Ministry of Finance
of the Czech Republic

2015 Pension Projections Update

Jindřich Marval and Zbyněk Štork

Information paper 2/2015

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Contents

Information papers of the Ministry of Finance of the Czech Republic are designed to provide information on current issues related to economic policy, with particular emphasis on fiscal policy. Information papers are referred by a Ministry of Finance internal opponent. This information study was reviewed by the Ageing Working Group on 25 September 2014 and consequently endorsed by the Economic Policy Committee. The decision to publish the paper by the relevant department is based on the judgement of the head of the particular unit responsible for dealing with the given issue.

The views expressed in the paper do not necessarily reflect those of the Ministry of Finance of the Czech Republic.

1 Introduction

The long-term sustainability of public finances is constantly a hot issue in the whole European Union. The consequences of the impacts of an ageing population are based on long-term projections prepared in cooperation with the Ageing Working Group (AWG) of the Economic Policy Committee of the EU. Development analyses are based on the assumptions of demographic development (EUROPOP) and the macroeconomic framework consistent for all EU countries and Norway. These projections do not therefore reflect the current medium-term macroeconomic and fiscal outlooks of the Czech Republic. Projections are carried out under an assumption of unchanged policies (reflecting the system which is legislatively underpinned at the time of drafting the projection). Long-term analyses do not aim at forecast of specific values, but only to illustrate trends and long-term dynamics.

The Czech Republic has delivered several reforms either in the pay-as-you-go system (1st pillar) or in funded schemes in recent years. The statutory retirement age was gradually being prolonged in several steps until finally in 2011 the forever rising retirement age, without any upper limit, was approved, implicitly taking into account the rise in life expectancy. This was part of the pay-as-you-go (PAYG) reform initiated mainly due to a ruling of the Constitutional Court (regulation No. 135/2010 Coll.), which found part of the provisions of the Act on Pension Insurance stipulating the calculation of pension entitlement (in particular the section on the amount of reduction thresholds) to be unconstitutional. The change in the calculation of pension benefits was, however, constructed to be fiscally neutral.

Since 2010, the penalty for early old-age retirement has been increased, thus reducing the attractiveness of retiring before reaching the statutory retirement age. Specifically, the penalty rate was increased from 0.9% to 1.2% for the period from the 361st day to the 720th day before reaching the statutory retirement age. The percentage assessment of earnings-related old-age pension subsequently decreases by this percentage for every 90 days, also when already commenced.

In disability pensions, a new three-tiered disability structure depending on the percentage reduction in working capacity of the policyholder was introduced in 2008. In the former system the full disability pension is now the third degree and belongs to the people whose working capacity diminished by at least 70% and the accrual rate is the same like for old-age pensions, i.e. 1.5%. The former partial disability pension is now equivalent to the second degree and belongs to those, whose working capacity diminished by 50-69% and the accrual rate is one half of the one in the third degree, i.e. 0.75%. The first degree is new and belongs to those, whose working capacity diminished by 35-49% and the accrual rate here is one third of the one in the third degree, i.e. 0.5%. Disabled persons aged 65 or older (i.e. if their statutory retirement age is higher than 65 years) that belong to the third degree are automatically administratively reclassified as old age pensioners. This reform was to some extent already reflected in the previous round of projections (see Marval and Štork, 2012) but the impact was more important than had been assumed there.

For 2013–2015, the total increase in pensions paid out (regular indexation) was originally limited to one third of the consumer price index growth and one third of real wage growth. However, the government has approved an amendment to Act No. 155/1995 Coll. (Act No. 183/2014 Coll.) according to which the validity of the reduced indexation has been shortened by one year and an extraordinary indexation of 1.8% (calculated for the average old-age pension) is effective for 2015. From 1 January 2016, the indexation formula will again be in the form of the total sum of full consumer price growth and one third of real wages growth. In the following years, the Act does not expect any extraordinary discretion of the government that could change the indexation size by government decision. The special benefit in the amount of CZK 600 for every pensioner that is to be paid out in December 2015 is not reflected in the level of pension expenditures. The reason is that the last known year was set to be 2013 and the decision about this benefit was made in June 2015. Nevertheless, it does not affect the trend of expenditures but only the level in 2015.

In the meantime, the pension savings pillar has been present. The pension savings scheme has been effective since 1 January 2013. This scheme was primarily designed for people under 35 who can choose to join the scheme whenever they want. Persons over 35 years have had only limited time (6 months from the time they first become pension insurance payers after the reform's initiation) to join. It has not been allowed to change the decision taken by an insured person. The obligation of paying concerns just those periods when a participant pays social contributions to the PAYG system, i.e. there are no payments from the state budget for so called state insures to the pension savings pillar. However, if the participant does not pay social contributions, he/she is treated according to the law for the PAYG scheme. Financing of the pension savings pillar is provided by funds transferred from participants in the first pillar in the amount of 3 p.p. from the total contribution rate of 28%. In addition to this, each insured person has to pay an additional 2p.p. from his or her own sources. The total contribution rate is thus increased to 30%, of which 25p.p. is directed into the existing PAYG system and the remaining 5p.p. into the pension savings pillar. It was planned that the pay-out phase for the saved funds from the pension savings pillar should have been provided by a life insurance company selected by each participant. It should have been possible to draw the paid benefit in the 3 ways of annuity (life-long with or without sur-

vivor's pension for his/her heirs or 20-year long). However, in line with its Policy Statement, the current Government has decided to cancel the pension savings pillar as of 1 January 2016, whereby the winding up process should last until the end of 2016. Before 31 March 2016, pension companies will inform participants of the termination of the pension savings pillar. Funds accumulated in this system will be returned to the participants either by transferral to their accounts in the 3rd pillar or they will be paid into their bank accounts or in cash. Pension companies will pay out money to the participants according to the selected method in the period from 15 October 2016 to 31 December 2016.

The third pillar is a 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. The insurance can be contracted by any Czech or other EU citizen aged 18 and over, who participates in the state pension system or the public health insurance scheme in the Czech Republic. Compared to the 1st pillar and with respect to pension sustainability and adequacy, the 3rd pillar plays a rather minor role. Besides the state subsidy, any employer can support his employees with an additional contribution to the employee's fund. Both employer and employee contributions are subject to additional tax allowances. Moreover, a so-called preretirement scheme has been established since 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 certain minimum amount of accumulated funds in the private 3rd pillar so as to provide a monthly pension amounting to at least a third of the average wage. The old-age pension will not be subsequently reduced for the years when the pre-pension is drawn.

As the importance of the 3rd pillar for adequacy of pension benefits and long-term sustainability is minor, it is not included in the pension projections.

Long-term projections were updated for the last time in autumn 2014 in connection with the scheduled publication of the Ageing Report 2015. The results of the projections were reviewed by the Ageing Working Group on 25 September 2014. The projections end in 2060.

In current projections we define the constant policy assumptions as:

Indexation: The indexation rule effective from 2016 is designed again as a strict rule, therefore from 2016 onwards we use the indexation rule strictly inflation (measured by consumption price index – CPI) plus 1/3 of real wages growth. For the year 2015 there is an exception in the law that pensions are indexed by 1.8%.

Early retirement versus pre-retirement: Despite the fact that the pre-retirement scheme is scarcely drawn,[1] we assume increasing popularity as this is financially more advantageous than the early retirement scheme. On the other hand, the pre-retirement scheme requires quite high capital savings. This is why we assume that people 5 years prior to statutory retirement age will draw upon these schemes less than at 100%. This is reflected in the lower coverage in particular age cohorts.

Pension savings pillar: In 2013, the update of the pension projections was peer reviewed taking into account the pension savings pillar. Our previous estimate of the two highest deciles to enter the pension savings pillar has turned out to be overly optimistic. For various reasons, mainly the uncertainty about the future of this scheme, participation was very low (around 85 thousand people). The decrease in the social insurance revenue as well as the expected decrease in future public spending on pensions is absolutely negligible (less than 0.006% of GDP or just nearly 0.1% of the total amount collected in pension insurance). As the effect on sustainability is negligible, we did not include the pension savings scheme in projections.

Wage profiles: The observed wage profile across the ages from 15 to 65+ shows relatively high inertia. This enables us to assume a constant wage profile in the future. We assume the shift in the age specific wage profile from 2013 onwards with respect to the postponement of the 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 7.7% higher than the 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 the constant policy assumption to the lowest possible extent. For a detailed explanation, see Annex D.

[1] The opportunity to draw pre-retirement was only used by 687 persons before the end of 2014, receiving an average benefit of CZK 9,370.

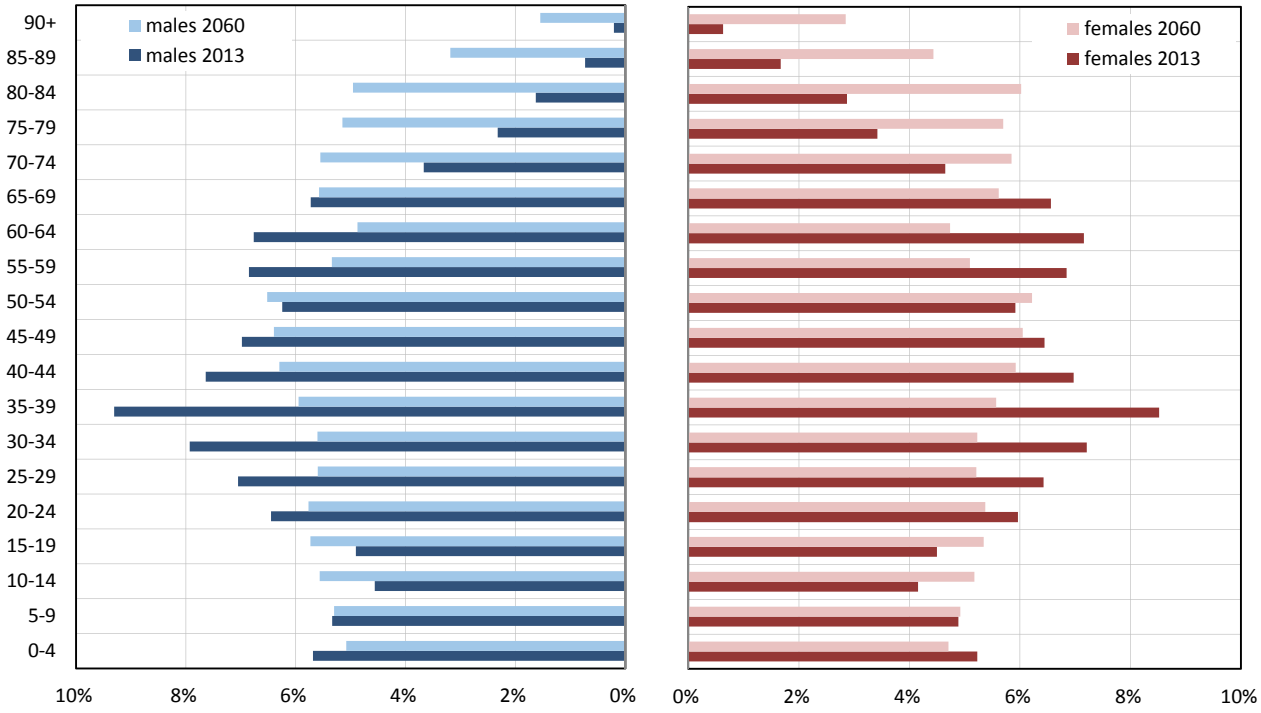
2 Demographic and Labour Forces Projections

This section illustrates important assumptions about demographic and labour force projections. Both are exogenous of the pension projection model. Demography is provided by EUROSTAT and labour force projections as well as all macroeconomic assumptions are the result of the Cohort Simulation Model (CSM) of the European Commission. We fully employ all these assumptions in the pension model.

2.1 Demographic Development

Czech population is relatively young, with great majority of people in productive ages. This is mainly thanks 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 to fully compensate the number of active population at later stage. Thus the age pyramid somehow flattens during the next almost 50 years.

Figure 2.1: Age Pyramid Comparison: 2013 vs 2060



Source: Eurostat

Although the number of the population increases, reaching its peak in 2055, the old-age dependency ratio comparing elderly (65+) with active population (15-64) more than doubles over the projection horizon, reaching slightly more than 50%. This is not only due to a continuous decrease in the number of active population but also because of the increase in longevity – the share of the population 80+ of over 65+ raises from 22.8% to 40.8% – as life expectancy increases by 8.2 p.p. for men and 6.7 p.p. for women. Survivor rates improve over time.

Table 2.1: Main Demographic Variables

		2013	2020	2030	2040	2050	2060	Peak year
Population	*thousands*	10 514	10 655	10 783	10 916	11 077	11 078	2055
	y/y	0.0	0.2	0.1	0.2	0.1	-0.1	2015
Old-age dependency ratio (pop65/pop15-64)		25%	32%	35%	41%	48%	50%	2058
Ageing of the aged (pop80+/pop65+)		23%	21%	30%	32%	31%	41%	2060
Men - Life expectancy at birth		75.1	76.5	78.3	80.1	81.7	83.3	2060
Men - Life expectancy at 65		15.7	16.6	17.8	19.0	20.1	21.2	2060
Women - Life expectancy at birth		81.2	82.3	83.8	85.3	86.6	87.9	2060
Women - Life expectancy at birth		19.2	20.0	21.2	22.4	23.5	24.5	2060
Men - Survivor rate at 65+		80.6	82.8	85.6	87.9	89.9	91.5	2060
Men - Survivor rate at 80+		44.1	49.0	55.5	61.5	66.9	71.7	2060
Women - Survivor rate at 65+		90.7	91.8	93.0	94.1	95.0	95.7	2060
Women - Survivor rate at 80+		65.7	69.3	74.0	78.0	81.5	84.5	2060
Net migration		-1.3	28.0	35.8	40.7	25.5	21.2	2039
Net migration over population change		-0.4	1.4	3.9	2.0	3.0	-3.4	2056

Source: Eurostat.

However, the migration balance seems rather positive, while overall changes in demographic structure will affect the pension system. That is why the system incorporated the rule of the continuous increase in the retirement age, which, despite the absence of a strict link to life expectancy, evolves well in line with the life expectancy increase (Figure 2.2). This means that the years spent in pension are constant over time (Figure 2.3). The reason why years spent in pension up to 2031 decline faster for women is in the temporarily faster increase of retirement ages in order to equalize the retirement age for both sexes. The further constant difference is due to differences in life expectancies.

