:	:	:

Source: MoF calculations.

There are two opposite effects driving future development of **disability pensions**. First, positive effect is related to legislative changes that introduced three levels of disability (instead of previous two) from 2010 onwards and more strict eligibility conditions for any of disability types.¹⁴ Second, temporary negative effect stems from the fact that postponement of retirement age until 2030 brings more disabled persons in preretirement ages due to their higher disability rates.¹⁵ Number of disability pensions slightly decreases in next couple decades, which is a result of recent trend observed from the data. This is reflected in mild decline in expenditures. Disabled people of any type are automatically transferred to old age pensions at the age of 65.

¹⁴ Impact of the reform on the number disability pensions is shown in Figure D.15—Figure D.17.

¹⁵ Illustration of disability profiles development can be found in Annex D.

There is not any special **minimum pension scheme**. Minimum amount of benefit is ensured by flat rate component same for every pension type and minimum earnings related component. For details of pension calculations see system description in Section 1.1.1.

3.3 Main Driving Forces behind the Projection Results and Their Implications

Table 3.4 shows results of the public pension decomposition. It is apparent that the main contribution to the increase of pension expenditure by 2.9 p.p. over time is the ageing population that will change the ratio between the elderly and active population. **Dependency ratio** is also behind the decrease of pension expenditure in the last decade, illustrating the outflow of strong generations from retirement.

Opposing to that, **coverage ratio** will decrease over time with an exception of the last decade when it increases because of a positive change in cohort effect. The decline in the first two decades is related to the postponement of the retirement age, especially in early-age coverage ratio.¹⁶ This will reduce the number of pensioners and together with the increase of population aged 65+ will influence the ratio. Following decades are mainly a result of population development in the respective cohorts of 50–64. Decline in the first half of projection horizon in case of old-age coverage ratio is a compound result of growing population aged 65+ and a slowdown of an increase in number of pensioners (relative to population mainly in cohorts 65–69) due to some increase in participation rates.

Table 3.4: Factors behind the Change in Public Pension Expenditures between 2019 and 2070 – Pensioners

percentage points of GDP

	2019	2030	2040	2050	2060	2019
	-	-	-	-	-	-
	2030	2040	2050	2060	2070	2070
Public pensions to GDP	0.8	1.0	1.6	0.4	-0.9	2.9
Dependency ratio effect	1.5	1.5	2.1	0.9	-1.1	4.8
Coverage ratio effect	-1.0	-0.3	-0.4	-0.2	0.3	-1.6
Coverage ratio old-age	-0.3	-0.2	0.1	0.1	0.1	-0.2
Coverage ratio early-age	-3.2	0.4	0.6	-0.2	-0.3	-2.7
Cohort effect	0.4	-1.2	-2.9	-1.5	2.0	-3.1
Benefit ratio effect	0.2	-0.1	0.1	-0.2	-0.2	-0.3
Labour Market/Labour intensity effect	0.2	0.1	-0.1	-0.1	0.2	0.2
Employment ratio effect	0.1	0.2	-0.1	-0.1	0.1	0.2
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.0
Career shift effect	0.0	-0.1	0.0	0.0	0.1	0.0
Residual	0.0	0.0	-0.1	0.0	0.0	-0.1

Source: European Commission, MoF calculations.

The main effect on **benefit ratio** will have the evolution of average careers. As noted in Section 2.2, average career will increase until 2030 with postponement of retirement age and decline in last decades of projection due to abolishment of study periods as non-contributory periods. Besides that, there are also other tendencies affecting benefit ratio, that is, in general, dampen by assumed indexation. Indexation of pensions is represented by an inflation growth (measured by the aggregate consumer price index) plus a half of the growth in real average wage. For the future, the indexation rule is set to be strict without possible discretions.¹⁷ Second effect that drags the benefit ratio down is assumed additional increase of early retirement pensions comparing to observed data in order to improve coverage of inactive people determined by CSM.¹⁸ Early retirement pension benefits are subject to permanent penalization and thus are quite substantially lower than regular pension benefit. On the other hand, there is a positive effect on the ratio after 2040 due to higher inflows of new pensioners from stronger generations. Higher newly granted pensions thus support benefit ratio.

Labour market effects are rather moderate with minor fluctuations over projection horizon.

¹⁶ The issue of the decrease in coverage ratio is addressed in detail in Annex B.

¹⁷ It is true that the Government has limited possibility to increase indexation up to 2.7% every year in case that legislated indexation (CPI + ½ real average wage growth) is lower than this threshold. Given the macroeconomic assumptions this situation does not occur in projection horizon. Inflation is assumed to be 2% and average real wage growth (2020–2070) is 1.9%.

¹⁸ Details can be found in Annex B.

Table 3.5: Benefit Ratio, Replacement Rate at Retirement, and Coverage by Pension Scheme

%	2019	2030	2040	2050	2060	2070	change 2019-2070
Public scheme (BR)	38.5	39.3	38.5	38.8	38.1	37.3	-1.2
Coverage	100.0	100.0	100.0	100.0	100.0	100.0	0.0
Public scheme old-age earnings related (BR)	38.7	40.1	39.5	39.7	38.8	38.1	-0.6
Public scheme old-age earnings related (RR)	45.1	46.5	45.7	45.2	44.3	42.9	-2.2
Coverage	83.3	82.6	84.1	86.2	86.9	85.9	2.5
Private occupational scheme (BR)	:	:	:	:	:	:	:
Private occupational scheme (RR)	:	:	:	:	:	:	:
Coverage	:	:	:	:	:	:	:
Private individual scheme (BR)	:	:	:	:	:	:	:
Private individual scheme (RR)	:	:	:	:	:	:	:
Coverage	:	:	:	:	:	:	:
Total benefit ratio	38.5	39.3	38.5	38.8	38.1	37.3	-1.2
Total replacement rate	34.3	35.5	36.5	35.6	33.6	33.1	-1.1

Source: European Commission calculations, MoF calculations.

Benefit ratio represents relationship between average pension benefit and economy wide average wage, while the replacement rate is a share of average newly granted pension benefit on average gross wage at retirement. Both wages develop in line (for details see explanation in Section 1.3). Table 3.5 shows evolution of these ratios over time for public scheme. As the public pension that includes old-age, disability and survivor's benefits is the only scheme covered in the projections, its benefit ratio does not differ from the benefit ratio.

Naturally, the highest pension benefits are paid out to old-age pensioners, therefore the replacement rate for such old-age earnings related pension is higher than that for the whole public scheme. Average new pension benefits that are in nominator of replacement rate are every year calculated in the same way from pensionable earning which correspond to wages.¹⁹ Therefore average replacement rate would tend to be constant over time. Unfortunately, it is not the case of old-age pensions, where also another factor plays role. It depends on distribution of number of people retiring around statutory retirement age. The more people retire earlier than at statutory retirement age, the higher penalization applies to more pensioners, and thus the lower resulting average pension benefit. This effect is behind quite erratic evolution of replacement rate,²⁰ because it depends on number of people assigned with early old-age pension in order to cover assumed number of inactive people. This reason applies also for explanation of the evolution of replacement rate (and also benefit ratio) over time. These ratios fall mainly because of additional coverage of inactive people as explained in Annex B. The biggest part of additionally covered people with an early old age pension is in the period up to 2040 until when the gap between statutory and effective retirement opens (see Figure 2-2 and Figure 2-3). The more people retire before statutory retirement age and the more earlier, the higher penalization applies to more pensioners, and thus the lower resulting average pension benefit and consequently replacement rate (and benefit ratio). All replacement rates are illustrated on Figures in Annex D (Figure D.20—Figure D.26).²¹ Additionally, the effect that materializes in the last decade and drags down mainly the replacement rate stems from shorter average careers induced by disregarded education periods in pension benefit calculations (see Section 2.2).

In case of benefit ratio, not only newly granted pensions play role, but also those paid out matter. All types of pensions are losing over time in comparison with average wage due to indexation by consumer price index plus one half of real wage growth. Rather stable inflow of new pensions prevents the ratio from falling. Same effects apply on average pension benefit in case of benefit ratio²².

¹⁹ Calculation of pensionable earning from wage through reduction brackets using reduction coefficients is described at the beginning of Section 1.1.1 and also in equation (4.20).

²⁰ The reason for erratic development in case of new pensions during the first two decades is in the retirement age postponement that happens every few years. As we work with yearly model, we are not able to capture the smooth pattern of retirement increase. If we smooth the line we would see stable development with rather minor decreases in replacement rates due to described effect. Intuition can be drawn from Figure 2.1.

²¹ Figures of replacement rates show visible jump at the beginning of projection horizon (mainly in 2021). This is due to the recent negative development connected with COVID-19 and short-term outlook, when wages are expected to fall causing the temporary increase in the replacement rate. It is worth noting that the projections use macroeconomic data from commonly agreed macroeconomic assumptions calculated by CSM only.

²² It is worth noting why the benefit ratio for the whole public scheme is not very different from the benefit ratio for old age pensions (with higher average pension). In case of old-age pensions there is no difference between pensions and pensioners. On the other hand calculation of benefit

In fact, all pensions in the Czech Republic are covered by the social security pension scheme, therefore public scheme coverage is 100% and also old age pensioners continually represent around 82 to 87% of the system –.

While not as dramatic as old-age dependency ratio increase, the dependency in the pension system that measures share of pensioners (receivers of pension benefits) over employees (contributors to the system) increases from recent 54.7% to 75.7% over time. It is mainly due to rise in retirement age until 2030 that helps to limit the increase in dependency. As a result, the difference between the two dependencies, denoted as “system efficiency”, declines.

Table 3.6: System Dependency Ratio and Old-age Dependency Ratio

	2019	2030	2040	2050	2060	2070	change 2019-2070
Number of pensioners (thousand) (I)	2 898	2 931	3 146	3 396	3 449	3 271	374
Employment (thousand) (II)	5 298	5 016	4 760	4 445	4 298	4 320	-978
Pension System Dependency Ratio (SDR) (I)/(II)	54.7	58.4	66.1	76.4	80.2	75.7	21.0
Number of people aged 65+ (thousand) (III)	2 109	2 382	2 659	2 983	3 083	2 850	741
Working age population 20 - 64 (thousand) (IV)	6 388	6 168	5 882	5 444	5 212	5 312	-1 077
Old-age Dependency Ratio (ODR) (III)/(IV)	33.0	38.6	45.2	54.8	59.2	53.7	20.6
System efficiency (SDR/ODR)	1.7	1.5	1.5	1.4	1.4	1.4	-0.2

Source: Eurostat, European Commission.

Shares of pensioners on inactive population (in Table 3.7 for both sexes and in Table 3.10 for women) include two effects. Due to the increase in retirement age, the share decreases in relevant cohorts since they are no longer allowed to retire for full benefits. It is the case of age group of 60–64. On the other hand, disability pensions rises due to higher disability rate in these older ages. However, the disability rates (probability of becoming disabled) do not fully offset the old age pensions. Also participation rates are very low in these ages. Factors driving the share of pensioners over inactive people down for a certain period of projection outweigh the effect of rising disability rates.

In the projection, all persons that fulfil the minimum age limit even for early retirement pension are covered. The age specific share of old-age pension allowed for early pensions (in cohorts of age-3 and age-5 at a later stage) stems from observed data and such a distance from retirement age is kept constant over time. From the available data, it is visible that huge penalizations for early retirement are effective and that lower share of people retires in earlier ages. The share increases as the statutory age approaches. As we needed to incorporate the CSM assumption about lower effective retirement age and increase the coverage, we made additional adjustments described in Annex B. The model recalculates the number of old-age pensions with increased share of early pensions beyond what data say so that the more inactive people are covered. While doing this we respect the fact that the demand for early retirement increases as retirement age approaches. The rest of inactive people that could possibly retire is covered by so-called preretirement scheme described in Chapter 1.1.2. All people at the statutory retirement age and older are old-age pensioners automatically. Consequently, declining share of pensioners to inactive people in the age group 55–59 and 60–64 during the first couple of decades is fully explained by the fact that people from these cohorts are gradually losing eligibility for (early) old-age pensions as well as for preretirement scheme.

