Peer reviews on pension projections

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Contents

1 OVERVIEW OF THE PENSION SYSTEM

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 for the private and public sectors (mandatory)
- Occupational pension schemes for 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, on the one hand, covers all employees and self-employed persons of the private sector. On the other hand, civil servants and other employees of the government, local authorities, public institutions, and the Luxembourg national railways have their own statutory pension schemes, namely the special pension schemes for the public sector. People belonging to a pension scheme by virtue of working for an international body are not subject to a national pension scheme.

An occupational pension scheme can be set up by an employer or promoter in order to provide workers with a supplementary pension benefit. Since 2019, occupational pensions are accessible to the self-employed as well. Private pension plans consist of tailored contracts between an insurer and an individual that can be established under specific conditions.

Public authorities provide for different social assistance measures directed at individuals with insufficient financial resources. However, as Luxembourg makes no distinction between the working age population and the elderly, it follows that there are no particular social assistance measures for older people.

1.1 DESCRIPTION

1.1.1 The general pension scheme

The general pension scheme for the private sector in Luxembourg is based on a system of compulsory insurance. It covers old age, early old age, disability, and survivor pensions.

Qualifying conditions

There are three ways for a scheme member to gain access to an old age or early old age pension, each depending on age as well as on specific qualifying conditions. 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 ***CY***. An insured person that is at least 60 years old and has accumulated a combined total of 40 years of contributory periods ***CY*** and credited non-contributory periods ***NY*** (e.g. years of study or years taken off to bring up children) qualifies for an early old age pension ***EOA60***, provided that contributions have been paid for at least 10 years. Individuals that are at least 57 years old gain access to early old age benefits ***EOA57*** if they accumulated a total of 40 years of contributory periods ***CY***.

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

	Minimum conditions	*2019*	*2030*	*2040*	*2050*	*2060*	*2070*
OA65	Contributory period ***CY***	10	10	10	10	10	10
	Statutory retirement age	65	65	65	65	65	65
EOA60	Combined periods ***CY***+***NY*** (of which ***CY***)	40 (10)	40 (10)	40 (10)	40 (10)	40 (10)	40 (10)
	Retirement age	60	60	60	60	60	60
EOA57	Contributory period ***CY***	40	40	40	40	40	40
	Retirement age	57	57	57	57	57	57

The entitlement to a disability pension requires at least one year of contributions during the three years preceding disability as well as an age younger than 65. Indeed, there are no disability pensions beyond that age threshold, since all such pensions are automatically converted to old-age pensions at 65. Similar entitlement conditions hold for survivor pensions in the case of deceased actives, where a minimum 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. In the case of a full 40-year-career, the minimum pension is situated at 90% of a specific reference amount ***REF***, which roughly corresponds to the social minimum wage. For each missing year, this quantity is reduced by one fortieth, down to the aforementioned eligibility threshold of 20 years.

The pension formula

The current pension formula is determined as a sum of four components ***P = P1 + P2 + P3 + P4*** and depends on a total of four annual pension formula parameters ***q1, q2_base, q2,*** and ***q3*** introduced in the 2012 pension reform. Its main elements are defined as follows:

- The pro rata enhancement ***P1***. It is calculated as a given percentage ***q1*** of the total contributory income ***TCI***.
- The incremental enhancement ***P2***. For each full year that the sum of the individual's age ***AGE*** plus the total of contributory years ***CY*** exceeds the given annual parameter ***q2_base***, the pro-rata enhancement is increased by a fixed percentage ***q2***, up to a ceiling of 2.05%.
- The flat rate ***P3***. This corresponds to a given percentage ***q3*** of the reference amount ***REF***, which is calculated based on the number of qualifying years ***QY.*** The latter number includes both contributory years ***CY*** as well as credited non-contributory years ***NY***, and it is capped at 40.
- The end-of-year allowance bonus ***P4***. This represents 2.5% of the reference amount ***REF***. It is due as long as the global contribution rate has not to be increased. The periods taken into account are the same as for the flat rate component.