Figure 2.2: Retirement Age vs. Life Expectancy

(age)

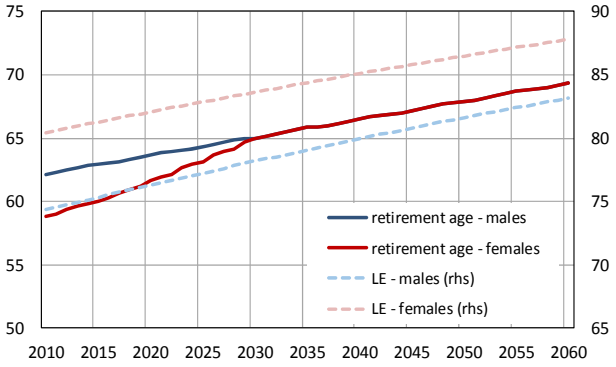
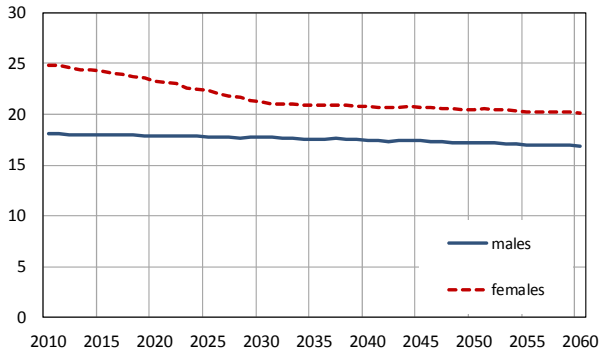


Figure 2.3: Years Spent in Pension

(years of age)



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

2.2 Labour Forces

Labour force projections are the result of the common CSM model and assumptions made for a particular country. The characteristics of the labour market situation for older cohorts summarized in Table 2.2 show overall positive development as participation rates increase over time. These rates for the cohort 55—64 increase from the recent 55.1% to 78.3% and for people aged 65—74 triple over the horizon. Consequently the share of older workers in the labour force increases. This is a result of changes in the population structure and, importantly, of retirement age postponement.

Table 2.2: Participation Rate, Employment Rate and Share of Workers for the Age Groups 55—64 and 65—74

	2013	2020	2030	2040	2050	2060	Peak year
Labour force participation rate 55-64	55%	58.0%	65.9%	68.0%	74.8%	78.3%	2060
Employment rate for workers aged 55-64	51.9%	54.9%	62.7%	64.9%	71.3%	74.8%	2060
Share of workers aged 55-64 on the total labour force	94.2%	94.7%	95.1%	95.4%	95.4%	95.5%	2055
Labour force participation rate 65-74	8.0%	9.6%	12.8%	18.1%	19.9%	24.1%	2059
Employment rate for workers aged 65-74	7.9%	9.4%	12.6%	17.8%	19.6%	23.8%	2059
Share of workers aged 65-74 on the total labour force	98.4%	98.5%	98.6%	98.6%	98.6%	98.6%	2033
Median age of the labour force	40	42	44	44	42	43	2026

Source: European Commission.

The magnitude of the increase in participation rates is mainly driven by assumptions about effective entry and exit ages from the labour market. The average effective working career is prolonged by some 2 years over the next fifty years. The average contributory period is the only variable in Table 2.3 that does not depend on CSM, but is primarily a result of the pension model. Its development over time reflects the postponement of the statutory retirement age rather than the assumed effective retirement age. The reason lies in the pension system, where people also acquire pension rights (contributory periods) when not active on the labour market. It happens through partly reduced contributory periods[2] and partly through voluntary social contributions. Another effect is the extension of the contributory period for the whole career. The description of driving forces applies equally for both, males and females.

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

		2013	2020	2030	2040	2050	2060	Peak year
Males								
Average effective entry age (CSM) (I)		22.4	22.3	22.3	22.3	22.3	22.3	2013
Average effective exit age (CSM) (II)		64.3	63.4	64.1	64.9	65.6	66.3	2060
Average effective working career (CSM) (II)- (I)		41.8	41.1	41.8	42.6	43.3	43.9	2060
Contributory period		44.4	45.4	46.4	46.4	47.4	48.4	2057
Contributory period/Average working career		1.1	1.1	1.1	1.1	1.1	1.1	2029
Duration of retirement*		16.3	18.0	18.5	19.0	19.3	20.4	2060
Duration of retirement/average working career	%	39.0	43.8	44.3	44.6	44.6	46.4	2060
Percentage of adult life spent at retirement**	%	26.1	28.4	28.6	28.8	28.8	29.7	2060
Early/late exit***		2.0	2.1	2.2	1.9	1.5	3.5	2059
Females								
Average effective entry age (CSM) (I)		24.8	25.7	25.7	25.7	25.7	25.7	2018
Average effective exit age (CSM) (II)		63.5	61.4	62.7	64.4	65.6	66.3	2060
Average effective working career (CSM) (II)- (I)		38.8	35.7	37.0	38.7	39.9	40.5	2060
Contributory period		41.5	43.5	44.5	46.5	47.5	48.5	2057
Contributory period/Average working career		107.1	122.1	120.2	120.1	119.1	119.7	2017
Duration of retirement*		20.0	23.5	23.0	23.2	22.6	23.6	2021
Duration of retirement/average working career	%	51.6	65.9	62.1	59.9	56.7	58.2	2021
Percentage of adult life spent at retirement**	%	30.5	35.1	34.0	33.3	32.2	32.8	2021
Early/late exit***		1.5	1.9	2.7	2.0	1.5	3.2	2059

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

Because the statutory age (important and legislated for the pension system) grows at a faster pace than effective age (used by CSM) the share of the contributory period for the average working career increases over time. However, this difference poses a form of pressure on the pension system and also touches the question on how to understand constant policy setting.[3]

[2] Reduced contributory periods are those so called non-contributory periods (see below).

[3] For detailed discussion of the differences in assumption between CSM and the pension model please see Annex D.

The duration of retirement as calculated using the assumption of CSM about effective age increases by 4.1 p.p. for men and 3.6 p.p. for women, and so do other indicators: the share of the retirement duration over the average working career and the percentage of adult life spent in retirement. However, the legislated increase of the statutory retirement age and penalizations for early retirement protect the system from dramatic inflows of old age pensioners. Regardless of the assumption that people will, for some reason, leave the labour market, part of them will not be able to draw an old-age pension (not even an early pension). Thanks to these parameters of the pension system, when retirement age is set according to life expectancy, the real duration of retirement is stable over the projection horizon as shown in Figure 2.3.

Calculations in Table 2.3 referring to CSM show the average effective working career[4] important for the labour market and consequently for the whole set of macroeconomic assumptions. Both demographic and macroeconomic assumptions enter the pension model exogenously without any feedback, i.e. the pension model fully employs all original assumptions and does not apply any changes to them.

On the other hand, the contributory periods in the fourth rows in each part of Table 2.3 show the periods that are used by the pension model solely to calculate pension benefits of all pension types. It is clear that they differ from the effective working career assumed by CSM from the beginning, i.e. from 2013 for which real data is mentioned in Table 2.3. These statistics shows such high values even when our legislation currently only recognizes years of career back to 1986. According to the law, this lower limit applies for the future too, but as time goes by the length of recognized career will extend to the whole career. This single effect will contribute to the increase of the contributory period in the future.

The reason why these “contributory periods” or better to say “period covered by insurance” can be higher than the average effective working career assumed by CSM is in the 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).

[4] It can be found in third rows in each part of Table 2.3.

3 Pension Projection Results

The third section presents the results of the national pension model that applies current policy settings based on AWG assumptions (Section 2).

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

The pension projection exercise focuses on mandatory social security pensions as the most important scheme. It fully covers all types of pensions – i.e. 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, financed by their budgets and not from social security contributions. These schemes are of minor importance and do not pose additional pressures on public finances with changes in population structure.

Projections also exclude the pension savings pillar established from 1 January 2013. The data for the early years show very low participation of people and thus the impact on public finances is only negligible. The third pillar, voluntary fully funded private scheme similarly plays a very minor role. Moreover, detailed data for the contribution side is not available and the expenditure side is not possible to analyse as benefits have a lump sum form in many cases.

Therefore, pension projections fully cover and respect all settings of the pay-as-you-go pillar.

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

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

	2006	2007	2008	2009	2010	2011	2012
1 Eurostat total pension expenditure	8.0	7.9	8.2	9.1	9.2	9.7	9.9
2 Eurostat public pension expenditure	8.0	7.9	8.1	9.0	9.2	9.6	9.8
3 AWG public pension expenditure	7.4	7.3	7.7	8.4	8.5	8.8	9.0
4 Difference (2) - (3)	0.7	0.6	0.4	0.6	0.7	0.8	0.8

Source: Eurostat, MoF Calculations.

3.2 Overview of Projection Results

The social security scheme is the major source of benefits for the elderly generation based on the 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 the population structure and longevity, resulting in a higher number of pensions over time as illustrated in Figure F.14 in Annex F.

Pension benefits are not taxed in the absolute majority of cases. This is due to the relatively high threshold up to which the income of pensioners is tax exempt. Only pensioner's income exceeding 36 times the minimum wage[5] is subject to 15% Personal Income Tax. Currently, only a negligible number of pensioners (not even 1% of them) pay taxes. Moreover, such negligible personal income tax revenue is a source of the public budgets and not of the social security system itself. For these reasons tax calculations are not part of the projection exercise and therefore gross and net pensions are equal.

Table 3.2: Projected Pension Spending and Contributions
(% of GDP)

	2013	2020	2030	2040	2050	2060	Peak year
Public pension expenditure	9.0	9.0	9.0	9.0	9.6	9.7	2057
Public pension contributions	7.9	7.9	7.9	7.9	7.9	7.9	2013

Source: MoF calculations.

[5] Minimum gross wage is set from 1 August 2013 to be CZK 102,000 per year (approx. EUR 3,926).

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

In light of the most recent population and macroeconomic assumptions, pension expenditures are expected to increase from the current 9.0% to 9.7% of GDP. The greatest part is taken by old-age pensions being mostly affected by changes in the population structure. However, the increase is somewhat limited, due to postponement in retirement. Thus the overall increase between the years 2013 and 2060 is expected to be 0.7p.p.

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

	2013	2020	2030	2040	2050	2060	Peak year
Total public pensions	9.0	9.0	9.0	9.0	9.6	9.7	2057
of which							
Old age and early pensions	7.3	7.5	7.5	7.4	8.0	8.1	2056
Disability pensions	1.1	0.9	0.8	0.9	0.9	0.9	2014
Survivors' pensions	0.7	0.6	0.7	0.7	0.7	0.7	2058

Source: MoF calculations.

There are two opposite effects driving the future development of disability pensions. First, the positive effect is related to legislative changes that introduced three levels of disability (instead of the previous two) from 2010 onwards and more strict eligibility conditions for any of the disability types. In addition, compared to the last projection round, when only rough estimates of impacts were available, experience from the past four years shows the positive impact of this reform.[6] The second, negative effect stems from the fact that the postponement of the retirement age brings more disabled persons in preretirement ages due to their higher disability rates.[7] Although the numbers of disability pensions increase over time, the expenditures as a share on GDP do not seem to be much higher due to indexation lower than nominal GDP growth. Disabled people of any type are automatically transferred to old age pensions at the age of 65 or at the statutory retirement age if higher.

There is not any special minimum pension scheme. The minimum amount of benefit is ensured by a flat rate component as the same for every pension type and minimum earnings related component.

3.3 The Main Driving Forces behind the Projection Results and Their Implications

Table 3.4 shows the results of the public pension decomposition.[8] It is apparent that the main contribution to the increase of pension expenditure by 0.7p.p. over time is the ageing population that will change the ratio between the elderly and active population.

On the contrary, the coverage ratio will decrease over time. The main reason should be seen in the continuous postponement of the retirement age that takes place during the projection horizon. This will reduce the number of pensioners and together with the increase of population aged 65+ will influence the ratio. It is the case of both, early-age and old-age ratios, because all these cohorts are affected by the statutory age increase. The early-age coverage decline is bigger, being more affected by the retirement age increase at the beginning. The issue of the decrease in the coverage ratio is addressed in detail in Annex D.

[6] The impact of the reform on the number of disability pensions is shown in Figure F.15—Figure F.17.

[7] An illustration of disability profiles development can be found in Annex F.

[8] Detailed explanation of individual effects can be found in Annex B.

Table 3.4: Factors behind the Change in Public Pension Expenditures between 2013 and 2060 – Pensions
(percentage points of GDP)

	2013 - 2020	2020 - 2030	2030 - 2040	2040 - 2050	2050 - 2060	2013 - 2060	Average annual change
Public pensions to GDP	0.0	-0.1	0.0	0.7	0.1	0.7	0.016
Dependency ratio effect	2.3	1.2	1.4	1.8	0.5	7.2	0.153
Coverage ratio effect	-1.7	-0.7	-0.8	-0.7	-0.2	-4.1	-0.095
Coverage ratio old-age	-0.8	-0.2	-0.5	-0.3	-0.1	-1.8	-0.040
Coverage ratio early-age	-1.9	-2.6	-0.6	-0.2	-0.4	-5.7	-0.131
Cohort effect	-2.1	0.6	-1.3	-2.7	-0.6	-6.1	-0.145
Benefit ratio effect	0.0	-0.5	-0.4	0.1	0.1	-0.7	-0.016
Labour Market/Labour intensity effect	-0.4	0.0	-0.1	-0.4	-0.2	-1.1	-0.023
Employment ratio effect	-0.3	0.0	0.1	-0.3	-0.1	-0.6	-0.016
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.0	0.003
Career shift effect	-0.1	0.0	-0.2	-0.1	0.0	-0.4	-0.010
Residual	-0.2	-0.1	-0.1	-0.1	0.0	-0.5	-0.003

Source: MoF calculations, European Commission.

The benefit ratio will mainly decline in several early decades thanks to the assumed indexation. The indexation of pensions is represented by inflation growth (measured by the aggregate consumer price index) plus a third of the growth in real average wage. For the future, the indexation rule is set to be strict without possible discretions. A second effect that drags the benefit ratio down is the assumed additional increase of early retirement pensions compared to the observed data in order to improve the coverage of inactive people determined by CSM.[9] Early retirement pension benefits are subject to permanent penalization and thus are quite substantially lower than regular pension benefits. This mostly happens in the medium term, which can also be inferred from replacement rates of old age pension benefits in Figure F.21. Disability pensions also contribute to the lower benefit ratio (see the replacement rates in Figure F.22—Figure F.24), because of the lower inflows of new pensioners with higher benefits. Paid out pensions are devaluated by indexation, which is lower than wage growth.