The same effect plays role also when comparing pensioners to the whole population. The result is here only more pronounced, because there is no compensation of labour market through participation rates.²³

ratio for the whole public scheme uses a share of all pension expenditures (including outlays for pensions in concurrence) on number of pensioners (which is lower than number of pensions). Therefore comparison of the two benefit ratios may be misleading.

²³ If every inactive person is covered by pension benefit e.g. in cohort 65–69, the difference in terms of population must be active persons.

Table 3.7: Pensioners (Public Schemes) to Inactive Population Ratio by Age Group

%	2019	2030	2040	2050	2060	2070	Peak year
Age group -54	10.1	9.8	9.2	8.6	9.0	9.0	2019
Age group 55-59	128.2	105.6	96.5	98.1	101.0	100.4	2019
Age group 60-64	123.0	82.4	83.0	82.3	82.6	81.8	2020
Age group 65-69	114.3	103.0	100.0	100.0	100.0	100.0	2019
Age group 70-74	101.4	100.0	100.0	100.0	100.0	100.0	2020
Age group 75+	100.3	100.0	100.0	100.0	100.0	100.0	2019

Source: MoF calculations.

Table 3.8: Pensioners (Public Schemes) to Population Ratio by Age Group

%	2019	2030	2040	2050	2060	2070	Peak year
Age group -54	4.0	4.1	3.9	3.7	3.9	3.9	2027
Age group 55-59	16.7	14.1	13.6	13.6	13.6	13.7	2019
Age group 60-64	63.4	40.4	38.0	37.5	37.4	36.7	2020
Age group 65-69	95.9	85.6	79.6	80.3	80.5	80.0	2019
Age group 70-74	98.7	95.7	95.6	95.5	95.4	95.4	2019
Age group 75+	100.3	100.0	100.0	100.0	100.0	100.0	2019

Source: MoF calculations.

In fact, same comments as for overall numbers apply to female pensioners as well. The drop in coverage rate is, comparing to males, only bit more pronounced and affects also age cohort of 55–59 to larger extent. The former is caused by faster increase in their retirement age comparing to males and the latter because women have currently lower retirement age.

Table 3.9: Female Pensioners (Public Schemes) to Inactive Population Ratio by Age Group

%	2019	2030	2040	2050	2060	2070	Peak year
Age group -54	9.7	9.7	9.0	8.3	8.8	8.8	2027
Age group 55-59	122.0	100.8	91.7	93.3	96.3	95.6	2019
Age group 60-64	124.3	80.4	80.8	80.0	80.1	79.1	2020
Age group 65-69	110.0	100.0	100.0	100.0	100.0	100.0	2020
Age group 70-74	102.0	100.0	100.0	100.0	100.0	100.0	2020
Age group 75+	101.7	100.0	100.0	100.0	100.0	100.0	2019

Source: MoF calculations.

Table 3.10: Female Pensioners (Public Schemes) to Population Ratio by Age Group

%	2019	2030	2040	2050	2060	2070	Peak year
Age group -54	4.4	4.5	4.3	4.0	4.2	4.2	2027
Age group 55-59	18.9	17.1	16.5	16.5	16.5	16.5	2020
Age group 60-64	78.9	45.0	41.0	40.7	40.4	39.6	2020
Age group 65-69	98.1	85.9	80.8	81.5	81.7	81.2	2019
Age group 70-74	100.1	96.1	96.0	95.7	95.7	95.6	2019
Age group 75+	101.7	100.0	100.0	100.0	100.0	100.0	2019

Source: MoF calculations.

New old-age pension expenditures (first lines in each section of Table 3.11) are product of number of new pensions and average newly granted pension benefit. The Table 3.11 disaggregates calculation of earnings related component of new old-age pension benefit more into main driving factors. One of the main inputs in pension benefit calculation is a statistic of distribution of new pensions according to i) personal assessment base and ii) contributory period. It allows to calculate not only the average contributory period, but also the average pensionable earning in the base year.

We assume that this distribution will be shifted in accordance with retirement age and the extension of acknowledged contributory periods for the whole career. Therefore, the average contributory periods would increase during first decades. Afterwards average careers are expected to decline in following years as education period will be no longer recognized as contributory periods (see Section 2.2). It is worth noting, that average contributory periods are somewhat different for men and women. Men have currently 44.9 contributory years on average and end up with 41.9 years, while women have 43.1 years, due to currently lower retirement age, and end up with 42.1 in 2070. The difference, with the contribution period of women being higher than of men after the retirement age unifies at 65, stems from the administrative data. Already in 2019, women have somewhat longer contributory periods with respect to their retirement age than men. In the base year, men have higher retirement age by 2.3 years (63.5 years versus 61.2 years in case of women), but average contributory period is higher only by 1.8 years (44.9 years versus 43.1 years for women). The difference then affects the whole projection.

Table 3.11: Disaggregated New Public Pension Expenditure

old-age and early earnings-related pensions

Total		2019	2030	2040	2050	2060	2070	Peak year
Projected new pension expenditure	<i>million EUR</i>	537	998	1 999	2 599	3 031	4 182	2070
I. Number of new pensions	<i>thousands</i>	97.2	114.8	155.4	137.3	112.1	112.6	2041
II. Average contributory period	<i>years</i>	44.1	47.0	47.0	43.0	42.0	42.0	2030
III. Average accrual rate	<i>%</i>	1.5	1.5	1.4	1.5	1.5	1.5	2021
IV. Monthly average pensionable earnings	<i>thousands EUR</i>	0.7	1.1	1.6	2.4	3.5	5.0	2070
V. Sustainability/adjustment factors		1.0	1.0	1.0	1.0	1.0	1.0	:
VI. Average number of months paid the first year		12.0	12.0	12.0	12.0	12.0	12.0	2019
Monthly average pensionable earnings/Monthly economy-wide average wage		53.2	54.2	54.2	54.2	54.2	54.2	2020
Men		2019	2030	2040	2050	2060	2070	Peak year
Projected new pension expenditure	<i>million EUR</i>	304	526	1 082	1 428	1 688	2 312	2070
I. Number of new pensions	<i>thousands</i>	50.9	57.7	78.0	70.1	58.0	57.5	2041
II. Average contributory period	<i>years</i>	44.9	46.9	46.9	42.9	41.9	41.9	2030
III. Average accrual rate	<i>%</i>	1.5	1.5	1.5	1.6	1.6	1.5	2021
IV. Monthly average pensionable earnings	<i>thousands EUR</i>	0.7	1.1	1.7	2.5	3.7	5.2	2070
V. Sustainability/adjustment factors		1.0	1.0	1.0	1.0	1.0	1.0	:
VI. Average number of months paid the first year		12.0	12.0	12.0	12.0	12.0	12.0	2019
Monthly average pensionable earnings/Monthly economy-wide average wage		55.6	56.6	56.6	56.6	56.6	56.6	2020
Women		2019	2030	2040	2050	2060	2070	Peak year
Projected new pension expenditure	<i>million EUR</i>	233	473	917	1 171	1 343	1 870	2070
I. Number of new pensions	<i>thousands</i>	46.3	57.1	77.4	67.3	54.1	55.2	2040
II. Average contributory period	<i>years</i>	43.1	47.1	47.1	43.1	42.1	42.1	2030
III. Average accrual rate	<i>%</i>	1.5	1.5	1.4	1.5	1.5	1.4	2021
IV. Monthly average pensionable earnings	<i>thousands EUR</i>	0.7	1.0	1.5	2.3	3.3	4.8	2070
V. Sustainability/adjustment factors		1.0	1.0	1.0	1.0	1.0	1.0	:
VI. Average number of months paid the first year		12.0	12.0	12.0	12.0	12.0	12.0	2019
Monthly average pensionable earnings/Monthly economy-wide average wage		50.5	51.5	51.5	51.5	51.5	51.5	2020

Source: MoF calculations.

Average pensionable earning develops in line with the wage development, so its ratio to economy wide average wage is constant over time. Pensionable earning is considered to be economy wide average wage “transformed” into personal assessment base through reduction brackets using reduction coefficients as described at the beginning of Section 1.1.1 and also in equation (4.20). Because wage is the base for the calculation, and also reduction brackets develop in line with wages, the share is constant over projection horizon.

As the model works with annual data and statistics (averages of new pensions over year), we work with full year of 12 months.

Value of average accrual rate is legislated to be 1.5%. Numbers in the Table 3.11 are slightly different, which is caused by calculation method of accrual rate in this table as a resulting residual variable.²⁴ It is affected by distribution of the retirement around statutory retirement age, which has consequences in the form of bonuses or penalizations. Its development over time is connected with evolution of replacement rate of average newly granted pension benefits that is also largely affected by early or postponed retirement. Naturally, the distribution (and the two variables) would be more or less constant over time if there is no adjustment to the population covered by pension system²⁵. When additional adjustment applies in order to reach desired coverage of inactive people (targeting to 100% in relevant cohorts), average replacement rate of new pensions (and thus average accrual rate) deviates. In the years with relatively higher share of early retirees and/or lower share of later retirements, average replacement rate (and average accrual rate) decreases and vice versa.

As pension formula is the same for both sexes, identical driving factors work for all parts of the Table 3.11. Only minor differences can be seen in recent shorter careers of women and their lower income.

3.4 Financing of the Pension System

The only income of the pay-as-you-go system itself stems from pension insurance contribution (28%) paid from employees' income.²⁶ Therefore numbers of contributors and employed are equal. Contribution burden is shared between employee (6.5%) and employer (21.5%). In the same way, the total revenues of the system from public contributions in Table 3.13 are split between the two groups. State does not take part in the system, not even in case of unemployed people, students or women on maternity leave. The only relief for these people is in the fact that they acquire pension rights through the so called non-contributory periods without paying contributions.

Table 3.12: Financing of the System

	Public employees	Private employees	Self-employed
Contribution base	salary	wage	profit
Contribution rate/contribution			
Employer	21.5%	21.5%	28.0%
Employee	6.5%	6.5%	:
State	:	:	:
Other revenues	Balance of pension system is part of general government budget.	Balance of pension system is part of general government budget.	Balance of pension system is part of general government budget.
Maximum contribution	four times average wage	four times average wage	four times average wage
Minimum contribution	:	:	25% of average wage

Source: Pension Insurance Act (No. 155/1995).

Table 3.13: Revenue from Contribution, Number of Contributors in the Public Scheme, Total Employment

	2019	2030	2040	2050	2060	2070	change 2019-2070
Public contribution (% GDP)	8.5	8.5	8.5	8.5	8.5	8.5	0.0
Employer contribution	6.5	6.5	6.5	6.5	6.5	6.5	0.0
Employee contribution	2.0	2.0	2.0	2.0	2.0	2.0	0.0
State contribution	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other revenues	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of contributors (I) (1000)	5 305	5 016	4 760	4 445	4 298	4 320	-986
Employment (II) (1000)	5 298	5 016	4 760	4 445	4 298	4 320	-978
Ratio of (I)/(II)	1.0	1.0	1.0	1.0	1.0	1.0	0.0

Source: European commissions, MoF calculations.

²⁴ It is only an issue of illustration in the Table 3.12, which illustrates ex-post calculated average accrual. When calculating new pension benefit for each pensioner, model, of course, works with the legislated accrual rate of 1.5%.

²⁵ As discussed in Annex B.

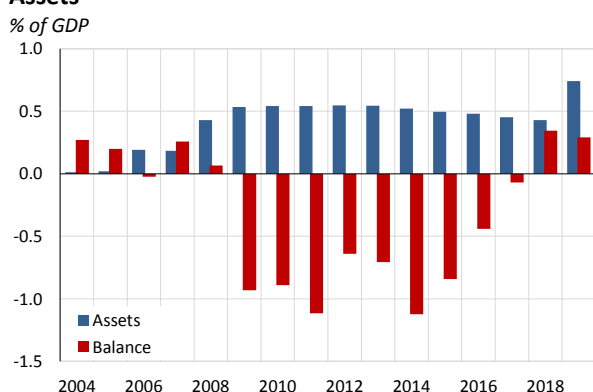
²⁶ For details, see Section 1.1.1.

