Part 1 Overview of the pension system

Elements in the Norwegian public old age pension system

The Norwegian old age pension system consists of the following elements:

- A universal public old age pensions system
- Mandatory government occupational pension schemes
- Mandatory (as from 2006) private sector occupational pension schemes
- Private individual pension schemes.

The present public old age pension system ('the reformed system') came into effect in 2011.

Public (social security) old age pensions include a minimum income guarantee and an earning-related benefit. It is financed on a pay-as-you-go basis. With retirement at age 67, before-tax replacement rate for pensioners with average income amounts to 51 pct. in the reformed old age pension system. After tax replacement rate, including supplementary pensions, amounts to 72 pct.

The reformed system consists of a model for accumulating pension entitlements introduced gradually for cohorts born after 1953 and fully for cohorts born after 1962. Accumulated entitlements ('pension wealth') is given by (1).

$$(1) \quad W_A = \alpha \cdot \sum_{i=0}^{A-1} I_i \cdot (1+r)^{A-i}$$

W_A pension wealth by age of retirement (A)
α rate of earning of pension entitlements (18,1 per cent of pensionable income up to a ceiling of 7,1 times the basic amount (corresponds to approximately 115 per cent of average wage for a full time employee)
I_i pensionable income by age i (pension entitlements can be earned from age of 13 till age of 75)
r discount rate (set equal to nominal wage growth) for adjustment of pension entitlements

Linking benefits to entitlements, the present public old age pension system introduces life expectancy adjustment of pensions, flexible retirement from the age of 62 (provided the pension level exceed the level of the guarantee pension at the age of 67) and rules for indexation of pensions. At the time of retirement, the annual pension benefit ($B_{K,A}$) is calculated by dividing the accumulated pension entitlements by an annuity divisor ($\Phi_{K,A}$) mainly reflecting remaining life expectancy, see (2).

$$(2) \quad B_{K,A} = \frac{W_A}{\Phi_{K,A}} = \frac{W_A}{\sum_{x=A}^{\infty} p_{K,A,x} \cdot \frac{(1+w)^{x-A} \cdot (1-u)^{x-A}}{(1+r)^{x-A}}} = \frac{W_A}{\sum_{x=A}^{\infty} p_{K,A,x} \cdot (1-u)^{x-A}}$$

$p_{k,A,x}$ average of the probabilities of person from cohort K surviving to respectively x and x+1 years from age of retirement A
r discount rate (set equal to nominal wage growth) for calculating present values of pension benefits
w nominal wage growth applied for regulation of pension benefits
u fixed adjustment factor (0,75 per cent per year) subtracted from nominal wage growth in regulating pension benefits

Thus, the accumulated entitlements is converted into an annuity over the average expected remaining lifetime. An increase in life expectancy reduces the annual benefits. The old age pension arrangement

implies that the present value of public old age pension expenditures is invariant to individual timing of taking out pension and shifts the expenditure risk associated with increases in longevity from tax payers to each cohort of pensioners.

Life expectancy for a cohort is calculated on the basis of period mortality in the decade preceding the cohort reaching 60 years of age. This rule is also applied in the projections.

Taking into account the annuity divisor and the fixed annual adjustment factor subtracted from nominal wage growth, annual pension benefits at age x – A may be expressed by

$$(3)\quad B_{K,A,x} = \frac{W_A}{\Phi_{K,A}} = \frac{W_A}{\sum_{x=A}^{\infty} p_{K,A,x} \cdot (1-u)^{x-A}} \cdot \left[(1+w)\cdot(1-u)\right]^{x-A}$$

The reformed system also introduces increased flexibility by allowing continued employment for old age pensioners, without reductions in the pensions.

The present system allows flexible retirement from the age of 62. The information on statutory age under the new system in table 1 reflects limitations to the flexibility. Guarantee pension alone can be drawn only from the age of 67 and disability pensioners will not become old age pensioners before the age of 67. 67 years also functions as a reference age for calculation of annuity divisors, compared to the previous system retiring earlier than 67 years implies a reduction in annual pension payments.

Other old age pensions

The ***government occupational pension schemes*** supplement public old age pension system. Following an agreement in 2019, the previous system guaranteeing government sector employees gross pension benefits (including public old age pensions) of at least 2/3 of final gross wages from the age of 67 for persons born 1963 and later is replaced by a system with mechanisms resembling to the public old age pension system. In particular, the new system increases flexibility with respect to counteract life expectancy adjustments by working longer as well as enabling changes between government and private employment without loss of pension entitlements.

The central government occupational pension scheme is financed by employee contributions (2 per cent of wages) and additional funding from employers. Local government occupational pension schemes are funded systems, with premiums from employees at 2 per cent of wages and additional funding provided by employers. The pension funds may be administered by insurance companies or locally.

Mandatory private sector occupational pension were introduced in 2006, but non-mandatory defined benefit schemes (and since 2001 also defined contribution schemes) have existed for a long time. The introduction was a part of the pension reform process. As the system matures, the private sector occupational pension schemes ensure supplementary pensions also to private sector employees. The legislation on mandatory private sector occupational schemes covers the entire private sector. Under the legislation, it is possible to choose between three occupational schemes; defined benefits (DB) scheme, a defined contribution scheme (DC) and a mixed system (DC when employed, DB after retirement).

Neither government nor private sector occupational pension schemes are included in the projections. The expenditures associated with government occupational schemes amounts to approximately 1 per cent of Mainland GDP.

Table 1	Qualifying conditions for retirement		2019	2030	2040	2050	2060	2070
Qualifying condition for retiring with a full pension	Statutory retirement age - men[1]		67	67	67	67	67	67
	Statutory retirement age - women[1]		67	67	67	67	67	67
	Minimum requirements	Contributory period - men	:	:	:	:	:	:
		Retirement age - men	:	:	:	:	:	:
		Contributory period - women	:	:	:	:	:	:
		Retirement age - women	:	:	:	:	:	:
Qualifying condition for retirement *without* a full pension	Early retirement age - men[2]		62	62	62	62	62	62
	Early retirement age - women[2]		62	62	62	62	62	62
	Penalty in case of earliest retirement age		:	:	:	:	:	:
	Bonus in case of late retirement		:	:	:	:	:	:
	Minimum contributory period - men		:	:	:	:	:	:
	Minimum contributory period - women		:	:	:	:	:	:
	Minimum residence period - men		:	:	:	:	:	:
	Minimum residence period - women		:	:	:	:	:	:

[1] Statutory retirement age in old system, reference age in the new system

[2] Pension reform with flexible age of retirement from 62 years coming into effect in 2011

Source: MoF

Disability pensions

The purpose of disability benefits is to ensure subsistence for people whose earning ability is permanently impaired by at least 50 per cent due to illness, injury or defect. Disability pensions are granted if there are no prospects of an improvement in earning ability. Disability pension amount to 66 per cent of income prior to disability. Disability pension is in principle a permanent benefit, but it can be reassessed with changes in income and health of the recipient. Recipients of disability pension who reach the age of 67 will automatically have their pension converted to an old-age pension.