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

$$P1 = q1 * TCI$$

$$P2 = (AGE + CY - q2\_base) * q2 * TCI, \text{ if } AGE + CY > q2\_base$$

$$P3 = min(40, QY) / 40 * q3 * REF$$

$$P4 = min(40, QY) / 40 * 0.025 * REF$$

Disability pensions are calculated in the same way as old age pensions. Yet, in order to ensure that recipients of disability pensions receive an adequate income, the periods taken into account for the pro rata and flat rate enhancements are extended up to the age of 55 and 65, respectively (special pro rata and flat rate enhancements). A notional salary corresponding to the average of those monthly salaries on which actual contributions have been paid is then used to calculate the pro rata enhancement.

The surviving spouse's pension is composed of three quarters of the pro rata enhancement, including any incremental or special enhancement, as well as the entire flat rate 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 to be reduced according to specific rules. The surviving child's pension is composed of one quarter of the pro rata enhancement, again including any incremental or special enhancement, one third of the flat rate component and one third of the end-of-year allowance.

Indexation of pensions

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

New pensions are calculated with respect to a given reference year for the evolution of prices and real wages. Then, they are fully indexed to prices by applying the current inflation index. In addition, the revaluation mechanism is applied, where new pensions are adapted according to the real wage evolution up to the fourth year preceding entitlement.

Pensions in payment are indexed to price evolution in a non-periodic way. An adjustment is performed each time prices increase by more than 2.5% when compared to the inflation index at the time of the previous application. Moreover, as long as the pension scheme's income from contributions exceeds its expenditure, a readjustment mechanism is fully applied at an annual pace. Here, pensions in payment are indexed to real wage evolution with respect to the second year preceding the evaluation date. However, as soon as the above condition is not satisfied anymore, the readjustment mechanism is to be reduced by at least 50% if not abrogated.

Financing of the general pension scheme

The funding of the general pension scheme is based on a system of division into ten-year coverage periods with mandatory formation of a reserve fund exceeding one and a half times the total amount of annual pension expenditure. The contribution rate is set at the beginning of each ten-year period to a percentage value that shall guarantee the funding of the scheme throughout the period. After five years however, the system's financial situation is reassessed, and the global contribution rate may be modified for a new period of ten years if necessary.

The global contribution rate amounts to 24% of the gross contributory income, the latter being assessed starting at the social minimum wage and capped at five times that amount (income ceiling). The share of costs is distributed in equal parts of 8% among the employer, the employee, and the central government. 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 task of the reserve fund is to optimize the management of the scheme's reserve and to achieve investment security while minimizing the risk that is inherent in financial markets.

1.1.2 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. From then on, there exist two distinct pension schemes for the public sector.

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 latter 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.

1.1.3 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 legal 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.

1.1.4 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.

1.1.5 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 (REVIS), which, since 2019, replaces the minimum guaranteed income (RMG), but also for housing and cost-of-living benefits.

The REVIS social inclusion income is a means-tested, taxable, and non-contributory benefit. It is largely dependent on household composition and currently amounts 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.

All social assistance benefits are at the charge of the central government.

1.2 RECENT REFORMS INCLUDED IN THE PROJECTIONS

No reforms have been enacted since the last projection exercise.

1.3 "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 1.1.1 will be modulated in accordance with Article 225bis of the Social Security Code once the financial resources of the general pension scheme are insufficient, which is projected to happen in 2027. The law foresees that, in this case, the readjustment mechanism is to be reduced by at least 50% if not abrogated.

More precisely, the indicator that triggers the modulation of the indexation rate via the readjustment mechanism is the so-called "prime de repartition pure" of the general pension scheme. It is defined as the ratio of current expenditure divided by the contributions base. According to Article 225bis of the Social Security Code, if this indicator exceeds the global contribution rate of 24% (or, equivalently, the ratio of contributions to current expenditure falls below 1), then the readjustment mechanism has to be modulated, and the resulting indexation rate has to be situated between 0% and 50%.