One must distinguish between flows and stock. If the pension system in the Czech Republic has higher expenditures than revenues, the deficit is financed by other revenues from the State budget (taxes). If the opposite is the case, the surplus is transferred to the pension reserve fund created in 2004. This fund should accumulate assets to support the future pension reform.

Figure 3.1 shows evolution of the system balance and assets of the pension fund. Social security system balances illustrate yearly differences between income from contributions and expenditures paid out to all types of pensioners (it is the flow variable). Besides the social contributions, some ad hoc inflows, e.g. from dividends paid by state-owned companies are transferred to the State budget to finance the deficit of the pension system. Pension fund assets variable shows the stock at the end of every year. These assets cannot be spent deliberately. This prevents the assets to be depleted and the deficits are covered from other government revenues in the State budget. Thus, the assets are real on the one hand, but on the other hand, they are preserved just according to law but virtually would be already depleted. This is assumed for the future as this reflects the economic reality of the pension account. The system itself does not accumulate assets anymore. As the system currently runs deficits, the same is projected into the future (see Figure 3.2).

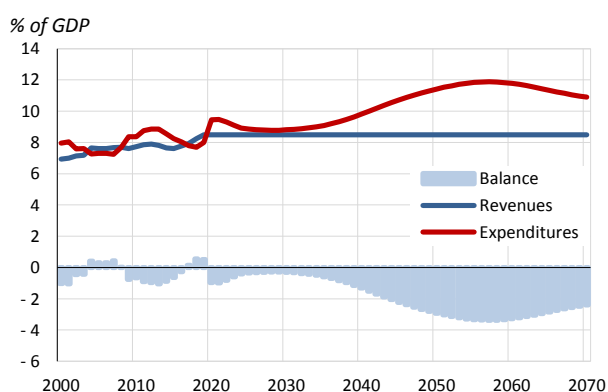
Figure 3.1: Social Security Balance and Pension Fund

Assets



Source: MoF.

Figure 3.2: Revenues, Expenditures and Balance



Source: MoF calculations.

Table 3.14: Pension Assets and Reserves and Return on Assets

% of GDP, %

	average 1999-2008	average 2009-2018	2019	2030	2040	2050	2060	2070	average 2019-2070
Public pension scheme									
assets and reserves	0.1	0.5	0.7	0.0	0.0	0.0	0.0	0.0	0.0
average return	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Private occupational schemes									
assets and reserves	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
average return	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Private individual mandatory schemes									
assets and reserves	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
average return	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Private individual non-mandatory schemes									
assets and reserves	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
average return	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Source: MoF.

3.5 Sensitivity Analysis

Besides the baseline scenario discussed in all other parts of this document, several sensitivity analysis have been carried out. In the system with one pillar, the effects on public pensions and total pensions are the same.

Higher life expectancy shows higher expenditures simply because pensioners live longer and thus the pay-out period of pension is extended compared to the baseline. Pension system does not include any automatic compensation mechanism for longevity that would reduce this effect.

Under the assumption of **lower migration**, the increase in pension expenditures is somewhat higher. The reason is solely in lower employment and lower GDP that raises the ratio. The level of total expenditures is lower in this scenario comparing to the baseline. **Higher migration** has similar opposite effects.

Lower fertility scenario has quite large effect on pension expenditure through negative impact on working population and thus on performance of the economy. It is the lower GDP that is mainly behind larger increase in the share of expenditure spending.

Table 3.15: Public and Total Pension Expenditure under Different Scenarios

pps deviations from the baseline

	2019	2030	2040	2050	2060	2070	change 2019-2070 (pps)
	Public Pension Expenditure						
Baseline	8.0	8.8	9.8	11.4	11.8	10.9	2.9
Higher life expectancy at birth (+2y)	0.0	0.1	0.2	0.3	0.5	0.7	0.7
Higher migration (+33%)	0.0	-0.1	-0.2	-0.4	-0.4	-0.3	-0.3
Lower migration (-33%)	0.0	0.1	0.2	0.4	0.5	0.3	0.3
Lower fertility (-20%)	0.0	0.0	0.0	0.4	0.9	1.5	1.5
Higher employment rate of older workers (+10 pps.)	0.0	-0.4	-0.8	-0.9	-0.3	0.2	0.2
Higher TFP growth (convergence to 1.2%)	0.0	0.0	-0.1	-0.2	-0.3	-0.3	-0.3
TFP risk scenario (convergence to 0.8%)	0.0	0.0	0.1	0.2	0.3	0.3	0.3
Policy scenario: linking retirement age to change in life expectancy	0.0	0.0	-0.5	-0.9	-1.2	-1.4	-1.4
Policy scenario: unchanged retirement age	0.0	0.8	1.4	1.6	1.8	2.2	2.2
Policy scenario: offset declining pension benefit ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lagged recovery scenario	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Adverse structural scenario	0.0	0.3	0.4	0.6	0.7	0.7	0.7
Total Pension Expenditure							
Baseline	8.0	8.8	9.8	11.4	11.8	10.9	2.9
Higher life expectancy at birth (+2y)	0.0	0.1	0.2	0.3	0.5	0.7	0.7
Higher migration (+33%)	0.0	-0.1	-0.2	-0.4	-0.4	-0.3	-0.3
Lower migration (-33%)	0.0	0.1	0.2	0.4	0.5	0.3	0.3
Lower fertility (-20%)	0.0	0.0	0.0	0.4	0.9	1.5	1.5
Higher employment rate of older workers (+10 pps.)	0.0	-0.4	-0.8	-0.9	-0.3	0.2	0.2
Higher TFP growth (convergence to 1.2%)	0.0	0.0	-0.1	-0.2	-0.3	-0.3	-0.3
TFP risk scenario (convergence to 0.8%)	0.0	0.0	0.1	0.2	0.3	0.3	0.3
Policy scenario: linking retirement age to change in life expectancy	0.0	0.0	-0.5	-0.9	-1.2	-1.4	-1.4
Policy scenario: unchanged retirement age	0.0	0.8	1.4	1.6	1.8	2.2	2.2
Policy scenario: offset declining pension benefit ratio	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lagged recovery scenario	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Adverse structural scenario	0.0	0.3	0.4	0.6	0.7	0.7	0.7

Source: MoF calculations.

Higher employment of older workers lowers pension expenditures by contributing to higher GDP and creates less pressure on pensions as people remain at labour market longer time. However, in the longer horizon it will result in higher accumulated pension rights for longer career and bonuses for working after statutory retirement age and thus the expenditure will, in the second half of horizon, increase more dynamically than in the baseline. Moreover, when compared to the baseline, there is another effect worth noting which deepens mentioned effects. It lies in additional coverage of inactive people that takes place in the baseline, but not in this scenario as labour market here covers those who are inactive in the baseline. Thus in the baseline, there is in absolute number more pensioners also forced

to accept permanently reduced pension. This fact in the long term reduces pension expenditure and is the main reason why the baseline has lower expenditure over GDP than this sensitivity scenario at the end of the horizon.

Higher total factor productivity growth is slightly more demanding from the level of total expenditures point of view. But the opposite is true looking at the GDP ratios. This scenario creates higher GDP (causing higher denominator effect) and somewhat higher wages. However the newly granted pensions will be higher, the indexation rule will translate only 1/2 of this positive effect into the growth of the pension benefit.

TFP risk scenario affects GDP and wages in a negative way. The level of pension expenditures is lower, but as in the case of lower total factor productivity the effect of lower GDP dominates and thus the resulting expenditure shares are higher compared to the baseline.

Analysis of the **policy scenario linking statutory retirement age to gains in life expectancy** shows lower expenditure to GDP. This happens through permanent postponement of retirement age that limits the increase in pension expenditure. In the first two decades, the difference is very limited, as both scenarios equally postpone the retirement age.²⁷ In the following decades the difference increases and is broadly similar as the difference of the current baseline from the pre-reform pension system as discussed in following Section 3.6.

On the other hand, if the **retirement age is fixed** on the current level and additional postponement until the age 65 reached in 2030 is abolished, pension system would, in the long horizon, require higher expenditure up to 2.2% of GDP.

The third policy **scenario of offsetting declining benefit ratio** does not differ from the baseline. The decline of benefit ratio is already in the baseline rather moderate amounting to max 4% over projection horizon in comparison with the base year 2019.

The last two scenarios anticipating possible effects of current economic downturn show, that temporary adverse shock shown in **lagged recovery scenario** has practically no effect on long term development of pension system. On the other hand, the **adverse structural scenario** assuming permanent negative shock on macroeconomic development has negative impact on pension system that translates into higher expenditure GDP ratio. Although paid out pension benefits are, due to lower wages, not as high as in the baseline, the main reason behind higher expenditure shares lies in denominator effect, i.e. lower GDP.

3.6 Description of the Changes in Comparison with Previous Projection Rounds

Current projections, fifth in a row, break the trend in improving results in each previous projection round and bring worse results in terms of higher increase of expenditures. Table 3.16 shows evolution of all projection rounds. Results in 2009 were better compared to 2006 mainly due to delay of the statutory retirement age (up to 65, still differentiated for women with children) and also due to more favourable demographic outlook. 2012 projections further improved the situation through parametric changes in the system. Sizable impact had mainly further postponement of retirement age and reform in disability pensions. 2015 round further ameliorated results thanks to better demographic and macroeconomic assumptions. 2018 projections brought higher expenditures mainly because of the adoption of pension reform introducing a cap on retirement age at 65 and introduction of higher indexation of paid out pension benefits amounting to CPI plus ½ real wage growth (instead of 1/3).

Table 3.16: Overall Change in Public Pension Expenditure to GDP under the 2006, 2009, 2012, 2015 and Current Projection Exercises

% of GDP

		Public pensions to GDP	Depen. ratio effect	Coverage ratio effect	Benefit ratio effect	Labour market effect	Residual (incl. Interact. effect)
2006 Ageing Report	<i>period (2004-2050)</i>	5.6	10.5	-3.5	-0.6	-0.3	-0.6
2009 Ageing Report	<i>period (2007-2060)</i>	3.3	9.5	-3.5	-1.2	-0.5	-1.1
2012 Ageing Report	<i>period (2010-2060)</i>	2.6	9.1	-4.6	-0.3	0.0	-1.1
2015 Ageing Report	<i>period (2013-2060)</i>	0.7	6.8	-3.6	-1.0	-0.5	-0.9
2018 Ageing Report	<i>period (2016-2070)</i>	2.8	5.4	-1.9	-0.5	0.0	-0.3
2021 Ageing Report	<i>period (2019-2070)</i>	2.9	4.8	-1.6	-0.3	0.2	-0.1

Source: MoF calculations.

²⁷ Link of retirement age to changes in life expectancy at 65 is in the policy scenario applied after the legislated postponement of retirement age.

Recent projection update shows very similar expenditure dynamics between 2019 and 2070. Also sizes of impacts of disaggregated factors behind this evolution are comparable. The dependency ratio pushes the expenditure share up, while coverage ratio somewhat limits the dynamics, as discussed in Section 3.3.

Table 3.17: Decomposition of the difference between 2018 and the new public pension projection

% of GDP

		2019	2030	2040	2050	2060	2070
Ageing report 2018		8.1	8.2	9.2	10.8	11.6	10.9
Change in assumptions	<i>pps of GDP</i>	-0.1	0.5	0.4	0.2	0.1	0.1
Improvement in the coverage or in the modelling	<i>pps of GDP</i>	0.0	0.1	0.3	0.4	0.1	-0.2
Change in the interpretation of constant policy	<i>pps of GDP</i>	0.0	0.0	0.0	0.0	0.0	0.0
Policy related changes	<i>pps of GDP</i>	0.0	0.0	0.0	0.0	0.0	0.0
New projection		8.0	8.8	9.8	11.4	11.8	10.9

Source: MoF calculations.

