2024 Ageing Report – Pension projections

COUNTRY FICHE FOR LUXEMBOURG

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1   INTRODUCTION

The present country fiche for Luxembourg is part of the 2024 Ageing Report, which provides long-term projections of the economic and budgetary impact of population ageing at unchanged policy. The 2024 edition is the eighth update and covers the period up to 2070.

This fiche was prepared by the General Inspectorate of Social Security (Inspection générale de la sécurité sociale – IGSS). The pension projections presented in this fiche incorporate the macroeconomic assumptions and methodologies agreed within the Ageing Working Group of the Economic Policy Committee. The projections have been peer reviewed by the other Member States and the European Commission within the Ageing Working Group. The projections were finalised in the autumn of 2023 and represent the situation of the pension system on 01/12/2023.

Section 2 provides a general overview of the pension system in Luxembourg. Section 3 describes the demographic and labour market assumptions underlying the pension expenditure projections presented in Section 4, which also discusses the sensitivity scenarios around the baseline. Finally, Section 5 gives an overview of the model used to produce the pension projections, while an overview of the reporting tables is provided in the subsequent annex.

2 OVERVIEW OF THE PENSION SYSTEM[1]

Various instruments have been created in Luxembourg to ensure that elder people continue to receive an income. They may be categorized as follows:

- Public pension schemes of the private and public sectors (mandatory)
- Occupational pension schemes of the private sector (voluntary)
- Private individual pension schemes (voluntary)
- Social assistance

All people who are covered by public pension insurance in Luxembourg belong to either the general pension scheme or a special pension scheme. The general pension scheme covers all employees and self-employed workers of the private sector. Civil servants and other employees of the government, local authorities, public institutions, and the Luxembourg national railways each have their own statutory pension scheme, all of which constitute the special pension schemes for the public sector. People affiliated to a pension scheme by virtue of working for an international body are not subject to a national pension scheme.

Occupational pension schemes are collective schemes that may be set up by employers or promoters to provide employees or self-employed workers with a supplementary pension benefit. Private individual pension schemes consist of tailored contracts between a financial institution or an insurance company and an individual that may be established under specific conditions.

Public authorities provide for a variety of social assistance measures directed at households or individuals with insufficient financial resources, including most notably the social inclusion income REVIS, but also housing and cost-of-living benefits as well as the energy allowance. However, as Luxembourg makes no distinction between the working age population and elder people, it follows that there are no particular social assistance measures for the latter.

2.1 DESCRIPTION

2.1.1 The general pension scheme

The general pension scheme of the private sector is based on a system of compulsory insurance. It covers all individuals that exercise a remunerated professional activity in Luxembourg's private sector and offers (early) old-age, disability, and survivor pension benefits.

Financing of the general pension scheme

The general pension scheme is financed on a pay-as-you-go basis, applying a system of division into ten-year coverage periods with mandatory formation of a reserve fund. At any point in time, the law requires the reserve fund to exceed the minimum threshold of one and a half times the annual pension expenditure. The contribution rate is set at the beginning of each ten-year period to a percentage value (currently amounting to 24%) of the gross contributory income that shall guarantee the funding of the scheme throughout the period. After five years, the system's financial situation is reassessed, and the global contribution rate may be revised for a new period of ten years if necessary.

The gross contributory income is assessed starting at the social minimum wage, while the income ceiling is situated at five times that amount. The share of costs is distributed in equal parts of 8% among the employer, the employee, and the central government.

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[1] For more details, see European Commission and EPC (2023), '2024 Ageing Report: Underlying assumptions and projection methodologies', European Economy, Institutional Paper 257.For an exhaustive description of pension schemes, please consult the PENSREF database.

Income from contributions is currently running ahead of what would be required by a straightforward burden-sharing system by around 2 percentage points. The resulting surplus is assigned to the pension fund reserve.

The key objective of the reserve pension fund is to accumulate resources, which by prudent investment in financial assets would ensure pension sustainability in case of future increases pension expenditure (see Section 4.5).

Qualifying conditions

Access to a pension is granted upon demand and subject to the fulfilment of specific qualifying conditions that each depend on the type of pension, the applicant's age, and the number and type of recognized pension insurance periods. Insurance periods are subdivided into contributory periods *CP* and credited non-contributory periods *NP* (e.g. studies or childcare).

There are three types of (early) old-age pension, with gradually more restrictive qualifying conditions at younger ages:

- To be eligible for an old-age pension *OA65*, an insured person needs to be at least 65 years old and have accumulated a total of 10 years of contributory periods *CP*.

- An insured person that is at least 60 years old and has accumulated a combined total of 40 years of contributory periods *CP* and credited non-contributory periods *NP* qualifies for an early old-age pension *EOA60*, provided that contributory periods account for at least 10 years.

- Individuals that are at least 57 years old gain access to an early old-age pension *EOA57* provided that they accumulated a total of 40 years of contributory periods *CP*.

The entitlement to a disability pension requires at least one year of contributions during the last three years preceding disability as well as an age younger than 65. In fact, there are no disability pensions at all beyond that age threshold, since they are automatically converted to old-age pensions at age 65.

Similar eligibility conditions hold for survivor pensions in the case of deceased active workers, where a minimum of one year of contributions in the three years preceding death is required.

A minimum pension is guaranteed for members that have belonged to the scheme for at least 20 years of contributory periods *CP* and credited non-contributory periods *NP*. It constitutes an integral part of the pension.

Table 1 – Qualifying conditions for retirement (identical for men and women)

	Minimum conditions	*2022*	*2030*	*2040*	*2050*	*2060*	*2070*
OA65	Minimum contributory period *CP*	10	10	10	10	10	10
	Full qualifying periods *CP+NP*	40	40	40	40	40	40
	Statutory retirement age	65	65	65	65	65	65
EOA60	Min. combined periods *CP+NP* (of which *CP*)	40 (10)	40 (10)	40 (10)	40 (10)	40 (10)	40 (10)
	Early retirement age	60	60	60	60	60	60
EOA57	Minimum contributory period *CP*	40	40	40	40	40	40
	Early retirement age	57	57	57	57	57	57
Penalty in case of earliest retirement age		-					
Bonus in case of late retirement		-					
Minimum residence period		-					

There is no concept of a "full" pension in the sense that the pension benefit is reduced by a certain penalizing amount if specific conditions are not met. Similarly, no explicit bonuses are granted in the case of a late retirement. As described above, retirement at an age below 65 is only available in the case of a full 40-year career (*CP+NP* or *CP,* depending on the retirement age).

The pension formula

The pension benefit is defined as a sum of four components **P = P1 + P2 + P3 + P4.** It depends on the applicant's age **AGE** and insurance career **CP/NP**, the total contributory income **TCI,** a specific reference amount **REF**, which roughly corresponds to the social minimum wage, and a total of four annual pension formula parameters **q1, q2$_{base}$, q2,** and **q3**. Its main elements are defined as follows:

- The pro-rata component **P1**. It is calculated as a given percentage **q1** of the total contributory income **TCI**.
- The incremental component **P2**. For each full year that the sum of the applicant's age **AGE** and the total number of contributory years **CP** exceeds the annual parameter **q2$_{base}$**, the pro-rata component is increased by a fixed percentage **q2**, up to a ceiling of 2.05%.
- The flat component **P3**. In the case of a full career of 40 or more years of combined periods **CP+NP,** it corresponds to a given annual percentage **q3** of the reference amount **REF.** For each missing year, this quantity is reduced by 1/40th.
- The end-of-year allowance **P4**. It represents 2.5% of the reference amount **REF** in the case of a full career of 40 or more years of combined periods **CP+NP**. For each missing year, this quantity is reduced by 1/40th. The end-of-year allowance is due only as long as the global contribution rate is not increased.

Complementing the above information, Table 2 describes the evolution of the annual pension formula parameters **q1**, **q2$_{base}$**, **q2**, and **q3**.

Table 2 – Evolution of the annual pension formula parameters

Year	q1 (%)	q2$_{base}$	q2 (%)	q3 (%)	Year	q1 (%)	q2$_{base}$	q2_2 (%)	q3 (%)
before 2013	1.850	93	0.010	23.500	2033	1.719	96	0.018	25.863
2013	1.844	93	0.011	23.613	2034	1.713	96	0.019	25.975
2014	1.838	93	0.011	23.725	2035	1.707	97	0.019	26.088
2015	1.832	93	0.012	23.838	2036	1.700	97	0.019	26.200
2016	1.825	93	0.012	23.950	2037	1.694	97	0.020	26.313
2017	1.819	93	0.012	24.063	2038	1.688	97	0.020	26.425
2018	1.813	94	0.013	24.175	2039	1.682	97	0.021	26.538
2019	1.807	94	0.013	24.288	2040	1.675	97	0.021	26.650
2020	1.800	94	0.013	24.400	2041	1.669	98	0.021	26.763
2021	1.794	94	0.014	24.513	2042	1.663	98	0.022	26.875
2022	1.788	94	0.014	24.625	2043	1.657	98	0.022	26.988
2023	1.782	94	0.015	24.738	2044	1.650	98	0.022	27.100
2024	1.775	95	0.015	24.850	2045	1.644	98	0.023	27.213
2025	1.769	95	0.015	24.963	2046	1.638	98	0.023	27.325
2026	1.763	95	0.016	25.075	2047	1.632	99	0.024	27.438
2027	1.757	95	0.016	25.188	2048	1.625	99	0.024	27.550
2028	1.750	95	0.016	25.300	2049	1.619	99	0.024	27.663
2029	1.744	95	0.017	25.413	2050	1.613	99	0.025	27.775
2030	1.738	96	0.017	25.525	2051	1.607	99	0.025	27.888
2031	1.732	96	0.018	25.638	2052	1.600	100	0.025	28.000
2032	1.725	96	0.018	25.750	after 2052	1.600	100	0.025	28.000

Formally, the composition of the pension formula can be summarized as given in the following box.

The Pension Formula

$$P = P1 + P2 + P3 + P4,$$ where

$P1 = q1 * TCI$

$P2 = (AGE + CP - q2\_base) * q2 * TCI,$ if $AGE + CP > q2\_base$

$P3 = min(40, CP+NP) / 40 * q3 * REF$

$P4 = min(40, CP+NP) / 40 * 0.025 * REF$

Disability pensions are calculated in the same way as old-age pensions. However, to ensure that disability pensioners receive an adequate income, the periods taken into account for the pro-rata and flat components are extended up to the age of 55 and 65, respectively (special pro-rata and flat components). A notional salary based on the average of all monthly salaries on which actual contributions have been paid is used to calculate the special pro-rata component.

The surviving spouse's pension is composed of three quarters of the pro-rata component, the special pro-rata component (if applicable), and the incremental component as well as the entire flat component and end-of-year allowance of the pension that the deceased person has been or would have been entitled to. If the surviving spouse's total income exceeds a fixed ceiling, the survivor pension is reduced according to specific rules. The surviving child's pension is composed of one quarter of the pro-rata component, the special pro-rata component (if applicable), and the incremental component as well as one third of the flat component and one third of the end-of-year allowance.

In the case of a full 40-year combined career of contributory periods **CP** and credited non-contributory periods **NP**, the minimum pension is defined as 90% of the reference amount **REF**. For each missing year, this quantity is reduced by 1/40th, down to the eligibility threshold of 20 years mentioned in the previous section.

Indexation of pensions

Currently implemented pension indexation mechanisms not only take into account the evolution of prices, but also, to a certain extent and under specific conditions, the evolution of real wages. The rules applied differ between the first calculation of new pensions and the adaptation of pensions in payment.

A new pension is calculated with respect to a given reference year, thus neutralising price and real wage evolution. The resulting amount is then fully indexed to prices by applying the current inflation index. In addition, the revalorisation mechanism is applied, where the new pension is adapted taking into account the real wage evolution up to the fourth year preceding entitlement.

Pensions in payment are fully indexed to price evolution each time prices increase by more than 2.5% when compared to the inflation index at the time of the previous indexation. In addition, the stock of pensions is indexed at an annual pace to real wages by means of the semi-automatic readjustment mechanism. Here, the real wage evolution of the second year preceding the indexation date is multiplied with the moderator coefficient, a scaling parameter assuming values between 0 and 1.

As long as the pension scheme's income from contributions exceeds its expenditure (which has been the case since the introduction of the mechanism by the 2012 pension reform), the moderator coefficient is set to one, implying a full 100% application of the readjustment mechanism. More precisely, the indicator that triggers the modulation of the indexation rate via the readjustment mechanism is the so-called "prime de répartition pure" of the general pension scheme. It is defined as the ratio of current expenditure divided by the contributions base.