As will be discussed in Section 2.1, EUROSTAT considerably downgraded projected population growth for Luxembourg in its EUROPOP 2019 release of population projections. Indeed, while former iterations saw Luxembourg exceed the 1 000 000-inhabitant mark by 2070 at the latest, a remarkable downward revision of the long-term assumptions on net migration causes the resident population to increase only very prudently, reaching a mere 785 000 in 2070.

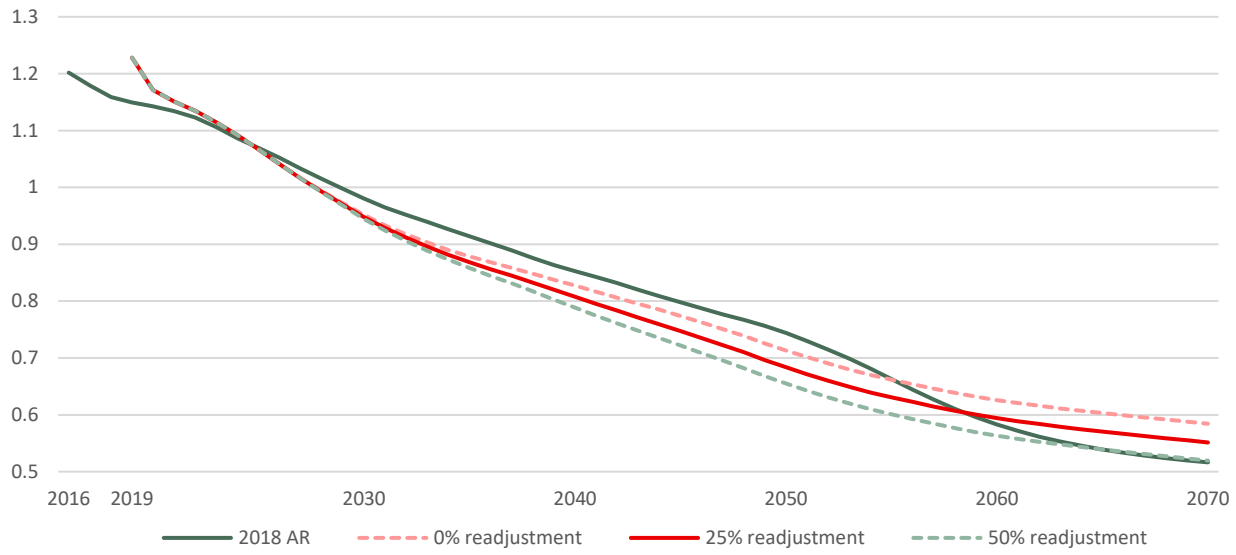
Although an optimization of the long-term assumption on the proportion of the cross-border workforce inside national employment counterbalances the effects on employment (see Section 2.2), the present macroeconomic scenario still has to be considered being a worst-case type scenario for Luxembourg.

Indeed, with a projected GDP growth amounting to 1.8% on average between 2019 and 2070, Luxembourg's economic growth has not only been downgraded by respectively 0.5 pp. and 0.8 pp. in comparison with previous exercises, but also by 1.2 pp. with respect to the baseline projections released[1] at national level in the context of the 2012 pension reform. Now, the latter responded to the given macroeconomic context (based on a GDP growth of 3%) by assuming a full abrogation of the readjustment mechanism.

[1] https://www.chd.lu/wps/PA_RoleDesAffaires/FTSByteServingServletImpl?path=D58EB1F66D12C9CD3CBC719618DDBE9A5829B3A40D92691A750A989DA67059AD0D1176B35D4720ED36413487E6AD6230$9A81872E8F5BC8B9F1836F7647DC3324

In the perspective of the “prime de repartition pure” indicator, it is suitable to compare the ratio of contributions to pension expenditure under different application rates of the readjustment mechanism with the values obtained in the previous exercise. In the 2018 projections, this ratio amounted to 0.805 on average between 2019 and 2070, whereas in the current exercise, a 50% application rate would lead to 0.768, a 25% indexation rate would imply 0.788, and a 0% application rate would yield 0.807. Graph 1 depicts the corresponding projected trajectories.