Differences between last rounds' three projection years with real data of 2016–2019 are solely due to changes in assumptions, mainly in GDP. It has been higher than expected in last projections. Also in all years, the revision of nominal GDP plays role (compare 2016, as a base year of last projection).

Table 3.18: Breakdown of the Difference between the 2018 Projections and Outcome Figures

%, *pps of GDP*

	2016	2017	2018	2019
Ageing Report 2018 projections	8.2	8.1	8.0	8.1
Assumptions	-0.1	-0.3	-0.4	-0.1
Coverage of projections	0.0	0.0	0.0	0.0
Constant policy impact	0.0	0.0	0.0	0.0
Policy-related impact	0.0	0.0	0.0	0.0
Actual public pension expenditure	8.0	7.8	7.7	8.0

Source: MoF calculations.

Projection of pension expenditure differs for two reasons. First, modelling approach to average length of careers for men and women has been improved. This was thanks to the input from simulations of Ministry of Labour and Social Affairs that allows us to incorporate effects of retirement age postponement and cancelling of education periods' valuation on contributory periods. Although the latter is not a new legislative change, previously we used our simplified estimate of career profiles, which developed in line with assumed effective retirement age. Our aggregated model does not allow estimating possible effect of periods of education and their distribution among population on "average" gathering future pension rights. With the input from simulations of average careers evolution, we see continuous effect of increasing retirement age in first decades. Longer careers means higher pension rights and thus higher pension benefits while retiring. In later decades, this effect is offset by shortening careers because of disregarded periods of education, which limits pension benefits and total expenditure.

Second reason of difference stems from assumptions. Although population projections have not changed much, updated macroeconomic scenario has an impact on current results. Medium term macroeconomic development is affected by economic downturn, which increases expenditure on GDP by denominator effect. This effect slowly vanishes.

Pension expenditures are also higher due to higher assumption of participation rates for men and women over projection horizon. This fact leaves less inactive people in the population that are left to be covered by the pension system. It should be noted that this fact does not have any impact on initial share of old-age pensioners to population over projection horizon. But it has an effect on additional coverage of inactive people as explained in Annex B. Because there is less inactive people additionally covered by permanently reduced early retirement pension and thus more people with regular permanently higher pension²⁸ also expenditures are somewhat higher.

²⁸ Although they receive regular pension few years later (usually 1–2 years), pension is permanently higher, due to penalizations of early retirement.

4 Pension Projection Model

This Section aims at introducing the technical tool for computation and main data used for projection. In order to better understand the results presented in previous Section, we try to explain all steps of calculations and illustrate them with semi-results that are for practical purposes and reader's convenience moved to annexes.

4.1 Institutional Context

The pension model has been built in the Ministry of Finance, which maintains, updates and uses the model. The model is a semi-aggregated simulation model written and run under the MATLAB application. It enables to make long-term projections and simulate the impact of changes in all relevant parameters of the current system.

Presented projection results are prepared primarily for 2018 Ageing Report. AWG platform is in fact the main and the only "formal" reviewer of these projections. However, Ministry of Finance (MoF) cooperates with Ministry of Labour and Social Affairs (MoLSA) – which runs own long term projections – and consults these results on collegial basis. Results of the two institutions are comparable and differences explainable. They mainly stem from i) characteristics of models; MoLSA runs micro-simulation model while MoF uses macro-model and ii) assumptions about demography and macroeconomic framework used.

4.2 Assumptions and Methods Applied

Pension projections fully respect commonly agreed AWG assumptions. The model aims at incorporating all features of the pension system as described in Section 1.1.1. For detailed description of methods, see Section 1.

4.3 Data Used

The model uses data since 2000. The most of them come from the Czech Social Security Administration, which is in charge of collecting social security contributions and disbursing all pension benefits. The model makes use of the information on:

- the number of pensions disaggregated by type of pension, single age and gender
- the number of new pensions (by type of pension, single age and sex),
- average pension benefit (by type of pension, single age and sex),
- average newly granted pension benefit (by type of pension, single age and sex),
- matrix of the number of new pensions (by type of pension) for a given combination of personal calculation basis and contributory period.

Apart from the above mentioned data running the model requires a population projection (disaggregated by single age and sex), assumption on the average wage and labour market. All these data are taken from AWG assumptions.

Publicly available data on wage statistics from Czech Statistical Office are used for calculation the share of pre-retirement wage on average wage. The share is then applied to AWG wage assumptions.

4.4 Reforms Incorporated in the Model

The model fully applies current legislation. Since the last projection round, the model works with the statutory retirement age ceiling of 65 years. At the same time, the law states that every 5 years this limit will be revised considering changes of life expectancy (for detailed description see Section 1.1.1. Nevertheless, as this revision is crucially dependent on action of the Government and the Parliament, we assume, in accordance with the current law and no-policy-change principle, increase of retirement age up to 65 years and constant thereafter.

4.5 General Description of the Model

The model makes distinction among various pension benefits (old-age, disability, widows'/widowers' and orphans'), sexes (males, females) and generations (the year of birth).

In accordance with the Czech legislation the model explicitly differentiates several types of pensions:

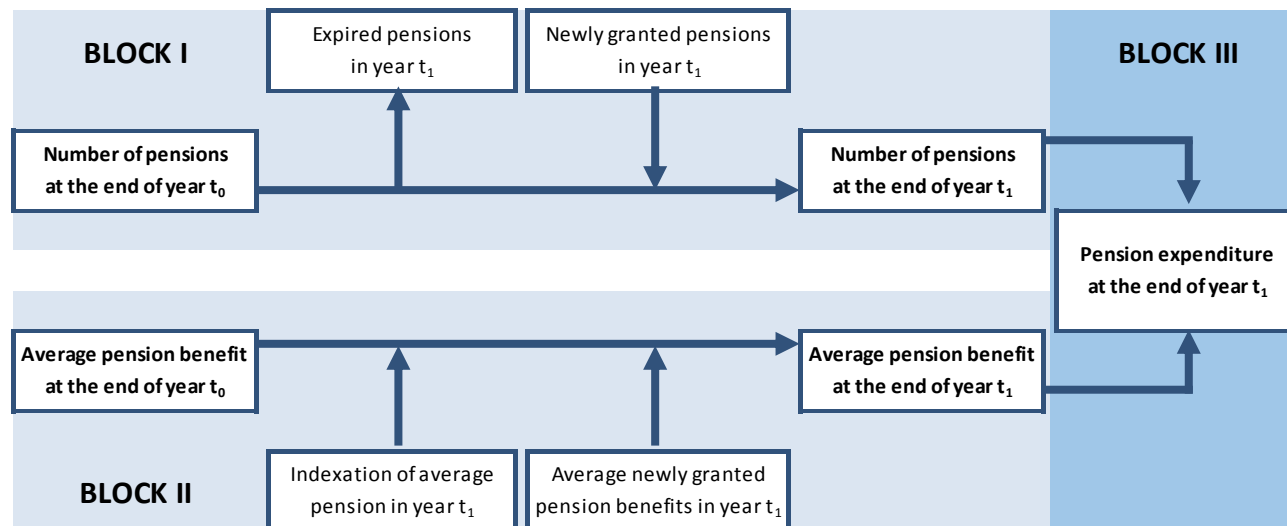
- Old-age pensions (including early retirement old-age pensions that can be granted up to five years prior to statutory retirement age);
- Disability pensions (distinguishes between all three types: 3rd degree – when working capacity is reduced by at least 70%, 2nd and 1st degree – with working capacity reduced by 50 - 69% and 35 - 49% respectively);
- Widow's/widower's pensions solo;
- Widow's/widower's pensions in concurrence with other pensions (disability, old-age);
- Orphan's pensions.

The distinction between males and females is important since they differ in their earnings profiles, length of their career and contribution periods. These differences result in different level of pension benefits. It is also important to apply cohort approach since the cohorts (generations) are not homogenous. Generations (identified by the year of birth) differ in some important characteristics, e.g. mortality rates (affects for instance the number of survivors' pensions or the average lengths of receiving an old-age pension), disability rates (influences the number of disability pensions) and affiliation with a generation is also decisive for determination of the statutory retirement age.

The model primarily works with the number of pensions, not with the number of pensioners. The number of pensioners is somewhat lower than the number of pensions since some pensioners may be entitled to receive more (two) types of pension benefits. According to the Czech pension legislation recipients of disability or old-age pensions may under given conditions receive widow's/widower's pension at the same time. Thus, the number of pensioners can be obtained by subtracting the number of widow's/widower's pensions in concurrence with other pensions from the total number of pensions.

The model consists of three main building blocks, which is illustrated on Figure 4.1. The first block calculates the number of pensions and flow of new pensions. The second one computes the level of new pension benefits. The third block combines the information on the stock and flow of pensions with the projection of new pension benefits, which gives the evolution of an average pension benefit and spending on all pension benefits in the projection horizon. All blocks work directly with generational data, so we are still able to distinguish between males, females, single ages, years of birth and calendar years.

Figure 4.1: Simplified Structure of the Model



4.5.1 Block I – Number of Pensions²⁹

The number of pensions is calculated based on the cohort methodology. The computation rests on the idea, that there is a certain probability that an individual of given age and sex and from given cohort retires, becomes disabled or becomes orphan/widow/widower.

Old-age and disability pensions

First of all, we stem from observed age specific shares and probabilities and assume their evolution in the future. Age specific shares of respective pension (pen_s)³⁰ are given by number of pensions (pen) on population (pop) for each calendar year (t), age (a) and sex (s).

²⁹ Graphs showing developments of numbers of pensions are in Annex D (Figure D.13—Figure D.19).

$$pen_{-s_t^{a,s}} = \frac{pen_t^{a,s}}{pop_t^{a,s}}. \quad (4.1)$$

This allows us to calculate conditional probability of becoming receiver of the respective pension (pen_p)

$$pen_{-p_t^{a,s}} = \frac{pen_{-s_t^{a,s}} - pen_{-s_{t-1}^{a-1,s}}}{1 - pen_{-s_{t-1}^{a-1,s}}}. \quad (4.2)$$

All pensions except the old-age can be terminated, when the pensioner changes its status, e.g. disability pension can be ended due to renewed working capacity or becoming entitled to old-age pension.³¹ The conditional probability that a person ceases to be a pensioner can be expressed as follows

$$pen_{-p_t^{a,s}} = 1 - \frac{pen_{-s_t^{a,s}}}{pen_{-s_{t-1}^{a-1,s}}}. \quad (4.3)$$

Such shares and probabilities for the base year are then transformed from dimension age/calendar year into age/generation³²

$$pen_{-s_t^{a,s}} \Rightarrow pen_{-s_t^{g,s}}, \quad pen_{-p_t^{a,s}} \Rightarrow pen_{-p_t^{g,s}} \quad (4.4)$$

and projected into the future.³³ While projecting probabilities, we must take into account continuously increasing development of statutory retirement age (until the age ceiling is reached). Therefore, in case of old-age, each generation with higher retirement age³⁴ than the base generation takes the probability of retirement from a person who is as many years younger as the difference in their retirement ages, i.e. in such case

$$pen_{-p_{g+a+(ret^{g,m}-ret^{1953m})}^{g,m}} = pen_{-p_{1953+a}^{1953m}} \quad \text{and} \quad pen_{-p_{g+a+(ret^{g,f}-ret^{1956f})}^{g,f}} = pen_{-p_{1956+a}^{1956f}} \quad (4.5)$$

for males (m) and females (f). Such splitting is done in ages where probability profiles are flat (depending on the type of pension). We stem from generations that retire in the base year 2016 (generation of men born in 1953 has retirement age equal to 63 years, i.e. 2016 = 1953 + 63, while the generation of women born in 1956 reaches the statutory retirement age in 2016 = 1956 + 60).