The number of persons receiving disability pensions (352 000) measures up to 10,7 per cent of population in the age group 20 – 66 in 2019. This contributes to a relatively high level of disability pensions expenditures in 2019 (3,3 per cent measured as a share of Mainland GDP).

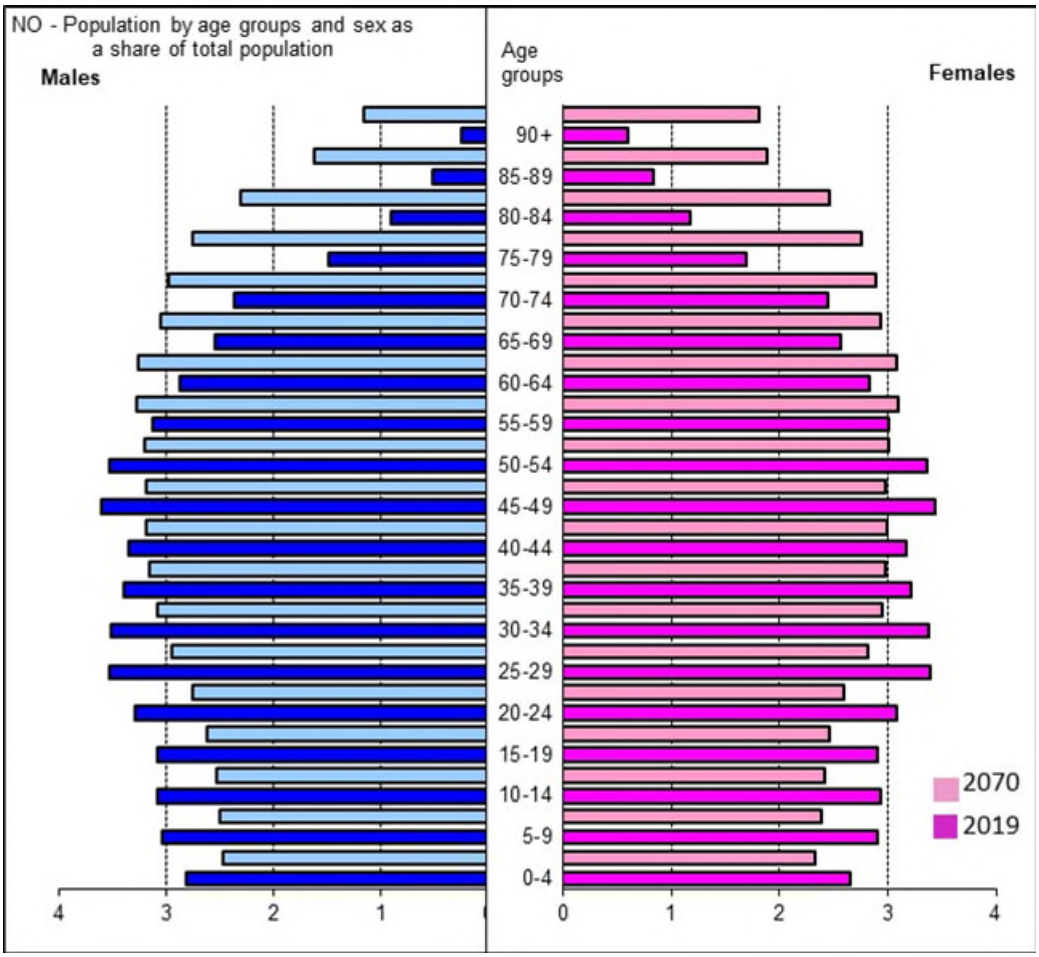
Part 2 Demographic and labour forces projections

Table 2 gives an overview of EUROSTAT 2020 projections for main demographic variables . Total population is projected to increase from 5,3 million persons in 2019 to 6,6 million persons in 2060 and 6,7 million persons in 2060. Lower fertility and slightly lower immigration explains most of the decrease in population growth compared to EUROSTAT 2017 demographic projections, where total population in 2070 was projected to be 7,0 million persons.

Table 2	Main demographic variables								
	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Population (thousand)	5 348	5 784	6 110	6 362	6 553	6 718	6717,8	2070	1370,0
Population growth rate	0,7	0,7	0,5	0,3	0,3	0,2	0,7	2024	-0,4
Old-age dependency ratio (pop 65+ / pop 20-64)	29,4	35,4	41,3	44,1	48,5	52,4	52,4	2070	23,0
Old-age dependency ratio (pop 75+ / pop 20-74)	10,8	15,0	17,9	21,2	22,5	25,2	25,2	2070	14,4
Ageing of the aged (pop 80+ / pop 65+)	24,5	30,1	32,7	37,1	37,8	39,3	39,3	2070	14,7
Men - Life expectancy at birth	81,4	82,5	83,7	84,8	85,9	86,9	86,9	2070	5,5
Women - Life expectancy at birth	84,6	85,9	87,1	88,2	89,3	90,3	90,3	2070	5,7
Men - Life expectancy at 65	19,7	20,5	21,4	22,2	23,0	23,8	23,8	2070	4,1
Women - Life expectancy at 65	21,9	22,9	23,9	24,8	25,7	26,6	26,6	2070	4,7
Men - Survivor rate at 65+	89,8	91,3	92,4	93,4	94,2	94,9	94,9	2070	5,1
Women - Survivor rate at 65+	93,4	94,4	95,1	95,8	96,4	96,9	96,9	2070	3,5
Men - Survivor rate at 80+	63,8	68,4	72,2	75,6	78,7	81,4	81,4	2070	17,6
Women - Survivor rate at 80+	75,8	79,5	82,4	84,9	87,1	89,0	89,0	2070	13,3
Net migration (thousand)	25,3	27,2	25,9	25,2	24,4	23,4	28,5	2024	-1,9
Net migration over population change	0,7	0,7	0,9	1,1	1,4	1,5	1,5	2070	0,8

Graph 1 further illustrates how Norway shares challenges related to an ageing population with EU member states.

Graph 1 Age pyramid comparison: 2019 vs 2070



Pension reform effects on employment have not been taken into account in the projections, implying relative stable participation rates for age group 65 – 74 in table 3.

Table 3 Participation rate, employment rate and share of workers

	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Labour force participation rate 20-64	82,1	81,5	81,6	81,4	81,3	81,2	82,3	2021	-0,9
Employment rate of workers aged 20-64	79,4	78,9	79,0	78,9	78,7	78,7	79,4	2019	-0,7
Share of workers aged 20-64 in the labour force 20-64	96,7	96,8	96,9	96,9	96,9	96,9	96,9	2058	0,2
Labour force participation rate 20-74	73,1	72,2	71,2	71,4	70,2	70,0	73,1	2022	-3,1
Employment rate of workers aged 20-74	70,7	69,9	69,0	69,2	68,1	67,9	70,7	2019	-2,9
Share of workers aged 20-74 in the labour force 20-74	96,8	96,9	97,0	97,0	97,0	97,0	97,0	2059	0,2
Labour force participation rate 55-64	73,9	71,5	70,0	70,3	70,2	70,3	74,2	2020	-3,6
Employment rate of workers aged 55-64	72,8	70,4	69,0	69,2	69,2	69,2	72,8	2019	-3,6
Share of workers aged 55-64 in the labour force 55-64	98,4	98,5	98,5	98,5	98,5	98,5	98,5	2035	0,0
Labour force participation rate 65-74	19,0	19,9	18,5	18,6	18,5	18,2	19,9	2030	-0,8
Employment rate of workers aged 65-74	18,8	19,7	18,4	18,4	18,3	18,0	19,7	2030	-0,8
Share of workers aged 65-74 in the labour force 65-74	98,9	98,9	98,9	98,9	98,9	98,9	98,9	2041	0,0
Median age of the labour force	40,0	40,0	40,0	41,0	41,0	41,0	41,0	2045	1,0