Graph 1 - Ratio of contributions to pension expenditure



Thus, a full abrogation of the readjustment mechanism would be justified in view of aligning the current projections with the former ones on the deficit. However, in order to take into account the uncertainty about the exact choice of a rate between 0% and 50% as well as the fact that a 50% rate has been applied in recent projection exercises, it is assumed that the readjustment mechanism is applied at a rate of 25% from 2027 onwards.

2 OVERVIEW OF THE DEMOGRAPHIC AND LABOUR FORCE PROJECTIONS

2.1 DEMOGRAPHIC DEVELOPMENTS

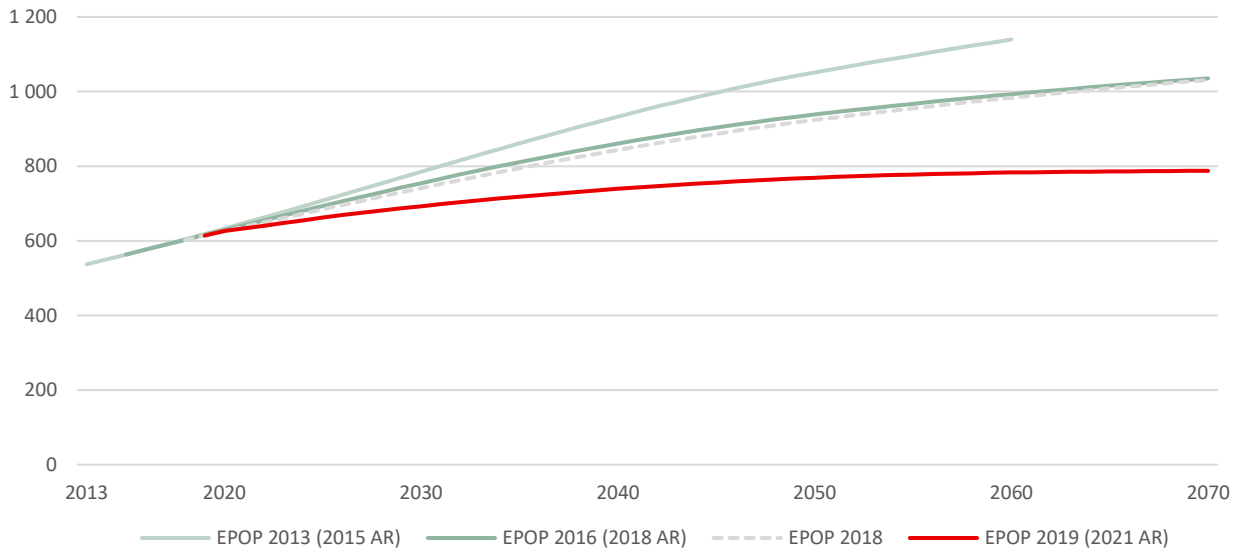
The most recent population projections EUROPOP 2019 provided by EUROSTAT expect the resident population of Luxembourg to show only a moderate increase over the projection period, passing from around 615 000 inhabitants in 2019 to just above 785 000 in 2070. As can be seen in Table 3, projected population growth is the fastest in the beginning of the projection and considerably slows down after a few projection years already. Indeed, half of the projected population growth is reported until as early as 2032, when the number of inhabitants crosses the 700 000 mark, whereas population almost stagnates towards the end.