If this indicator surpasses the global contribution rate of 24% (or, equivalently, if the ratio of contributions to current expenditure falls below one), then the readjustment mechanism has to be modulated, and the government is required to submit a draft law containing a revision of the moderator coefficient to a value between 0 (no readjustment) and 0.5 (50% readjustment).

2.1.2   Special pension schemes

The public sector includes the civil service, local authorities, the Luxembourg national railways and all those public institutions whose staff is not subject to the general scheme. In 1999, a major reform has overhauled public pensions in Luxembourg.

On the one hand, the original scheme, now known as the transitional special pension scheme, concerns civil servants and persons treated as such who were appointed on 31 December 1998 at the latest. Here, pension benefits are calculated based on the final salary earned by the civil servant at a reference replacement rate of 83.33%. For years of service after 1 January 1999, the replacement rate is gradually lowered from 83.33% to 72%. Pensions that had been entitled prior to the entry into force of the new law were not affected by the 1999 reform.

On the other hand, the new special pension scheme essentially corresponds to the general pension scheme, diverging only in a few selected procedural and funding arrangements. It applies to civil servants who entered the public service after 31 December 1998. The new special pension scheme retains the status of a special scheme, but it is based on the same principles as the general scheme for the private sector with the exception of the absence of an income ceiling for the assessment of contributions.

Pensions awarded under the transitional and new special schemes are paid by the general government. Members of both schemes contribute at the rate of 8% of the gross contributory income.

2.1.3   Occupational pension schemes

In Luxembourg, an occupational pension scheme is a voluntary mechanism designed by an employer or a promoter to provide workers with benefits that are complementary to those foreseen by the public pension system. In the past, occupational pension schemes only applied to companies, which could set them up for their employees. Since 2019, however, independent workers are also able to join specific occupational pension schemes that have to be duly approved by the supervisory authority. The legal framework allows such schemes to supply employees and independent workers with a coverage in case of retirement, death, or disability.

The law only allows for collective pension schemes to be established, individual pension plans not being within its scope. Occupational pension schemes are either funded in the form of a pension fund or a group insurance policy. Companies may also fund their pension scheme through provisions on their balance sheet. Employees can participate in the financing of their occupational pension scheme as well by bringing in personal contributions.

2.1.4   Private individual pension schemes

A pension plan is a contract between an insurer and an individual. It is accessible to all taxpayers residing in Luxembourg as well as to non-residents who opt to be treated in the same way as residents for tax purposes, on condition that at least 90% of their total earned income from domestic and foreign sources is taxable in Luxembourg. From a fiscal point of view, the cost of premiums paid into a pension plan is tax-deductible under the heading of special expenses.

2.1.5   Social assistance

Public authorities provide different social assistance measures for individuals with insufficient financial resources. In contrast to other countries, there is no distinction made in Luxembourg between working age adults and retired adults. Thus, elder people can apply most notably for the newly created social inclusion income (Revenu d'inclusion sociale – REVIS), which, since 2019, replaces the minimum guaranteed income (Revenu minimum garanti – RMG), but also for housing and cost-of-living benefits and the energy allowance.

The REVIS social inclusion income is a means-tested, taxable, and non-contributory benefit. It is largely dependent on household composition and currently amounts for a one-person household at least to about 70% of the social minimum wage. Moreover, it is indexed to price evolution in the same way as pensions in payment, and it is further adapted in parallel with the social minimum wage, that is, every two years. Housing and cost-of-living benefits are also means-tested, but the latter are non-taxable. To tackle the issue of rising energy prices, the central government has introduced an energy allowance in 2022, which is means-tested and non-taxable.

All social assistance benefits are at the charge of the central government. Next to the central government, the Social welfare offices (Offices sociaux) provide social welfare services at a local level that aim to ensure that every individuals has access to the essentials, such as medical care, housing, food, clothing, drinking water, and domestic energy.

2.2   RECENT REFORMS INCLUDED IN THE PROJECTIONS

No reforms have been enacted since the last projection exercise.

2.3   "CONSTANT POLICY" ASSUMPTIONS USED IN THE PROJECTION

No deviations from the standard constant policy assumptions have been implemented.

Just as in previous projection exercises, the pension projections discussed in this paper assume that the readjustment mechanism described in Section 2.1.1 will be modulated in accordance with Article 225bis of the Social Security Code once the financial resources of the general pension scheme are insufficient. In this case, the law stipulates that the moderator coefficient of the readjustment mechanism has to be set to a value between 0 (full abrogation of the readjustment mechanism) and 0.5 (readjustment mechanism applied at a rate of 50%).

It is projected that the ratio of contributions to current expenditure falls below one in 2028. Thus, in view of the uncertainty about the exact choice of a value between 0 and 0.5 and the fact that a coefficient of 0.25 has been applied in the 2021 projection exercise, it is assumed that the same coefficient for the readjustment mechanism is applied (i.e. 25%) once contributions are insufficient. For this projection exercice, it is also considered that there is a delay of 3 years between the triggering observation and the implementation of the modulated readjustment mechanism, it follows that the 25% rate is applied from 2031 onwards (see Section 4.7).

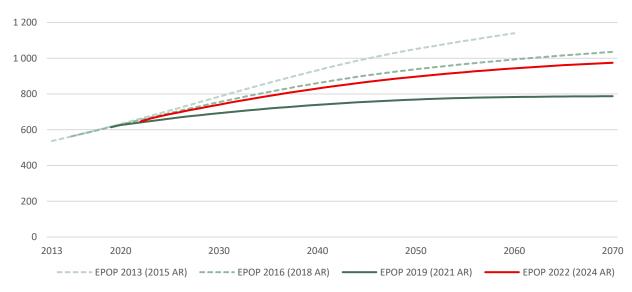# 3   OVERVIEW OF THE DEMOGRAPHIC AND LABOUR FORCE PROJECTIONS

3.1   DEMOGRAPHIC DEVELOPMENTS

The most recent population projections EUROPOP 2022 provided by EUROSTAT expect the resident population of Luxembourg to show a continuous increase over the projection period, passing from around 645 000 inhabitants in 2022 to just above 975 000 in 2070. As can be seen in Table 3, projected population growth is the fastest in the beginning of the projection and slows down throughout the projection interval. Indeed, half of the projected population growth is reported until 2038, when the number of inhabitants crosses the 810 000 mark, whereas population increases less pronouncedly towards the end.
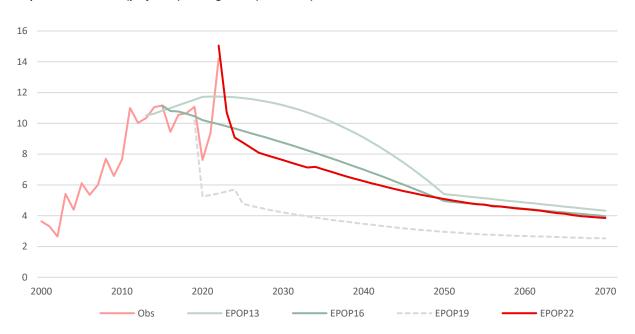
Table 3 – Main demographic variables

	2022	*2030*	*2040*	*2050*	*2060*	*2070*	*peak value*	*peak year*	*change 2022-70*
Population (thousand)	654	745	835	900	945	976	976	2070	322
Population growth rate	2.2%	1.4%	0.9%	0.6%	0.4%	0.2%	2.3%	2023	-1.9%
Old-age dep. ratio (pop65/pop20-64)	23.1	27.2	33.4	39.5	48.0	55.4	55.4	2070	32.3
Old-age dep. ratio (pop75/pop20-74)	9.2	10.3	13.8	17.4	20.8	26.0	26.0	2070	16.8
Ageing of the aged (pop80+/pop65+)	26.6	25.3	27.9	33.5	34.3	37.9	37.9	2070	11.4
Men - Life expectancy at birth	80.7	81.6	83.1	84.5	85.7	86.9	86.9	2070	6.2
Women - Life expectancy at birth	85.0	86.0	87.4	88.6	89.8	90.8	90.8	2070	5.8
Men - Life expectancy at 65	19.4	20.2	21.1	22.1	23.0	23.9	23.9	2070	4.5
Women - Life expectancy at 65	22.5	23.3	24.3	25.3	26.2	27.1	27.1	2070	4.6
Men - Survivor rate at 65+	89.2	90.1	91.6	92.8	93.8	94.7	94.7	2070	5.5
Women - Survivor rate at 65+	93.7	94.2	95.0	95.8	96.4	96.9	96.9	2070	3.2
Men - Survivor rate at 80+	62.4	65.7	70.1	74.0	77.4	80.4	80.4	2070	18.0
Women - Survivor rate at 80+	75.8	78.1	81.4	84.1	86.5	88.6	88.6	2070	12.8
Net migration (thousand)	15.0	7.6	6.2	5.1	4.4	3.9	15.0	2022	-11.2
Net migration over population change	2.4%	1.0%	0.8%	0.6%	0.5%	0.4%	2.4%	2022	-2.0%

The updated set of population projections represents an upward revision of the figures issued by EUROSTAT for the 2021 Ageing Report and is more in line with the 2015 and 2018 EUROPOP vintages. Indeed, the new projected population approaches the 1 000 000 inhabitant mark in 2070, which has been surpassed by both latter projections, while population stayed below 800 000 in the last exercise.

Graph 1 – Evolution of projected population (thousands)

With assumptions on both fertility and life expectancy naturally showing a certain rigidity between different exercises, it is clear that the net migration assumption is the main determinant of the observed fluctuations in population growth between different projections. A look at recent administrative data reveals that net migration has followed a relatively stable path in the past decade, averaging slightly more than 10 000 net immigrants per year between 2011 and 2019. Net migration exhibits a drop during the pandemic, before reaching a peak following the significant inflow of Ukrainian refugees in 2022.
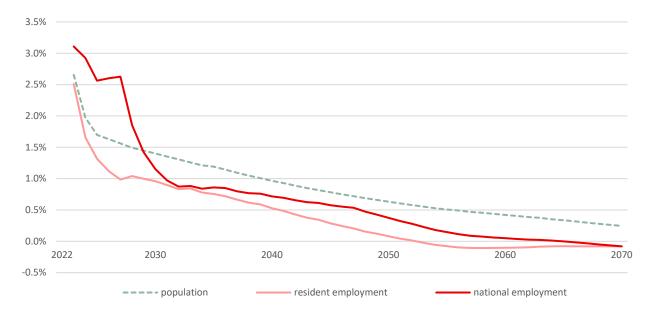
Graph 2 – Evolution of (projected) net migration (thousands)

EUROSTAT has revised its projection methodology prior to the publication of EUROPOP 2019, most notably by introducing a new model to project migration. While former net migration projections take into account the constant high net migration levels of the past decade, with figures starting at around 10 000 net immigrants and then slowly decreasing in accordance with the general convergence, the new migration model that has been first applied for EUROPOP 2019 produces a different outcome. For both the 2019 and 2022 vintages, an instant drop of net migration is projected for the first projection year, and the subsequent convergence sets in right thereafter at this lower point.

For this projection exercise, the abrupt downward revision of net migration seems justified in view of the shock caused by the refugees.

3.2 LABOUR FORCE

The upward revision of population projections discussed above has repercussions on the long-term evolution of the resident labour force. Population growth is still decreasing from the beginning of the projection forward, and it is clear by construction that the implied resident employment growth follows a similar path. However, this happens at higher levels than in the previous projection exercise. Indeed, resident employment now grows at an average rate of 0.4% between 2022 and 2070, compared to 0.1% in the 2021 exercise.

Graph 3 – Evolution of projected population and employment growth

However, the upward revision reported for the resident employment growth does not carry over to cross-border employment growth. This is because, contrary to the last projection exercise and again more in line with previous vintages, it is assumed that the relative proportion of the cross-border workforce will not cross the 50% mark in the long term. Instead, cross-border employment grows at a 1.0% rate on average between 2022 and 2070, which is comparable with the previous exercise.

A look at the past evolution of both stock and net job creation of national employment shows that this assumption is on the prudent side. Indeed, apart from the few years following the 2008 economic crisis, the non-resident part in national employment is steadily rising. The corresponding ratio in net job creation has been stabilizing at an average 56% since 2015, while it easily surpassed this value in the years preceding the great recession.

Graph 4 – Observed evolution of the share of cross border workers in the national labour market

At present, no explicit linkage of legislated retirement ages with evolution of life expectancy is foreseen by the law. However, taking into account incentives to postpone retirement introduced by the 2012 pension reform, participation rates of the age group 55-64 have been revised upwards with respect to the 2021 projection exercise.