Regarding the decrease in contribution period relative to average of effective working career in tables 4 and 4b, the following mechanisms seem to be at work in the pension projections:

- The contributory period (associated with new pensioners) for immigrants (also including those who has repatriated after spending a part of their working life and Norway) will on average be shorter compared to contributory periods for persons devoting 100 per cent of their working career in Norway. Immigrants on average spend fewer years in Norway compared to natives and accordingly obtain fever years of accumulation of pension entitlements even though they share age and gender specific participation rates with natives (by assumption in the cohort simulation method-projections).

- For persons taking out old age pensions while continuing to work, the contributory period applies for the working career up to the time of taking out pensions.

TABLE 4a	Exit ages and expected duration of retirement - MEN								
	2020	2030	2040	2050	2060	2070	peak value	peak year	change 2020-2070
Average effective retirement age (administrative data)*	64,8								
Average labour market exit age (CSM)**	66,0	66,0	66,0	66,0	66,0	66,0	66,0	2020	0,0
Contributory period	37,2	32,9	28,7	26,2	27,0	29,7	37,2	2020	-7,6
Duration of retirement***	18,8	19,6	20,5	21,3	22,1	22,9	22,9	2070	4,1
Duration of retirement/contributory period	0,5	0,6	0,7	0,8	0,8	0,8	0,8	2055	0,3
Percentage of adult life spent in retirement****	28,1	29,0	29,9	30,7	31,5	32,3	32,3	2070	4,2
Early/late exit*****	1,2	1,1	0,9	1,0	1,0	1,0	1,2	2020	-0,3

TABLE 4b	Exit ages and expected duration of retirement - WOMEN								
	2020	2030	2040	2050	2060	2070	peak value	peak year	change 2020-2070
Average effective retirement age (administrative data)*	66,0								
Average labour market exit age (CSM)**	64,7	64,7	64,7	64,7	64,7	64,7	64,7	2020	0,0
Contributory period	35,2	34,1	32,3	30,0	28,9	30,8	35,2	2020	-4,5
Duration of retirement***	21,9	22,9	23,9	24,8	25,7	26,6	26,6	2070	4,7
Duration of retirement/contributory period	0,6	0,7	0,7	0,8	0,9	0,9	0,9	2059	0,2
Percentage of adult life spent in retirement****	31,9	32,9	33,9	34,7	35,5	36,3	36,3	2070	4,4
Early/late exit*****	1,8	1,7	1,4	1,7	1,6	1,5	1,9	2023	-0,3

** The effective retirement age shows the age at which people on average start receiving an old-age pension benefit. It is calculated on the basis of the administrative data for 2019 (see Annex Tables A4a and A4b); ** The labour market exit age as calculated based on Labour Force Survey data for the base year and estimated by the Cohort Simulation Model thereafter; *** 'Duration of retirement' is calculated as the difference between the life expectancy at the average labour market exit age and that exit age itself; **** The 'percentage of adult life spent in retirement' is calculated as the ratio between the duration of retirement and the life expectancy minus 20 years; ***** Early/late exit is the ratio between those who retire and are below the statutory retirement age and those who retire at the statutory retirement age or above.*

Part 3 Pension projection results

Coverage

The projections illustrate how AWG assumptions on demographic and macroeconomic developments give rise to developments in public pension expenditures between 2019 and 2070. The projections are carried out by means of the dynamic micro simulation model MOSART developed and maintained in Statistics Norway. The model combines a detailed description of the Norwegian old age and disability pension schemes with assumptions on macroeconomic developments for projection purposes. The model takes into account the phasing in of the reformed public old age pension system from 2011, distinguishing between pensioners earning pension entitlements under the previous and the reformed old age pension scheme.

The AWG-projections covers public old age, disability and survivors pensions. The results are reported as shares of Mainland GDP (also referred to as GDP in the remainder), which equals total GDP minus value added in petroleum extraction and ocean transport. Table 5 compares EUROSTAT and Ageing Working Group (AWG) figures on pension expenditure.

TABLE 5	Eurostat (ESSPROS) vs. Ageing Working Group definition of pension expenditure (% GDP)									
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Eurostat total pension expenditure	8,6	8,3	8,3	8,5	8,8	9,3	10,3	10,9	10,7	:
Eurostat public pension expenditure (A)	:	:	:	:	:	:	:	:	:	:
Public pension expenditure (AWG: outcome) (B)	:	:	:	:	9,7	9,9	10,5	10,7	10,8	10,9
Difference Eurostat/AWG: (A)-(B)	:	:	:	:	-0,9	-0,6	-0,2	0,2	-0,1	:
Expenditure categories not considered in the AWG definition	:	:	:	:	:	:	:	:	:	:
- [please specify]	:	:	:	:	:	:	:	:	:	:
- [please specify]	:	:	:	:	:	:	:	:	:	:
- ...	:	:	:	:	:	:	:	:	:	:

Overview of projection results

In the projections, public pensions increase from 11,0 per cent measured as a share of Mainland GDP in 2019 to 13,6 per cent 2060, see Table 6.

TABLE 6	Projected gross and net pension spending and contributions (% of GDP)								
Expenditure	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Gross public pension expenditure	11,0	12,3	12,6	12,7	13,2	13,6	13,6	2070	2,6
Private occupational pensions	:	:	:	:	:	:	:	:	:
Private individual mandatory pensions	:	:	:	:	:	:	:	:	:
Private individual non-mandatory pensions	:	:	:	:	:	:	:	:	:
Gross total pension expenditure	11,0	12,3	12,6	12,7	13,2	13,6	13,6	2070	2,6
Net public pension expenditure*	11,0	12,3	12,6	12,7	13,2	13,6	13,6	2070	2,6
Net total pension expenditure*	11,0	12,3	12,6	12,7	13,2	13,6	13,6	2070	2,6
Contributions	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Public pension contributions	11,0	12,3	12,6	12,7	13,2	13,6	13,6	2070	2,6
Total pension contributions	11,0	12,3	12,6	12,7	13,2	13,6	13,6	2070	2,6

Table 7 shows that the increase is mainly due to developments in old-age pensions. The decline in the share of minimum pensions as a share of total (public) old age pensions is due to phasing-out of basic pensions in the reformed public old age pension system. In the previous system, old age pensions consisted of a basic amount (equal for all) and additional income related pensions calculated from a positive threshold income level. The new system also has a minimum guarantee pension, but income related pensions are calculated from total income (not only from income above a threshold level). Thus, total pensions will on average consist of a substantially larger fraction of income related pensions (with income related pensions covering both the basic pension and income related pensions in the previous system). With the phasing out of the old pension system the proportion of the population receiving pensions calculated as a sum of basic (non-income related) pensions and income related pensions from the previous old age pensions system will decline over time. However, also under the new system there will be a fraction of the pensioners who are only entitled to minimum/guarantee (not income related) pensions. The level of this guarantee pension is comparable to the basic pension under the previous system.