Projected probabilities from (4.2) and (4.3) are then used to calculate shares on population for all future generations:

$$pen_{-s_{t+1}^{g,s}} = pen_{-s_t^{g,s}} \cdot (1 - pen_{-p_t^{g,s}}) + pen_{-p_t^{g,s}}, \quad (4.6)$$

Or in accordance with (4.3)

$$pen_{-s_{t+1}^{g,s}} = pen_{-s_t^{g,s}} \cdot (1 - pen_{-p_t^{g,s}}). \quad (4.7)$$

Having derived this, it is easy to get numbers of old-age and all three disability types pensioners as a product of respective shares and population

$$pen_t^{g,s} = pen_{-s_t^{g,s}} \cdot pop_t^{g,s}. \quad (4.8)$$

If we sum this over generations and sexes, we obtain total number of pensions for a calendar year.

$$pen_t = \sum_{g,s} pen_{-s_t^{g,s}} \cdot pop_t^{g,s}. \quad (4.9)$$

³⁰ pen represents here old-age (oa) and disability pensions of all three types ($dis3$, $dis2$, $dis1$); $_s$ denotes share.

³¹ Beyond the statutory retirement age all disability pensions are considered to be old-age pensions. As a result disability pensions disappear after reaching the statutory retirement age.

³² The notation may seem a bit tricky, as we keep the index t for calendar year even in the generational form. The explanation behind is that $t = g + a$ and in generational form we keep g fixed, thus all shifts in t are translated into shifts of a .

³³ For illustration of age specific shares, see Annex D (Figure D-1—Figure D-12).

³⁴ For information about the development of retirement age in the model see Section 4.6.

Widows'/widowers' pensions

Somewhat different approach is used to calculate the number of survivors' pensions. The number of widow's pensions (*wid*) depends on marital status, probability of spouse to die in a given year and compound probability of the couple to die within the same year. Moreover, we assume (on the basis of fairly stable mortality rates) that before the age a_0 ³⁵ ($a_0 = t_0 - g$) the profile of widow's/widower's pension is the same as in the base year. The ratio of widow's pensions after age a_0 is calculated as follows:

$$wid_{-s_t^{g,f}} = wid_{-s_{t-1}^{g,f}} + \varepsilon_{a+k}^{g+k,m} \cdot (1 - \varepsilon_a^{g,f}) \cdot \frac{mpop_{t_0}^{g,f}}{pop_{t_0}^{g,f}} - \varepsilon_a^{g,f} (wid_{-s_{t-1}^{g,f}}), \quad (4.10)$$

ε stands for mortality rate and *mpop* is the number of married population. The same relation similarly holds for men. Since married couples are not necessarily of the same age, ε of the other sex should be viewed as an average mortality rate of the other sex of given generation $g+k$ around the corresponding age $a+k$, where k is the average age difference in a legal union (computed for the base year t_0).

The number of widow's/widower's pensions is further split into the solo pensions (*wids*) and pensions in concurrence (*widc*) with other pensions (old-age and disability) according to the probability that the person is a recipient of old-age or disability pension, which is given by the fraction of population that receives old-age (*oa*) or disability pension ($dis = dis1 + dis2 + dis3$).

$$wids_t^{g,s} = wid_t^{g,s} \cdot \left(1 - \frac{oa_t^{g,s} + dis_t^{g,s}}{pop_t^{g,s}} \right), \quad (4.12)$$

$$widc_t^{g,s} = wid_t^{g,s} - wids_t^{g,s}. \quad (4.13)$$

Orphans' pensions

The number of orphan's pensions (*or*) is projected simply on the basis of the existing profile (age and sex specific ratio of orphan's pensions to population) since mortality rates for those aged less than 26 are not subject to any major changes. With respect to their limited importance this seems to be a good approximation, i.e. shares on population are same in all years as in the base year:

$$or_{-s_t^{a,s}} = or_{-s_{2013}^{a,s}}. \quad (4.14)$$

The number of pensions is calculated similarly for other pension types

$$or_t^{a,s} = or_{-s_t^{a,s}} \cdot pop_t^{a,s}. \quad (4.15)$$

Newly granted pensions (for all types of pensions)

The number of new pensions (*npen*) in generation g and sex s is consistent with the stock of pensions (*pen*), from which it is computed with the use of the probability of survivorship derived from sex and generation specific mortality rate (ε)

$$npen_t^{g,s} = pen_t^{g,s} - pen_{t-1}^{g,s} \cdot (1 - \varepsilon_t^{g,s}). \quad (4.16)$$

Unfortunately, there is no such straightforward relationship in the case of disability pensions since a disability benefit is withdrawn when the working capacity is restored. Thus, the number of new pensions computed according to (4.16) would be underestimated and spending on disability benefits and an average benefit would be lower (under the assumption of indexation lower than the wage growth).

$$ndis_t^{g,s} = k_{g+a}^{g,s} \cdot dis_t^{g,s}, \quad (4.17)$$

$$k_{g+a}^{g,s} \equiv k^{a,s} = \frac{ndis_{2016}^{a,s}}{dis_{2016}}. \quad (4.18)$$

The model assumes a fixed relationship between the number of new pensions and the stock of pensions in a given age (a) and the ratio was calibrated on the basis of 2016 data³⁶.

³⁵ After this age the entitlement for widow's/widower's pension is permanent (i.e. till the end of one's life) as opposed to the age before when the entitlement is only temporary (it lasts a year). The legislation sets the age to be four years before the statutory retirement age and as such it will rise with the postponement of this benchmark.

³⁶ That is, the model assumes a constant probability of restoring the working capacity.

4.5.2 Block II – Average Newly Granted Pension Benefits

This block enables to (i) assess the impact of the government decisions (pertaining to the indexation of the main parameters of the pension formula) on the level of newly granted pensions in the short run and (ii) simulate the impact of changes in the pension formula in the long run.

The changes in pension formulae are simulated in a matrix with two dimensions – assessment basis and contribution period. It is a matrix, which gives the number of pensions for a given combination of personal calculation basis (average earnings during the contributory period) and contributory period. We assume that the distribution of pension numbers within this matrix will be shifted in terms of contributory periods in accordance with postponement of retirement and the extension of acknowledged contributory periods for the whole career.

Having such distribution, it is possible to compute a pension benefit for each cell of the matrix for each projection year on the basis of the pension formula (equations 4.19 – 4.21). Weighing the pension benefits by the number of recipients gives the average newly granted pension.

$$npen_v = frc + erc, \quad (4.19)$$

$$erc = \left\{ \begin{array}{l} \min(pab, rb_1) \cdot rc_1 + \\ + \max[\min(pab - rb_1, rb_2 - rb_1), 0] \cdot rc_2 + \\ + \max[pab - rb_2, 0] \cdot rc_3 \end{array} \right\} \cdot \frac{cp_1 + 0.8 \cdot cp_2}{365} \cdot ar, \quad (4.20)$$

$$pab = \frac{\sum_{y=Y-1-\min(car, Y-1-1986)}^{Y-1} ycb_y \cdot \prod_{t=y}^{Y-1} \frac{w_{t+1}}{w_t}}{\min(car, Y-1-1986) - \frac{ncp}{365}}. \quad (4.21)$$

$npen_v$ stands for newly granted pension benefit, frc for flat rate component (currently in 2016 amounts to 2,440 CZK \approx 90 EUR), erc earnings related component, pab personal assessment base, rb reduction brackets (currently $rb_1 = 12,200$ CZK \approx 451 EUR and $rb_2 = 110,900$ CZK \approx 4,102 EUR),³⁷ rc reduction coefficient (currently $rc_1 = 100\%$ up to rb_1 , $rc_2 = 26\%$ up to rb_2), cp contribution period up to the statutory retirement age in days (including non-contributory periods assessed as if contributory but only up to 80%), ar accrual rate (1.5%), car years of career, Y year of retirement, ycb yearly calculation basis³⁸ in present value calculated on the basis of index derived from the growth rate of average wage in the economy (w) and ncp is for excluded non-contributory periods.

The description concerns mainly old-age pensions. In fact, the same procedure is used for other pension benefits with minor changes in the pension formula. For details of calculation, see description in Section 1.1.1.

4.5.3 Block III – Average Pension and Total Pension Spending

In the base year the average pension benefit (for all types of pensions) is reported for each age and sex by the Czech Social Security Administration. It then enters the equation computing total pension expenditure. Total spending on a given type of pension (pen_e) in equation 4.22 is a function of the average pension benefit (pen_v) from the previous year indexed in accordance with the pension legislation ($index$), the value of newly granted average pension benefit ($npen_v$) calculated in the Block II of the model, and the number of pensions (pen) and newly granted pensions ($npen$) from the Block I.

$$pen_e_t = \sum_{g,s} (pen_t^{g,s} - npen_t^{g,s}) \cdot pen_v_{t-1}^{g,s} \cdot (1 + index_t) + npen_t^{g,s} \cdot npen_v_t^{g,s}. \quad (4.22)$$

Total pension expenditure is simply a sum of the pension spending on all the pension types.

In the projection horizon the average pension benefit (pen_v) for a given generation g and sex s is calculated on the basis of the pension spending (pen_e) and the number of pensions (pen). The average pension in respective year of projection is a weighted average of average pension from the previous period and the newly granted pension benefits

³⁷ rb_1 and rb_2 are assumed to develop with wages.

³⁸ Current legislation of the pension system takes into consideration all career years but not those before year 1986.

$$pen_v_t^{g,s} = \frac{pen_e_t^{g,s}}{pen_t^{g,s}} = \frac{(pen_t^{g,s} - npen_t^{g,s})}{pen_t^{g,s}} \cdot pen_v_{t-1}^{g,s} \cdot (1 + index_t) + \frac{npen_t^{g,s}}{pen_t^{g,s}} \cdot npen_v_t^{g,s}. \quad (4.23)$$

Replacement rate of each pension type is simply share of average pension benefit of paid out pension (pen_v), resp. newly granted pension ($npen_v$), over average gross wage at retirement (aw_ret)

$$pen_rr_t^{g,s} = \frac{pen_v_t^{g,s}}{aw_ret_t}, \quad npen_rr_t^{g,s} = \frac{npen_v_t^{g,s}}{aw_ret_t}. \quad (4.24)$$

4.6 Additional Features of the Model

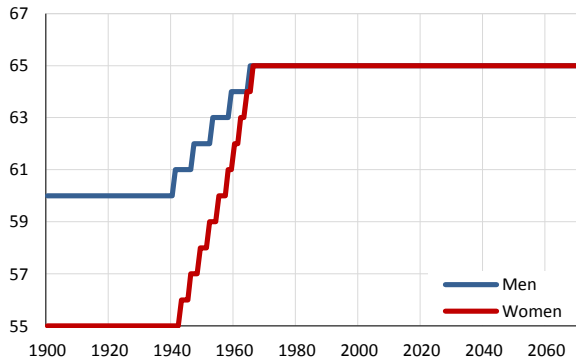
Statutory Retirement Age Increase

The model must take into consideration the continuous increase in retirement age. According to the legislation, statutory age changes for each generation by several months until the age ceiling at the age of 65. However, the model works with yearly data, therefore the evolution of statutory age is not so smooth. This causes somewhat erratic development in case of data for new pensions.

There are still differences in retirement age not only in case of sexes, but for women the number of children raised matters too. For the modelling purposes, we work with an average woman that has two children.

Figure 4.2: Evolution of Statutory Retirement Age in the Model

age for respective generation



Source: Pension Insurance Act (No. 155/1995), MoF calculations.

A Methodological Annex

Methodological annex summarizes required explanations of some pension projection features. To some extent, these issues are also included in several parts throughout the document, where the respective clarifications are needed.

Economy-wide average wage at retirement

In order to estimate the relationship between economy wide average wage and average wage at retirement, we used the data of the Czech Statistical Office on wage distribution. We examined data for past fourteen years, which show relatively high inertia of the wage profile across the ages from 15 to 65+. This enables us to assume constant wage profile in the future. We assume the shift in the age specific wage profile from 2019 onwards with respect to postponement of retirement age and thus constant relationships to average wage. This means that the average gross wage at retirement grows exactly at the same pace as the average wage given by the AWG assumptions and is approximately by 0.8% lower than economy wide average wage.