Table 4 – Participation rate, employment rate, and share of workers

	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2022-70
Labour force participation rate 20-64	77.6	78.8	78.9	77.8	77.7	78.4	79.0	2037	0.8
Employment rate of workers aged 20-64	74.5	74.9	74.9	73.9	73.8	74.5	75.0	2037	0.0
Workers 20-64 in labour force 20-64	96.0	95.1	95.0	95.0	95.0	95.0	96.0	2022	-1.0
Labour force participation rate 20-74	69.4	68.9	67.9	66.2	64.2	64.3	69.9	2024	-5.1
Employment rate of workers aged 20-74	66.6	65.5	64.5	62.9	61.0	61.1	66.8	2023	-5.5
Workers 20-74 in labour force 20-74	95.9	95.0	95.0	95.0	95.0	95.0	95.9	2022	-1.0
Labour force participation rate 55-64	48.4	48.5	50.5	51.7	51.4	53.3	53.3	2070	4.9
Employment rate of workers aged 55-64	46.3	45.9	47.7	48.9	48.5	50.2	50.2	2070	4.0
Workers 55-64 in labour force 55-64	95.6	94.5	94.4	94.5	94.3	94.3	95.6	2022	-1.3
Labour force participation rate 65-74	5.6	4.3	4.0	4.2	4.3	4.3	5.6	2022	-1.3
Employment rate of workers aged 65-74	5.3	4.0	3.7	3.9	4.0	4.0	5.3	2022	-1.2
Workers 65-74 in labour force 65-74	94.0	92.4	92.7	92.9	93.0	93.1	94.2	2023	-0.9
Median age of the labour force	39.0	39.0	40.0	41.0	41.0	41.0	41.0	2041	2.0

The average effective exit age, which remained constant at just above 60 years in the 2021 vintage, now increases towards 61.5 years for both men and women (Table 5 and Table 6). In contrast with the previous projections, the average length of the contributory period in Luxembourg is expected to remain roughly constant, at a rather lower level. As it will be explained in more detail in Section 4.3, this phenomenon is closely related with the upward revision of the new pensioners with incomplete careers in Luxembourg of migrant and cross-border workers.

Table 5 – Labour market effective exit age and average contributory period - MEN

	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2022-70
Average effective retirement age*	60.7								
Average labour market exit age (CSM)**	60.6	60.7	61.0	61.2	61.3	61.5	61.5	2070	1.0
Contributory period in Luxembourg	24.7	23.6	24.1	24.3	25.2	25.6	25.6	2070	0.9
Duration of retirement***	21.8	23.5	24.5	25.6	26.5	26.6	27.3	2068	4.8
Duration of retirement/contributory period in Luxembourg	88%	99%	102%	105%	105%	104%	107%	2068	16%
Percentage of adult life spent in retirement****	34%	37%	37%	38%	39%	39%	40%	2068	5%
Early/late exit*****	3.3	3.7	3.5	3.5	3.0	3.6	5.0	2026	0.3

Table 6 - Labour market effective exit age and average contributory period - WOMEN

	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2019-70
Average effective retirement age*	61.1								
Average labour market exit age (CSM)**	60.9	61.0	61.0	61.1	61.3	61.5	61.5	2070	0.6
Contributory period in Luxembourg	26.0	25.4	25.5	25.1	25.3	25.3	26.0	2022	-0.7
Duration of retirement***	28.8	26.9	28.0	29.0	29.9	30.8	30.8	2070	2.0
Duration of retirement/contributory period in Luxembourg	111%	106%	110%	115%	118%	122%	122%	2068	11%
Percentage of adult life spent in retirement****	43%	40%	41%	41%	42%	43%	43%	2022	-1%
Early/late exit*****	4.6	4.9	4.5	4.5	3.6	4.5	6.4	2025	0.0

* The 'average effective retirement age' is the age at which people start receiving a pension benefit (old-age, early or disability). It is calculated on the basis of the administrative data on new pensioners for 2022, showing projected data for the other years for the total. ** 'Average labour market exit age (Cohort Simulation Model)' refers to 2023 instead of 2022. *** 'Duration of retirement' is the remaining life expectancy at the average labour market exit age. **** 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 exit the labour market before reaching the statutory retirement age and those who exit at or beyond the statutory retirement age. For 2022, the value refers to 2023.

The reported increases in life expectancy together with the constant retirement ages yield an increase in the expected duration of retirement. Thus, pensions will have to be paid for a longer period, which will have a negative impact on the finances of the pension system.

4   PENSION PROJECTION RESULTS

4.1   EXTENT OF THE COVERAGE OF THE PENSION SCHEMES

The pension projection model provides almost full coverage. It includes all public pension expenditure items, that is, early old-age, old-age, disability, and survivor pension benefits, from the general pension scheme of the private sector (ESSPROS scheme 3) and the special pension schemes of the public sector (ESSPROS scheme 6).

Table 7 – Eurostat (ESSPROS) vs. Ageing Working Group definition of pension expenditure (% GDP)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	change 2013-last avail. year
1 ESTAT total pension exp.	9.2	9.2	9.2	9.2	9.5	9.5	9.7	10.1	9.6	0.4
2 ESTAT public pension exp.	9.1	9.1	9.2	9.2	9.5	9.5	9.7	10.1	:	0.9
3 AWG public pension exp.	8.7	8.7	8.8	8.8	9.0	9.2	9.3	9.7	9.2	0.5
4 Difference (2) - (3)	0.5	0.4	0.4	0.4	0.5	0.3	0.4	0.4	:	-0.1

Due to the high level of pension provision from public pension schemes, the second and third pillar schemes only play a subordinate role in terms of coverage and expenditure. Occupational schemes and individual pension plans are both contracted on a voluntary basis, and while a few occupational schemes have developed in some foreign or very large industrial and commercial companies as well as in the banking sector, private plans are almost non-existent. Detailed information is available neither on occupational pension schemes nor on individual private pensions. For these two reasons, occupational and private individual pensions are both excluded from the projections.

While minimum pension provision is included in the projections, expenditure of other social assistance measures for people in retirement, such as the REVIS social inclusion income, amounts to less than 0.1% of GDP and is hence not taken into account.

4.2   OVERVIEW OF PROJECTION RESULTS

The projected development of public pension expenditure as a share of GDP shows a steady increase between 2022 and 2070. Starting at roughly 9.2% of GDP, it reaches about 17.5% of GDP at the end of the projection period. The figures on net pension expenditure are calculated by applying a constant rate of 17.1% for social security contributions and taxes based on ESSPROS data. After an early fluctuation due to a denominator effect that can be attributed to differences between the GDP deflator and inflation assumptions, income from contributions is projected to evolve between 9.2% and 9.4% of GDP.

Table 8 – Projected gross and net pension spending and contributions (% of GDP)

	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2019-70
Gross public pension expenditure	9.2	9.7	11.2	12.5	15.0	17.5	17.5	2070	8.3
Net public pension expenditure*	7.6	8.1	9.3	10.4	12.4	14.5	14.5	2070	6.8
Public pension contributions	9.8	9.2	9.3	9.4	9.4	9.4	9.8	2022	-0.4
Balance of the public pension system**	0.6	-0.6	-1.9	-3.1	-5.6	-8.0	-8.0	2070	-8.6

* Net pension expenditure excludes taxes on pensions and compulsory social security contributions paid by beneficiaries.

** Public pension contributions - gross public pension expenditure (peak value/year shows most negative value).

As shown in Table 9, the essential driving force behind the reported development of pension expenditure are old-age and early pensions. Indeed, because of Luxembourg's remarkable economic growth over the last 35 years, the private sector has experienced a considerable increase in scheme members since the late 1980s. Clearly, these active contributors eventually become pension beneficiaries once they are eligible for retirement.

Table 9 – Projected gross public pension spending by scheme (% of GDP)

	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2022-70
Total public pensions	9.2	9.7	11.2	12.5	15.0	17.5	17.5	2070	8.3
of which									
Old-age and early pensions	7.2	7.9	9.3	10.5	12.9	15.3	15.3	2070	8.1
Disability pensions	0.6	0.6	0.7	0.7	0.8	0.8	0.8	2061	0.2
Survivor pensions	1.4	1.2	1.2	1.3	1.3	1.4	1.4	2022	0.0

4.3 DESCRIPTION OF MAIN DRIVING FORCES BEHIND THE PROJECTION RESULTS AND THEIR IMPLICATIONS

As the share of cross-border workers in national employment is assumed to further increase from its current level of 46% to reach the 50%-mark eventually, the standard decomposition of the ratio of public pension expenditure to GDP into the dependency, coverage, benefit ratio, employment rate and labour intensity is not significant in the case of Luxembourg. Indeed, demographic components and labour force considerations essentially focused on resident population do only partially capture the expected impacts. Thus, in order to provide a meaningful analysis, the decomposition is limited to two components, namely the dependency ratio and the benefit ratio.

Table 10 – Factors behind the change in public pension expenditures between 2022 and 2070 (in percentage points of GDP)

	2022-30	2030-40	2040-50	2050-60	2060-70	2022-70
Public pension expenditure	0.6	1.5	1.3	2.4	2.5	8.3
Dependency ratio*	1.1	2.5	2.7	3.5	3.2	13.0
Benefit ratio**	-0.5	-0.7	-0.6	-0.2	0.0	-2.0
Residual	-0.1	-0.4	-0.7	-0.9	-0.7	-2.8

* Ratio between pensioners and contributors
** Ratio between pension expenditure divided by pensioners and GDP divided by contributors

The benefit ratio has an attenuating effect on public pension expenditure throughout the projection. The average pension decreases because of the effects of the 2012 pension reform on pension indexation and the pension formula as the share of pensions paid to cross-border and migrant workers with incomplete careers remains significant throughout the projection.

Clearly, the pressure on the public pension spending comes from changes in the dependency ratio of the pension system. Over the projection period, the support ratio (see Table 11), that is, the number of contributors per pensioner, is continuously decreasing before eventually falling below one. This means that fewer and fewer contributors have to support more and more pensioners.

However, this evolution is not exclusively linked to ageing phenomena. Indeed, the pace of the reported decrease is the highest in the beginning, when current active scheme members from the period of remarkable economic growth starting in the late 1980s begin to retire. It then progressively slows down towards the end of the projection, as the assumed decline in employment growth from the mid-2020s translates to a less pronounced growth of the number of pensioners.

Table 11 – Number of pensioners and contributors in the public pension scheme (in 1000), support ratio

	2022	2030	2040	2050	2060	2070	Change 2022-70
Number of pensioners	227.4	305.9	414.5	531.6	666.4	779.7	552.3
Number of contributors	525.0	629.7	686.4	728.8	743.6	745.3	220.3
Support ratio	2.3	2.1	1.7	1.4	1.1	1.0	-1.4

The replacement rate at retirement is projected to decline until the second half of the projection, before it stabilizes towards the projection horizon. The benefit ratio shows a slight increase in the first projection year due to the application of an already legislated high (in comparison with the productivity assumption) readjustment and then declines throughout the projection.

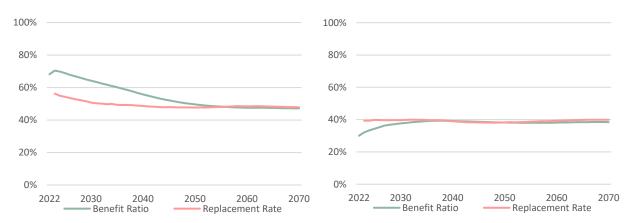**Table 12 - Replacement rate at retirement (RR) and benefit ratio (BR)**

	2022	*2030*	*2040*	*2050*	*2060*	*2070*	*Change 2022-70*
Public scheme (BR)	52%	53%	48%	44%	43%	42%	-10 pp.
Public scheme (RR)	49%	46%	44%	43%	44%	44%	-5 pp.
Public scheme old-age earnings related (BR)	58%	56%	50%	45%	44%	44%	-14 pp.
Public scheme old-age earnings related (RR)	51%	47%	46%	45%	46%	47%	-4 pp.

For a better understanding of the reported progress of the benefit ratio and the replacement rate presented in Table 12, it is convenient to disaggregate into residents and non-residents.

The projected evolution of both indicators is affected by different factors:

- Gradual evolution of the annual pension formula parameters until 2052;

- Changes in the underlying average career lengths;

- Indexation of pensions in payment;

- Denominator effect coming from a decline in the productivity assumption after 2040.