TABLE 7	Projected gross public pension spending by scheme (% of GDP)								
Pension scheme	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Total public pensions	11,0	12,3	12,6	12,7	13,2	13,6	13,6	2070	2,6
Old-age and early pensions	7,6	8,8	9,2	9,1	9,5	9,9	9,9	2070	2,2
Flat component	:	:	:	:	:	:	:	:	:
Earnings-related	5,0	6,9	8,1	8,5	8,9	9,2	9,2	2070	4,2
Minimum pensions (non-contributory) i.e. minimum income guarantee for people above	2,6	2,0	1,1	0,6	0,6	0,7	2,8	2020	-1,9
Disability pensions	3,29	3,46	3,44	3,58	3,62	3,69	3,7	2070	0,4
Survivors' pensions	0,06	0,05	0,04	0,03	0,02	0,02	0,06	2020	0,0
Other pensions	:	:	:	:	:	:	:	:	:
Special pension schemes	2019	2030	2040	2050	2060	2070	Peak value	Peak year	change 2019-2070
Country-specific scheme 1 [please specify]									
Country-specific scheme 2 [please specify]									
...									

Driving forces behind the projection results

Helping to identify driving demographic and macroeconomic forces - based on the common AWG methodology - behind the pension projections, the following arithmetic decomposition has been used to link growth of the pension expenditures to developments in the dependency ratio, coverage and benefit ratios as well as the employment rate and labour intensity.

$$\frac{PensionExp}{GDP} = \overbrace{\frac{Population65+}{Population20-64}}^{DependencyRatio} \times \overbrace{\frac{Numberof\ Pensioners(Pensions)}{Population65+}}^{CoverageRatio}$$

$$\times \overbrace{\frac{Averageincomefrompensions(AveragePension)}{\frac{GDP}{HoursWorked20-74}}}^{Benefit\ Ratio} \times \overbrace{\frac{Population20-64}{HoursWorked20-74}}^{Labour\ Market\ /LabourIntensity}$$

A further decomposition of the coverage ratio aims at investigating the take-up ratios for old-age pensions and early pensions:

$$\overbrace{\frac{\text{Number of Pensioners}}{\text{Population } 65+}}^{\text{Coverage Ratio}} =$$

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

The labour market indicator is further decomposed according to the following:

$$\overbrace{\frac{\text{Population } 20-64}{\text{Hours Worked } 20-74}}^{\text{Labour Market / Labour Intensity}} =$$

$$\overbrace{\frac{\text{Population } 20-64}{\text{Working People } 20-64}}^{\text{1/ Employment Rate}} \times \overbrace{\frac{\text{Working People } 20-64}{\text{Hours Worked } 20-64}}^{\text{1/ Labour intensity}} \times \overbrace{\frac{\text{Hours Worked } 20-64}{\text{Hours Worked } 20-74}}^{\text{1/ Career shift}} \quad [3]$$

Applying this decomposition in Table 8, population ageing and the associated increase in the dependency ratio contributes substantially to an increase in pensions-to-GDP ratio . Population ageing is less pronounced compared with recent national demographic projections. For instance, national demographic projections provided by Statistics Norway from June 2019 imply an increase in the number persons in the age group 67+ as a share of population 20 - 66 years of age from 21 per cent in 2019 to 48 per cent in 2060, whereas EUROSTAT 2020 demographic projections gives an increase to 42 per cent in 2060. The dependency ratio effect towards 2070 is approximately 10,2 percentage points lower compared to AWG18-projections.

TABLE 8 Factors behind the change in public pension expenditures between 2019 and 2070 (in percentage points of GDP) - pensioners

	2019-30	2030-40	2040-50	2050-60	2060-70	2019-70
Public pensions to GDP	1,4	0,3	0,1	0,5	0,4	2,6
Dependency ratio effect	2,3	2,0	0,8	1,3	1,1	7,4
Coverage ratio effect*	0,6	-0,1	0,5	0,4	-0,3	1,1
Coverage ratio old-age	0,6	0,3	0,4	0,7	0,1	2,1
Coverage ratio early-age	1,7	-0,4	-0,3	0,2	0,0	1,1
Cohort effect	-1,9	-1,9	0,0	-1,0	-1,0	-5,8
Benefit ratio effect	-1,4	-1,4	-1,3	-1,1	-0,3	-5,5
Labour market effect	0,0	-0,1	0,1	0,0	0,0	0,0
Employment ratio effect	0,1	0,0	0,0	0,0	0,0	0,1
Labour intensity effect	0,0	0,0	0,0	0,0	0,0	0,0
Career shift effect	-0,1	0,0	0,0	-0,1	0,0	-0,1
Residual	-0,1	-0,1	-0,1	-0,1	0,0	-0,4

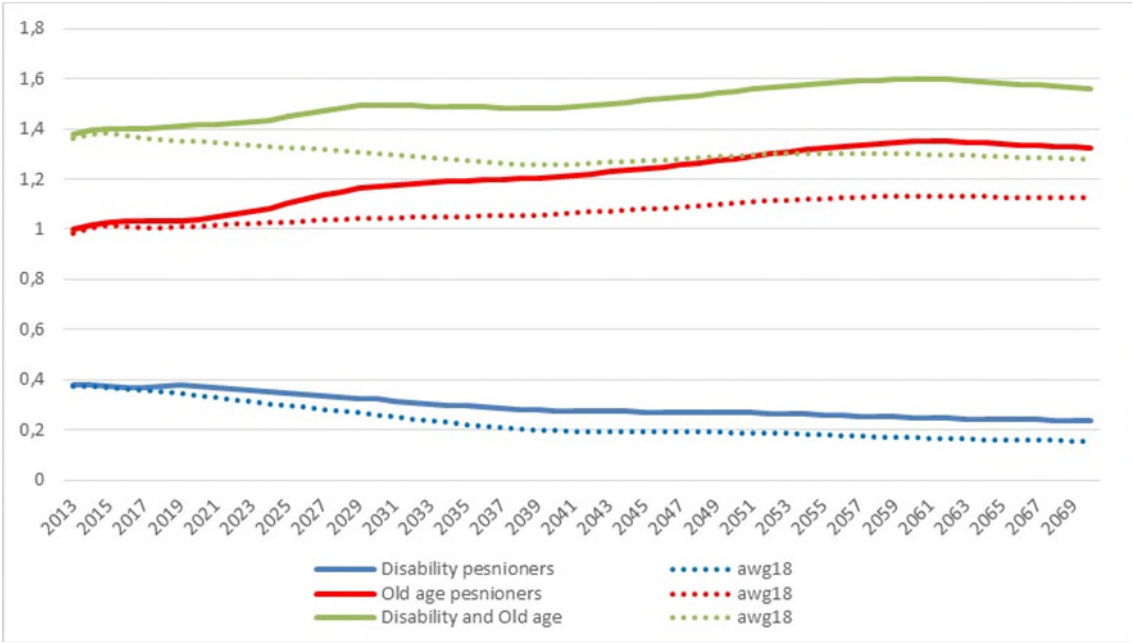
The increased coverage ratio, contributing to an increase in the public pension to GDP ratio by 1,1 percentage points towards 2070, can be traced back to an increase in the ratio of old age pensioners to persons 65 years and above (see graph 2). The increase in the coverage ratio associated with old age pensioners, which is more pronounced compared to AR18 projections, results from including pensioners living abroad[1] (see graph 3) in the projections as well as taking into account an increased number of persons working while receiving old age pensions.