Table A.1: Economy Wide Average Wage at Retirement Evolution

thousands of euro

	2019	2030	2040	2050	2060	2070	% change 2019-2070
Economy-wide average wage at retirement	15.6	23.3	35.1	52.4	76.7	109.9	602.3
Economy-wide average wage	15.8	23.5	35.4	52.9	77.4	110.8	602.3

Source: European Commission, MoF calculations.

Pensions vs. pensioners

The model primarily works with the number of pensions, not with the number of pensioners. The number of pensioners is somewhat lower than the number of pensions since some pensioners may be entitled to receive more (two) types of pension benefits. According to the Czech pension legislation recipients of disability or old-age pensions may under given conditions receive widow's/widower's pension at the same time. Thus, the number of pensioners can be obtained by subtracting the number of widow's/widower's pensions in concurrence with other pensions from the total number of pensions. The ratio between pensioners and pensions is rather stable over time amounting to 80% – 86%.

Pension taxation

Pension benefits are not taxed in absolute majority of cases. This is due to relatively high threshold up to which income of pensioners is tax exempt. Only pension benefits exceeding 3times minimum wage³⁹ are subject to 15% Personal Income Tax. Currently only a negligible number of pensioners (not even 1% of them) pays taxes. Moreover, such negligible personal income tax revenue is a source of the state budget and not of the social security system itself. For these reasons tax calculations are not part of projection exercise.

Disability pension

Disabled people of any type could occur only in ages under 65. At 65 they are automatically transferred to old-age pensions. There has not been any reform since last projections. Evolution of disability rates is rather stable over the horizon as illustrated in Table A.2. Graphical illustrations of disability profiles development can be found in Annex D.

Table A.2: Disability Rates by Age Groups

%

	2019	2030	2040	2050	2060	2070
Age group -54	3.3	3.2	3.1	2.9	3.0	3.0
Age group 55-59	14.9	12.9	12.4	12.5	12.5	12.6
Age group 60-64	12.2	11.0	10.1	9.9	10.1	10.2
Age group 65-69	0.1	0.0	0.0	0.0	0.0	0.0
Age group 70-74	0.0	0.0	0.0	0.0	0.0	0.0
Age group 75+	0.0	0.0	0.0	0.0	0.0	0.0

Source: Mof calculations.

³⁹ Minimum gross wage is set from 1st January 2020 to be 175,200 CZK per year (approx. 6,825 EUR).

Survivor pensions

The way of calculation of survivors' pensions is in detail introduced at the end of Section 4.5.1. Equation 4.11 and 4.15 give intuition, that the development of both widows'/widowers' and orphans' pensions is affected solely by population projection (and mortality rates). It is confirmed by illustrative graphs Figure D-18 and Figure D-19, where numbers of pensions are more or less stable over projection horizon. The same applies to expenditure too as replacement rates are constant over time. See Figure D-25 and Figure D-26.

Non-earnings related minimum pension

Desired minimum amount of any pension is ensured by the flat rate component (which is the same for everyone) and the minimum earnings related component for each pension type. Another instrument that also prevents people from the poverty is the institute of the subsistence level.⁴⁰ Both these instruments are set by the government and are revaluated on irregular basis. There is not any special minimum pension scheme besides this one inbuilt in all pension types. For details of pension calculations see system description in Section 1.1.1.

Contributions

Public pension contributions are paid by working population from their wages that develop in line with GDP over the horizon. We assume constant contribution rate, which equals to 28% as stipulated by law. Contribution burden is shared between employee (6.5%) and employer (21.5%). This results in the constant share of contributions on GDP in all projection years.

Alternative pension spending decomposition

Not surprisingly Table A.3 is similar to Table 3.4 with the difference that it focuses rather on decomposition based on number of pensions instead of pensioners. The results are, however, quite similar. The difference between pensions and pensioners is caused solely by widow's/widower's pensions in concurrence, which is not considered among the number of pensioners. Dependency ratio and Labour market effect are exactly the same in the two tables, as number of pensions or pensioners do not play any role here. Coverage ratio effect decreases here less simply because there are fewer pensioners than pensions in the nominator. Benefit ratio changes over decades are comparable.

Table A.3: Factors behind the Change in Public Pension Expenditures between 2016 and 2070 – Pensions

alternative decomposition, in percentage points of GDP

	2019	2030	2040	2050	2060	2070	2019
	-	-	-	-	-	-	-
	2030	2040	2050	2060	2070	2070	2070
Public pensions to GDP	0.8	1.0	1.6	0.4	-0.9	2.9	2.9
Dependency ratio effect	1.4	1.6	2.3	1.1	-1.3	5.0	5.0
Coverage ratio effect	-0.9	-0.4	-0.4	-0.1	0.2	-1.7	-1.7
Coverage ratio old-age	-0.4	-0.4	-0.1	0.0	0.1	-0.9	-0.9
Coverage ratio early-age	-2.7	0.2	0.3	-0.1	-0.1	-2.5	-2.5
Cohort effect	0.3	-1.1	-1.9	-0.7	0.8	-2.5	-2.5
Benefit ratio effect	0.4	0.1	0.2	-0.2	-0.2	0.3	0.3
Labour Market/Labour intensity effect	0.2	0.0	-0.1	-0.1	0.1	0.2	0.2
Employment ratio effect	0.2	0.2	-0.1	-0.1	0.1	0.2	0.2
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Career shift effect	0.0	-0.1	0.0	0.0	0.0	0.0	0.0
Residual	-0.1	-0.3	-0.5	-0.3	0.3	-0.9	-0.9

Source: European Commission, MoF calculations.

Numbers of people that start receiving one of above mentioned pension types are illustrated in the Table A.4. It shows administrative data on new pensions in the base projection year 2019. The greatest part comes to **old-age pensions** that have, naturally, peak in cohorts where statutory retirement ages for each generation of men (63.5 in 2019) and women (61.2 in the same year) occur. It is also clear from the data of past years that retirement is highly concentrated around the statutory retirement age and only very minor part of retirees opt for an early retirement scheme due to high permanent penalties imposed in the scheme. In case of men, however, there are couple of retirees even before minimum age for early retirement. This is related with the scheme for miners and workers in difficult conditions that have specific lower retirement age. Impact of this scheme on pension projections is negligible.

⁴⁰ A person whose income is lower than the subsistence level has a claim for social support benefits.

Disability pensions are concentrated solely before retirement age, because at that moment all disability pensions are transferred into old-age pension when the pensioner is 65 at most. **Survivors' pensions** include orphans pensions affecting age group 15–49 only and widows', widowers' pensions that occurs in all cohorts mentioned in the Table A.4.

Table A.4: Administrative Data on New Pensioners (2019)

	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	6 618	0	5 381	1 237	0
50 - 54	2 671	223	2 265	183	0
55 - 59	4 134	460	3 383	291	0
60 - 64	48 731	45 973	2 467	291	0
65 - 69	4 188	4 181	0	7	0
70 - 74	12	12	0	0	0
75+	3	1	0	2	0
	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	8 965	0	6 960	2 005	0
50 - 54	3 683	0	3 030	653	0
55 - 59	9 699	4 860	3 666	1 173	0
60 - 64	38 344	37 224	561	559	0
65 - 69	4 248	4 227	0	21	0
70 - 74	23	6	0	17	0
75+	25	2	0	23	0
	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	15 583	0	12 341	3 242	0
50 - 54	6 354	223	5 295	836	0
55 - 59	13 833	5 320	7 049	1 464	0
60 - 64	87 075	83 197	3 028	850	0
65 - 69	8 436	8 408	0	28	0
70 - 74	35	18	0	17	0
75+	28	3	0	25	0

Note: Data refer to year 2019.

Source: Czech Social Security Agency.

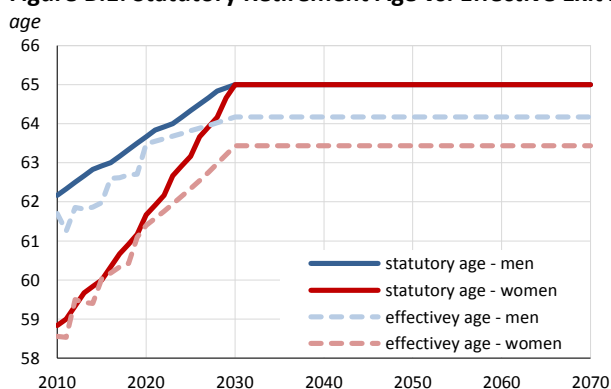
B Annex: Coverage Rate Adjustments

This annex aims at shedding some light on differences between the Cohort Simulation Model (CSM) and the national pension model that have impact on pension projection exercise. Naturally, there are and will be reasonable differences between the two models by definition. Therefore it requires more explanation, how the pension model has been adjusted, mainly on the share of pensioners over inactive people, as illustrated in Table 3.7 and Table 3.9.

Statutory Retirement Age vs. Effective Retirement Age

What causes the problem with coverage rate decline is the difference between the statutory retirement age and effective retirement age assumed by CSM. The Czech Republic has legislated increase in statutory retirement age up to 65 years as shown in the following Figure B.1. Although the retirement age is assigned to each generation (according to the year of birth), with a simple calculation, it can be assigned to calendar years as depicted by solid lines for men and women. This retirement age postponement is crucial for the pension model, which shifts the profiles of pensions according to that, as shown in Equation 4.5.

Figure B.1: Statutory Retirement Age vs. Effective Exit Age in CSM Assumptions



Source: European Commission, Pension Insurance Act (No. 155/1995).

On the other hand, macroeconomic assumptions work with effective retirement. It is assumed that with increasing retirement age there will be a weaker link between the two ages, i.e. the higher the retirement age the more people will tend to leave labour market relatively earlier.⁴¹ Thus the share of inactive people over population increases.

Pension model adjustments

Pension model, as was introduced in Section 4.5.1 respects current legislation and shifts profiles with respect to statutory retirement age, which is the only relevant age for e.g. old-age pension entitlements. On the other hand, there is an automatic adjustment from the disability pensions' scheme. As visible in quoted Figures, the share of disabled people in population increases with age. This increase and shifts of profile stem from past observed data.

However, the pension model incorporates additional adjustments in order to consider commonly agreed assumption to the highest possible extent. But at the same time it is important to stick to the assumption of no-policy change projections. With this regard, the only solution seems to assume that people will opt much more for early retirement as the pension age increases. Therefore the model takes the initial result of projection of numbers of pensions and calculates numbers of uncovered inactive people. Further on, it analyses, whether a person could possibly be entitled for early retirement pension. If yes, such a person is additionally assigned early retirement pension. In this respect, we assume that this additional demand for early retirement increases with the proximity of statutory age. The problem is that old age pensions are, in case of some ages and cohorts (namely 55–59), unable to cover additional inactive people, as they are not allowed even for early retirement.

In addition to that, we expect that in line with this rationale more people will tend to withdraw their capital savings from 3rd pillar and opt for pre-retirement scheme.⁴²

There are not additional adjustments made in other types of pensions, e.g. in disabilities. Last observed data and the reform effective since 2010 show strong effect of tightening eligibility conditions in order to limit possible leaking from labour market. To use disability pensions for increasing coverage, it would require quite substantial jumps in disability profiles. This would violate the rule of no policy change.

⁴¹ However, recent data shows that it has not been the case as effective retirement age develops with statutory retirement age. This is mainly due to very strict and painful penalizations for early retirement.

⁴² For details about pre-retirement scheme see Section 1.1.2.