Labour market effects help to limit pension expenditure growth mainly through the employment ratio effect. The share of the working population (cohort 20—64) increases due to the assumed higher effective retirement age (as a result of the statutory retirement age postponement).

Table 3.5: Factors behind the Change in Public Pension Expenditures between 2013 and 2060 – Pensioners
(percentage points of GDP)

	2013 - 2020	2020 - 2030	2030 - 2040	2040 - 2050	2050 - 2060	2013 - 2060	Average annual change
Public pensions to GDP	0.0	-0.1	0.0	0.7	0.1	0.7	0.016
Dependency ratio effect	2.3	1.2	1.4	1.8	0.5	7.2	0.153
Coverage ratio effect	-1.6	-0.6	-0.7	-0.7	-0.3	-3.8	-0.088
Coverage ratio old-age	-0.6	0.0	-0.3	-0.1	-0.1	-1.1	-0.023
Coverage ratio early-age	-1.7	-2.4	-0.6	-0.2	-0.4	-5.4	-0.123
Cohort effect	-2.1	0.6	-1.3	-2.7	-0.6	-6.1	-0.145
Benefit ratio effect	-0.1	-0.6	-0.5	0.0	0.1	-1.0	-0.022
Labour Market/Labour intensity effect	-0.4	0.0	-0.1	-0.4	-0.2	-1.1	-0.023
Employment ratio effect	-0.3	0.0	0.1	-0.3	-0.1	-0.6	-0.016
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.0	0.003
Career shift effect	-0.1	0.0	-0.2	-0.1	0.0	-0.4	-0.010
Residual	-0.2	-0.1	-0.1	-0.1	0.0	-0.5	-0.003

Source: MoF calculations, European Commission.

Not surprisingly Table 3.5, focusing rather on pensioners instead of pensions, shows quite similar results. 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. The dependency ratio and labour market effect are exactly the same in

[9] Details can be found in Annex D.

the two tables, as the number of pensions or pensioners do not play any role here. The coverage ratio effect decreases less here simply because there are fewer pensioners than pensions in the nominator. Benefit ratio changes during decades are comparable.

Table 3.6: Replacement Rate at Retirement and Coverage by Pension Scheme
(%)

	2013	2020	2030	2040	2050	2060	Peak year
Public scheme - all pensions							
Replacement rate	32.2	35.6	32.5	32.8	34.5	33.7	2014
Benefit rate	42.8	43.8	41.0	38.9	39.1	39.5	2014
Coverage	100.0	100.0	100.0	100.0	100.0	100.0	2013
Public scheme - old-age pensions							
Replacement rate	43.3	46.8	43.3	42.5	47.1	49.3	2014
Benefit rate	42.6	44.5	42.0	39.9	40.2	40.7	2014
Coverage	66.9	68.0	67.8	67.9	69.2	68.5	2052

Note: Replacement rate is a share of an average newly granted pension benefit (expenditures on newly granted pensions over the number of pensions) on average gross wage at retirement.
Benefit rate is a share of pension benefit of an average pensioner (total pension expenditures over the number of pensioners) on average gross wage.
Source: MoF calculations.

The benefit ratio represents the relationship between the average pension benefit and economy wide average wage, while the replacement rate (RR) is a share of the average newly granted pension benefit on the average gross wage at retirement. Both wages develop in line (for details see the explanation in the Introduction). Table 3.6 shows the evolution of these ratios over time for the public scheme. As this is the only scheme covered in the projections, it does not differ from the total numbers in the last row. The public scheme in the first two rows includes the average pension benefit over all types of pensions, i.e. old-age, disability and survivor's.

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. The average new pension benefits that are in the nominator of RR are calculated every year in the same way from pensionable earnings which correspond to wages.[10] Therefore the average replacement rate tends to be constant over time. Unfortunately, it is not the case of old-age pensions, where another factor plays a role. It depends on the distribution of the number of people retiring around the statutory retirement age. The more people that retire early before the statutory retirement age, the higher penalization applies to more pensioners, and thus the lower resulting average pension benefit. This effect is behind the quite erratic evolution of the replacement rate,[11] because it depends on the number of people assigned with early old-age pension in order to cover the assumed number of inactive people. This reason also applies for the explanation of the evolution of RR (and also BR) over time. These ratios fall mainly because of the additional coverage of inactive people as explained in Annex D. The biggest part of additionally covered people with an early old age pension is in the period up to 2040. The more people that retire early before the statutory retirement age, the higher penalization applies to more pensioners, and thus the lower resulting average pension benefit and consequently RR (and BR). All the replacement rates are illustrated in the Figures in Annex F (Figure F.20—Figure F.26).

In the case of the benefit ratio, not only the newly granted pensions play a role, but also those paid out matter. All types of pensions are losing over time in comparison with wages due to the indexation of CPI plus one third of real wage growth. The quite stable new pension inflows prevent the ratio from falling. The same effects on the average pension benefit apply in the case of the benefit ratio[12] as well.

[10] The calculation of pensionable earnings from wages through reduction brackets using reduction coefficients is described by equation (A.20).

[11] Although it seems that the replacement rate for old-age pension increases over time, it is more due to the values in the denoted years in the table. The reason for erratic development in the case of new pensions is in the retirement age postponement that happens every couple of years. As we work with the yearly model, we are not able to capture the smooth pattern of retirement increase. If we smooth the line we would see much more stable development with rather minor decreases in replacement rates due to the described effect. Some intuition can be drawn from Figure F.21.

[12] It is worth noting why the benefit ratio for the whole public scheme is higher than the benefit ratio for old age pensions (with higher average pension) in some years. In case of old-age pensions there is no difference between pensions and pensioners. On the other hand, the calculation of the benefit ratio for the whole public scheme uses a share of all pension expenditures (including outlays for pensions in concurrence) on the number of pensioners (which is lower than the number of pensions). Therefore, a comparison of the two benefit ratios may be misleading.

In fact all pensions in the Czech Republic are covered by the social security pension scheme, therefore the public scheme coverage is 100% and old age pensions also constantly represent a great part of the system – around 67—69%. When it comes to pensioners, public scheme coverage remains at 100% and the latter ratio amounts to ca 80%.

Similarly to old-age dependency ratio, also the dependency in the pension system measuring share of pensioners (receivers of pension benefits) over employees (contributors to the system) increases from recent 58.7% to 67.6% over time. However, the increase is not as dramatic as in the case of demographic dependency (which more than doubles). It is mainly due to an increase in the retirement age that helps to stabilize the system. At the end of the projection horizon the retirement age is around 69 years of age, well above the considered group of elderly (65+). As a result, we can observe a decline in the difference between the two dependencies, denoted as "system efficiency".

Table 3.7: System Dependency Ratio and Old-age Dependency Ratio

		2013	2020	2030	2040	2050	2060	Peak year
Number of pensioners (I)		2 882	2 876	3 023	3 152	3 311	3 315	2059
Employment (II)		4 935	4 875	4 827	4 778	4 698	4 696	2013
Pension System Dependency Ratio (SDR) (I)/(II)	%	58.4	59.0	62.6	66.0	70.5	70.6	2058
Number of people aged 65+ (III)		1 797	2 153	2 403	2 697	3 041	3 128	2058
Working age population 15 - 64 (IV)		7 149	6 802	6 797	6 619	6 285	6 247	2013
Old-age Dependency Ratio (ODR) (III)/(IV)	%	25.1	31.7	35.3	40.8	48.4	50.1	2058
System efficiency (SDR / ODR)		2.3	1.9	1.8	1.6	1.5	1.4	2013

Source: MoF calculations, European Commission.

The shares of pensioners of the inactive population (in Table 3.8 for both sexes and in Table 3.10 for women) include two effects. Due to the continuous increase in the retirement age, the share decreases in relevant cohorts since they are no longer allowed to retire. It is mainly the case of the age groups of 60—64. On the other hand, there is, of course, an increase in disability pensions due to a higher disability rate in these higher ages. However, the disability rates (probability of becoming disabled) do not fully offset the old age pensions. Moreover, participation rates are also very low in these ages. These factors drive the share of pensioners over inactive people down for a certain period of projection.[13]

In the projection, all persons that fulfil the minimum age limit for the even early retirement pension are covered. The age specific share of old-age pension allowed for early pensions (in the cohorts of age-3 and age-5 at a later stage) stemming from the observed data is kept constant over time (constant regarding the distance from the retirement age for the respective generation). It is visible in all years we have data for that huge penalizations for early retirement are effective and that a lower share of people retire at early ages. The share increases as the statutory age approaches. However, as we want to incorporate the CSM assumption about the lower effective retirement age and increase the coverage, we made additional adjustments described in Annex D. So the model recalculates the number of old-age pensions with the increased share of early pensions beyond what the data says so that the more inactive people are covered. While doing this we respected the fact that the demand for early retirement increases as retirement age approaches. The rest of inactive people that could possibly retire will be covered by the so-called preretirement scheme. All people at the statutory retirement age and older are old-age pensioners automatically. Consequently, the declining share of pensioners to inactive people in the age groups 60-64 and 65-69 are fully explained by the fact that people from these cohorts are gradually losing eligibility for (early) old-age pensions as well as for the preretirement scheme.

Table 3.8: Pensioners to Inactive Population Ratio by Age Group
(%)

	2013	2020	2030	2040	2050	2060	Peak year
Age group -54	10.9	11.0	11.2	10.4	9.7	10.4	2028
Age group 55-59	124.4	91.2	86.0	98.4	111.5	115.0	2013
Age group 60-64	116.5	99.5	89.2	72.7	68.5	69.6	2013
Age group 65-69	109.8	100.0	100.0	100.0	98.9	92.0	2013
Age group 70-74	106.9	100.0	100.0	100.0	100.0	100.0	2013
Age group 75+	100.6	100.0	100.0	100.0	100.0	100.0	2013

Source: MoF calculations.

[13] Pension projections respect assumptions about the labour force and inactive people and cover a major share of these "residual" people with a pension. For a detailed discussion of the problem please see Annex D.

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

Table 3.9: Pensioners to Population Ratio by Age Group
(%)

	2013	2020	2030	2040	2050	2060	Peak year
Age group -54	4.3	4.4	4.7	4.5	4.4	4.6	2029
Age group 55-59	26.3	19.1	15.6	15.7	16.2	16.1	2013
Age group 60-64	79.5	63.4	48.7	33.3	24.3	20.9	2013
Age group 65-69	98.8	85.4	80.1	73.1	64.8	54.3	2013
Age group 70-74	101.5	96.0	94.9	93.7	93.1	92.4	2013
Age group 75+	100.4	100.0	100.0	100.0	100.0	100.0	2013

Source: MoF calculations.

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

Table 3.10: Female Pensioners to Inactive Population Ratio by Age Group
(%)

	2013	2020	2030	2040	2050	2060	Peak year
Age group -54	10.4	10.7	10.9	9.9	9.2	10.0	2028
Age group 55-59	116.8	79.8	73.6	91.9	112.7	114.9	2013
Age group 60-64	117.6	100.0	85.8	69.4	69.5	72.8	2013
Age group 65-69	108.4	100.0	100.0	100.0	98.9	91.4	2013
Age group 70-74	107.1	100.0	100.0	100.0	100.0	100.0	2013
Age group 75+	102.4	100.0	100.0	100.0	100.0	100.0	2013

Source: MoF calculations.

Table 3.11: Female Pensioners to Population Ratio by Age Group
(%)

	2013	2020	2030	2040	2050	2060	Peak year
Age group -54	4.6	4.8	5.1	4.9	4.6	4.9	2028
Age group 55-59	34.2	24.7	18.6	18.7	19.1	19.0	2013
Age group 60-64	94.9	72.9	53.9	35.8	25.9	23.3	2013
Age group 65-69	100.1	88.3	83.3	76.3	66.8	55.1	2013
Age group 70-74	102.7	96.6	95.6	94.5	93.8	92.6	2013
Age group 75+	102.3	100.0	100.0	100.0	100.0	100.0	2013

Source: MoF calculations.

New old-age pension expenditures (first lines in each section of Table 3.12) are a multiple of the number of new pensions and the average newly granted pension benefit. Table 3.12 disaggregates this calculation more into the main driving factors. One of the main inputs in the pension benefit calculation is the statistic of the distribution of the new pensions according to i) the personal calculation base and ii) contributory period. It allows for calculating 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 the postponement of retirement and the extension of acknowledged contributory periods for the whole career. Therefore the average contributory periods increase over time.

The average pensionable earning develops in line with wage development, so its share on the economy wide average wage is rather constant over time. Pensionable earning is considered to be the economy wide average wage "transformed" into a personal calculation basis through reduction brackets using reduction coefficients as described in equation (A.20). Because wage is the base for the calculation, and also reduction brackets develop in line with wages, the share is constant. The only minor changes in the first projection years are due to specific reduction brackets and reduction coefficients up to 2015 (see Marval and Štork, 2012).

Table 3.12: Projected and Disaggregated New Public Pension Expenditure
(old-age and early earnings-related pensions)

		2013	2020	2030	2040	2050	2060	Peak year
Total								
Projected new pension expenditure	*mil EUR*	445.0	802.3	1 059.5	1 874.0	2 571.8	3 095.9	2059
I. Average contributory period	*years*	43.0	44.5	45.5	46.4	47.4	48.4	2057
II. Monthly average pensionable earnings	*thous. EUR*	0.6	0.7	1.0	1.4	2.0	2.9	2060
III. Average accrual rates	*%*	1.8	2.0	1.8	1.7	1.9	1.9	2014
IV. Number of new pensioners	*thous. EUR*	83.4	115.8	112.7	139.5	119.5	96.1	2042
V. Average number of months paid the first year		12	12	12	12	12	12	2013
VI. Sustainability factor		:	:	:	:	:	:	:
Monthly average pensionable earnings/Monthly economy-wide average wage	*%*	59.6	57.7	57.7	57.7	57.7	57.7	2014
Males								
Projected new pension expenditure	*mil EUR*	255.9	411.3	557.5	970.7	1 363.9	1 623.2	2059
I. Average contributory period	*years*	44.4	45.4	46.4	46.4	47.4	48.4	2057
II. Monthly average pensionable earnings	*thous. EUR*	0.6	0.7	1.0	1.5	2.2	3.1	2060
III. Average accrual rates	*%*	1.8	1.9	1.7	1.7	1.8	1.8	2014
IV. Number of new pensioners	*thous. EUR*	44.3	57.6	55.9	67.9	61.0	49.0	2042
V. Average number of months paid the first year		12	12	12	12	12	12	2013
VI. Sustainability factor		:	:	:	:	:	:	:
Monthly average pensionable earnings/Monthly economy-wide average wage	*%*	63.4	61.3	61.3	61.3	61.3	61.3	2014
Females								
Projected new pension expenditure	*mil EUR*	189.1	391.1	502.0	903.3	1 207.9	1 472.8	2059
I. Average contributory period	*years*	41.5	43.5	44.5	46.5	47.5	48.5	2057
II. Monthly average pensionable earnings	*thous. EUR*	0.5	0.6	0.9	1.3	1.9	2.7	2060
III. Average accrual rates	*%*	1.8	2.1	1.8	1.7	1.9	2.0	2021
IV. Number of new pensioners	*thous. EUR*	39.1	58.2	56.8	71.5	58.5	47.1	2042
V. Average number of months paid the first year		12	12	12	12	12	12	2013
VI. Sustainability factor		:	:	:	:	:	:	:
Monthly average pensionable earnings/Monthly economy-wide average wage	*%*	55.3	53.5	53.5	53.5	53.5	53.5	2014

Source: MoF calculations.