The reduction in the number of disability pensioners, which is less pronounced compared to the projections in AR18, works in the other direction. In the projections, the number of disability pensioners follows from demographics through age- and education background specific transition rates. In addition,

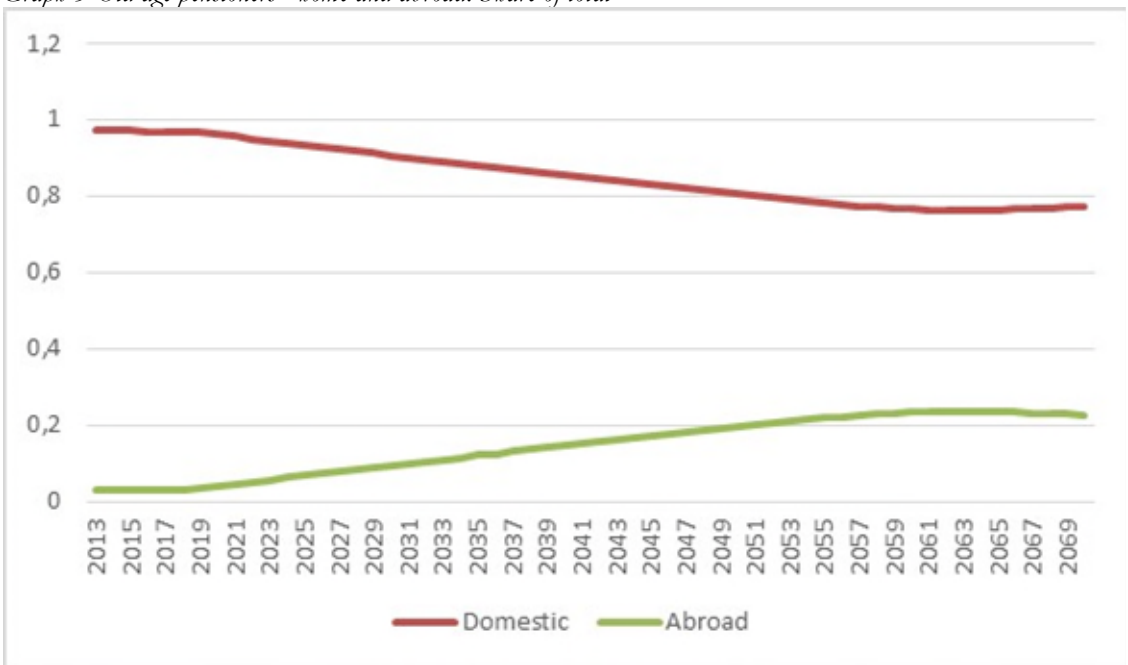
[1] Repatriated immigrants or expatriated persons born and employed in Norway, neither of which are counted in the population figures.

calibration of projections to employment assumption (resulting from the cohort simulation model) is carried out by means of adjustment of the transition rates – in particular for the 50 – 61 year age group. This procedure is in principle unchanged between projection rounds, but updates of population projections – to a large extent related to immigration – makes it challenging to ensure consistency between projection rounds.

Graph 2 Old age and disability pensioners. Share of population 65+



Graph 3 Old age pensioners - home and abroad. Share of total



The reformed pension system, allowing for continued work while receiving old age pensions, have contributed to a relatively substantial increase in the number of old age pensioners from 2010 to 2015 not being reflected in corresponding declines in participation rates for older persons. The increase in number of persons 62 years and above receiving old age pensions while working at the same time contributes to a reducing average replacement rates compared to the replacement rates by retirement at 67 years of age.

With pension wealth (pension entitlements) being divided by expected remaining living years in order to determine yearly pension payments, this development has given rise to a decline in yearly pension payments at the individual level (compared to the case of postponing the take-up of pension benefits).

The decline in the benefit ratio reported in Table 9 reflects the introduction of life expectancy adjustment of pensions and the subtraction of a fixed factor (0,75 per cent per year) from nominal wage growth in regulating pension benefits, both coming into effect from 2011. Inclusion of pensioners living abroad in the projections, with shorter spells of work and accumulation of pension entitlements in Norway, also contributes to the decline in the aggregate benefit ratio (this effect dampens the effect of foreign pensioners on the coverage ratio

With regard to the subtraction of a fixed factor (0,75 per cent per year) from nominal wage growth in regulating pension benefits, this feature of the pension system contributes to a reduction of pension expenditures compared to the old pension system without under-regulation. However, the subtraction has only minor consequences for changes in old age pensions as a share of GDP once the new system has settled. This reflects that the under-regulated pensions for, say, a 70 year old in 2040 is not accumulated into under-regulation of the pension payments for a 70 year old in 2060.

The increase in pension expenditures in the first part of the projection period (towards 2030 – 40) is primarily related to cohort effects associated with increased labour participation for women during the 1970s and 1980s.

The continued modest increase in pension expenditure as a share of GDP towards 2060 reflects a combination of the following factors:

- Method for life age adjustment (also applied in the projections) – based on observed mortality (averaged over 10 years) at the time of cohorts reaching 60 years instead of assumptions based projections of mortality – may involve lag effects compared to actual development measured ex post.

- Disability pensioners partially exempted from life age adjustments. This is incorporated for the entire projected period by assumption, but reflects provisional arrangements in place for disability pensioners become old age pensioners before 2018.

TABLE 9	Replacement rate at retirement (RR), benefit ratio (BR) and coverage by pension scheme (in %)						
	2019	2030	2040	2050	2060	2070	change 2019-2070 (pps)
Public scheme (BR)	56 %	48 %	42 %	38 %	35 %	34 %	-22 %
Coverage	:	:	:	:	:	:	:
Public scheme: old-age earnings related (BR)	44 %	43 %	45 %	47 %	46 %	46 %	2 %
Public scheme: old-age earnings related (RR)	:	:	:	:	:	:	:
Coverage	:	:	:	:	:	:	:
Private occupational scheme (BR)	:	:	:	:	:	:	:
Private occupational scheme (RR)	:	:	:	:	:	:	:
Coverage	:	:	:	:	:	:	:
Private individual schemes (BR)	:	:	:	:	:	:	:
Private individual schemes (RR)	:	:	:	:	:	:	:
Coverage	:	:	:	:	:	:	:
Total benefit ratio	:	:	:	:	:	:	:
Total replacement rate	:	:	:	:	:	:	:

In line with the comments on developments in the coverage ratio above, the relative developments in Pension System Dependancy Ratio (SDR - pensioners divided by employees) and Old Age Dependancy Ratio in table 10 may be somewhat obscured due to pensioners living abroad and pensioners using the option of continued work both amplifying the growth in number of pensioners in the projections. The effects on pension expenditures are in both cases dampened by the same developments contributing ta reduction in average pension benefits.