Considering resident workers (Graph 5, left part), it is observed that the replacement rate continuously decreases until the early 2050s and remains roughly constant thereafter. This is a direct consequence of the annual decreases in the accrual rate introduced by the 2012 pension reform. On the one hand, this effect is more pronounced until the mid-2030s since the average career length in Luxembourg declines for new pensioners due to the growing proportion of migrants in the resident workforce. It is less pronounced in the 2040s due to the aforementioned denominator effect. Similar observations hold for the benefit ratio. However, the reduction to 25% of the readjustment mechanism from the early 2030s onwards causes the decline to happen at an increasing pace.

Graph 5 – Evolution of the replacement rate at retirement and benefit ratio - RESIDENTS (left) and NON-RESIDENTS (right)

In contrast, the replacement rate remains roughly constant for non-resident workers (Graph 5, right part), increasing only slightly during the last two decades. Here, pensioners present on average a low career length in Luxembourg in the beginning of the projection period since they spent a significant part of their working career abroad. In the long term, commuters tend to remain longer in the national labour market. The resulting increase in the average contributory period in Luxembourg cancels out the attenuating effect of the annual decreases in the accrual rate until the early 2050s. The benefit ratio follows an upward path until the early 2030s, when the setting in of the modulated readjustment mechanism causes a deflection of the trajectory.

The proportions of pensioners by age class behave as expected. Over the period ranging from 1980 to 1995, the average entry age to the pension scheme increased substantially from 17 to 21 years. This causes a slight decrease of the relative proportion of pensioners aged between 55 and 59 until the mid-2030s, as less people are eligible for an early old-age pension at age 57.

In the age bracket from 60 to 64, an increase in the relative proportion of pensioners is projected towards the end of the projection. This is because people are assumed to enter the labour market at progressively younger ages on average throughout the projection, causing a higher proportion of people to be eligible for an early old-age pension at age 60 towards the horizon.

Table 13 – Ratio of pensioners (all schemes) to the sum of pensioners and contributors by age group

	2022	*2030*	*2040*	*2050*	*2060*	*2070*
0-54	2%	2%	2%	2%	2%	2%
55-59	20%	17%	15%	15%	16%	16%
60-64	71%	72%	71%	72%	74%	77%
65+	100%	100%	100%	100%	100%	100%

Table 14 - Ratio of FEMALE pensioners (all schemes) to the sum of pensioners and contributors by age group

	2022	*2030*	*2040*	*2050*	*2060*	*2070*
0-54	3%	3%	3%	3%	3%	3%
55-59	23%	19%	16%	15%	16%	16%
60-64	73%	74%	72%	71%	73%	74%
65+	100%	100%	100%	100%	100%	100%

A closer look at new public pension expenditure reveals that its trajectory, over the long term, is mainly driven by an increase in the number of new pensioners. The gradual decline of the average accrual rate introduced by the 2012 pension reform slightly counterbalances these effects, as it is causing the average pension benefit to decrease over time.

As explained above, active scheme members from the period of remarkable economic growth starting in the late 1980s and lasting until the beginning of the projection induce a progressive increase in the number of new pensioners that lasts until the late 2050s. The average contributory period decreases by a year until the mid-2030s because of the increasing share of pensioners with incomplete careers retiring at age 65. In turn, a small increase of the average contributory period is projected in the final two decades, as people enter the national labour market at progressively younger ages throughout the projection.

Table 15 - Projected and disaggregated new public pension expenditure (old-age and early earnings-related pensions)

	2022	*2030*	*2040*	*2050*	*2060*	*2070*
I Projected new pension expenditure (millions EUR)*	365.4	536.8	799.9	1369.5	2439.6	3141.7
II. Average contributory period	25.2	24.3	24.6	24.6	25.3	25.5
III. Monthly average pensionable earnings	4926.5	5791.4	8070.1	11490.8	16120.7	22322.3
IV. Average accrual rates (%)	2.3	2.1	2.0	1.9	1.9	1.9
V. Sustainability/Adjustment factor	1.0	1.0	1.0	1.0	1.0	1.0
VI. Number of new pensions ('000)	10.7	14.9	16.9	21.1	26.2	24.1
VII Average number of months paid the first year	12.0	12.0	12.0	12.0	12.0	12.0
Monthly average pensionable earnings / Monthly economy-wide average wage	97%	98%	101%	102%	103%	102%

* New pension expenditure (I) equals the product of II, III, IV, V, VI, and VII

4.4 FINANCING OF THE PENSION SYSTEM

As described in Section 2.1.1, the general pension scheme for the private sector is financed by contributions, and the global contribution rate amounts to 24% of the gross contributory income. The share of costs is distributed in equal parts of 8% among the employer, the employee, and the central government. Moreover, a reserve fund has been constituted, whose assets have to exceed the legal threshold of one and a half times the total amount of annual pension expenditure.

The special pension schemes for the public sector are financed by contributions as well (see Section 2.1.2). Here, scheme members contribute at the rate of 8% of the gross contributory income. Since pensions are paid by the general government, there are no explicit state contributions. For the projections, however, a hypothetical rate of 16% is applied.

While the minimum contribution is equal to the social minimum wage for all schemes, a maximum contribution of 5 times the social minimum wage (SMW) applies to the general pension scheme for the private sector.

Table 16 – Legislated contributions to public pension schemes

	Public employees	Private employees	Self-employed
Contribution rate/contribution			
Employer		8%	16%
Employee	8%	8%	
*State**	(16%)	8%	8%
*Other revenues**		Buffer fund of at least 1.5 times the amount of annual benefits	Buffer fund of at least 1.5 times the amount of annual benefits
Maximum contribution	no	5 times SMW	5 times SMW
Minimum contribution	SMW	SMW	SMW

* Includes only legislated contributions.

As discussed in Section 4.2, income from contributions is projected to evolve around between 9.2% and 9.4% of GDP for the most part. By design, GDP and contributions both evolve according to the same macroeconomic assumptions. Thus, there is not much fluctuation apart from that coming from changes in the composition of the active population and, in the beginning of the projections, from the difference between the GDP deflator and consumer price indexation. The number of contributors grows in line with national employment growth and includes cross border workers. Hence, a strong increase is projected in the first half of the projection period, which is then followed by a more prudent evolution.

Table 17 – Revenue from contribution (% of GDP) and number of contributors in the public scheme (in 1000)

	Average 2012-21	2022	2030	2040	2050	2060	2070	Change 2022-70
Public pension contributions (%GDP)		9.8	9.2	9.3	9.4	9.4	9.4	-0.3
Employer contributions		3.3	3.1	3.1	3.1	3.1	3.1	-0.1
Employee contributions		3.3	3.1	3.1	3.1	3.1	3.1	-0.1
*State contribution**		3.3	3.1	3.1	3.1	3.1	3.1	-0.1
*Other revenues**		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of contributors (1000)		525	630	686	729	744	745	220

* Includes only legislated contributions.

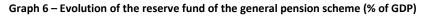## 4.5 PENSION ASSETS AND RETURN ON ASSETS

The reserve fund of the general pension scheme has been constantly accumulating funds in the past 30 years, except for the base year 2022, when a significant loss has been reported due to a negative change in asset valuation. Currently, it amounts to about 31.4% of GDP, which roughly equals 4.3 times the annual pension expenditure and hence by far exceeds the legal threshold of 1.5 times that amount.
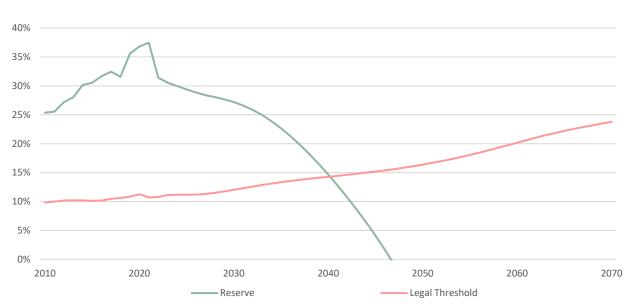
In absolute terms, the reserve fund is projected to increase further until the early 2030s and decline afterwards. As a percentage of GDP however, the peak is attained in the base year, and a continuous decrease is reported throughout the years. Notable events are projected to occur in the 2040s, as the reserve is projected to fall below the legal threshold in 2041, before being exhausted in 2047.

Table 18 – Public pension assets and reserves (% GDP) and return on assets (%)

	Average 2012-21	2022	2030	2040	2050	2060	2070	Average 2022-70
Stock of assets (end-of-year; %GDP)	32.1	31.4	27.2	14.6	0.0	0.0	0.0	13.0
Fund balance (billion EUR)		0.6	0.6	-1.9	-7.8	-20.8	-41.1	
Fund expenditure		6.1	9.9	17.1	29.3	51.2	83.5	
Disbursements (to pension scheme)		5.6	9.3	16.1	27.5	48.2	78.6	
Other expenditure (incl. administrative costs)		0.5	0.6	1.0	1.7	3.0	4.9	
Fund revenues		6.7	10.5	15.2	21.4	30.4	42.4	
Return on assets		0.4	1.0	0.9	0.0	0.0	0.0	
Other income (incl. pension contributions)		6.7	9.5	14.2	21.4	30.4	42.4	
Nominal rate of return	2.2%	1.8%	3.2%	3.6%	3.9%	4.0%	4.0%	3.6%
Change in asset valuation (billion EUR)		-3.6	0.0	0.0	0.0	0.0	0.0	

The nominal rate of return evolves in line with the long-term interest rate assumption, reaching 4% in 2052. Changes in asset valuation are set to zero throughout the projection. Clearly, disbursements to the pension scheme account for the largest proportion of fund expenditure, while pension contributions represent the largest part of fund revenues. Other expenditure items included in the table are most notably composed of administrative costs and transfers of contributions. Changes in asset valuation are assumed zero across the projection.

Graph 6 – Evolution of the reserve fund of the general pension scheme (% of GDP)

4.6 SENSITIVITY ANALYSIS[2]

4.6.1 AWG sensitivity tests

Four demographic sensitivity scenarios are discussed. Each alternative is deduced from variations of the EUROPOP 2022 baseline scenario provided by EUROSTAT that modulate the three main assumptions the population projections are based on, namely life expectancy, migration, and fertility.

In the higher life expectancy scenario, the fact that no demographic calibration mechanism is included in the pension formula yields a moderate increase of expenditure in terms of GDP with respect to the baseline scenario, which slowly fades in and becomes more and more apparent in the second half of the projection.

The higher and lower migration scenarios have an immediate impact and act mainly on the denominator. In fact, changes in the migration assumption directly affect employment growth and consequently GDP growth. An increased level of GDP leads to a lower ratio of pension expenditure to GDP and vice versa. Thus, as labour input varies, with pension expenditure being rather rigid in the beginning of the projection, the ratio of expenditure to GDP is impacted in the short to medium term. It is only towards the end of the projection that employees affected by the assumed alteration of employment rates retire and hence cause the numerator to deviate from the baseline as well. This leads to an attenuation of the above denominator effect in the second half of the projection interval.

The lower fertility scenario can be considered as a delayed lower employment scenario. Indeed, changes in the fertility assumption affect employment in the medium term, when former new-borns start to work. This leads to a phasing in of the denominator effect explained above that occurs at a later point in time. In turn, the impact on pension expenditure in the numerator is even more delayed and hence barely noticeable until towards the end of the projection.

Four economic scenarios are presented: one modulating the inflation assumption, a second one altering the employment rate assumption of older workers, and the remaining two acting on the TFP assumption.

In the high inflation scenario, changes with respect to the baseline occur in the first projection years, as differences between the assumed GDP deflator and CPI figures are projected to remain present over a longer period in time. The denominator effect coming from a higher nominal GDP growth cause a downward revision of pension expenditure when compared with the baseline.

Table 19 – Public pension expenditure under different scenarios (pp. deviation from the baseline)

Public pension expenditure	*2022*	*2030*	*2040*	*2050*	*2060*	*2070*	*change 2022-70*
Baseline (%GDP)	9.2	9.7	11.2	12.5	15.0	17.5	8.3
Higher life expectancy at birth (+2y)	0.0	0.0	0.1	0.2	0.3	0.5	0.5
Higher migration (+33%)	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2
Lower migration (-33%)	0.0	0.1	0.1	0.2	0.3	0.2	0.2
Lower fertility (-20%)	0.0	0.0	0.0	0.1	0.6	1.1	1.1
Higher inflation scenario (2% by 2052)	0.0	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3
Higher employment rate of older workers (+10 pps)	0.0	-0.2	-0.4	-0.5	-0.6	-0.3	-0.3
Higher productivity (TFP converges to 1%)	0.0	0.0	0.0	-0.1	-0.3	-0.5	-0.5
Lower productivity (TFP converges to 0.6%)	0.0	0.0	0.1	0.3	0.6	0.7	0.7
Policy scenario: link retirement age to longevity	0.0	-0.1	-0.2	-0.6	-1.3	-2.2	-2.2
Policy scenario: constant retirement age	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Policy scenario: constant benefit ratio	0.0	0.0	0.0	0.9	1.5	1.8	1.8

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[2] For more information on the design of the sensitivity scenarios, see Chapter 5 of Part I in European Commission and EPC (2023), '2024 Ageing Report: Underlying assumptions and projection methodologies', European Economy, Institutional Paper 257.