The value of the average accrual rate (part of pensionable earnings reflected in the pension benefit) is legislated to be 1.5%. The numbers in Table 3.12 are slightly higher, which is caused by the calculation of the new pension benefit. It consists of a flat rate and earnings related component. The accrual rate applies in the case of the calculation of the latter only,[14] while the first is set by a certain amount and develops with wages. The simplified calculation in Table 3.12 does not describe this in detail. To reach the correct sum of the two components of pension benefits from pensionable earning thus requires the higher accrual rate.[15] As the model works with yearly data and uses yearly statistics (averages of new pensions over year), we work with the full year of 12 months. Sustainability factor, which is not present in the Czech pension system, usually adjusts pension benefits according to balance of the pension system.

The pension formula is the same for both sexes, so the same driving factors work for all parts of Table 3.12. Only minor differences can be seen in the recent shorter careers of women and their lower income.

3.4 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.

[14] See equation (A.20).

[15] It is only the issue of the illustration in Table 3.12. The model, of course, works with the legislated accrual rate of 1.5%.

The 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. The pension system does not include any automatic compensation mechanism for longevity that would reduce this effect.

The higher labour productivity is slightly more demanding from the level of the total expenditures point of view. But the opposite is true looking at the GDP ratios. This scenario creates higher GDP (higher denominator for per GDP spending) and somewhat higher wages. However the newly granted pensions will be higher, the indexation rule will translate only 1/3 of this positive effect into the growth of the pension benefit.

The lower labour productivity works symmetrically to the previous scenario. Thus, despite the savings on total expenditures, the effect of lower GDP predominates.

The higher employment rate is marginally lower in terms of expenditures compared to the baseline. Also as in the case of higher productivity, the GDP as the denominator is somewhat higher dragging the share down.

The higher employment of older workers slightly lowers pension expenditures by contributing to higher GDP and results in very similar outcomes compared to the higher employment rate scenario.

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 compared to the baseline.

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

Table 3.13: Pension Expenditures under Different Scenarios
(percentage points, deviations from the baseline)

	2013	2020	2030	2040	2050	2060	Peak year
Baseline	9.0	9.0	9.0	9.0	9.6	9.7	2057
Higher life expectancy (2 extra years)	0.0	-0.1	-0.2	0.0	0.2	0.5	2060
Higher lab. productivity (+0.25 pp.)	0.0	-0.1	-0.5	-0.4	-0.4	-0.3	2013
Lower lab. productivity (-0.25 pp.)	0.0	-0.1	-0.2	0.0	0.1	0.3	2060
Higher emp. rate (+2 pp.)	0.0	-0.2	-0.5	-0.4	-0.4	-0.2	2013
Higher emp. of older workers (+10 pp.)	0.0	-0.4	-0.8	-0.5	-0.3	0.0	2013
Lower migration (-20%)	0.0	-0.1	-0.2	0.0	0.1	0.3	2060
TFP risk scenario	0.0	-0.1	-0.2	0.0	0.1	0.4	2060
"Policy" scenario*	0.0	-0.2	-0.5	-0.5	-0.5	-0.4	2013

*Note: * For explanations, see Box 1.*
Source: MoF calculations.

Analysis of the **"policy" scenario** shows lower expenditure shares on GDP. This happens through a very fast increase in the retirement age (faster than life expectancy growth) and a better assumption about the effective retirement age, which brings a higher and longer participation of older workers. However, in case of this scenario, it is crucial to look more closely at its assumptions (exogenous for the pension model). For details, see the following Box 1.

Box 1: Exogenous Assumptions of "Policy" Scenario in Comparison with the Baseline
The analysis of the "policy" scenario aims at showing the impact of linking the statutory retirement age to the life expectancy gains. As mentioned in Section 2.1 the increase of the statutory retirement age in the Czech pension system is set with respect to life expectancy and even goes beyond that for women whose age increases even more in order to catch up with men (Figure 2.2). However, the "policy" scenario assumptions surprisingly suggest a higher retirement age (mainly for men) than in the baseline scenario. This is the reason why it is necessary to look more in detail at the assumptions about linking retirement age to life expectancy in both scenarios and, of course, show the consequences.

The reason lies in the different reference values of life expectancy. The pension system and illustrations of Figure 2.2 and Figure 2.3 compare the increase of retirement age to life expectancy at the age of 65, i.e. that of the generation close enough around the retirement age in the respective calendar year. On the other hand, the higher retirement age suggested by the "policy" scenario considers the life expectancy at birth in respective calendar years. Because gains in life expectancy in the case of new-borns are higher, the proposed retirement age is higher too (in the case of women the age grows even a bit more than that!). Comparison of the statutory retirement ages for the two scenarios is illustrated in Figure 3.1. When we compare the number of years spent in pension in Figure 3.2 (here equally deducting from life expectancy at 65 for both scenarios), we can see that under the "policy" scenario, the years in pension decline over the horizon. In 2060, women will spend 19.8 years in retirement instead of the current 24.4 in 2013 (which is similar in both scenarios) and men 14 instead of 18 years now. **So the "policy" scenario assumptions suggest an unprecedentedly higher retirement age than would stem from the life expectancy increase.**

Figure 3.1: Retirement Age: Baseline vs "Policy" Scenario

(age)

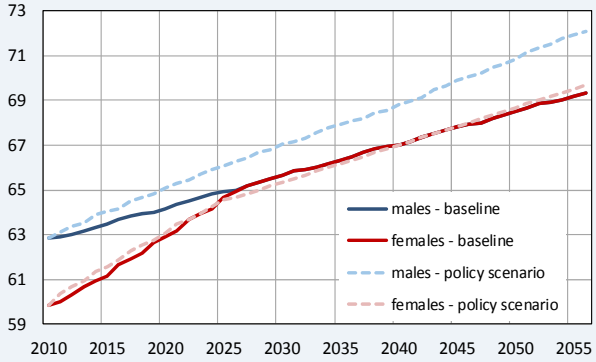
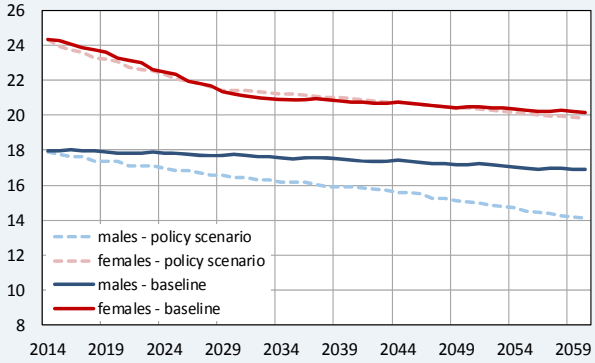


Figure 3.2: Years in Pension: Baseline vs "Policy" Scenario

(years of age)



Source: MoF calculations.

There is another aspect that is worth mentioning. It is the difference in the assumption of the effective retirement age, which affects mainly men. Annex D mentions that the linking of the effective retirement age to the statutory age is assumed to be weakened as the retirement age reaches higher levels, i.e. the higher the retirement age the lower the effect on the effective age increase. Therefore a line depicting the difference between statutory and effective age should be upward sloping. The slope of the line should be driven by the respective levels of the retirement age (pace of retirement age increase in our case, while starting from the same point in 2013). We can observe from the graphs below that the differences for men (Figure 3.3) grow practically at the same pace despite a much higher retirement age in the "policy" scenario in all projection years (Figure 3.1). **This shows the stronger link of the effective age to the statutory age than in the baseline.** In the case of women, statutory retirement is approximately the same in both scenarios and also the gap in Figure 3.4 develops more or less in line.

Figure 3.3: Difference: Statutory – Effective Retirement Age for Males

(years of age)

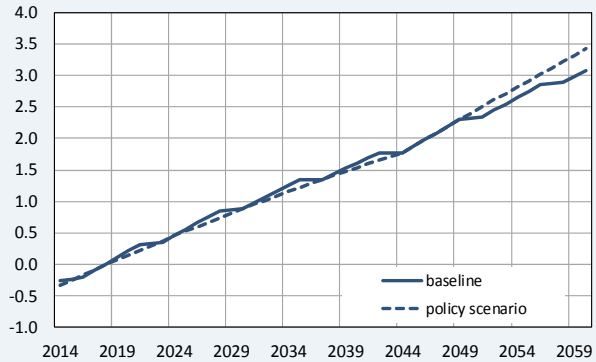
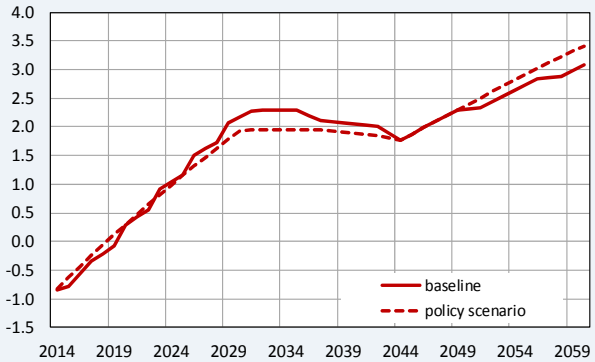


Figure 3.4: Difference: Statutory – Effective Retirement Age for Females

(years of age)



Source: MoF calculations.

Therefore the "policy" scenario further lowers pressures on the pension system as it generates a lower number of old-age pensioners. There is a higher number of disability pensioners (as the disability rates increase with age), but they do not fully offset old-age pensioners. Moreover, their pension benefits are lower. The higher retirement age also positively affects the labour market through higher participation and employment rates and therefore it consequently generates a higher GDP. It is, on the

other hand, redeemed by a more dramatic increase in retirement age and the continuous decrease of life spent in pension for future generations, which is supported by a somewhat better assumption on the effective retirement age.

As a result, the "policy" scenario does not answer the question, what would the pension expenditure be if the increase of the retirement age is linked to the life expectancy gains. Such an interpretation would be misleading! The results are solely driven by exogenous assumptions of the dramatically higher retirement age and much more favourable situation on the labour market, which assumes a closer linking of the statutory and effective retirement ages than in the baseline. It is clear from Figure 2.2 and Figure 2.3 that the legislated increase of the retirement age is slightly higher than the increase of life expectancy. Therefore the strict linking of these two variables should definitely lead to higher pension expenditure pressures in the future.

3.5 Description of the Changes in Comparison with Previous Projection Rounds

The current projections, the fourth in a row, again bring better results than the previous ones. The results in 2009 were better compared to 2006, mainly due to the delay of the statutory retirement age (up to 65, still differentiated for women with children) and also due to a more favourable demographic outlook. 2012 projections further improved the situation through parametric changes in the system. Mainly the further postponement of the retirement age and reform in disability pensions have a sizable impact.

Table 3.14: Change in Public Pension Expenditure to GDP under the 2006, 2009, 2012 and 2015 Projection Exercises
(% of GDP)

	Public pensions to GDP	Dependency ratio	Coverage ratio	Employment effect	Benefit ratio	Labour intensity	Residual (incl. interact. effect)
2006*	5.58	10.46	-3.46	-0.28	-0.56	:	-0.58
2009**	3.27	9.55	-3.51	-0.47	-1.21	:	-1.08
2012***	2.73	9.25	-4.64	-0.58	-0.21	0.01	-1.10
2015****	0.74	7.17	-4.09	-0.65	-0.73	0.01	-0.93

*Note * 2004-2050; ** 2007-2060; *** 2010-2060; **** 2013-2060.*
Source: MoF calculations, European Commission.

The past projection rounds also limit public expenditure as a share of GDP. Demography is one factor that improved the dependency ratio. Macroeconomic assumptions are also more favourable.[16] Overall, a change in assumptions improved results by approx. 1 p.p. at the end of the horizon. Minor improvements have been made in terms of modelling, where we had a much closer look at the issue of early and late retirement and the calculation of respective penalization and bonuses. This relates to the issue of coverage as discussed in Annex D, where we more precisely defined additional adjustments in order to fulfil no policy change assumptions. While previous (2012AR) projections were based on data in ESA95, current projections are based on the updated ESA2010, which contributes to lower per GDP spending approximately by 0.5 p.p. over the projection horizon.

Table 3.15: Decomposition of the Difference between 2012 and the New Public Pension Projection
(% of GDP)

	2013	2020	2030	2040	2050	2060
Ageing report 2012	8.7	8.7	8.9	9.7	11.0	11.8
Change in assumptions	0.2	0.8	0.9	0.2	-0.8	-1.5
Improvement in the coverage or in the modelling	0.0	-0.2	-0.4	-0.4	-0.2	-0.2
Change in the interpretation of constant policy	0.0	0.0	0.0	0.0	0.0	0.0
Policy related changes	0.0	-0.3	-0.5	-0.5	-0.5	-0.5
New projection	9.0	9.0	9.0	9.0	9.6	9.7

Source: MoF calculations.

Policy related changes are those connected to disability pensions. There has not been any reform since the last projections, however, recently we have more data and can better assess the impact of the reform effective from 2010. Three years ago, when the three-tier disability system replaced the two-tier one, we had to work with one year obser-

[16] It is worth noting that also change in exchange rate assumption plays role here. Our projections are originally carried out in Czech Korunas (CZK), but GDP comes from AWG macroeconomic assumptions in Euros. For the last projection round it was assumed the exchange rate amounting to 25.284 CZK/EUR (value from 2010 using for years of projections), while recent results are calculated using the rate 25.980 CZK/EUR. This "depreciation" of some ca 3% has an impact on expenditure to GDP shares, which tend to be somewhat lower.

vations only. Now we can use data for the past four years, which definitely allow a more accurate calculation of disability probabilities.