TABLE 10	System dependency ratio and old-age dependency ratio						
	2019	2030	2040	2050	2060	2070	change 2019-2070
Number of pensioners (thousand) (I)	1325,2	1787,6	2118,7	2422,0	2764,6	2921,9	1596,7
Employment (thousand) (II)	2721,7	2880,5	2953,1	3019,2	3049,8	3054,7	333,0
Pension system dependency ratio (SDR) (I)/(II)	48,7	62,1	71,7	80,2	90,6	95,7	47,0
Number of people aged 65+ (thousand) (III)	930,4	1189,9	1421,3	1557,4	1724,1	1868,0	937,7
Working age population 20-64 (thousand) (IV)	3164,1	3360,4	3443,7	3532,1	3554,0	3562,1	398,0
Old-age dependency ratio (OADR) (III)/(IV)	29,4	35,4	41,3	44,1	48,5	52,4	23,0
System efficiency (SDR/OADR)	1,7	1,8	1,7	1,8	1,9	1,8	0,2

In tables 11 and 12 the number of pensioners by age groups (total and female) is divided by total and inactive population respectively. The inclusion of pensioners living abroad in the projections contributes to ratios above 100 for the older age groups.

TABLE 11a	Pensioners (public scheme) to inactive population ratio by age group (%)					
	2019	2020	2030	2040	2050	2070
Age group -54	11,5	11,8	13,0	14,2	14,3	14,2
Age group 55-59	109,6	111,0	87,2	80,9	81,8	85,5
Age group 60-64	139,2	146,7	160,7	140,4	138,1	140,5
Age group 65-69	121,0	130,9	157,9	153,7	163,2	151,1
Age group 70-74	114,6	110,9	127,3	132,7	144,4	135,4
Age group 75+	108,3	105,0	107,8	116,7	122,9	137,3

TABLE 11b	Pensioners (public schemes) to total population ratio by age group (%)					
	2019	2030	2040	2050	2060	2070
Age group -54	4,6	5,1	5,5	5,6	5,7	5,6
Age group 55-59	20,4	18,8	18,5	18,5	19,4	19,3
Age group 60-64	47,4	57,3	52,6	51,5	52,3	51,8
Age group 65-69	84,8	109,0	108,7	115,5	115,7	107,2
Age group 70-74	106,1	117,9	123,1	134,2	142,0	125,9
Age group 75+	108,3	107,8	116,7	122,9	131,9	137,3

TABLE 12a	Female pensioners (public scheme) to inactive population ratio by age group (%)					
	2019	2030	2040	2050	2060	2070
Age group -54	13,3	15,1	16,5	16,8	17,0	16,6
Age group 55-59	111,1	92,3	82,8	87,0	93,2	91,6
Age group 60-64	115,7	144,3	124,6	125,9	129,7	131,2
Age group 65-69	109,4	139,6	134,4	141,0	146,5	139,0
Age group 70-74	110,6	118,0	120,8	126,8	139,2	127,8
Age group 75+	107,2	105,9	111,8	115,3	121,1	128,7

TABLE 12b	Female pensioners (public scheme) to total population ratio by age group (%)					
	2019	2030	2040	2050	2060	2070
Age group -54	5,6	6,1	6,5	6,7	6,7	6,6
Age group 55-59	25,4	24,0	23,3	22,5	24,1	23,7
Age group 60-64	44,9	58,5	54,5	53,4	53,6	54,0
Age group 65-69	82,8	105,2	103,2	108,7	112,4	106,6
Age group 70-74	105,1	112,6	115,6	121,7	133,3	122,3
Age group 75+	107,2	105,9	111,8	115,3	121,1	128,7

Table 13 reports developments in expenditure on new public pensions (total, men and women respectively) and how they are linked the average contributory period, average pension earnings, average accrual rates and the number of new pensioners.

The decomposition Table 14 attempts a reporting consistent with the phasing in of the reformed old-age pensions system. Thus the figures capture, in line with the pension projections, a weighed effect of accumulation of pension entitlements for persons earning pensions under the old and new system. The accrual rate (adjusted for length of pension period) for 2013 (see item IV in the table) thus mainly reflects accumulation of pension earnings under the old system, which is below a hypothetical accrual rate which would apply for a pensioner (born in 1943) in 2013 with accumulation of pension earnings under the new system. Phasing-in effects thus contributes to a temporary increase in the accrual rate. The temporary increase is stronger for women compared to men. In the projections men to a larger degree than women opt for early take-out of pensions (often in combination with continued work), dampening the increase in accrual rate adjusted for the length of pension period. Regarding the development in the accrual rate towards 2070, it will gradually decrease under the new system due to adjustments embodied in the new old age pension system for increases in expected lifetime towards 2070. A pensioner deciding to retire at a

given age in 2016 will enjoy higher yearly pensions (relative to pensionable income) compared to a pensioner retiring at the same age in 2070. The effect of immigration towards declining average contributory periods towards 2070is also less pronounced for women than for men.

TABLE 13a	Projected and disaggregated new public pension expenditure (old-age and early earnings-related pensions)							
New old-age earnings-related pensions	2019	2030	2040	2050	2060	2070		
Projected new pension expenditure (million EUR)*	1020,6	1864,8	2406,9	3652,5	5292,2	7398,9		
I. Number of new pensions (1000)	64,0	82,6	84,7	103,0	107,8	101,2		
II. Average contributory period (years)	38,6	33,5	30,3	27,9	27,9	30,2		
III. Average accrual rate (%) (c/A)	0,87	0,94	0,92	0,87	0,85	0,84		
Notional-accounts contribution rate (c)	0,1	0,2	0,2	0,2	0,2	0,2		
Annuity factor (A)	15,9	18,5	19,0	19,7	20,6	21,4		
IV. Monthly average pensionable earnings (1000 EUR)	4,0	6,0	8,5	12,1	17,2	24,1		
V. Sustainability/adjustment factors	:	:	:	:	:	:		
VI. Average number of months paid the first year	0,0	0,0	0,0	0,0	0,0	0,0		
(Monthly average pensionable earnings) / (monthly economy-wide average wage)	1,0	1,1	1,1	1,1	1,1	1,1		

TABLE 13b	Disaggregated new public pension expenditure (old-age and early earnings-related pensions) - MEN							
New old-age earnings-related pensions	2019	2030	2040	2050	2060	2070		
Projected new pension expenditure (million EUR)*	590,7	1002,7	1265,9	1946,6	2777,1	3962,0		
I. Number of new pensions (1000)	32,6	44,2	46,3	57,2	56,8	52,8		
II. Average contributory period (years)	39,8	32,9	28,7	26,2	27,0	29,7		
III. Average accrual rate (%) (c/A)	0,78	0,82	0,81	0,79	0,77	0,76		
Notional-accounts contribution rate (c)	0,1	0,2	0,2	0,2	0,2	0,2		
Annuity factor (A)	16,5	18,7	19,1	19,7	20,7	21,5		
IV. Monthly average pensionable earnings (1000 EUR)	4,8	7,0	9,8	13,7	19,5	27,8		
V. Sustainability/adjustment factors	:	:	:	:	:	:		
VI. Average number of months paid the first year	0,0	0,0	0,0	0,0	0,0	0,0		
(Monthly average pensionable earnings) / (monthly economy-wide average wage)	1,3	1,2	1,2	1,2	1,2	1,2		