Table 3 – Main demographic variables

	2019	*2030*	*2040*	*2050*	*2060*	*2070*	*peak value*	*peak year*	*change 2019-70*
Population (thousand)	620	695	741	770	783	788	787.5	2070	167.6
Population growth rate	2.0	0.8	0.5	0.3	0.1	0.0	2.0	2019	-1.9
Old-age dep. ratio (pop65/pop20-64)	22.6	29.6	37.8	45.5	52.8	56.1	56.1	2070	33.6
Old-age dep. ratio (pop75/pop20-74)	9.2	11.3	15.7	20.3	24.1	27.9	27.9	2070	18.7
Ageing of the aged(pop80+/pop65+)	27.5	26.2	29.2	34.9	37.2	41.5	41.5	2070	14.0
Men - Life expectancy at birth	80.3	81.7	83.1	84.4	85.5	86.6	86.6	2070	6.3
Women - Life expectancy at birth	85.0	86.3	87.5	88.7	89.8	90.8	90.8	2070	5.8
Men - Life expectancy at 65	19.1	20.1	21.1	22.0	22.9	23.7	23.7	2070	4.6
Women - Life expectancy at 65	22.5	23.5	24.5	25.4	26.3	27.1	27.1	2070	4.6
Men - Survivor rate at 65+	88.1	89.9	91.3	92.5	93.6	94.5	94.5	2070	6.4
Women - Survivor rate at 65+	93.5	94.5	95.3	96.0	96.5	97.0	97.0	2070	3.5
Men - Survivor rate at 80+	61.3	66.4	70.6	74.3	77.6	80.5	80.5	2070	19.2
Women - Survivor rate at 80+	76.6	80.2	83.0	85.5	87.6	89.3	89.3	2070	12.7
Net migration (thousand)	10.2	4.2	3.5	3.0	2.7	2.5	10.2	2019	-7.7
Net migration over population change	0.8	0.8	0.9	1.4	3.5	12.1	12.1	2070	11.2

This moderate population increase stands in contrast with figures issued by EUROSTAT for the 2015 and 2018 Ageing Report projection exercises and for the intermediate EUROPOP 2018 projection. Indeed, in all these former iterations, the projected population amounted to more than 1 000 000 inhabitants in 2070.

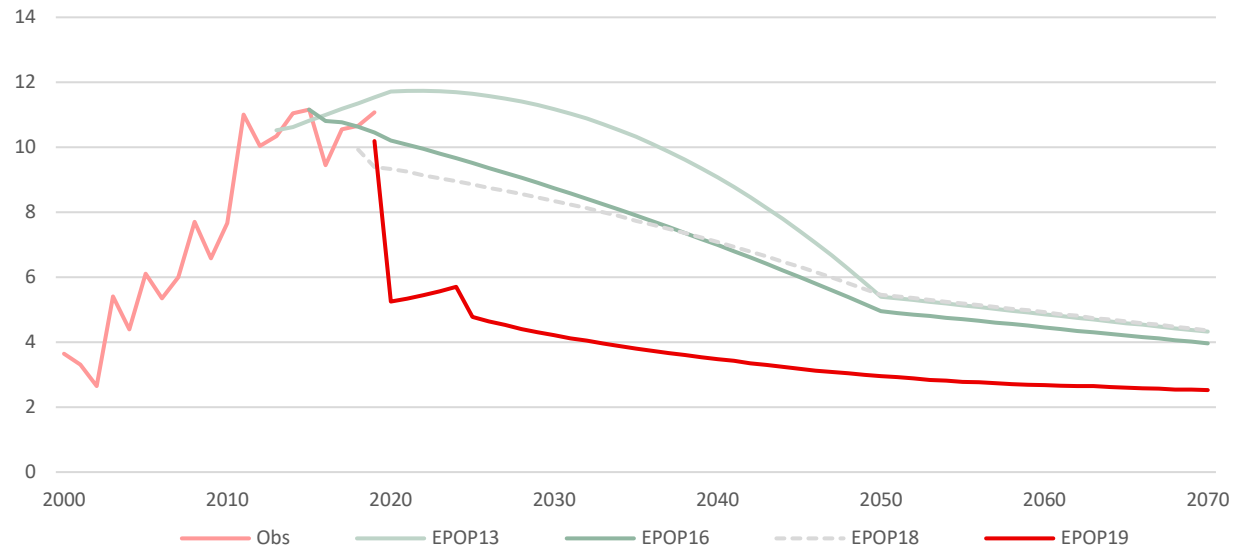
Graph 2 – Evolution of projected population (thousands)



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 considerable decreases in population growth.