A higher employment rate of older workers leads to a decrease of the expenditure to GDP ratio. For the most part of the projection, a moderate denominator effect is observed. Towards the end, pensions are catching up again, whence the deviation from the baseline slowly diminishes.

A modified TFP rate not only has an impact on labour productivity and hence on GDP, but also on pensions in payment by means of the readjustment mechanism. Under the assumption of a full application of the readjustment mechanism, this would mean that the numerator and the denominator of the expenditure-to-GDP ratio would be affected in a similar way when modifying the TFP assumption. However, the readjustment mechanism is to be applied only at a rate of 25% from the early 2030s onwards in the baseline scenario. This implies that pensions and GDP do not grow at a similar pace anymore afterwards, and the deviation from the baseline scenario becomes more and more visible.

Finally, three policy scenarios assess the impact of political decisions on pension expenditure.

A significant downward revision with respect to the baseline scenario is observed when a direct linking of the retirement age to increases in life expectancy is foreseen. Here, a gradual increase of the early and statutory retirement ages in line with assumed changes to the CSM exit ages has been implemented, causing people to stay longer in the labour market and pensions to be paid over a shorter period.

This yields a considerable reduction of pension expenditure. In addition, a slightly more pronounced growth of GDP, resulting from assumed increases in employment growth, induces a supplementary minor denominator effect.

Current legislation does not include an increase of early and statutory retirement ages. Projected increases in average labour market exit ages are driven by incentives to work longer introduced by the 2012 pension reform and by increases of past average entry ages to the pension scheme leading to fewer pensioners aged 57-59, as discussed prior to Table 13. Thus, the unchanged retirement age scenario is the same as the baseline scenario.

The political measures that are assumed to offset the decline in the benefit ratio focus on pension indexation, more specifically on the readjustment mechanism. Indeed, while a constant 25% of the indexation to real wage growth is applied in the baseline scenario from the early 2030s onwards, this quota is adapted at an annual pace once the benefit ratio has fallen by 10% with respect to the base year, which is projected to happen in 2042. From then on, the moderator coefficient of the readjustment mechanism is set to the precise annual value ensuring that the benefit ratio of all pensions remains constant for the remainder of the projection. By design, these adjustments increase pension expenditure in the second half of the projection interval.
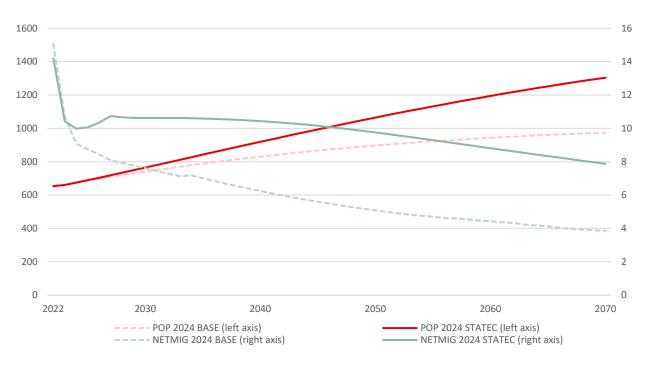
4.6.2   An additional macroeconomic scenario by STATEC

As discussed in Section 3.1, the new EUROPOP 2022 population projections by EUROSTAT that provide the basis for the macroeconomic scenario used for the current projection exercise account for an upward revision of the projected population for Luxembourg with respect to the previous exercise. Still, net migration is projected to drop by about 33% in the first projection year and further decrease afterwards.

In Luxembourg, relative economic attractiveness with respect to other European countries has proven to be the main determinant of migration. However, the EUROSTAT projection model does not take into account any macroeconomic effects on migration, which implies that its demographic projection for Luxembourg is not linked to the projected economic growth.
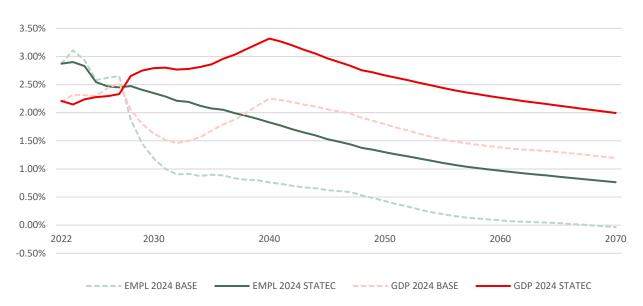
In this context, STATEC, Luxembourg's national statistical institute, has agreed to provide an additional macroeconomic scenario based on population projections that rely on the bidirectional relation between GDP and population. More precisely, long-term migration flows are driven by Luxembourg's attractiveness with respect to its neighbouring countries, which is deduced from the respective long-term GDP assumptions. This yields employment growth trajectories that contrast those given in the baseline scenario. In terms of productivity, the STATEC scenario applies the exact assumptions from the baseline scenario.

Graph 7 depicts the projected evolution of net migration and the resulting population. Migration, as projected by STATEC, is influenced by the net income differential between Luxembourg and its neighbouring countries, which in turn is driven by GDP per employee developments. Therefore, it evolves at a considerably higher level when compared to the baseline. Still, in line with the convergence assumption, a continuous decrease is projected by STATEC from the late 2020s until the end of the projection, when 8 000 net immigrants are reported. It is clear that these developments directly affect population growth. In fact, according to the STATEC projections, population will cross the 1 000 000 mark in the late 2040s, before eventually reaching about 1 300 000 residents in 2070.

Graph 7 – Evolution of projected population and net migration (in 1000)

In line with the recent observations on the share of cross-border workers in net job creation presented in Section 3.2, the relative proportion of cross-border workers in national employment is projected to exceed 50% in the long term, attaining 55% in 2070. It follows that the discrepancy between the baseline and STATEC scenarios at the population level is further increased for employment. As a result, an average 1.0 pp. difference in employment growth is reported from 2028 onwards, as STATEC projections yield a more progressive decrease of employment growth. Naturally, the same holds for GDP growth since the productivity assumptions coincide.

Graph 8 – Evolution of projected employment growth and real GDP growth

Now, the evolution of pension expenditure in terms of GDP is just a corollary of the above. Differences in economic growth are rather moderate in the beginning of the projection period, causing only a small increase of pension expenditure in absolute figures towards the end of the projection. Hence, the denominator effect induced by the higher economic growth is predominant. It follows that the divergence between the STATEC and baseline scenarios is steadily increasing. At the end of the projection interval, pension expenditure reaches 12.8% of GDP in the STATEC scenario, which is equivalent to a difference of 4.6 pp. of GDP with respect to the baseline.
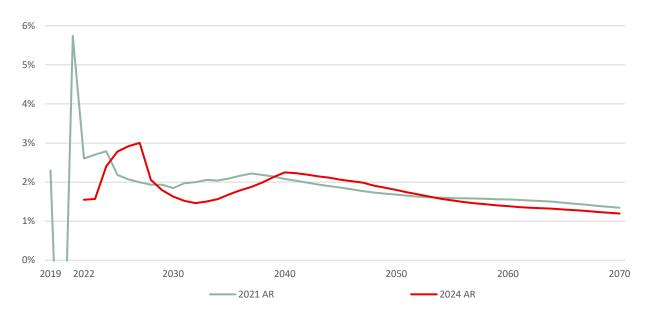
Table 20 - Public pension expenditure in the baseline and STATEC scenarios (% of GDP)

	2022	*2030*	*2040*	*2050*	*2060*	*2070*
2024 BASE	9.2	9.7	11.2	12.5	15.0	17.5
2024 STATEC	9.2	9.5	9.7	10.0	11.1	12.8
Difference (pp. of GDP)	0.0	-0.3	-1.5	-2.5	-3.8	-4.6

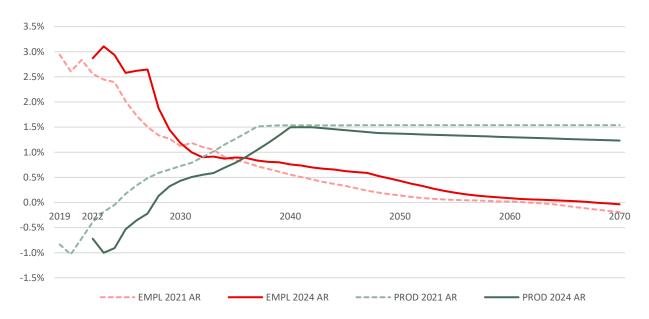## 4.7 CHANGES IN COMPARISON WITH PREVIOUS AGEING REPORT PROJECTIONS

Towards a detailed analysis of the differences in pension expenditure as share of GDP between the 2021 and 2024 projection exercises, it is advisable to have a closer look at the projected GDP growth rates and identify potential changes due to a denominator effect. Graph 9 compares the respective trajectories throughout the projection interval, leaving aside the outlier at -5.8% in first projection year of the previous vintage caused by the pandemic for increased legibility.

Graph 9 – Evolution of projected GDP growth

Since it is assumed that the average employment growth of cross-border workers in the national labour market remains unchanged (see Section 3.2), the upward revision of resident employment growth rates resulting from the more dynamic population projections carries over to total employment growth. Indeed, as can be seen in Graph 10, current employment growth rates are above their 2021 counterparts except for a brief 4-year period in the early 2030s.

In the first half of the projection, productivity growth follows a similar path than in the 2021 exercise in the sense that it still converges to 1.5%, albeit delayed by 3 years, as base year values in 2019 and 2022 stay at a comparably low level. The most notable change on the productivity side is observable in the second half of the projection. Due to a downward revision from 1.0% to 0.8% of the long-term TFP growth assumption, productivity growth evolves below the 2021 figures towards the end of the projection interval. Indeed, whereas it remained constant at 1.5% for over 30 years in the former projections, it now decreases from 1.5% in 2040 to just above 1.2% in 2070.

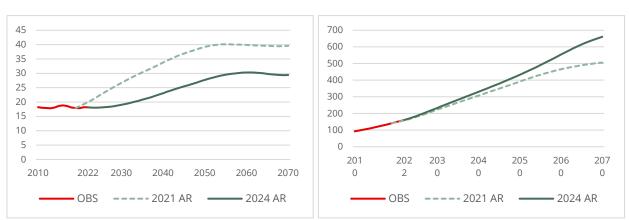**Graph 10 – Evolution of projected productivity and employment growth**

Overall, it follows that the small differences in projected economic growth emerge from the interplay between the lower productivity growth and higher employment growth assumptions. The latter are predominant where current GDP growth evolves above the 2021 level and the former are prevalent elsewhere. On average, economic growth amounts to 1.8% in both exercises.

Still, the changes to the macroeconomic assumptions induce a significant downward revision of the expenditure to GDP ratio. This is mostly due to a denominator effect originating in modified inflation and GDP deflator assumptions (the average growth rates in the first 10 projection years increase by 1.0 pp. and 1.8 pp., respectively), which is complemented by a numerator effect coming from the lower TFP convergence that translates to the readjustment mechanism. Towards the end of the projection, the higher growth in the number of pensions with respect to the 2021 vintage, which originates in the higher employment growth assumptions until 2030s, counterbalances the above effect. In particular, it causes the increase, which amplifies over time for the most part of the projection, to stagnate in the last decade.

Table 21 – Breakdown of the difference between the 2021 and the new public pension projection (% of GDP)

	2022	*2030*	*2040*	*2050*	*2060*	*2070*
2021 AR	10.0	11.4	13.0	14.8	16.7	18.0
Improvement in the coverage/modelling (pp of GDP)	0.0	-0.3	-0.4	-0.3	0.5	1.7
Change in assumptions (pp of GDP)	-0.8	-1.3	-1.4	-2.0	-2.2	-2.2
Change in the interpretation of constant policy (pp of GDP)	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
2024 AR	9.2	9.7	11.2	12.5	15.0	17.5

Improvements in the projection model explain the remainder of the observed differences. On the one hand, assumptions on disability probabilities and the probabilities of having a surviving spouse or orphan have been adapted to ensure a smoother transition from observed data to projected figures, as both disability and survivor pensioners were overestimated in the 2021 projection exercise. This yields a lower pension expenditure until the 2050s. On the other hand, the projected number of old-age pensioners has been revised upwards with respect to the previous exercise in a more significant way than what could be explained by changes in the assumption of employment growth. As Graph 11 shows, this change becomes more and more apparent towards the end of the projection.