TABLE 13c	Disaggregated new public pension expenditure (old-age and early earnings-related pensions) - WOMEN							
New old-age earnings-related pensions	2019	2030	2040	2050	2060	2070		
Projected new pension expenditure (million EUR)*	429,9	862,1	1140,9	1705,9	2515,1	3436,9		
I. Number of new pensions (1000)	31,4	38,4	38,4	45,8	51,0	48,3		
II. Average contributory period (years)	37,2	34,1	32,3	30,0	28,9	30,8		
III. Average accrual rate (%) (c/A)	1,03	1,13	1,07	0,99	0,96	0,96		
Notional-accounts contribution rate (c)	0,2	0,2	0,2	0,2	0,2	0,2		
Annuity factor (A)	15,2	18,3	18,9	19,8	20,5	21,3		
IV. Monthly average pensionable earnings (1000 EUR)	3,0	4,9	7,2	10,4	14,8	20,1		
V. Sustainability/adjustment factors	:	:	:	:	:	:		
VI. Average number of months paid the first year	0,0	0,0	0,0	0,0	0,0	0,0		
(Monthly average pensionable earnings) / (monthly economy-wide average wage)	0,8	0,9	0,9	0,9	0,9	0,9		

Table 14 gives an overview over the pay as you go financing of the financing of public pension expenditures.

TABLE 14	Revenue from contribution (Millions)		
	Public employees	Private employees	Self-employed
Contribution base	wage income	wage income	Income
Contribution rate/contribution			
Employer [1)]	14,2%	14,2%	
Employee [1)]	11,3%	11,3%	
*State**	Residual	Residual	Residual
*Other revenues**			
Maximum contribution			
Minimum contribution			

*only legislated contributions are reported

1) Economy-wide averages

Table 15 records projected developments of public pension expenditures together with employer and employee contributions.

TABLE 15	Revenue from contribution (%GDP) number of contributors in the public scheme (in 1000), total employment (in 1000) and						
	2019	2030	2040	2050	2060	2070	change 2019-2070 (pps)
Publicpension contributions (%GDP)	11,0	12,3	12,6	12,7	13,2	13,6	2,6
Employer contributions	*6,5*	*6,4*	*6,4*	*6,4*	*6,4*	*6,4*	*-0,1*
Employee contributions	*5,1*	*5,1*	*5,1*	*5,1*	*5,1*	*5,1*	*-0,1*
*State contribution**	*-0,6*	*0,9*	*1,2*	*1,3*	*1,7*	*2,1*	*2,7*
*Other revenues**	*0,0*	*0,0*	*0,0*	*0,0*	*0,0*	*0,0*	*0,0*
Number of contributors (I) (1000)	:	:	:	:	:	:	:
Employment (II) (1000)	2721,7	2880,5	2953,1	3019,2	3049,8	3054,7	333,0
(I) / (II)	:	:	:	:	:	:	:

Employer and employees public pension contributions are not directly linked to financing of public pension expenditures, but – similar to other taxes - used to finance government expenditures in general. Related to this, the state pension fund (SPF) is not directly linked to financing pension expenditures. Rather SPF is a general vehicle to decouple yearly expenditures from income streams from the petroleum sector. With a budget rule stating that non-oil budget deficits over time shall evolve in line with expected real return (3 %) from SPF, SPF gives a lasting contribution to financing government (pension and other) expenditures.

Sensitivity analysis

Table 17 illustrates the sensitivity of pension schemes to different economic assumptions. Important factors may be summarised as follows:

- Higher life expectancy contributes to an increase in the number of old age pensioners. The effect of pension expenditures is counteracted by the conversion of the implicit pension wealth of accumulated entitlements into an annuity over an increased average expected remaining lifetime. The net effect amounts to an increase in the GDP-ratio of pension expenditures by 0,2 percentage points compared to the baseline towards 2060. This effect reflects lags in life expectancy adjustments referred to above.

- Lower (higher) migration reduces (increases) pension expenditures, but the associated decrease in mainland GDP produces a net increase in pensions to GDP ratio compared to baseline. This may be considered a temporary effect, assuming no further shocks to migration are envisaged subsequent to 2070.

- Lower fertility has a substantial effect on pension expenditures towards 2070, reflecting reductions in Mainland GDP and tax bases relative to number of pensioners.

- In the higher labour productivity scenario, wage indexation contributes to higher pension expenditures. However, corresponding increases in private sector income and tax bases leaves the pension to mainland GDP ratio unchanged compared to the baseline projections. The same considerations apply for the Risk scenario (which is related to total factor productivity developments)

- The policy scenario linking retirement age to increases in life expectancy reflects changed developments in macroeconomic variables (employment and GDP) as well as a corresponding change (slight decrease) in number of pensioners.

- The scenario with higher employment among older persons reflect changed developments in macroeconomic variables (employment and GDP) whereas number of pensioners and pension expenditure per pensioners in fixed (wage adjusted) terms are unchanged compared to baseline.

- In the recovery scenarios, the effects reported in table 17 reflect changed developments in macroeconomic variables (employment, productivity/wages and GDP), whereas number of pensioners and pension expenditure per pensioners in fixed (wage adjusted) terms are unchanged compared to baseline.

TABLE17	Public and total pension expenditure under different scenarios (p.p. deviation from the baseline)						
Public pension expenditure	2019	2030	2040	2050	2060	2070	change 2019-2070 (pps)
Baseline (% GDP)	11,0	12,3	12,6	12,7	13,2	13,6	2,6
Higher life expectancy at birth (+2y)	0,0	0,1	0,1	0,2	0,2	0,2	0,2
Higher migration (+33%)	0,0	-0,2	-0,5	-0,6	-0,7	-0,7	-0,7
Lower migration (-33%)	0,0	0,3	0,5	0,8	0,9	0,9	0,9
Lower fertility (-20%)	0,0	0,0	0,2	0,5	0,9	1,4	1,4
Higher employment rate of older workers (+10 pps.)	0,0	-0,4	-0,5	-0,4	-0,5	-0,6	-0,6
Higher TFP growth (convergence to 1.2%)	0,0	0,0	0,0	0,0	0,0	0,0	0,0
TFP risk scenario (convergence to 0.8%)	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Policy scenario: linking retirement age to change in life	0,0	-0,1	-0,2	-0,3	-0,4	-0,4	-0,4
Lagged recovery scenario	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Adverse structural scenario	0,0	0,3	0,3	0,3	0,3	0,4	0,4

Table 18 compares the present pension projections with previous projections in 2018. Increased coverage ratio, not fully counteracted by effect of lower pension entitlements for the increased number of pensioners abroad, gives the main contribution to the increased growth in pension expenditures compared to AR18 projections.