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 since 2011. This means that these dispersions cannot be explained by changes in the latest data observations. Instead, EUROSTAT has revised its projection methodology prior to the publication of EUROPOP 2019, most notably by introducing a new model to project migration. The resulting impact on the projected net migration figures is staggering.

Graph 3 – Evolution of (projected) net migration (thousands)



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 applied for EUROPOP 2019 produces a different outcome. Here, an instant drop of net migration by about 50% in the year 2020 is reported, from about 10 200 to only 5 200 net immigrants.

A behaviour comparable to this sudden drop has never been observed in the past, and the resulting low level of net migration has not been registered in the past 15 years. The effect of this massive downward revision is then protracted and even amplified, as the subsequent convergence sets in at this lower point.

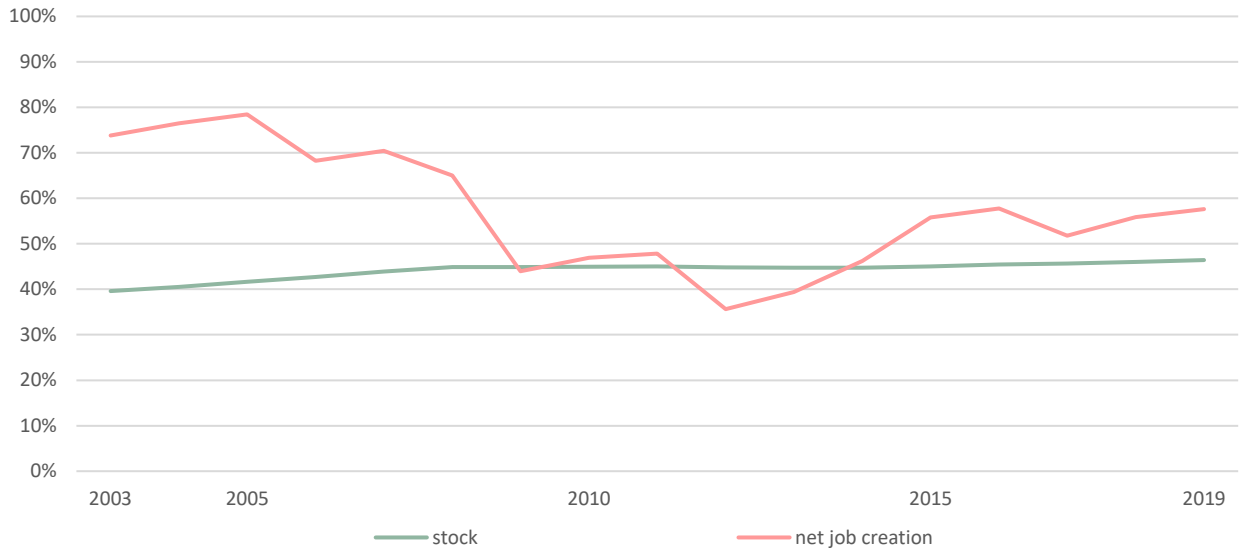
2.2 LABOUR FORCE

The downward revision of population projections discussed above has considerable repercussions on the long-term evolution of the resident labour force. With population growth strongly decreasing from the beginning of the projection forward, it is clear by construction that the implied resident employment growth follows a similar path. Still, national employment, which includes the cross-border workforce, shows a slightly less conservative trajectory with higher growth rates than resident employment.

Graph 4 – Evolution of projected population and employment growth

This is because, contrary to former projection exercises, it is assumed that the relative proportion of the cross-border workforce will cross the 50% mark in the long term. A look at the past evolution of both stock and net job creation of national employment shows that this assumption is justified. 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% in the last 5 years, while it easily surpassed this value in the years preceding the great recession.

Graph 5 – 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. Hence, no major variations in participation and employment rates for older workers are reported.