Comparison with the Previous Projection Round

Table 3.16 shows a detailed comparison of this projection exercise with the previous one. The first two parts of the Table illustrate the importance of the individual effect in the driving of pension expenditures. The numbers are calculated as percentage changes over certain projection periods. It is clear that the highest contribution to expenditure growth has the dependency ratio effect, which is the result of population ageing and longevity. However, there are also factors that limit the dynamic of expenditure pressures. It is mainly the continuous postponement of the retirement age, which is behind the decrease of the coverage ratio effect. Consequently, the induced higher number of the workforce improves the situation on the labour market and the better employment ratio effect helps the pension system.

The third part of Table 3.16 indicates changes between the two projection exercises. The overall public pension expenditure dynamics is lower by almost 22 p.p.[17] The biggest part is caused by a better population outlook with a more favourable dependency ratio effect. The worse coverage ratio effect is not a result of any policy measure but rather a consequence of higher additional coverage of inactive people in this exercise. This effect is also behind the lower benefit ratio, where more people are assumed to accept early retirement pension with a lower pension benefit.[18]

Table 3.16: Detailed Comparison of 2012 and the New Public Pension Projection

	2013 - 2020	2020 - 2030	2030 - 2040	2040 - 2050	2050 - 2060	2013 - 2060
(A) Ageing Report 2015						
Public pensions to GDP	0.3	-0.6	0.1	7.3	1.3	8.3
Dependency ratio effect	24.7	13.1	14.4	18.6	5.0	75.9
Coverage ratio effect	-18.0	-6.9	-8.1	-7.9	-2.5	-43.3
Benefit ratio effect	0.1	-5.7	-4.1	1.4	0.6	-7.8
Employment ratio effect	-4.0	-0.5	-1.3	-3.9	-1.8	-11.5
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.1
Residual	-2.5	-0.7	-0.9	-1.0	-0.1	-5.2
(B) Ageing Report 2012						
Public pensions to GDP	-4.8	2.7	8.4	14.9	8.8	30.0
Dependency ratio effect	35.0	13.1	16.5	25.0	11.9	101.5
Coverage ratio effect	-24.4	-6.5	-7.9	-8.4	-3.7	-50.9
Benefit ratio effect	-6.1	-3.1	2.0	3.4	1.5	-2.3
Employment ratio effect	-3.4	0.2	0.6	-2.6	-1.1	-6.4
Labour intensity effect	0.0	0.0	0.0	0.1	0.0	0.1
Residual	-5.9	-1.0	-2.8	-2.5	0.1	-12.1
(A - B) Difference: Ageing Report 2015 - Ageing Report 2012						
Public pensions to GDP	5.1	-3.3	-8.3	-7.6	-7.5	-21.7
Dependency ratio effect	-10.3	0.1	-2.1	-6.4	-6.9	-25.6
Coverage ratio effect	6.4	-0.4	-0.2	0.6	1.2	7.6
Benefit ratio effect	6.2	-2.6	-6.1	-2.0	-1.0	-5.5
Employment ratio effect	-0.6	-0.7	-1.9	-1.3	-0.7	-5.1
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.0
Residual	3.3	0.4	2.0	1.5	-0.2	6.9

Source: European Commission, MoF calculations.

[17] Note that the two projections differ in terms of the starting point. While the base year of 2012 Ageing report was in 2010, the recent exercise uses the last observed data from 2013.

[18] For details of additional coverage, please see Annex D.

4 Concluding Remarks on 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. Therefore the numbers of contributors and employment are equal. The contribution burden is shared between the employee (6.5%) and the employer (21.5%). In the same way the total revenues of the system from public contributions in Table 4.1 are split between the two groups. The state does not take part in the system, not even in the case of unemployed people, students or women on maternity leave. The only relief for these people is in the fact that they acquired pension rights through so called non-contributory periods without paying contributions.

Table 4.1: Contributions, Contributors and Employment

		2013	2020	2030	2040	2050	2060	Peak year
Public contribution	*mil. EUR*	12 456	15 203	22 100	31 808	45 268	64 646	2060
Employer contribution	*mil. EUR*	9 565	11 674	16 970	24 424	34 760	49 639	2060
Employee contribution	*mil. EUR*	2 892	3 529	5 130	7 384	10 509	15 007	2060
State contribution	*mil. EUR*	:	:	:	:	:	:	:
Number of contributors (I)	*thousands*	4 935	4 875	4 827	4 778	4 698	4 696	2013
Employment (II)	*thousands*	4 935	4 875	4 827	4 778	4 698	4 696	2013
Share of (I)/(II)	*%*	100	100	100	100	100	100	2013

Note: Employment includes self-employed. Division of contributions is done according to respective contribution rates, which implies that self-employed are included in both groups.
Source: MoF calculations.

The public pension account was created in 2004 and is part of the state budget. Therefore possible deficits would need to be taken care of by the government. During more favourable times it is designed to create surpluses from the excess of contributions over expenditures. Since 2012, part of VAT income has also been forwarded to the pension account. From that year onwards the investments into securities were stopped and funds are moving to bank accounts as securities mature.

The following Figure 4.1 shows the evolution of the main balances. The social security system balances illustrate the yearly differences between income from contributions and expenditures paid out to all types of pensioners. The pension account balance variable shows the balance at the end of every year (it is the flow variable). Besides the social contributions, the particular share of VAT (7.2 %) is transferred to the pension account by law and on the top of that some ad hoc inflows, e.g. from dividends paid by state-owned companies are transferred too. Moreover, the system has some assets which were accumulated in the past for future pension reform and cannot be spent (this is stock variable). This prevents the assets from being depleted and the deficits are covered from other government revenues in the State budget. Thus the assets are real, but on the other hand they are preserved just according to the law, but would virtually already be 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 4.2).

Figure 4.1: Pension Account Balance

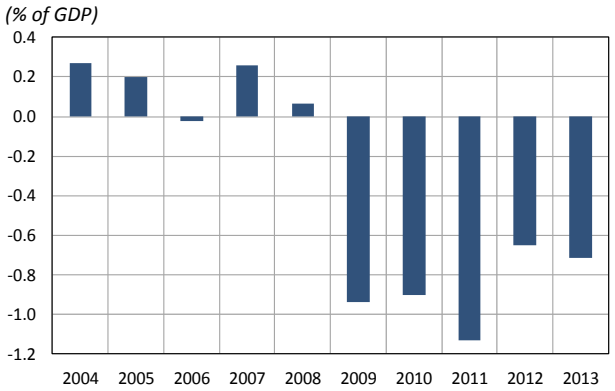
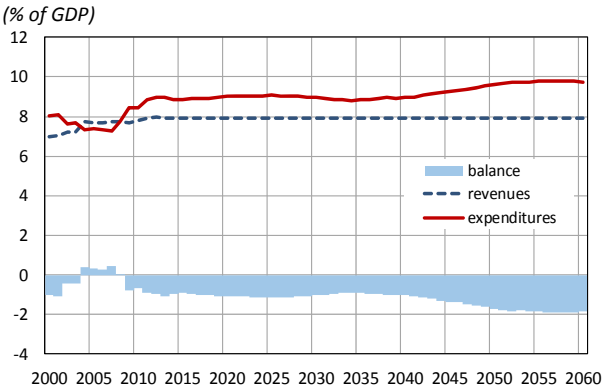


Figure 4.2: Projection of Revenues, Expenditures and Pension Account Balance



Source: MoF calculations.

Generally, it is necessary to view long-term projections as showing trends of the future development under certain long-term assumptions. It is not possible therefore to take the mentioned values strictly as values that will be valid for the given years. As shown in Table 3.16, any change in assumptions constitutes a serious determinant, having a relatively substantial impact on results.

Nevertheless, regardless of differences in the levels of individual assumptions, it is possible to discern from the course of trends and their mutual links certain characteristics or features that repeat. Approximately until the mid-2030s, expenditures should develop rather favourably, whereupon will follow an increase in expenditures on pensions due to demography. Nevertheless, projected expenditures already reach maximum values just before the end of the projection period (in 2057), which suggests a reversal and subsequent decrease in expenditures beyond the horizon of the projections (after 2060). Therefore, it is possible to suppose that, given the current setting, the sustainability of the pension system in itself is not simply wishful thinking. On the other hand, it is necessary to point out that from the perspective of long-term sustainability it is not only pensions that are important, but also other systems, in particular health care.

A Annex: Pension Projection Model

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

A.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 making long-term projections and simulating the impact of changes in all the relevant parameters of the current system.

The presented projection results are prepared primarily for the 2015 Ageing Report. The AWG platform is in fact the main and the only "formal" reviewer of these projections. However, the Ministry of Finance (MoF) cooperates with the Ministry of Labour and Social Affairs (MoLSA) – that runs its own long term projections – and consults these results on a collegial basis. Results of the two institutions are comparable and the differences explainable. They mainly stem from i) characteristics of models; MoLSA runs a micro-simulation model while MoF uses a macro-model and ii) assumptions about demography and the macroeconomic framework used.

A.2. Assumptions and Methods Applied

Pension projections fully respect commonly agreed AWG assumptions. The model aims at incorporating all features of the pension system. For a detailed description of methods, see Chapter A.5.

A.3. Data Used

The model has made use of data since the year 2000. 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 the 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 the 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 this data is taken from AWG assumptions.

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

A.4. Reforms Incorporated in the Model

The model fully applies to current legislation. There has not been additional reform since the last projection round that would require the changes in the modelling approach or other adjustments because of legislation changes.

A.5. General Description of the Model

The model makes a 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 three years prior to statutory retirement age);

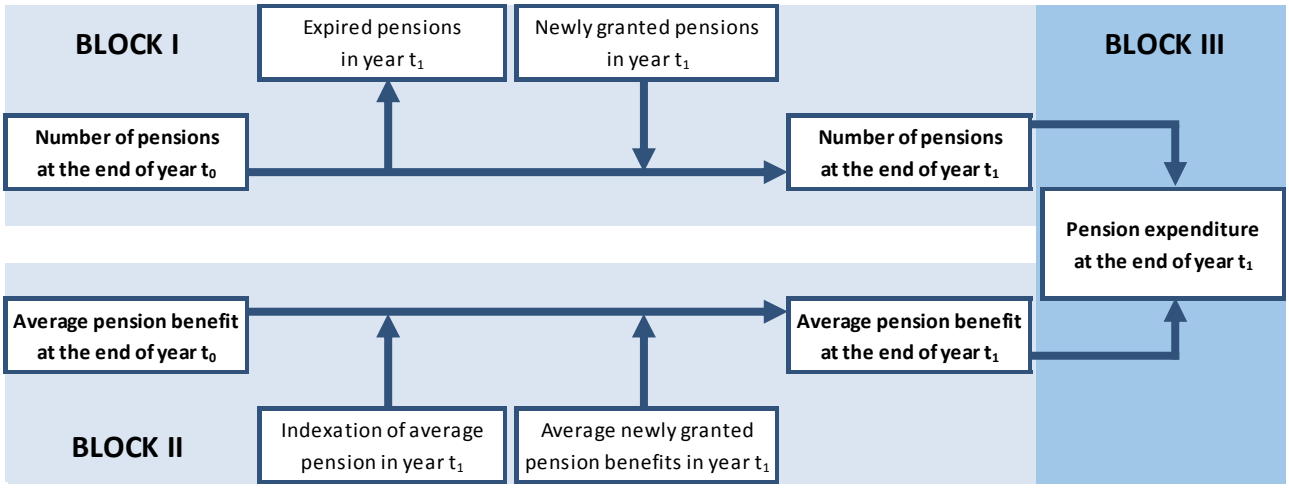
- Disability pensions (distinguishes between all three types: 3rd degree (when working capacity is reduced by at least 70%), 2nd and 1st degree (with working capacity reduced by 50 - 69% and 35 - 49% respectively);
- Widow's/widower's pensions solo;
- Widow's/widower's pensions in concurrence with other 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 a different level of pension benefits. It is also important to apply the 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 (impacts for instance the number of survivors´ pensions or the average lengths of receiving an old-age pension), disability rates (impacts the number of disability pensions) and affiliation with a generation is also decisive for the 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, the recipients of disability or old-age pensions may under the 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 are illustrated in Figure A.1. The first block calculates the number of pensions and the 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 give 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 A.1: Simplified Structure of the Model



A.1.5 Block I – Number of Pensions[19]

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

Old-Age and Disability Pensions

First of all, we stem from the observed age specific shares and probabilities and assume their evolution in the future. Age specific shares of the respective pension (pen_s)[20] are given by the number of each pension (pen) on the population (pop) for each calendar year (t), age (a) and sex (s)

[19] Graphs showing developments of the numbers of pensions are in Annex F (Figure F.13—Figure F.19).

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

$$pen\_s_t^{a,s} = \frac{pen_t^{a,s}}{pop_t^{a,s}} \tag{A.1}$$

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

$$pen\_p_t^{a,s} = \frac{pen\_s_t^{a,s} - pen\_s_{t-1}^{a-1,s}}{1 - pen\_s_{t-1}^{a-1,s}} \tag{A.2}$$

In case of some pensions (usually any except old-age) the pensioner changes its status since he/she can stop receiving e.g. a disability pension due to renewed working capacity or becoming entitled to old-age pension.[21] The conditional probability that a person ceased to be a pensioner can be expressed as follows

$$pen\_p_t^{a,s} = 1 - \frac{pen\_s_t^{a,s}}{pen\_s_{t-1}^{a-1,s}} \tag{A.3}$$

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

$$pen\_s_t^{a,s} \Rightarrow pen\_s_t^{g,s} \qquad pen\_p_t^{a,s} \Rightarrow pen\_p_t^{g,s} \tag{A.4}$$

and projected into the future.[22] While projecting probabilities, we must take into account the continuously increasing development of the statutory retirement age. Therefore in case of old-age, each generation with a higher retirement age[23] 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

$$pen\_p_{g+a+(ret^{g,m} - ret^{1951,m})}^{g,m} = pen\_p_{1951+a}^{1951,m} \quad \text{for males } (m) \text{ and} \quad pen\_p_{g+a+(ret^{g,f} - ret^{1954,f})}^{g,f} = pen\_p_{1954+a}^{1954,f} \tag{A.5}$$

for females (f). We stem from the generations that retire in the base year 2013 (generation of men born in 1951 has retirement age equal to 62 years, i.e. 2013 = 1951 + 62, whereas the generation of women born in 1954 reached the statutory retirement age, 2013 = 1954 + 59). Such splitting is done for convenience, usually in ages where probability profiles are a flat point (depending on the type of pension).