Graph 11 – Evolution of the number of pensions (1000) - DISABILITY (left) and OLD-AGE (right)

Indeed, in contrast with the 2021 projection exercise, the model now explicitly includes the inactive population (i.e. insured people that had been active in the past, but not in the base year). This enabled a revision of the methodology in relation with insurance periods spent abroad along with a refinement of the evolution of insurance careers. Instead of fading out exogenously, periods of work not accumulated in Luxembourg are now simulated endogenously as a residual by replicating the retirement behaviour of the base year. This generates a significant number of new pensioners with incomplete careers in Luxembourg throughout the projection, of which the majority retires at age 65.

In addition, a progressive revision of the distribution of new entrants to the active population has been implemented. While still entering the labour market at progressively younger ages throughout the projection, they now enter at higher ages than in the 2021 vintage, thus taking into account the changes in the modelling of insurance periods spent abroad. This implies a shorter time spent in the LU labour market, which drives the number of new pensioners further upwards in comparison with the former projections.

As a result, pension expenditure increases with respect to the former exercise towards the end of the projection, as the effect of the higher number of old-age pensioners becomes more and more dominant when compared with the aforementioned reduction of the number of disability and survivor pensioners.

Another change in the methodology of the model concerns the interpretation of the definition of accrual rate as represented in Table 15. Here, an increase is observable when comparing with the previous exercise. While only the earnings-related part has been considered in the latter projection, the new figures take into account the entire pension when dividing by the total contributory income.

Finally, a small proportion of the observed difference between the last and current projection exercises can be attributed to a change in the interpretation of the constant policy assumption. As explained in Section 2.3, there is a delay of 3 years between the observation that the contributions of the general pension scheme are insufficient to cover its current expenditure and the implementation of the modulated readjustment mechanism. The introduction of this delay, which was not included in the 2021 projections, increases pension expenditure by less than 0.05 percentage points of GDP.

Further extending the retrospective analysis, Table 22 compares former projection exercises going back to the 2006 vintage with the current set using the reduced decomposition of the increase of public pension expenditure as share of GDP into the dependency and benefit ratio effects[3]. It becomes apparent that the main driver behind reported expenditure increases is the change in the dependency ratio.

Table 22 – Overall change in public pension expenditure to GDP under consecutive projection exercises

	pp. change*	dependency ratio	benefit ratio	residual
2006 Ageing Report (2004-2050)	7.7	5.6	1.8	0.2
2009 Ageing Report (2007-2060)	13.5	11.1	1.9	0.5
2012 Ageing Report (2010-2060)	8.8	9.7	-0.8	-0.1
2015 Ageing Report (2013-2060)	4.0	3.6	0.3	0.1
2018 Ageing Report (2016-2070)	8.9	9.2	-0.1	-0.1
2021 Ageing Report (2019-2070)	8.7	11.7	-1.3	-1.7
2024 Ageing Report (2022-2070)	8.3	13.0	-2.0	-2.8

* The projection horizon has been extended over consecutive Ageing Reports, limiting comparability over time.

A closer look at the variations in the macroeconomic assumptions between the different exercises reveals that they are subject to a certain amount of fluctuations. For example, average economic growth rates evolved from 2.0% in the 2012 exercise up to 2.6% in 2015, then back down to about 2.3% in 2018 and now 1.8% in the former and current projections.

The underlying productivity assumptions have been roughly comparable between exercises until and including the 2021 projections, as TFP growth was always assumed to converge to 1.0%. This implies that the reported changes in GDP growth until the last exercise are induced by respective revisions of the assumed employment growth rates. The latter, in turn, are directly affected by changes in population growth. Hence, the variations of pension expenditure as share of GDP induced by the dependency ratio component can be entirely explained by fluctuations between the different population projections provided by EUROSTAT.

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[3] The dependency ratio is expressed as the quotient of the number of pensioners divided by the number of contributors, and the benefit ratio as the quotient consisting of pension expenditure divided by the number of pensioners as the numerator and GDP divided by the number of contributors as the denominator.

The dependency ratio effect further increases in the new projections. At first, this seems a little counterintuitive, since employment growth has been revised upwards in the 2024 vintage, as has been discussed in Section 3.2, and the resulting denominator effect should decrease the benefit ratio. However, the numerator is affected to a higher extent by the significant increase in the number of pensioners reported above.

In the 2006 and 2009 projection exercises, a positive benefit ratio effect further amplifies the increase in public pension expenditure, because contributory careers of people eligible for pension benefits become more and more complete throughout the respective projections. This phenomenon remains observable in recent projections, until and including the 2021 vintage. However, in projections from 2012 onwards, its effect is counterbalanced by the semi-automatic modulation of the readjustment mechanism (with moderator coefficients of 0.5 in the 2012, 2015, and 2018 projections, and 0.25 in the 2021 and 2024 exercises) and the annually decreasing accrual rate introduced in the 2012 pension reform.

Despite the fact that the moderator coefficient stays the same for the current projection, the attenuating effect of the benefit ratio further increases. This is, again, a corollary of the aforementioned changes in the model. The sustained high number of new pensioners with incomplete careers in Luxembourg retiring at age 65 causes the average contributory career to remain roughly constant at a rather low level. In turn, this means that the average pension benefit is lower than in previous projection exercises.

5 DESCRIPTION OF THE PENSION PROJECTION MODEL AND ITS BASE DATA

5.1 INSTITUTIONAL CONTEXT

The General Inspectorate of Social Security performs its demographic and financial projections associated with the pension schemes in Luxembourg using a customized version of the generic pension-modelling tool designed by the International Labour Organization (ILO). To take account of the particularities of the national labour market with its high proportion of cross-border workers, the modelling tool has been adapted to include dimensions such as residency status and employment status (beyond the general breakdown by age, sex, and benefit type).

As explained in Section 2.1.1, the funding of the general pension scheme is based on a system of division into ten-year coverage periods. Article 238 of the Code of Social Security stipulates that the global contribution rate be fixed for each coverage period based on a technical report and accompanying actuarial projections established by the IGSS. Moreover, an actualisation of the report and the forecasts is provided in the middle of each coverage period, which is then utilised to estimate if the current contribution rate is still adequate. In this context, the tool is used by the IGSS to ensure a regular evaluation of the financial situation of the general pension scheme.

The latest vintage of these national projections has been published in May 2022[4]. Given the legal context, their scope is limited to the general pension scheme, which explains the lower figures for income and expenditure compared to the AWG projections.

5.2 DATA USED TO RUN THE MODEL

Projections are based on individual register data available in the data warehouse at the IGSS. Based on the compulsory membership of people to the national social protection system, individual administrative data is available in common operational files of the national social security institutions. Administrative data associated with the active population is based on monthly income declarations, while administrative data of pensioners relies on monthly benefits paid out by the institutions.

5.3 REFORMS INCORPORATED IN THE MODEL

No new reforms have been enacted since the last projection exercise.

The 2012 pension reform is fully incorporated in the model. In particular, the annual pension formula parameters presented in Section 2.1.1 are included as well as the semi-automatic readjustment mechanism, whose precise interpretation is discussed in Section 2.3.

5.4 GENERAL DESCRIPTION OF THE MODEL

The national pension model used for providing actuarial projections of future income and expenditure of the general and special pension schemes is a standard deterministic cohort-based pension projection model. It is a fully customized version of the ILO generic pension-modelling tool and it closely complies with the social insurance legislation in Luxembourg and captures national pension particularities. At the same time, it is completely aligned with the demographic and macroeconomic framework used in the AWG projections exercise

The model includes two components. A demographic component projects the number of contributors and pensioners, and a financial component deduces income and expenditure of the pension systems.

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[4] https://igss.gouvernement.lu/de/publications/bilans_pension/bilan-pensions-2022.html

The model is based on macrosimulation techniques. Each status of a scheme member (active, inactive, pensioner) is explicitly modelled, and associated financial variables (salaries/revenues, pensions, etc.) are projected year by year. Age and career length specific earning profiles are used to compute total economic wage levels. Earning profiles are kept constant over the projection period. AWG labour productivity assumptions are applied to model real wage growth.

Furthermore, the model relies on standard actuarial mathematics for social security schemes and on actuarially assumed transition probabilities (mortality rates, disability rates, retirement rates, etc.) which are used to map the transition of scheme member (active, inactive, pensioner) from a given year onto next year.

The development of the active insured population is linked to the evolution of the national employment, including resident and cross-border workers. Associated assumptions are fully in line with the demographic and macroeconomic assumptions agreed by the AWG.

The active insured population as well as all pensioners are disaggregated into different population groupings depending on gender (males/females), employment category (public/private), and residency (residents/non-residents).

The model is written in the LIAM2 microsimulation-developing environment. As a declarative programming tool, LIAM2 offers a clean and simple structure that allows developers to construct complex yet easily understandable models.

In terms of structure, the model incorporates input files that regroup all exogenous data needed to run the model. Common demographic, macroeconomic, and pension-scheme-related assumptions are stored by projection year. For each population grouping, separate input files contain all relevant information for the base year, such as distributions of average insurable earnings, past contributory income, transition rates, etc.

After an initialization step, where input files are read and all base year tables are being established, the model proceeds with a year-by-year projection of the relevant demographic and financial variables. In the end of every projection step, the main results are written to specific output tables. At an aggregate level, the total number of contributors and the corresponding amount of contributions are provided as well as the total number of pensioners and the associated amount of pension benefits. Additional result files provide a disaggregation of the above output results at a detailed level by population grouping (according to gender, residency, and scheme membership), age, and types of pension benefits.

5.5 OTHER FEATURES OF THE MODEL

Given the significant share of cross-border workers with incomplete careers in the national labour market, the minimum eligibility requirements associated with the length of insurance career cannot be applied consistently due to a lack of information on the proportion of insurance periods spent abroad. As a result, partial careers abroad are simulated endogenously as a residual by replicating the retirement behaviour of the base year. This is realized using the average amount of years of membership in a foreign pension scheme, which is communicated when submitting the application form.
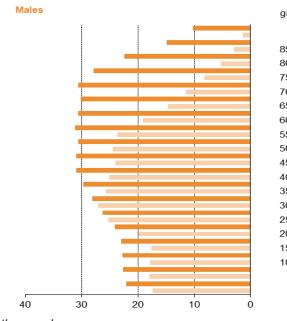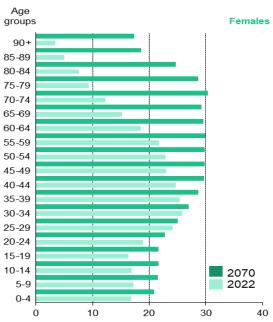
6 ANNEX: REPORTING TABLES

Table 1   **Qualifying conditions for retirement**

			2022	2030	2040	2050	2060	2070
Qualifying condition for retiring *with* a full pension		Statutory retirement age - men	65	65	65	65	65	65
		Statutory retirement age - women	65	65	65	65	65	65
	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	57	57	57	57	57	57
		Early retirement age - women	57	57	57	57	57	57
		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	-	-	-	-	-	-

Table 2   **Main demographic variables**

	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2022-2070
Population (thousand)	654	745	835	900	945	976	976	2070	322
Population growth rate	2.2%	1.4%	0.9%	0.6%	0.4%	0.2%	2.3%	2023	-1.9%
Old-age dependency ratio (pop 65+ / pop 20-64)	23.1	27.2	33.4	39.5	48.0	55.4	55.4	2070	32.3
Old-age dependency ratio (pop 75+ / pop 20-74)	9.2	10.3	13.8	17.4	20.8	26.0	26.0	2070	16.8
Ageing of the aged (pop 80+ / pop 65+)	26.6	25.3	27.9	33.5	34.3	37.9	37.9	2070	11.4
Men - Life expectancy at birth	80.7	81.6	83.1	84.5	85.7	86.9	86.9	2070	6.2
Women - Life expectancy at birth	85.0	86.0	87.4	88.6	89.8	90.8	90.8	2070	5.8
Men - Life expectancy at 65	19.4	20.2	21.1	22.1	23.0	23.9	23.9	2070	4.5
Women - Life expectancy at 65	22.5	23.3	24.3	25.3	26.2	27.1	27.1	2070	4.6
Men - Survivor rate at 65+	89.2	90.1	91.6	92.8	93.8	94.7	94.7	2070	5.5
Women - Survivor rate at 65+	93.7	94.2	95.0	95.8	96.4	96.9	96.9	2070	3.2
Men - Survivor rate at 80+	62.4	65.7	70.1	74.0	77.4	80.4	80.4	2070	18.0
Women - Survivor rate at 80+	75.8	78.1	81.4	84.1	86.5	88.6	88.6	2070	12.8
Net migration (thousand)	15.0	7.6	6.2	5.1	4.4	3.9	15.0	2022	-11.2
Net migration (% population previous year)	2.4%	1.0%	0.8%	0.6%	0.5%	0.4%	2.4%	2022	-2.0%