C Annex: Retirement Age

Table C.1: Retirement Age by the Year of Birth

y = year, m = month

Generation	Men	Women and number of raised children				
		0	1	2	3 and 4	5+
1936	60y+2m	57y	56y	55y	54y	53y
1937	60y+4m	57y	56y	55y	54y	53y
1938	60y+6m	57y	56y	55y	54y	53y
1939	60y+8m	57y+4m	56y	55y	54y	53y
1940	60y+10m	57y+8m	56y+4m	55y	54y	53y
1941	61y	58y	56y+8m	55y+4m	54y	53y
1942	61y+2m	58y+4m	57y	55y+8m	54y+4m	53y
1943	61y+4m	58y+8m	57y+4m	56y	54y+8m	53y+4m
1944	61y+6m	59y	57y+8m	56y+4m	55y	53y+8m
1945	61y+8m	59y+4m	58y	56y+8m	55y+4m	54y
1946	61y+10m	59y+8m	58y+4m	57y	55y+8m	54y+4m
1947	62y	60y	58y+8m	57y+4m	56y	54y+8m
1948	62y+2m	60y+4m	59y	57y+8m	56y+4m	55y
1949	62y+4m	60y+8m	59y+4m	58y	56y+8m	55y+4m
1950	62y+6m	61y	59y+8m	58y+4m	57y	55y+8m
1951	62y+8m	61y+4m	60y	58y+8m	57y+4m	56y
1952	62y+10m	61y+8m	60y+4m	59y	57y+8m	56y+4m
1953	63y	62y	60y+8m	59y+4m	58y	56y+8m
1954	63y+2m	62y+4m	61y	59y+8m	58y+4m	57y
1955	63y+4m	62y+8m	61y+4m	60y	58y+8m	57y+4m
1956	63y+6m	63y+2m	61y+8m	60y+4m	59y	57y+8m
1957	63y+8m	63y+8m	62y+2m	60y+8m	59y+4m	58y
1958	63y+10m	63y+10m	62y+8m	61y+2m	59y+8m	58y+4m
1959	64y	64y	63y+2m	61y+8m	60y+2m	58y+8m
1960	64y+2m	64y+2m	63y+8m	62y+2m	60y+8m	59y+2m
1961	64y+4m	64y+4m	64y+2m	62y+8m	61y+2m	59y+8m
1962	64y+6m	64y+6m	64y+6m	63y+2m	61y+8m	60y+2m
1963	64y+8m	64y+8m	64y+8m	63y+8m	62y+2m	60y+8m
1964	64y+10m	64y+10m	64y+10m	64y+2m	62y+8m	61y+2m
1965	65y	65y	65y	64y+8m	63y+2m	61y+8m
1966	65y	65y	65y	65y	63y+8m	62y+2m
1967	65y	65y	65y	65y	64y+2m	62y+8m
1968	65y	65y	65y	65y	64y+8m	63y+2m
1969	65y	65y	65y	65y	65y	63y+8m
1970	65y	65y	65y	65y	65y	64y+2m
1971	65y	65y	65y	65y	65y	64y+8m

Note: Each younger generation born after 1971 has the retirement age equal to 65 years.

Source: Pension Insurance Act (No. 155/1995).

D Annex: Detailed Results

This annex brings an overview of more detailed results for illustration so the reader can better see what is behind the results.

Cross sectional profiles – age specific shares

The following figures show cross sectional profiles in specific years that reflect the calendar year, in which the statutory retirement age increases by one additional year. It is apparent that the process takes longer for women despite the faster speed (rise by 2 months a year for men compared to 4 months for women) until they reaches the retirement age of men. It is a result of the much higher increase in statutory age for women.

Figure D.1: Old-Age Pensions – Males

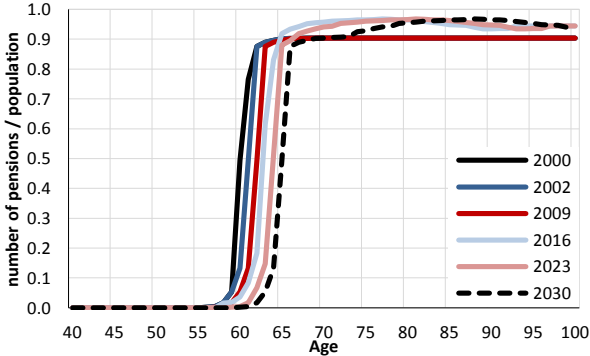


Figure D.2: Old-Age Pensions – Females

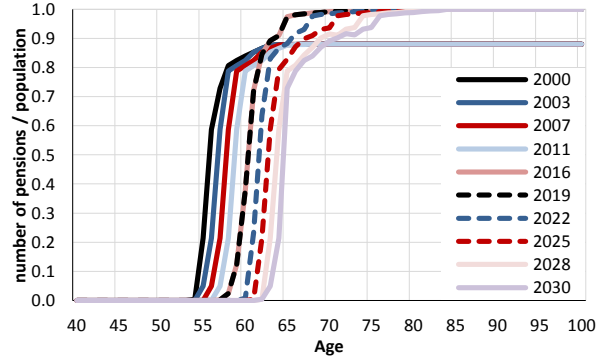


Figure D.3: 3rd Degree Disability Pensions – Males

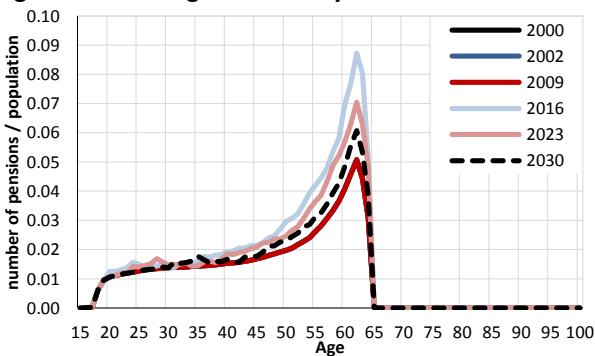


Figure D.4: 3rd Degree Disability Pensions – Females

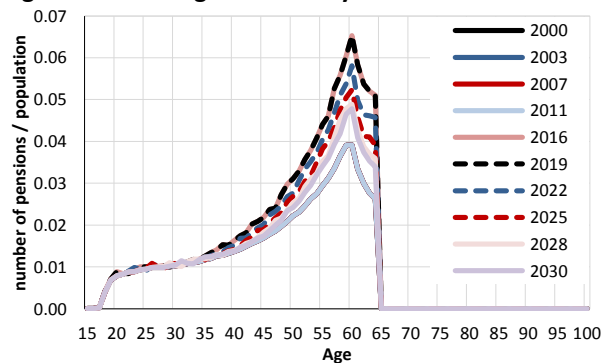


Figure D.5: 2nd Degree Disability Pensions – Males

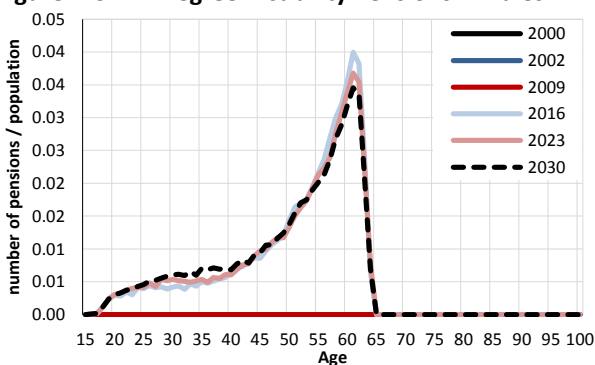


Figure D.6: 2nd Degree Disability Pensions – Females

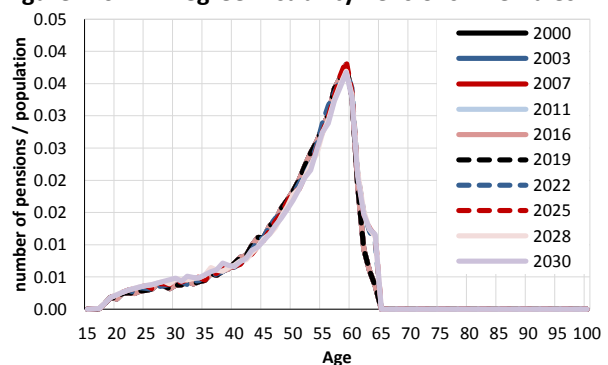


Figure D.7: 1st Degree Disability Pensions – Males

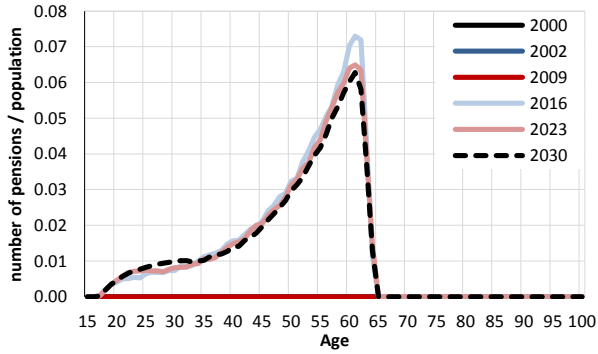
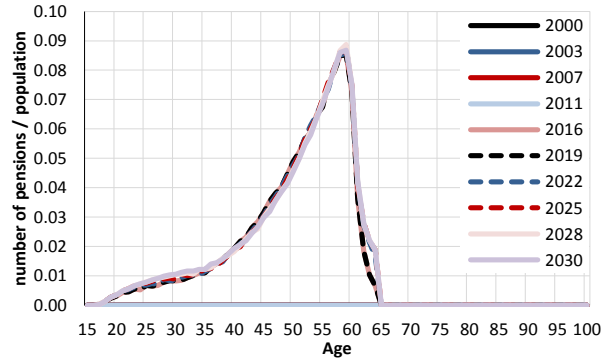


Figure D.8: 1st Degree Disability Pensions – Females



Note that minor changes in the peak of profiles for disability pensions for years at the beginning of projections are caused by generational effect of the 2010 reform. However, important feature of profiles – an increase of disability shares for pre-retirement ages – are clearly visible for projection years as retirement age increases.

Figure D.9: Widower's Pensions – Males

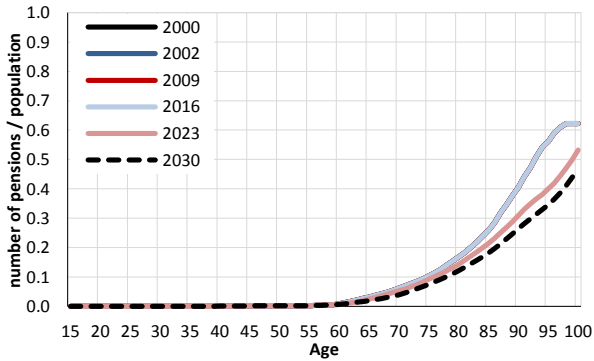


Figure D.10: Widows' Pensions – Females

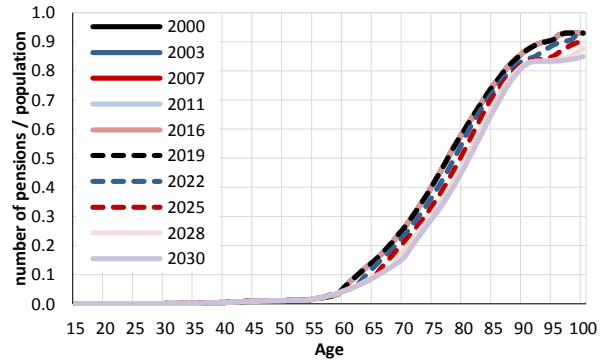


Figure D.11: Orphan's Pensions – Males

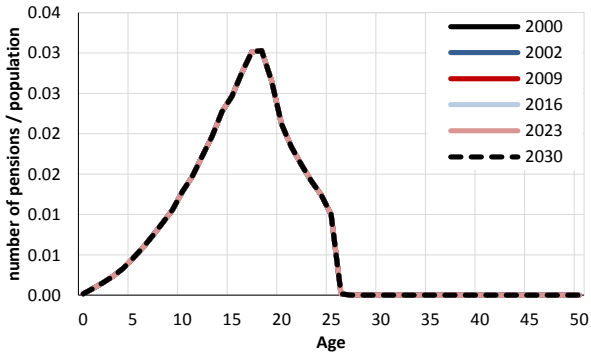
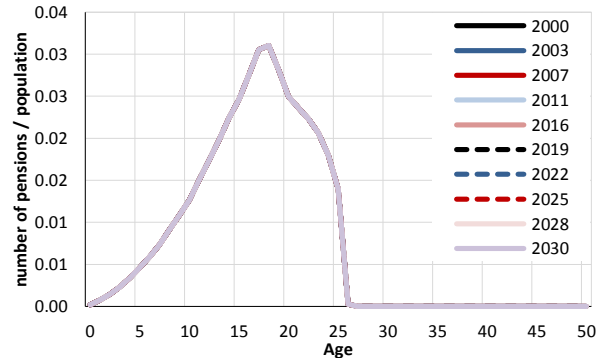


Figure D.12: Orphan's Pensions – Females



Profiles of orphans' pensions do not change with retirement age and are held constant for all years of projection.