Using projected probabilities are then used to calculate shares of the population for all future generations by

$$pen\_s_{t+1}^{g,s} = pen\_s_t^{g,s}\left(1 - pen\_p_{t+1}^{g,s}\right) + pen\_p_t^{g,s} \tag{A.6}$$

Or in accordance with (A.3)

$$pen\_s_{t+1}^{g,s} = pen\_s_t^{g,s}\left(1 - pen\_p_{t+1}^{g,s}\right) \tag{A.7}$$

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

$$pen_t^{g,s} = pen\_s_t^{g,s} pop_t^{g,s} \tag{A.8}$$

If we sum up the generations and sexes, we arrive at the total number of pensions for a calendar year.

$$pen_t = \sum_{g,s} pen\_s_t^{g,s} pop_t^{g,s} \tag{A.9}$$

Widows'/Widowers' Pensions

A somewhat different approach from the one outlined in the equations above has been used to calculate the number of survivors' pensions. The probability of receiving a widow's/widower's pension (wid_p) depends on the marital status, the probability of a spouse to die in a given year and the compound probability of the couple to die within the same year. This can be formally expressed as:

[21] After the statutory retirement age all disability pensions are considered to be old-age pensions. As a result disability pensions disappear behind the statutory retirement age.

[22] For the illustration of age specific shares, see Annex F (Figure F.1—Figure F.12).

[23] For information about the development of the retirement age in the model see Section A.6.

$$wid\_p_t^{g,f} = \left(\varepsilon_t^{g,m} - \varepsilon_t^{g,m}\varepsilon_t^{g,f}\right)\frac{mpop_t^{g,f}}{pop_t^{g,f}} \tag{A.10}$$

ε stands for the mortality rate and $mpop$ is the number of the 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 the average mortality rate of the other sex around the given age a ($= t - g$).

The number of widow's pensions (wid) can be derived from the equation (A.10) and the assumption on the ratio of the married population in a given starting age ($a_0 = t_0 - g$). Before the age a_0[24] we assume (on the basis of fairly stable mortality rates) that 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:

$$\frac{wid_t^{g,f}}{pop_t^{g,f}} = \frac{wid_{t-1}^{g,f}}{pop_{t-1}^{g,f}} + \varepsilon_t^{g,m}\left(\frac{mpop_{t_0}^{g,f}}{pop_{t_0}^{g,f}} - \frac{wid_{t-1}^{g,f}}{pop_{t-1}^{g,f}}\right) \tag{A.11}$$

This equation is used to calculate the total number of widow's/widower's pension. It 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 an old-age or disability pension, which is given by the fraction of the population that receives the old-age (oa) or disability pension ($dis = dis1 + dis2 + dis3$).

$$wids_t^{g,s} = wid_t^{g,s}\left(1 - \frac{oa_t^{g,s} + dis_t^{g,s}}{pop_t^{g,s}}\right) \tag{A.12}$$

$$widc_t^{g,s} = wid_t^{g,s} - wids_t^{g,s} \tag{A.13}$$

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 the population are the same in all years as in the base year

$$or\_s_t^{a,s} = or\_s_{2013}^{a,s} \tag{A.14}$$

The number of pensions is calculated similarly for other pension types

$$or_t^{a,s} = or\_s_t^{a,s} pop_t^{a,s} \tag{A.15}$$

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 the sex and generation specific mortality rate (ε)

$$npen_t^{g,s} = pen_t^{g,s} - pen_{t-1}^{g,s}\left(1 - \varepsilon_t^{g,s}\right) \tag{A.16}$$

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 (A.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).

$$ndis_t^{g,s} = k_{g+a}^{g,s} dis_t^{g,s} \tag{A.17}$$

$$k_{g+a}^{g,s} \equiv k^{a,s} = \frac{ndis_{2013}^{a,s}}{dis_{2013}^{a,s}} \tag{A.18}$$

[24] 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.

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 2013 data[25].

A.2.5 Block II – Average Newly Granted Pension Benefits

This block enables (i) assessing 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) simulating the impact of changes in the pension formula in the long run.

The changes in the pension formulae are simulated in a matrix with two dimensions – the assessment basis and contribution period. It is a matrix, which gives the number of pensions for a given combination of the 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 the contributory periods in accordance with the postponement of retirement and the extension of the 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 (A.19) – (A.21)). Weighing the pension benefits by the number of recipients gives the average newly granted pension.

$$npen\_v = frc + erc \tag{A.19}$$

$$erc = \begin{Bmatrix} \min(pcb, rb_1)rc_1 + \\ +\max[\min(pcb - rb_1, rb_2 - rb_1), 0]rc_2 + \\ +\max[\min(pcb - rb_2, rb_3 - rb_2), 0]rc_3 + \\ +\max[\min(pcb - rb_3), 0]rc_4 \end{Bmatrix} \frac{cp_1 + 0.8cp_1}{365} ar \tag{A.20}$$

$$pcb = \frac{\sum_{y=Y-1-\min(car,Y-1-1986)}^{Y-1} ycb_y \prod_{t=y}^{Y-1} \frac{w_{t+1}}{w_t}}{\min(car, Y-1-1986) - \frac{ncp}{365}} \tag{A.21}$$

$npen\_v$ stands for newly granted pension benefit, frc for flat rate component (currently in 2013 amounts to CZK 2,330 ≈ EUR 90), erc earnings related component, pcb personal calculation basis, rb reduction brackets (currently rb_1 = CZK 11,389 ≈ EUR 438, rb_2= CZK 30,026 ≈ EUR 1,156 and rb_3 = CZK 30,026 ≈ EUR 1,156),[26] rc reduction *coefficient* (currently rc_1 = 100% up to rb_1, rc_2 = 27% up to rb_2, rc_3 = 19% up to rb_3 and rc_4 = 6% above rb_3),[27] 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 basis[28] 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.

A.3.5 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. The total spending on a given type of pension (pen_e) in equation (A.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 the newly granted average pension benefit ($npen\_v$) calculated in Block II of the model, and the number of pensions (pen) and newly granted pensions ($npen$) from Block I.

$$pen\_e_t = \sum_{g,s} \left(pen_t^{g,s} - npen_t^{g,s}\right) pen\_v_{t-1}^{g,s}(1 + index_t) + npen_t^{g,s}\, npen\_v_t^{g,s} \tag{A.22}$$

The 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 the respective year

[25] That is, the model assumes a constant probability of restoring the working capacity.

[26] rb_1 and rb_2 are assumed to develop with wages, rb_3 will be zero since 2015 onwards according to the legislation.

[27] From 2015 onwards there will be only three reduction coefficients (as rb_3 will be cancelled). rc_1 = 100%, rc_2 = 26% and rc_3 = 0%.

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

of projection is the weighted average of the average pension from the previous period and the newly granted pension benefits

$$pen\_v_t^{g,s} = \frac{pen\_e_t^{g,s}}{pen_t^{g,s}} = \frac{\left(pen_t^{g,s} - npen_t^{g,s}\right)}{pen_t^{g,s}} pen\_v_{t-1}^{g,s}(1 + index_t) + \frac{npen_t^{g,s}}{pen_t^{g,s}} npen\_v_t^{g,s} \quad \text{(A.23)}$$

The replacement rate of each pension type is simply the share of the average pension benefit of the paid out pension (pen_v), resp. the newly granted pension ($npen\_v$), over the average gross wage at retirement (aw_ret)

$$pen\_rr_t^{g,s} = \frac{pen\_v_t^{g,s}}{aw\_ret_t} \qquad npen\_rr_t^{g,s} = \frac{npen\_v_t^{g,s}}{aw\_ret_t} \quad \text{(A.24)}$$

A.6. Additional Features of the Model

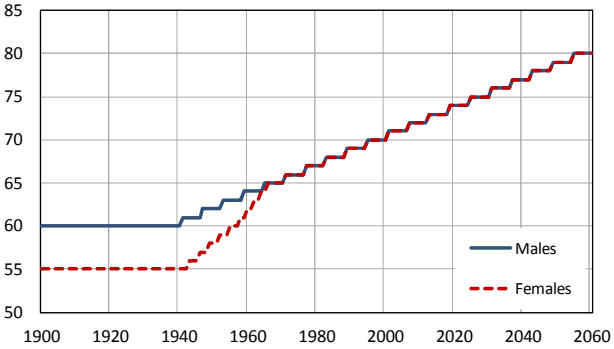
Statutory Retirement Age Increase

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

There are still differences in retirement age not only in the case of sexes, but for women the number of children raised matters too. For modelling purposes we work with an average woman that has 2 children.

Figure A.2: Evolution of Statutory Retirement Age in the Model

(retirement age for generations – years of birth)



Source: MoF calculations.

B Annex: Decomposition of Main Driving Forces Behind Projection Results

This Annex provides more details about driving forces behind projection results of pensions to GDP ratio. These factors are illustrated in Table 3.4 considering pensions and Table 3.5 for pensioners instead – i.e. adjusted for pensions in concurrence.

Pension to GDP ratio can be decomposed into the dependency, coverage, benefit ratio, employment rate and labour intensity.[29]

$$\frac{\text{Pension Expenditure}}{\text{GDP}} = \frac{\overbrace{\text{Population 65+}}^{Dependency\ Ratio}}{\text{Population 20-64}} \times \frac{\overbrace{\text{Number of Pensioners (Pensions)}}^{Coverage\ Ratio}}{\text{Population 65+}} \times \\ \times \frac{\overbrace{\text{Average income from pensions (Average Pension)}}^{Benefit\ Ratio}}{\text{Population 64+}} \times \frac{\overbrace{\text{Population 20-64}}^{Labour\ Market\ /\ Labour\ Intensity}}{\text{Hours Worked 20-74}} \quad \text{(B.1)}$$

Coverage ratio and labour market can be further decomposed as follows:

$$\frac{\overbrace{\text{Number of Pensioners}}^{Coverage\ Ratio}}{\text{Population 65+}} = \frac{\overbrace{\text{Number of Pensioners 65+}}^{Coverage\ Ratio\ Old-Age}}{\text{Population 65+}} \\ + \left(\frac{\overbrace{\text{Number of Pensions} \leq 65}^{Coverage\ Ratio\ Early-Age}}{\text{Population 50-64}} \times \frac{\overbrace{\text{Population 50-64}}^{Cohort\ Effect}}{\text{Population 65+}} \right) \quad \text{(B.2)}$$

$$\frac{\overbrace{\text{Population 20-64}}^{Coverage\ Ratio}}{\text{Hours Worked 20-74}} = \frac{\overbrace{\text{Population 20-64}}^{1\ /\ Employment\ Rate}}{\text{Population 20-64}} \times \frac{\overbrace{\text{Working People 20-64}}^{1\ /\ LabourIntensity}}{\text{Hours Worked 20-64}} \times \frac{\overbrace{\text{Hours Worked 20-64}}^{1\ /\ Career\ prolongation}}{\text{Hours Worked 50-74}} \quad \text{(B.3)}$$

[29] The illustrative decomposition is taken from EK (2015), page 85.

C Annex: Methodological Notes

The methodological annex summarizes the 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 the economy wide average wage and the average wage at retirement, we used the data of the Czech Statistical Office on wage distribution. We examined data for the past fourteen years, which show that wage profile across the ages from 15 to 65+ shows relatively high inertia. This enables us to assume a constant wage profile in the future. We assume the shift in the age specific wage profile from 2013 onwards with respect to the postponement of the 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 7.7% higher than economy wide average wage.

Table C.1: Economy Wide Average Wage at Retirement

(thousands EUR)

	2013	2020	2030	2040	2050	2060
Economy-wide average wage	11.5	13.7	20.2	29.3	42.5	60.7
Economy-wide average wage at retirement	12.3	14.8	21.7	31.6	45.7	65.3

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 the given conditions receive a 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% – 84%.

Pension Taxation

Pension benefits are not taxed in the absolute majority of cases. This is due to the relatively high threshold up to which the income of pensioners is tax exempt. Only pensioner's income exceeding 36 times the minimum wage[30] is subject to 15% Personal Income Tax. Currently only a negligible number of pensioners (not even 1% of them) pay 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 the projection exercise.

Disability Pension

Disabled people of any type could occur only in ages under 65 or statutory retirement age if higher. At 65 or statutory retirement, they are automatically transferred to old-age pensions.

There has not been any reform since the last projections. However, recently we have had more data and thus we can better assess the impact of the reform effective from 2010. Three years ago, when the three-tier disability system replaced the two-tier one, we had to work with one year observations only. Now we can use data for the past four years, which definitely allows for a more accurate calculation of disability probabilities.

In our system with the continuous increase of the retirement age, the disability rates play a role, mainly in pre-retirement ages. We observe the increased disability shares in the case of ages that are continuously becoming ineligible for old-age or even early retirement pension. Table C.2 shows the evolution of disability rates for crucial age cohorts over time. While for younger people (below age 55) disability rates are stable, older cohorts witness their increase, which is solely due to retirement age postponement. Graphical illustrations of disability profiles develop-

[30] Minimum gross wage is set from 1 August 2013 to be CZK 102,000 per year (approx. EUR 3,926).

ment can be found in Annex F. However, although disability profiles increase with deferred retirement, they do not fully offset missing retirement, while participation rates are also very low in these ages.[31]

Table C.2: Disability Rates by Age Groups

(%)

	2013	2020	2030	2040	2050	2060
Age group -54	3.3	3.4	3.6	3.4	3.3	3.5
Age group 55-59	16.3	13.7	13.1	13.2	13.7	13.8
Age group 60-64	11.1	10.5	9.2	12.2	14.9	17.2
Age group 65-69	0.1	0.0	0.0	1.4	4.8	8.1
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.

Survivor Pensions

The method of the calculation of survivors' pensions is introduced in detail at the end of Section A.1.5. Equation (A.11) and (A.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 F.18 and Figure F.19, where the numbers of pensions are more or less stable over the projection horizon. The same applies to expenditure too as the replacement rates are constant over time. See Figure F.25 and Figure F.26.