Graph 1 – Population by age groups, 2022 and 2070

Table 3 — Participation rate, employment rate and share of workers

	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2022-2070
Labour force participation rate 20-64	77.6	78.8	78.9	77.8	77.7	78.4	79.0	2037	0.8
Employment rate of workers aged 20-64	74.5	74.9	74.9	73.9	73.8	74.5	75.0	2037	0.0
Share of workers aged 20-64 in the labour force 20-64	96.0	95.1	95.0	95.0	95.0	95.0	96.0	2022	-1.0
Labour force participation rate 20-74	69.4	68.9	67.9	66.2	64.2	64.3	69.9	2024	-5.1
Employment rate of workers aged 20-74	66.6	65.5	64.5	62.9	61.0	61.1	66.8	2023	-5.5
Share of workers aged 20-74 in the labour force 20-74	95.9	95.0	95.0	95.0	95.0	95.0	95.9	2022	-1.0
Labour force participation rate 55-64	48.4	48.5	50.5	51.7	51.4	53.3	53.3	2070	4.9
Employment rate of workers aged 55-64	46.3	45.9	47.7	48.9	48.5	50.2	50.2	2070	4.0
Share of workers aged 55-64 in the labour force 55-64	95.6	94.5	94.4	94.5	94.3	94.3	95.6	2022	-1.3
Labour force participation rate 65-74	5.6	4.3	4.0	4.2	4.3	4.3	5.6	2022	-1.3
Employment rate of workers aged 65-74	5.3	4.0	3.7	3.9	4.0	4.0	5.3	2022	-1.2
Share of workers aged 65-74 in the labour force 65-74	94.0	92.4	92.7	92.9	93.0	93.1	94.2	2023	-0.9
Median age of the labour force	39.0	39.0	40.0	41.0	41.0	41.0	41.0	2041	2.0

TABLE 4   **Labour market effective behaviour**

TOTAL	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2022-2070
Average effective retirement age*	60.8	61.2	61.2	61.3	61.4	61.3	61.4	2064	0.5
Average labour market exit age (CSM)**	60.7	60.8	61.0	61.2	61.3	61.5	61.5	2070	0.8
Contributory period	25.2	24.3	24.6	24.6	25.3	25.5	25.5	2070	0.3
Duration of retirement***	25.3	25.2	26.3	27.3	28.2	28.7	29.0	2068	3.4
Duration of retirement/contributory period	100%	104%	107%	111%	112%	113%	114%	2068	12%
Percentage of adult life spent in retirement****	39%	38%	39%	40%	41%	41%	41%	2068	2%
Early/late exit*****	3.9	4.3	4.0	4.0	3.3	4.1	5.3	2025	0.1

MEN	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2022-2070
Average effective retirement age*	60.7								
Average labour market exit age (CSM)**	60.6	60.7	61.0	61.2	61.3	61.5	61.5	2070	1.0
Contributory period	24.7	23.6	24.1	24.3	25.2	25.6	25.6	2070	0.9
Duration of retirement***	21.8	23.5	24.5	25.6	26.5	26.6	27.3	2068	4.8
Duration of retirement/contributory period	88%	99%	102%	105%	105%	104%	107%	2068	16%
Percentage of adult life spent in retirement****	34%	37%	37%	38%	39%	39%	40%	2068	5%
Early/late exit*****	3.3	3.7	3.5	3.5	3.0	3.6	5.0	2026	0.3

WOMEN	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2022-2070
Average effective retirement age*	61.1								
Average labour market exit age (CSM)**	60.9	61.0	61.0	61.1	61.3	61.5	61.5	2070	0.6
Contributory period	26.0	25.4	25.5	25.1	25.3	25.3	26.0	2022	-0.7
Duration of retirement***	28.8	26.9	28.0	29.0	29.9	30.8	30.8	2070	2.0
Duration of retirement/contributory period	111%	106%	110%	115%	118%	122%	122%	2068	11%
Percentage of adult life spent in retirement****	43%	40%	41%	41%	42%	43%	43%	2022	-1%
Early/late exit*****	4.6	4.9	4.5	4.5	3.6	4.5	6.4	2025	0.0

*The 'average effective retirement age' is the age at which people start receiving a pension benefit (old-age, early or disability). It is calculated on the basis of the administrative data on new pensioners for 2022, showing projected data for the other years for the total. ** 'Average labour market exit age (Cohort Simulation Model)' refers to 2023 instead of 2022. *** 'Duration of retirement' is the remaining life expectancy at the average labour market exit age. **** 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 exit the labour market before reaching the statutory retirement age and those who exit at or beyond the statutory retirement age. For 2022, the value refers to 2023.*

TABLE 5   **Eurostat (ESSPROS) and AWG definition of pension expenditure (% GDP)**

	2013	2014	2015	2016	2017	2018	2019	2020	2021	change 2013- last available year
Eurostat total pension expenditure	9.2	9.2	9.2	9.2	9.5	9.5	9.7	10.1	9.6	0.4
Eurostat public pension expenditure (A)	9.2	9.2	9.2	9.2	9.5	9.5	9.7	10.1	:	0.9
Public pension expenditure (AWG: outcome) (B)	8.7	8.7	8.8	8.8	9.0	9.2	9.3	9.7	9.2	0.5
Difference Eurostat/AWG: (A)-(B)	0.5	0.5	0.4	0.4	0.5	0.3	0.4	0.4	:	-0.1

TABLE 6		Projected gross and net pension spending and contributions (% of GDP)							
	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2022-2070
Expenditure									
Gross public pension expenditure	**9.2**	**9.7**	**11.2**	**12.5**	**15.0**	**17.5**	**17.5**	**2070**	**8.3**
Private occupational pensions	:	:	:	:	:	:	0.0	2022	:
Private individual mandatory pensions	:	:	:	:	:	:	:	:	:
Private individual non-mandatory pensions	:	:	:	:	:	:	:	:	:
Gross total pension expenditure	9.2	9.7	11.2	12.5	15.0	17.5	17.5	2070	8.3
Net public pension expenditure*	7.6	8.1	9.3	10.4	12.4	14.5	14.5	2070	6.8
Net total pension expenditure*	7.6	8.1	9.3	10.4	12.4	14.5	14.5	2070	6.8
Contributions									
Public pension contributions	9.8	9.2	9.3	9.4	9.4	9.4	9.8	2022	-0.4
Total pension contributions	9.8	9.2	9.3	9.4	9.4	9.4	9.8	2022	-0.4
Balance of the public pension system (%GDP)**	0.6%	-0.6%	-1.9%	-3.1%	-5.6%	-8.0%	-8.0%	2070	-8.6%

*Net pension expenditure excludes taxes on pensions and compulsory social security contributions paid by beneficiaries. **Public pension contributions - gross public pension expenditure (peak value/year shows most negative value).*

TABLE 7		Projected gross public pension spending by scheme (% of GDP)							
	2022	2030	2040	2050	2060	2070	peak value	peak year	change 2022-2070
Total public pensions	9.2	9.7	11.2	12.5	15.0	17.5	17.5	2070	8.3
Old-age and early pensions	7.2	7.9	9.3	10.5	12.9	15.3	15.3	2070	8.1
Flat component	:	:	:	:	:	:	:	:	:
Earnings-related	7.2	7.9	9.3	10.5	12.9	15.3	15.3	2070	8.1
Minimum pensions (non-contributory)	:	:	:	:	:	:	:	:	:
Disability pensions	0.6	0.6	0.7	0.7	0.8	0.8	0.8	2061	0.2
Survivor pensions	1.4	1.2	1.2	1.3	1.3	1.4	1.4	2022	0.0
Other pensions	:	:	:	:	:	:	:	:	:

TABLE 8	Factors behind the change in public pension expenditures between 2022 and 2070 (in percentage points of GDP) - pensioners					
	2022-30	2030-40	2040-50	2050-60	2060-70	2022-70
Public pensions to GDP	0.6	1.5	1.3	2.4	2.5	8.3
Dependency ratio effect	1.8	2.2	2.0	2.7	2.3	11.0
Coverage ratio effect*	0.3	0.3	0.4	0.4	0.4	1.9
Coverage ratio old-age	0.6	0.9	0.7	0.6	1.0	3.8
Coverage ratio early-age	1.4	-0.6	0.4	2.6	-0.1	3.8
Cohort effect	-1.6	-1.3	-0.8	-2.6	-2.4	-8.8
Benefit ratio effect	-1.3	-0.9	-1.2	-0.6	-0.1	-4.2
Labour market effect	0.0	0.0	0.2	0.0	-0.1	0.0
Employment ratio effect	-0.1	0.0	0.2	0.0	-0.1	0.0
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.1
Career shift effect	0.0	0.0	0.0	0.0	0.0	0.0
Residual	-0.2	-0.1	-0.1	0.0	0.0	-0.4

* Subcomponents of the coverage ratio effect do not add up necessarily.

TABLE 9	Replacement rate at retirement (RR), benefit ratio (BR) and coverage by pension scheme (in %)						
	2022	2030	2040	2050	2060	2070	change 2022-2070 (pps)
Public scheme (BR)	52%	53%	48%	44%	43%	42%	-10%
Coverage	100%	100%	100%	100%	100%	100%	0%
Public scheme: old-age earnings related (BR)	58%	56%	50%	45%	44%	44%	-14%
Public scheme: old-age earnings related (RR)	51%	47%	46%	45%	46%	47%	-4%
Coverage	71%	76%	80%	81%	83%	85%	14%
Private occupational scheme (BR)	:	:	:	:	:	:	:
Private occupational scheme (RR)	:	:	:	:	:	:	:
Coverage	:	:	:	:	:	:	:
Private individual schemes (BR)	:	:	:	:	:	:	:
Private individual schemes (RR)	:	:	:	:	:	:	:
Coverage	:	:	:	:	:	:	:
Total benefit ratio	52%	53%	48%	44%	43%	42%	-10%
Total replacement rate (earnings-related benefits)	49%	46%	44%	43%	44%	44%	-5%

Coverage of each pension scheme is calculated as a ratio of the number of pensioners within the scheme and the total number of pensioners in the country. In case data on pensioners are not available, the calculation is based on the number of pensions.