TABLE 18	Overall change in public pension expenditure to GDP under the2006, 2009, 2012 and 2015 projection exercises					
	Public pension expenditure	*Dependency ratio effect*	*Coverage ratio effect*	*Benefit ratio effect*	*Labour market effect*	*Residual (incl. interaction effect)*
2006 Ageing Report (2004-2050)	:	:	:	:	:	:
2009 Ageing Report (2007-2060)	**4,68**	*8,21*	*-1,20*	*-2,35*	*0,26*	*-0,23*
2012 Ageing Report (2010-2060)	**4,93**	*7,98*	*-1,15*	*-1,64*	*0,02*	*-0,29*
2015 Ageing Report (2013-2060)	**2,48**	*5,56*	*-0,51*	*-0,19*	*-0,16*	*-0,27*
2018 Ageing Report (2016-2070)	**2,13**	*7,56*	*-0,92*	*-3,86*	*-0,35*	*-0,303*
2021 Ageing Report (2019-2070)	**2,60**	*7,40*	*1,14*	*-5,54*	*-0,02*	*-0,377*

Table 19 shows how the decrease in the public pension to GDP ratio towards 2060 compared to AR15 can be traced back to a decrease in the benefit ratio associated with the decreased share of disability pensioners and corresponding earlier take up of old age pensions.

TABLE 19a	Breakdown of the difference between the 2018 projections and outcome figures (% of GDP)					
	2016	2017	2018	2019		
Ageing Report 2018 projections	10,7	10,8	10,9	11,0		
Assumptions (pps of GDP)						
Coverage of projections (pps of GDP)						
Constant policy impact (pps of GDP)						
Policy-related impact (pps of GDP)						
Actual public pension expenditure	10,7	10,8	10,9	11,0		

TABLE 19b	Breakdown of the difference between the 2018 and the new public pension projection (% of GDP)					
	2019	2030	2040	2050	2060	2070
Ageing Report 2018 projections	11,0	11,7	11,9	12,0	12,5	12,8
Change in assumptions (pps of GDP)	0,0	0,6	0,8	0,8	0,7	0,8
Improvement in the coverage or in the modelling (pps of GDP)						
Change in the interpretation of constant policy (pps of GDP)						
Policy-related changes (pps of GDP)						
New projections	11,0	12,3	12,6	12,7	13,2	13,6

Part 4 Description of the pension projection model and its base data

Tax and pension systems are typically detailed and complex involving a large degree of individual heterogeneity. Accordingly, there are substantial aggregation problems when calculating the total effect on government budgets of changes in tax or pension systems. To overcome these problems, micro simulation models represent a socioeconomic system by a sample of decision units (e.g. persons), and then model the behaviour of these primary units. Contrary to what is possible in aggregate models, inhabited by one or a few representative agents, the detailed and complicated tax and benefit rules may be exactly reproduced.

The dynamic micro simulation model MOSART[2] is designed to analyse effects on individual pension entitlements, benefits, and government pension expenditures of changes in the Norwegian public pension system. The model simulates the life courses of the Norwegian population, using a set of transition probabilities to determine the occurrence of socio-demographic events, emphasizing what is relevant for individuals' accumulation of public pension entitlements. It captures the following events: migration, deaths, births, marriages, divorces, educational activities, retirement, and labour force participation. The model covers social security old age pensions and disability pensions.

Transitions between states over the life course depend on individual characteristics, and the transition probabilities have been estimated based on historical data. For retirement decisions, adjustments have been implemented in order to capture incentives for postponement of retirement in the reformed old age pension system. The model includes an accurate description of the pension system and captures relevant details of the population dynamics, as well as the heterogeneity of individual age-earnings profiles and individual public pension entitlements.

The macro assumptions from AWG is calibrated and translated to the model population in the micro simulation model, maintaining the heterogeneity of the model population while respecting aggregate assumptions from AWG concerning demographic developments (including net immigration), participation rates etc. by age and gender.

Statistics Norway maintains the MOSART-model and runs the projections for the government. The model is well established as the central tool for evaluating development in pension expenditures in Norway, and is updated on a regularly basis in order to capture changes in demographic projections as well as changes in social security old age and disability pensions systems. Accordingly the reform of the old age pension system is implemented in the current version of the model.

[2] Andreassen, L., Fredriksen, D., Gjefsen, H.M., Halvorsen, E. and Stølen, N.M. 2020. The dynamic cross-sectional microsimulation model MOSART. International Journal of Microsimulation 13(1); 92–113. https://www.microsimulation.org/IJM/V13_1/ijm.00214.pdf

Annex – methodology and administrative data

Economy- wide average wage at retirement

In the projections labour productivity is driving the evolution of economy-wide average wage, while seniority effects are also taken into account for projections of economy-wide average wage at retirement.

TABLE A1	Economy wide average wage at retirement (1000 EUR)						
	2019	2030	2040	2050	2060	2070	% change 2019-2070
Economy-wide average gross wage at retirement	69,5	96,0	139,0	195,2	282,2	393,2	466,1
Economy-wide average gross wage	45,6	67,8	95,7	135,7	192,5	273,5	499,4

Pensioners vs Pensions

Only number of pensioners specified in pension projection model.

Pension taxation

The projections assumes unchanged tax revenues as a share of pension expenditures.

Disability pension

The evolution of the disability pension expenditure and the number of pensions/pensioners entitled to a disability pension is follows from by demographic developments through age- and gender specific transition probabilities. Disability pensioners become old age pensioners at the age of 67.

Survivor pensions

Survivor pensions are included in the proejctions.

Non-earnings related minimum pension

In the previous system pensions consisted of a basic amount (equal for all) and additional income related pensions calculated from a positive threshold income level. The new system also has a minimum guarantee pension, but income related pensions are calculated from total income (not only from income above a threshold level). However, also under the new system there will be a fraction of the pensioners who are just entitled to minimum/guarantee (not income related pensions) pensions. The level of this guarantee pension is comparable to the basic pension under the previous system.

Contribution

Implicit contribution rate is by assumption constant over the projection horizon.

Administrative data

TABLE A4a	administrative data on new pensioners (2019) - men				
Age group	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	7523	0	7458	65	0
50 - 54	2294	0	2252	42	0
55 - 59	2624	0	2571	53	0
60 - 64	17195	14613	2523	59	0
65 - 69	16570	15947	602	21	0
70 - 74	457	457	0	0	0
75+	114	114	0	0	0

TABLE A4a	administrative data on new pensioners (2019) - women				
Age group	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	11495	0	11088	407	0
50 - 54	3462	0	3226	236	0
55 - 59	3459	0	3146	313	0
60 - 64	10434	6894	3124	416	0
65 - 69	24723	23915	695	113	0
70 - 74	308	308	0	0	0
75+	147	147	0	0	0

TABLE A4a	administrative data on new pensioners (2019) - total				
Age group	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	19018	0	18546	472	0
50 - 54	5756	0	5478	278	0
55 - 59	6083	0	5717	366	0
60 - 64	27629	21507	5647	475	0
65 - 69	41293	39862	1297	134	0
70 - 74	765	765	0	0	0
75+	261	261	0	0	0