Non-Earnings Related Minimum Pension

The 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 poverty is the institute of the subsistence level.[32] Both these instruments are set by the government and are revaluated on an irregular basis. There is not any special minimum pension scheme besides this one inbuilt in all pension types.

Contributions

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

[31] For a detailed discussion of the problem please see Annex D.

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

D Annex: Coverage Rate Adjustments

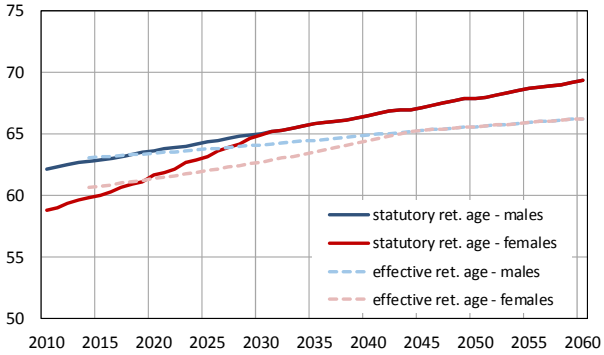
This annex aims at shedding some light on the differences between the Cohort Simulation Model (CSM) and the national pension model that have an impact on the pension projection exercise. Naturally, there are and will be reasonable differences between the two models by definition. Therefore it requires more explanation, how the pension model has been adjusted, mainly on the share of pensioners over inactive people, as illustrated in Table 3.8 and Table 3.10.

Statutory Retirement Age vs. Effective Retirement Age

What causes the problem with the coverage rate decline is the difference between the statutory retirement age and the effective retirement age assumed by CSM. The Czech Republic has legislated a continuous increase in the statutory retirement age as shown in the following Figures. This is directly set in the law and it is not a subject to any possible future approval of the Government and/or Parliament. Although the retirement age is assigned to each generation (according 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 (A.5).

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

(ages in calendar years)



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

On the other hand, macroeconomic assumptions work with effective retirement. It is assumed that with the 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 earlier.[33] The share of inactive people over the population increases in the years where people are not allowed to retire anymore as the participation rates themselves are set insufficiently to cover for this effect.

Pension Model Adjustments

The pension model, as was introduced in Section A.1.5 respects the current legislation and shifts profiles with respect to the statutory retirement, 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 the quoted Figures, the share of disabled people in the 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 the 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 much more opt for early retirement as the pension age increases. Therefore the model takes the initial result of the projection of numbers of pensions and calculates the numbers of uncovered inactive people. It further analyses, whether a person could possibly be entitled for early retirement pension. If yes, such a person is additionally assigned an early retirement pension. In this respect we assume that this additional demand for early retirement increases with the proximity of statutory age. The prob-

[33] Although recent data shows that it has not been the case as effective retirement age develops with the statutory retirement age. This is mainly due to the very strict and painful penalizations for early retirement. However, it seems reasonable to assume that this link will be weakened to some extent.

lem is that old age pensions are, in the case of some ages and cohorts, unable to cover additional inactive people, as they are not even allowed early retirement.

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

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

Effects of Additional Coverage on Pension Results

Beside the improvement in the ratio of pensioners over inactive people, model adjustments have other impacts on results. Early retirement pensions that are somewhat increased mean lower benefits for these pensioners. From pension system settings, certain reductions apply amounting to more than a quarter of an earnings-related pension benefits in the case of the earliest possible retirement. The adjustment assumption of higher demand for early retirement as the pension age approaches seems reasonable, because not many people would accept dramatic penalizations imposed when retiring at the earliest possible age.

If we assume that all inactive people would accept early retirement, it would result in unprecedentedly low replacement rates, and consequently, in a decrease of the total pension expenditure over time;[34] well below the current share of GDP at the end of the projection horizon. Such projections would definitely not be reliable.

[34] People would be assigned the benefit earlier but on a much lower permanent level. Total outlays for such a pensioner would in sum be lower than when assigned the regular pension benefit later. This would drag the total pension expenditure down.

E Annex: Retirement Age

Table E.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	60y2m	57y	56y	55y	54y	53y
1937	60y4m	57y	56y	55y	54y	53y
1938	60y6m	57y	56y	55y	54y	53y
1939	60y8m	57y4m	56y	55y	54y	53y
1940	60y10m	57y8m	56y4m	55y	54y	53y
1941	61y	58y	56y8m	55y4m	54y	53y
1942	61y2m	58y4m	57y	55y8m	54y4m	53y
1943	61y4m	58y8m	57y4m	56y	54y8m	53y4m
1944	61y6m	59y	57y8m	56y4m	55y	53y8m
1945	61y8m	59y4m	58y	56y8m	55y4m	54y
1946	61y10m	59y8m	58y4m	57y	55y8m	54y4m
1947	62y	60y	58y8m	57y4m	56y	54y8m
1948	62y2m	60y4m	59y	57y8m	56y4m	55y
1949	62y4m	60y8m	59y4m	58y	56y8m	55y4m
1950	62y6m	61y	59y8m	58y4m	57y	55y8m
1951	62y8m	61y4m	60y	58y8m	57y4m	56y
1952	62y10m	61y8m	60y4m	59y	57y8m	56y4m
1953	63y	62y	60y8m	59y4m	58y	56y8m
1954	63y2m	62y4m	61y	59y8m	58y4m	57y
1955	63y4m	62y8m	61y4m	60y	58y8m	57y4m
1956	63y6m	63y2m	61y8m	60y4m	59y	57y8m
1957	63y8m	63y8m	62y2m	60y8m	59y4m	58y
1958	63y10m	63y10m	62y8m	61y2m	59y8m	58y4m
1959	64y	64y	63y2m	61y8m	60y2m	58y8m
1960	64y2m	64y2m	63y8m	62y2m	60y8m	59y2m
1961	64y4m	64y4m	64y2m	62y8m	61y2m	59y8m
1962	64y6m	64y6m	64y6m	63y2m	61y8m	60y2m
1963	64y8m	64y8m	64y8m	63y8m	62y2m	60y8m
1964	64y10m	64y10m	64y10m	64y2m	62y8m	61y2m
1965	65y	65y	65y	64y8m	63y2m	61y8m
1966	65y2m	65y2m	65y2m	65y2m	63y8m	62y2m
1967	65y4m	65y4m	65y4m	65y4m	64y2m	62y8m
1968	65y6m	65y6m	65y6m	65y6m	64y8m	63y2m
1969	65y8m	65y8m	65y8m	65y8m	65y2m	63y8m
1970	65y10m	65y10m	65y10m	65y10m	65y8m	64y2m
1971	66y	66y	66y	66y	66y	64y8m
1972	66y2m	66y2m	66y2m	66y2m	66y2m	65y2m
1973	66y4m	66y4m	66y4m	66y4m	66y4m	65y8m
1974	66y6m	66y6m	66y6m	66y6m	66y6m	66y2m
1975	66y8m	66y8m	66y8m	66y8m	66y8m	66y8m
1976	66y10m	66y10m	66y10m	66y10m	66y10m	66y10m
1977	67y	67y	67y	67y	67y	67y

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

Each younger generation will have statutory retirement age higher by 2 additional months comparing the precedent generation. I. e. generation born in 1978 will retire at age 67y2m, 1979 at age 67y4m and so on.

F Annex: Detailed Results[35]

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 reach the retirement age of men. It is a result of the much higher increase in statutory age for women.

Figure F.1: Old-Age Pensions – Males

(number of pensions / population)

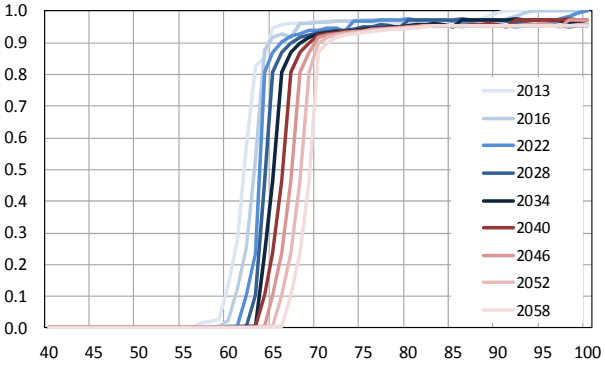


Figure F.2: Old-Age Pensions – Females

(number of pensions / population)

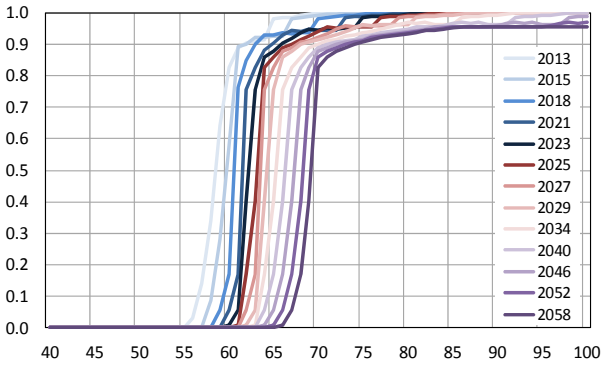


Figure F.3: 3rd Degree Disability Pensions – Males

(number of pensions / population)

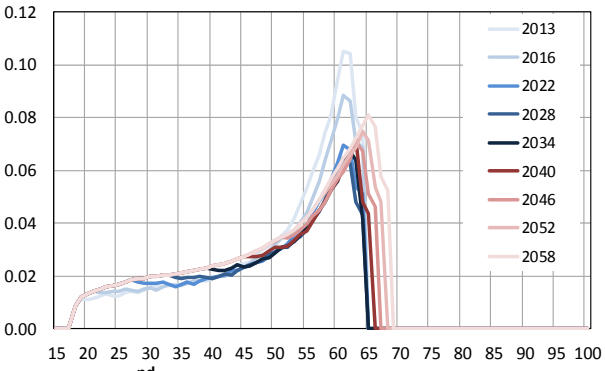


Figure F.4: 3rd Degree Disability Pensions – Females

(number of pensions / population)

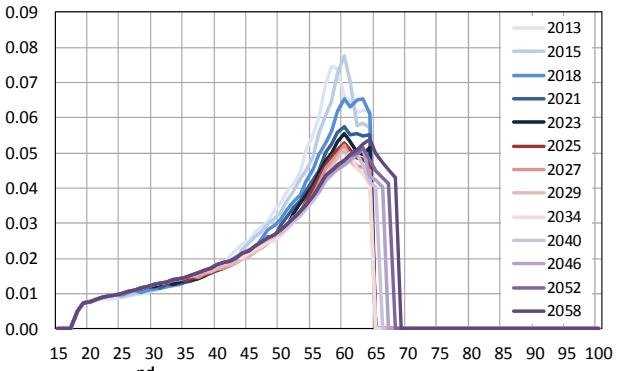


Figure F.5: 2nd Degree Disability Pensions – Males

(number of pensions / population)

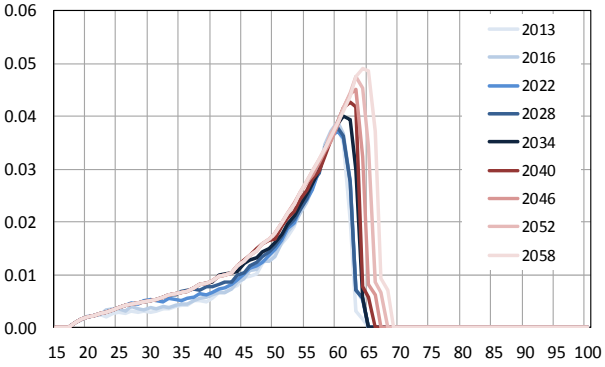
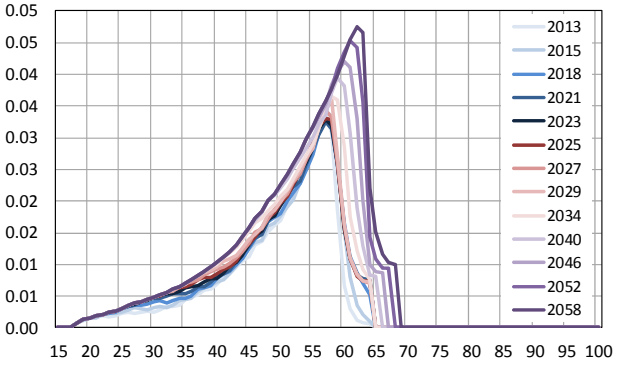


Figure F.6: 2nd Degree Disability Pensions – Females

(number of pensions / population)



[35] Source of all data for graphs in this Annex is in MoF calculations.