TABLE 10	System dependency ratio and old-age dependency ratio						
	2022	2030	2040	2050	2060	2070	change 2022-2070
Number of pensioners (thousand) (I)	227	306	415	532	666	780	552
Employment (thousand) (II)	319	355	383	396	395	393	74
Pension system dependency ratio (SDR) (I)/(II)	0.7	0.9	1.1	1.3	1.7	2.0	1.3
Number of people aged 65+ (thousand) (III)	97	126	167	206	250	285	188
Working-age population 20-64 (thousand) (IV)	419	465	501	523	522	514	95
Old-age dependency ratio (OADR) (III)/(IV)	0.2	0.3	0.3	0.4	0.5	0.6	0.3
System efficiency (SDR/OADR)	3.1	3.2	3.2	3.4	3.5	3.6	0.5

TABLE 11	Public pensioners to (inactive) population by age group (%)					
pensioners / inactive population	2022	2030	2040	2050	2060	2070
Age group -54	6.3	6.5	6.7	7.1	6.7	6.6
Age group 55-59	86.5	80.3	73.8	74.1	88.9	88.5
Age group 60-64	137.0	162.3	167.3	176.6	208.3	220.9
Age group 65-69	179.6	192.2	211.0	212.9	225.7	254.7
Age group 70-74	179.1	170.7	199.2	202.7	209.2	234.1
Age group 75+	171.1	187.0	197.2	216.6	226.4	232.0
pensioners / total population	2022	2030	2040	2050	2060	2070
Age group -54	2.4	2.4	2.5	2.7	2.6	2.6
Age group 55-59	28.9	25.7	22.9	22.5	26.2	25.3
Age group 60-64	100.9	116.6	117.3	119.8	139.3	143.9
Age group 65-69	167.2	179.5	197.6	199.3	210.6	236.9
Age group 70-74	171.9	168.3	196.1	199.6	205.7	230.1
Age group 75+	171.1	187.0	197.2	216.6	226.4	232.0

TABLE 12 — **Female public pensioners to (inactive) population by age group (%)**

female pensioners / inactive population	2022	2030	2040	2050	2060	2070
Age group -54	7.2	7.5	8.0	8.5	8.0	7.7
Age group 55-59	64.3	79.1	70.5	74.6	86.9	83.6
Age group 60-64	108.1	132.8	138.5	144.2	171.2	181.1
Age group 65-69	151.2	156.7	175.6	177.9	194.9	224.5
Age group 70-74	150.2	149.2	173.2	174.3	181.9	207.4
Age group 75+	160.5	179.0	189.5	208.7	219.7	226.0
female pensioners / total population	2022	2030	2040	2050	2060	2070
Age group -54	2.9	2.8	3.0	3.2	3.1	3.0
Age group 55-59	27.7	24.7	20.7	20.3	23.5	22.2
Age group 60-64	86.2	101.2	100.4	100.9	117.7	121.3
Age group 65-69	141.8	149.0	165.4	167.1	181.8	208.2
Age group 70-74	148.9	147.8	171.0	171.9	179.0	203.8
Age group 75+	160.5	179.0	189.5	208.7	219.7	226.0

TABLE 13 — **Breakdown of new public pension expenditure (old-age and early earnings-related pensions)**

TOTAL	2022	2030	2040	2050	2060	2070
Projected new pension expenditure (million EUR)*	365	537	800	1369	2440	3142
I. Number of new pensions (1000)	10.7	14.9	16.9	21.1	26.2	24.1
II. Average contributory period (years)	25.2	24.3	24.6	24.6	25.3	25.5
III. Average accrual rate (%)	2.3%	2.1%	2.0%	1.9%	1.9%	1.9%
IV. Monthly average pensionable earnings (1000 EUR)	4.9	5.8	8.1	11.5	16.1	22.3
V. Sustainability/adjustment factors	1.0	1.0	1.0	1.0	1.0	1.0
VI. Average number of months paid the first year	12.0	12.0	12.0	12.0	12.0	12.0
Monthly average pensionable earnings / monthly economy-wide average wage	1.0	1.0	1.0	1.0	1.0	1.0
MEN	2022	2030	2040	2050	2060	2070
Projected new pension expenditure (million EUR)*	233	346	504	870	1531	1958
I. Number of new pensions (1000)	6.6	9.3	10.5	12.9	15.6	14.2
II. Average contributory period (years)	24.7	23.6	24.1	24.3	25.2	25.6
III. Average accrual rate (%)	2.2%	2.1%	1.9%	1.9%	1.9%	1.9%
IV. Monthly average pensionable earnings (1000 EUR)	5.3	6.2	8.6	12.3	17.3	24.0
V. Sustainability/adjustment factors	1.0	1.0	1.0	1.0	1.0	1.0
VI. Average number of months paid the first year	12.0	12.0	12.0	12.0	12.0	12.0
Monthly average pensionable earnings / monthly economy-wide average wage	1.0	1.1	1.1	1.1	1.1	1.1
WOMEN	2022	2030	2040	2050	2060	2070
Projected new pension expenditure (million EUR)*	125	191	296	499	908	1184
I. Number of new pensions (1000)	4.1	5.5	6.4	8.2	10.5	9.9
II. Average contributory period (years)	26.0	25.4	25.5	25.1	25.3	25.3
III. Average accrual rate (%)	2.4%	2.2%	2.0%	2.0%	2.0%	2.0%
IV. Monthly average pensionable earnings (1000 EUR)	4.1	5.1	7.3	10.3	14.4	20.0
V. Sustainability/adjustment factors	1.0	1.0	1.0	1.0	1.0	1.0
VI. Average number of months paid the first year	12.0	12.0	12.0	12.0	12.0	12.0
Monthly average pensionable earnings / monthly economy-wide average wage	0.8	0.9	0.9	0.9	0.9	0.9

*New pension expenditure equals the product of I, II, III, IV, V & VI.

TABLE 14 — **Financing of the public pension system**

	Public employees	Private employees	Self-employed
Contribution base			
Contribution rate			
Employer		8%	16%
Employee	8%	8%	
*State**	(16%)	8%	8%
*Other revenues**		Buffer fund of at least 1.5 times the amount of annual benefits	Buffer fund of at least 1.5 times the amount of annual benefits
Maximum contribution	no	5 times SMW	5 times SMW
Minimum contribution	SMW	SMW	SMW

Includes only legislated contributions.

TABLE 15 — **Revenue from contribution and number of contributors in the public scheme**

	2022	2030	2040	2050	2060	2070	change 2022-2070 (pps)
Public pension contributions (%GDP)	9.8	9.2	9.3	9.4	9.4	9.4	-0.4
Employer contributions	3.3	3.1	3.1	3.1	3.1	3.1	-0.1
Employee contributions	3.3	3.1	3.1	3.1	3.1	3.1	-0.1
*State contribution**	3.3	3.1	3.1	3.1	3.1	3.1	-0.1
*Other revenues**	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Number of contributors (I) (1000)	525	630	686	729	744	745	220
Employment (II) (1000)	319	355	383	396	395	393	74
(I) / (II)	1.6	1.8	1.8	1.8	1.9	1.9	0.3

Includes only legislated contributions.

TABLE 16 — **Public pension assets and reserves (% GDP) and return on assets (%)**

	average 2012-2021	2022	2030	2040	2050	2060	2070	average 2022-2070
Stock of assets (end-of-year; %GDP)	32.1	31.4	27.2	14.6	0.0	0.0	0.0	13.0
Fund balance (million EUR)		0.6	0.6	-1.9	-7.8	-20.8	-41.1	
Fund expenditure		6.1	9.9	17.1	29.3	51.2	83.5	
Disbursements (to pension scheme)		5.6	9.3	16.1	27.5	48.2	78.6	
Other expenditure (incl. admin. costs)		0.5	0.6	1.0	1.7	3.0	4.9	
Fund revenues		6.7	10.5	15.2	21.4	30.4	42.4	
Return on assets		0.4	1.0	0.9	0.0	0.0	0.0	
Other income (incl. pension contrib.)		6.7	9.5	14.2	21.4	30.4	42.4	
Nominal rate of return	0.2%	1.8%	3.2%	3.6%	3.9%	4.0%	4.0%	3.6%
Change in asset valuation (million EUR)		-3.6	0.0	0.0	0.0	0.0	0.0	

TABLE 17 — **PENSION EXPENDITURE PROJECTIONS UNDER DIFFERENT SCENARIOS (PPS DEVIATION FROM THE BASELINE)**

Public pension expenditure	2022	2030	2040	2050	2060	2070	change 2022-2070 (pps)
Baseline (%GDP)	9.2	9.7	11.2	12.5	15.0	17.5	8.3
Higher life expectancy at birth (+2y)	0.0	0.0	0.1	0.2	0.3	0.5	0.5
Higher migration (+33%)	0.0	-0.1	-0.1	-0.2	-0.2	-0.2	-0.2
Lower migration (-33%)	0.0	0.1	0.1	0.2	0.3	0.2	0.2
Lower fertility (-20%)	0.0	0.0	0.0	0.1	0.6	1.1	1.1
Higher inflation scenario (2% by 2052)	0.0	-0.2	-0.2	-0.2	-0.3	-0.3	-0.3
Higher empl. rate of older workers (+10 pps)	0.0	-0.2	-0.4	-0.5	-0.6	-0.3	-0.3
Higher productivity (TFP converges to 1%)	0.0	0.0	0.0	-0.1	-0.3	-0.5	-0.5
Lower productivity (TFP converges to 0.6%)	0.0	0.0	0.1	0.3	0.6	0.7	0.8
Policy scenario: link retirement age to longevity	0.0	-0.1	-0.2	-0.6	-1.3	-2.2	-2.2
Policy scenario: constant retirement age	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Policy scenario: constant benefit ratio	0.0	0.0	0.0	0.9	1.5	1.8	1.8

TABLE 18	**Overall change in public pension expenditure to GDP under consecutive 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)	**7.4**	7.2	2.5	2.1	-4.4	0.0
2009 Ageing Report (2007-2060)	**15.2**	8.4	5.2	1.2	0.0	0.3
2012 Ageing Report (2010-2060)	**9.4**	11.2	0.3	-2.1	0.1	-0.1
2015 Ageing Report (2013-2060)	**4.1**	6.8	-2.4	0.1	-0.3	-0.2
2018 Ageing Report (2016-2070)	**8.9**	10.4	-0.8	-0.6	-0.1	-0.2
2021 Ageing Report (2019-2070)	**8.7**	12.1	2.5	-5.1	-0.2	-0.6
2024 Ageing Report (2022-2070)	**8.3**	11.0	1.9	-4.2	0.0	-0.4

- The disaggregation for 2006/2009/2012 is on the basis of the number of pensions; for the other vintages it is on the basis of pensioners.

- The projection horizon has been extended over consecutive Ageing Reports, limiting comparability over time.

TABLE 19	**Breakdown of the difference between the 2021 projections and outcome figures (% of GDP)**			
	2019	2020	2021	2022
Ageing Report 2021 projections (%GDP)	9.2	10.4	10.0	10.0
Assumptions (pps of GDP)	0.1	-0.7	-0.8	-0.8
Coverage of projections (pps of GDP)	-	-	-	-
Constant policy impact (pps of GDP)	-	-	-	-
Policy-related impact (pps of GDP)	-	-	-	-
Actual public pension expenditure (%GDP)	9.3	9.7	9.2	9.2

TABLE 20	**Breakdown of the difference between the 2021 and the new public pension projection (% of GDP)**					
	2022	2030	2040	2050	2060	2070
Ageing Report 2021 projections	10.0	11.4	13.0	14.8	16.7	18.0
Change in assumptions (pps of GDP)	-0.8	-1.3	-1.4	-2.0	-2.2	-2.2
Improvement in the coverage or in the modelling (pps of GDP)	0.0	-0.3	-0.4	-0.3	0.5	1.7
Change in the interpretation of constant policy (pps of GDP)	0.0	0.0	0.0	0.0	0.0	0.0
Policy-related changes (pps of GDP)	-	-	-	-	-	-
New projections	9.2	9.7	11.2	12.5	15.0	17.5

TABLE A1	**Economy-wide average wage at retirement (1000 EUR)**					
	2022	2030	2040	2050	2060	2070
Economy-wide average gross wage at retirement	66.9	77.5	103.6	144.3	201.2	278.5
Economy-wide average gross wage	60.7	70.6	96.0	135.6	188.4	261.6

TABLE A2	**Disability rates by age groups (%)**					
	2022	2030	2040	2050	2060	2070
Age group -54	0.2	0.2	0.2	0.2	0.2	0.2
Age group 55-59	1.2	1.2	1.2	1.2	1.2	1.2
Age group 60-64	1.5	1.5	1.5	1.5	1.5	1.5
Age group 65-69	-	-	-	-	-	-
Age group 70-74	-	-	-	-	-	-
Age group 75+	-	-	-	-	-	-

TABLE A3	Factors behind the change in public pension expenditure between 2022 and 2070 (percentage points of GDP) – pensions					
	2022-30	2030-40	2040-50	2050-60	2060-70	2022-70
Public pensions to GDP	0.6	1.5	1.3	2.4	2.5	8.3
Dependency ratio effect	1.6	2.2	2.0	2.7	2.3	10.8
Coverage ratio effect*	0.3	0.3	0.4	0.4	0.4	1.9
Coverage ratio old-age	0.6	0.9	0.7	0.6	1.0	3.8
Coverage ratio early-age	1.2	-0.6	0.4	2.6	-0.1	3.6
Cohort effect	-1.5	-1.3	-0.8	-2.6	-2.4	-8.6
Benefit ratio effect	-1.5	-0.9	-1.2	-0.6	-0.1	-4.3
Labour market effect	0.0	0.0	0.2	0.0	-0.1	0.0
Employment ratio effect	0.0	0.0	0.2	0.0	-0.1	0.0
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.1
Career shift effect	0.0	0.0	0.0	0.0	0.0	0.0
Residual	0.1	-0.1	-0.1	0.0	0.0	-0.1

* Subcomponents of the coverage ratio effect do not add up necessarily.