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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*	*peak value*	*peak year*	*change 2019-70*
Labour force participation rate 20-64	76.8	77.7	78.1	77.5	77.9	77.5	78.2	2037	0.8
Employment rate of workers aged 20-64	72.7	74.2	74.6	74.0	74.4	74.1	74.7	2037	1.4
Workers 20-64 in labour force 20-64	94.7	95.5	95.5	95.5	95.5	95.5	95.5	2066	0.8
Labour force participation rate 20-74	68.7	67.4	66.2	64.8	64.0	64.2	69.0	2020	-4.5
Employment rate of workers aged 20-74	65.1	64.3	63.2	61.9	61.1	61.4	65.1	2023	-3.7
Workers 20-74 in labour force 20-74	94.7	95.5	95.5	95.5	95.5	95.5	95.5	2065	0.8
Labour force participation rate 55-64	45.2	42.9	45.1	44.9	45.0	45.2	45.7	2066	0.0
Employment rate of workers aged 55-64	43.3	41.3	43.5	43.3	43.4	43.6	44.0	2066	0.3
Workers 55-64 in labour force 55-64	95.7	96.3	96.4	96.4	96.4	96.4	96.4	2063	0.7
Labour force participation rate 65-74	2.9	4.1	3.8	3.9	3.9	3.9	4.1	2029	1.0
Employment rate of workers aged 65-74	2.8	4.1	3.7	3.9	3.8	3.9	4.1	2029	1.0
Workers 65-74 in labour force 65-74	97.8	98.5	98.7	98.8	98.8	98.8	98.8	2065	0.9
Median age of the labour force	38.0	39.0	40.0	40.0	40.0	40.0	40.0	2031	2.0

For both men and women, the average effective exit age behaves in line with what could be expected from the above explanations (Table 5 and Table 6). However, the average length of the contributory period is expected to increase considerably for both sexes. As will be explained in more detail in Section 3.3, this phenomenon is closely related with current incomplete careers in Luxembourg of migrant and cross-border workers, which will become more and more complete throughout the projection as new entrants to the labour force are assumed to remain in the national labour market for their entire career.

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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*	*peak value*	*peak year*	*change 2019-70*
Avg. effective ret. age (admin. data)	60.9								
Average labour market exit age (CSM)*	60.4	60.4	60.4	60.4	60.4	60.4	63.7	2019	0.0
Contributory period	27.7	27.1	28.4	30.7	33.7	35.0	35.0	2070	7.4
Duration of retirement***	23.1	24.2	25.3	26.3	27.3	28.2	28.2	2070	5.1
Duration of retirement/contributory period	0.8	0.9	0.9	0.9	0.8	0.8	0.9	2034	0.0
Percentage of adult life spent in retirement****	35.3	36.3	37.4	38.3	39.2	40.0	40.0	2070	4.7
Early/late exit*****	5.6	3.2	3.2	3.2	2.9	2.9	5.9	2021	-2.6

* Average labour market exit age (CSM) refers to year 2020 instead of 2019.

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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*	*peak value*	*peak year*	*change 2019-70*
Avg. effective ret. age (admin. data)	61.6								
Average labour market exit age (CSM)*	60.1	60.1	60.1	60.1	60.1	60.1	60.1	2026	0.0
Contributory period	28.5	27.9	29.9	32.3	34.3	35.3	35.3	2070	6.8
Duration of retirement***	26.8	27.9	29.0	30.0	30.9	31.8	31.8	2070	5.0
Duration of retirement/contributory period	0.9	1.0	1.0	0.9	0.9	0.9	1.0	2033	0.0
Percentage of adult life spent in retirement****	38.9	39.9	40.8	41.6	42.3	43.0	43.0	2070	4.1
Early/late exit*****	8.8	4.3	4.6	4.1	3.6	3.5	8.8	2020	-5.3

* Average labour market exit age (CSM) refers to year 2020 instead of 2019.

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.