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

(number of pensions / population)

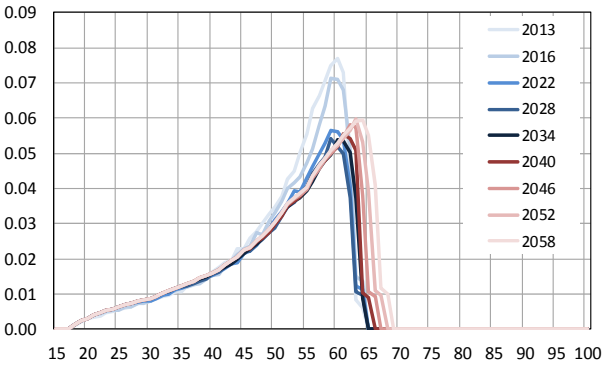
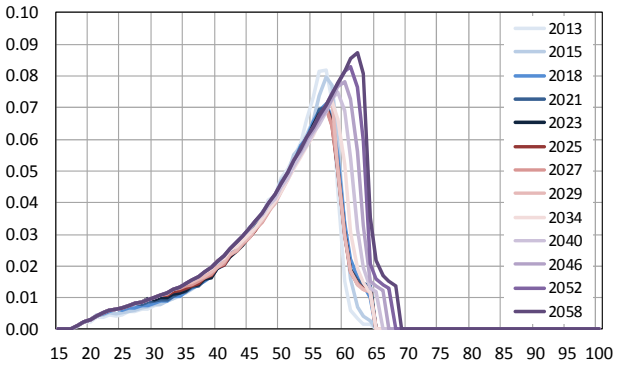


Figure F.8: 1st Degree Disability Pensions – Females

(number of pensions / population)



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

Figure F.9: Widower's Pensions – Males

(number of pensions / population)

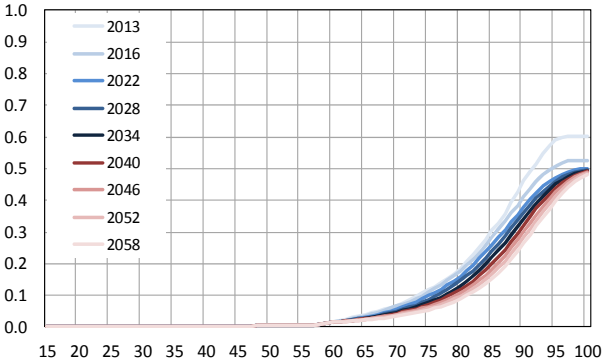


Figure F.10: Widows' Pensions – Females

(number of pensions / population)

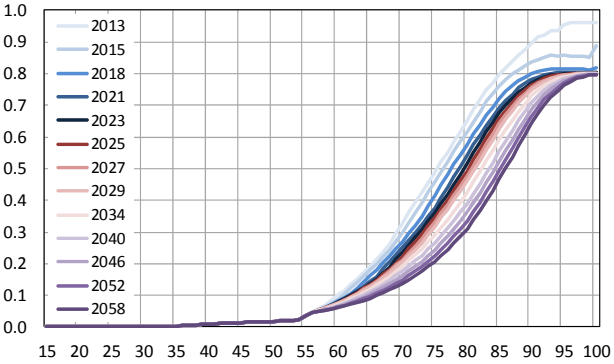


Figure F.11: Orphan's Pensions – Males

(number of pensions / population)

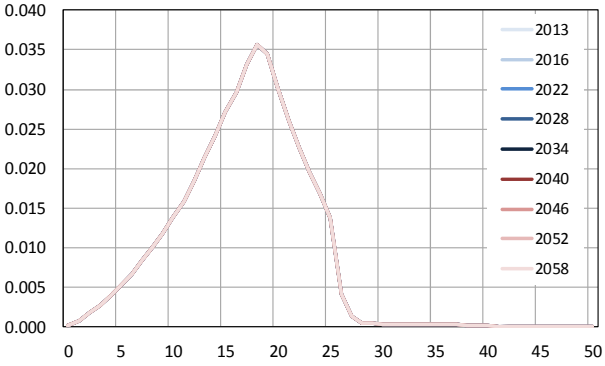
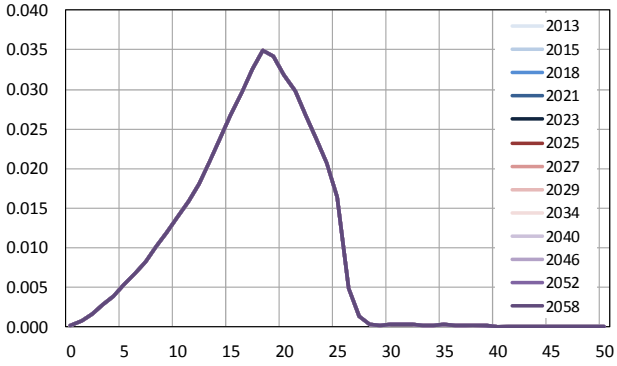


Figure F.12: Orphan's Pensions – Females

(number of pensions / population)



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

Numbers of Pensions

Figure F.13: Number of Pensions - All Pensions

(thousands pensions)

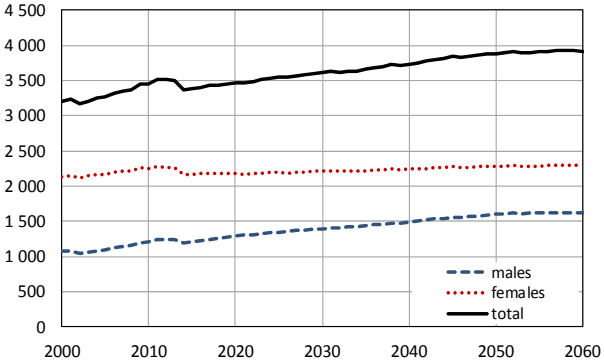


Figure F.14: Number of Pensions - Old-Age Pensions

(thousands pensions)

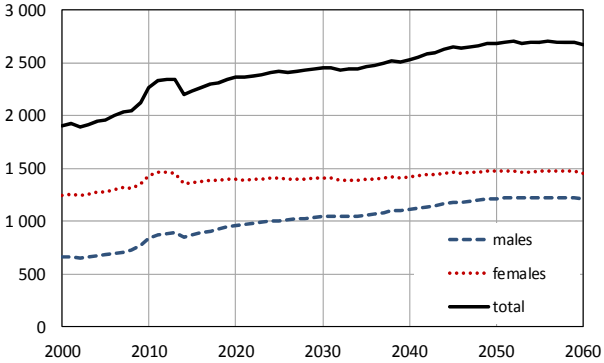


Figure F.15: Number of Pensions - 3rd Degree Disability Pensions

(thousands pensions)

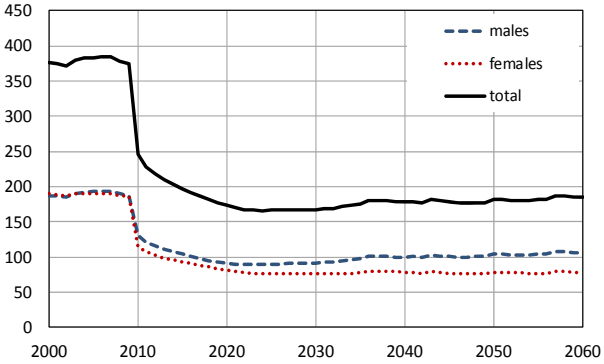


Figure F.16: Number of Pensions - 2nd Degree Disability Pensions

(thousands pensions)

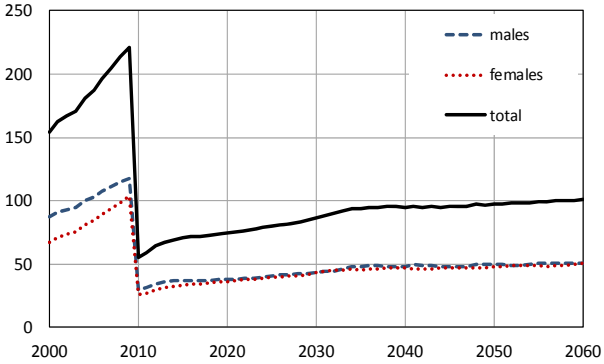


Figure F.17: Number of Pensions - 1st Degree Disability Pensions

(thousands pensions)

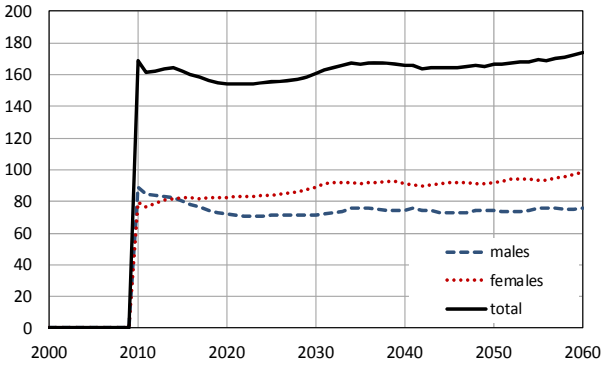


Figure F.18: Number of Pensions - Widows'/Widowers' Pensions

(thousands pensions)

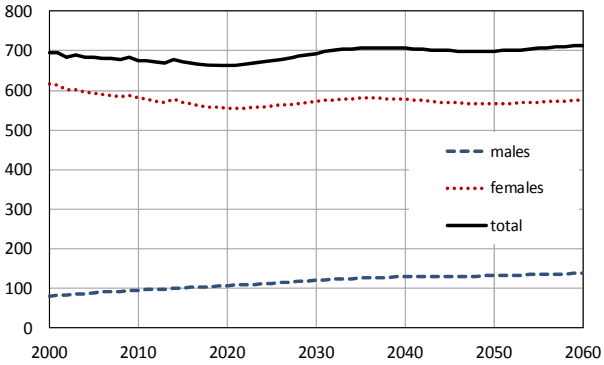
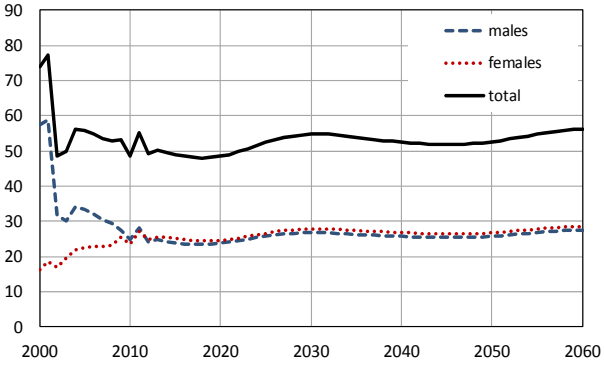


Figure F.19: Number of Pensions - Orphans' Pensions

(thousands pensions)



Replacement Rates

Figure F.20: Replacement Rates - All Pensions

(average pension / gross average wage at retirement)

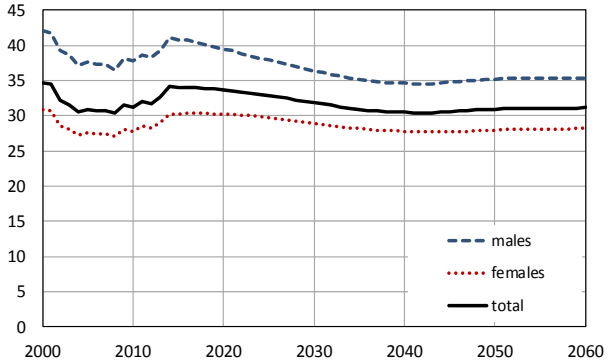


Figure F.21: Replacement Rates - Old-Age Pensions

(average pension / gross average wage at retirement)

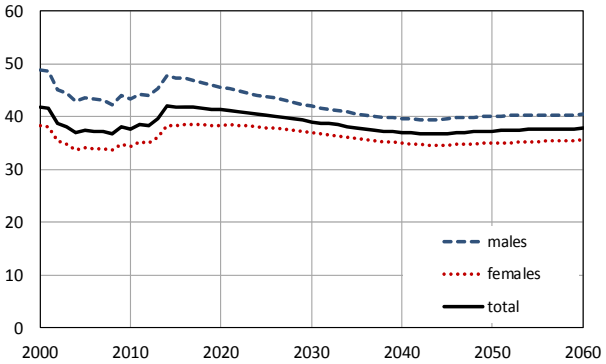


Figure F.22: Replacement Rates - 3rd Degree Disability Pensions

(average pension / gross average wage at retirement)

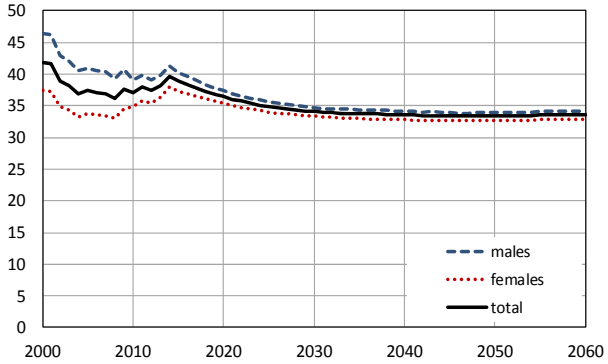


Figure F.23: Replacement Rates - 2nd Degree Disability Pensions

(average pension / gross average wage at retirement)

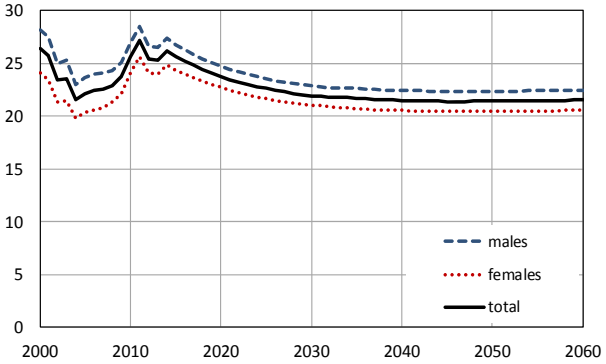


Figure F.24: Replacement Rates - 1st Degree Disability Pensions

(average pension / gross average wage at retirement)

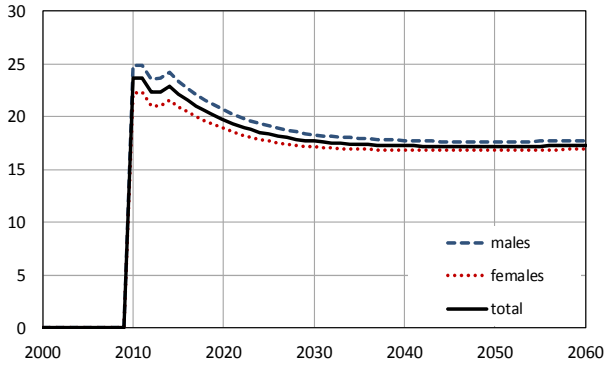


Figure F.25: Replacement Rates - Widows'/Widowers' Pensions

(average pension / gross average wage at retirement)

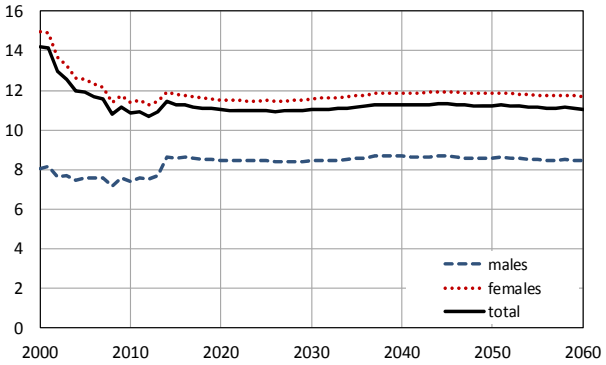
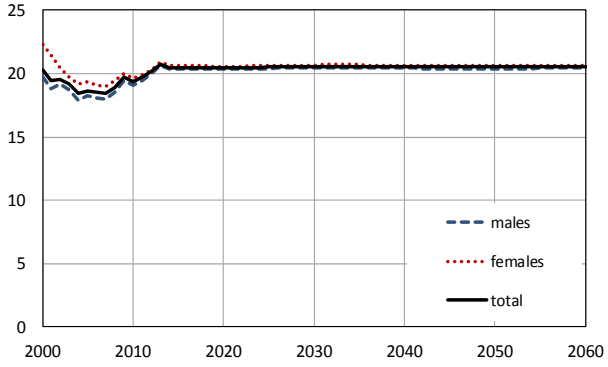


Figure F.26: Replacement Rates - Orphans' Pensions

(average pension / gross average wage at retirement)



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