Numbers of pensions

Figure D.13: Number of Pensions - All Pensions

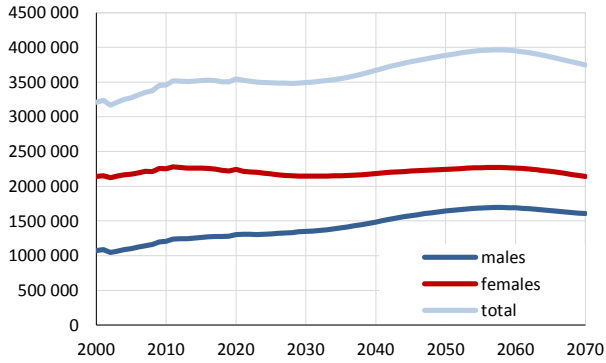


Figure D.14: Number of Pensions - Old-Age Pensions

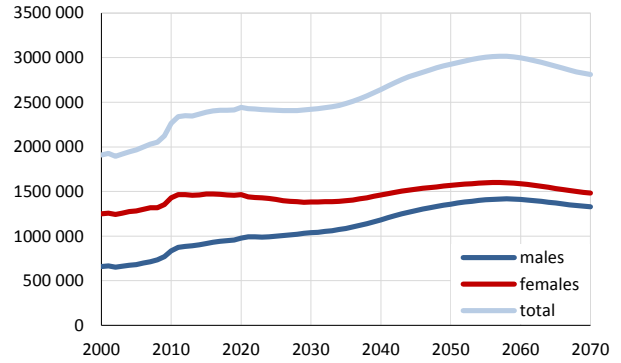


Figure D.15: Number of Pensions - 3rd Degree Disability Pensions

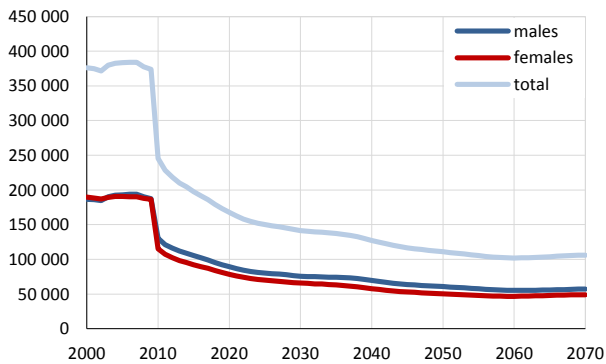


Figure D.16: Number of Pensions - 2nd Degree Disability Pensions

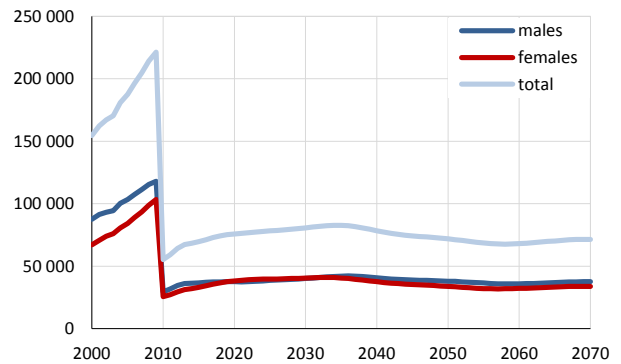


Figure D.17: Number of Pensions - 1st Degree Disability Pensions

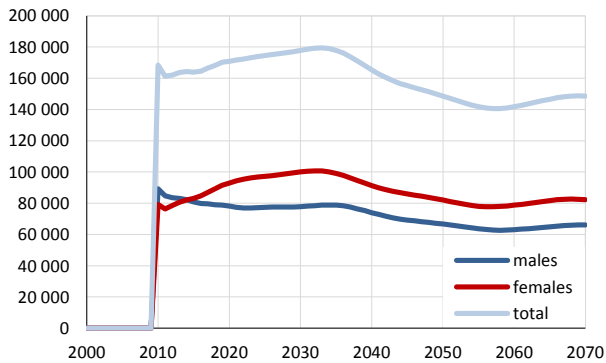


Figure D.18: Number of Pensions - Widows'/Widowers' Pensions

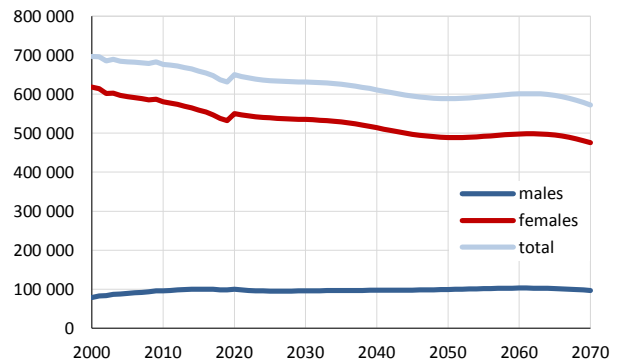
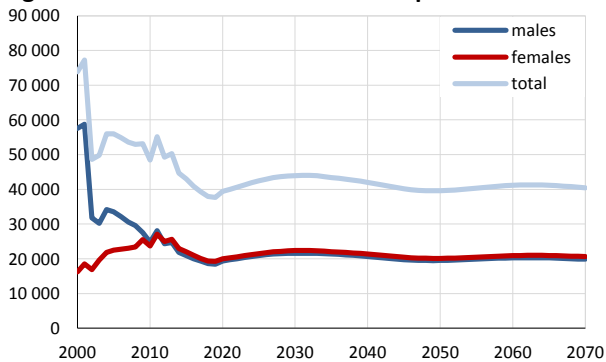


Figure D.19: Number of Pensions - Orphans' Pensions



Replacement rates

Figure D.20: Replacement Rates - All Pensions

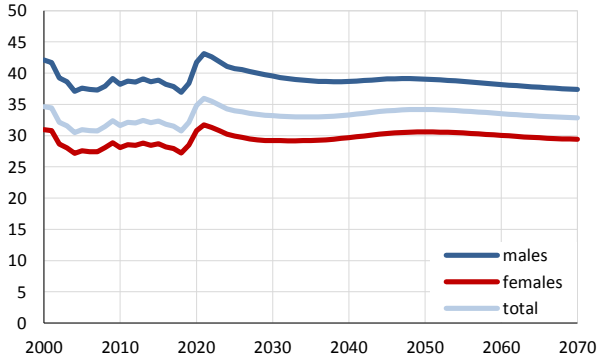


Figure D.21: Replacement Rates - Old-Age Pensions

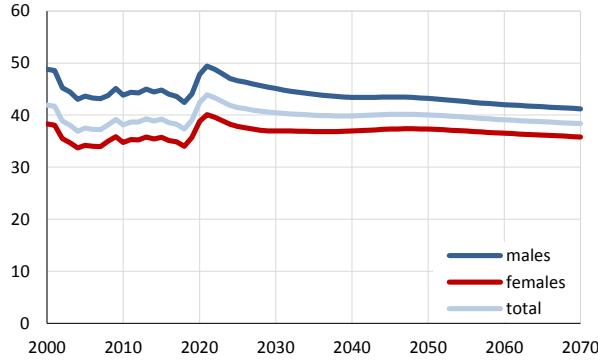


Figure D.22: Replacement Rates - 3rd Degree Disability Pensions

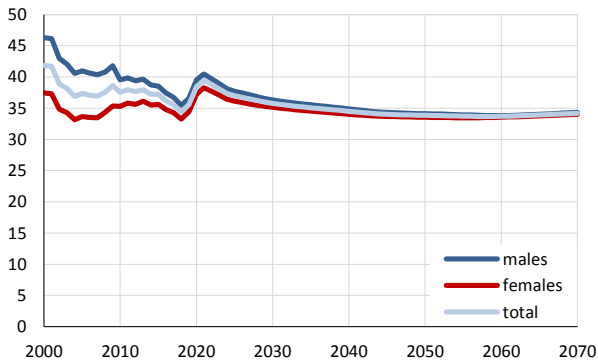


Figure D.23: Replacement Rates - 2nd Degree Disability Pensions

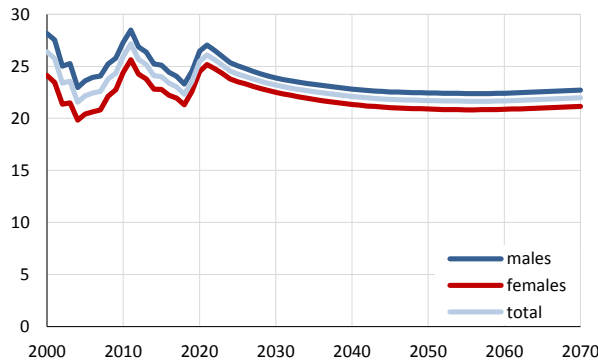


Figure D.24: Replacement Rates - 1st Degree Disability pensions

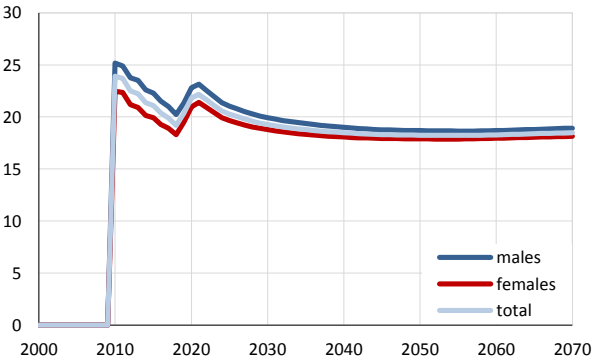


Figure D.25: Replacement Rates - Widows'/Widowers' pensions

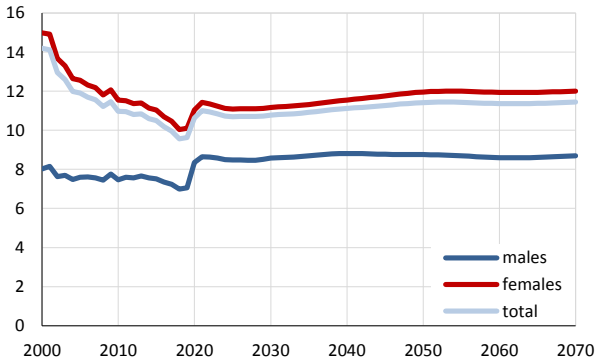
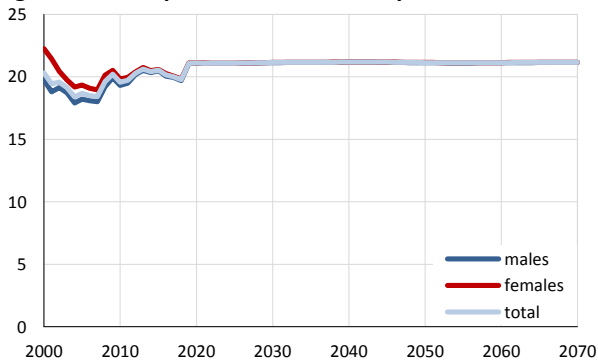


Figure D.26: Replacement Rates - Orphans' Pensions



**Pensions Projections
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