3 PENSION PROJECTION RESULTS

3.1 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)

	2009	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
1 ESTAT total pension exp.	9.6	9.2	9.2	9.6	9.6	9.3	9.3	9.1	9.4	9.3	
2 ESTAT public pension exp.	9.6	9.2	9.2	9.6	9.6	9.3	9.3	9.1	9.4	9.3	
3 AWG public pension exp.		8.9	8.8	9.2	9.2	9.1	9.2	9.1	9.3	9.2	9.2
4 Difference (2) - (3)		0.3	0.4	0.4	0.4	0.2	0.1	0.0	0.1	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 it is primarily the former that have developed in some foreign or very large industrial and commercial companies as well as in the banking sector. In addition, 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.

Apart from minimum pension provision, social assistance expenditure to people in the retirement age amounts to less than 0.1% of GDP and is not included in the projections.

3.2 OVERVIEW OF PROJECTION RESULTS

The projected development of public pension expenditure as a share of GDP shows a steady increase between 2019 and 2070. Starting at roughly 9.2% of GDP, it reaches about 18.0% of GDP at the end of the projection period. The figures on net pension expenditure are calculated by applying a constant rate of 15.4% for social security contributions and taxes combined. Apart from an early fluctuation due to a sudden drop of GDP in 2020, income from contributions is projected to remain almost constant at 9.9% of GDP.

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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*	*peak value*	*peak year*	*change 2019-70*
Gross public pension expenditure	9.2	11.4	13.0	14.8	16.7	18.0	18.0	2070	8.7
Net public pension expenditure	7.8	9.7	11.0	12.6	14.1	15.2	15.2	2070	7.4
Public pension contributions	9.9	9.9	9.9	9.9	9.9	9.9	10.7	2020	0.0

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 30 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 from the early 2020s until the early 2050s.

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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*	*peak value*	*peak year*	*change 2019-70*
Total public pensions	9.2	11.4	13.0	14.8	16.7	18.0	18.0	2070	8.7
of which									
*Old age and early pensions**	7.0	8.8	10.2	11.8	13.5	14.8	14.8	2070	7.7
Disability pensions	0.7	1.0	1.1	1.1	1.1	1.1	1.1	2070	0.5
Survivor pensions	1.5	1.7	1.8	1.9	2.0	2.1	2.1	2070	0.5

* Old age and early pensions are entirely earnings-related

When compared with the 2018 projection results, the present expenditure figures evolve at a slightly higher level throughout the projection period before reaching a comparable level towards the end. This is a consequence of a denominator effect due to the downward revision of economic growth, which is fading out as the projection progresses as it is more and more counterbalanced by the modified configuration of the readjustment mechanism presented in Section 1.3.

3.3 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 cross 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 2019 and 2070 (in percentage points of GDP)

	2019-30	*2030-40*	*2040-50*	*2050-60*	*2060-70*	*2019-70*
Public pension expenditure	2.2	1.6	1.8	1.8	1.3	8.7
Dependency ratio*	2.0	2.6	2.9	2.6	1.6	11.7
Benefit ratio**	0.2	-0.7	-0.5	-0.2	0.0	-1.3
Residual	0.0	-0.3	-0.6	-0.6	-0.3	-1.7

* ratio between pensioners and contributors

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

Clearly, the pressure on 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 so that less and less contributors have to support more and more pensioners. 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 markedly 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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*	*Change 2019-70*
Number of pensioners	207.2	312.8	419.9	524.1	609.3	654.0	446.7
Number of contributors	487.3	605.8	659.2	679.7	683.0	677.1	189.7
Support ratio	2.4	1.9	1.6	1.3	1.1	1.0	-1.3

The benefit ratio has an attenuating effect on public pension expenditure in the long term. At first, the major decline of GDP in 2020 induces additional pressure by virtue of the benefit ratio component, which is then continuously reduced as the benefit ratio decreases over time.

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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*	*Change 2019-70*
Public scheme (BR)	53%	54%	49%	47%	45%	45%	-8%
Public scheme (RR)	61%	52%	51%	50%	52%	52%	-9%
Public scheme old-age earnings related (BR)	59%	58%	53%	50%	48%	48%	-11%
Public scheme old-age earnings related (RR)	67%	56%	56%	55%	59%	60%	-7%

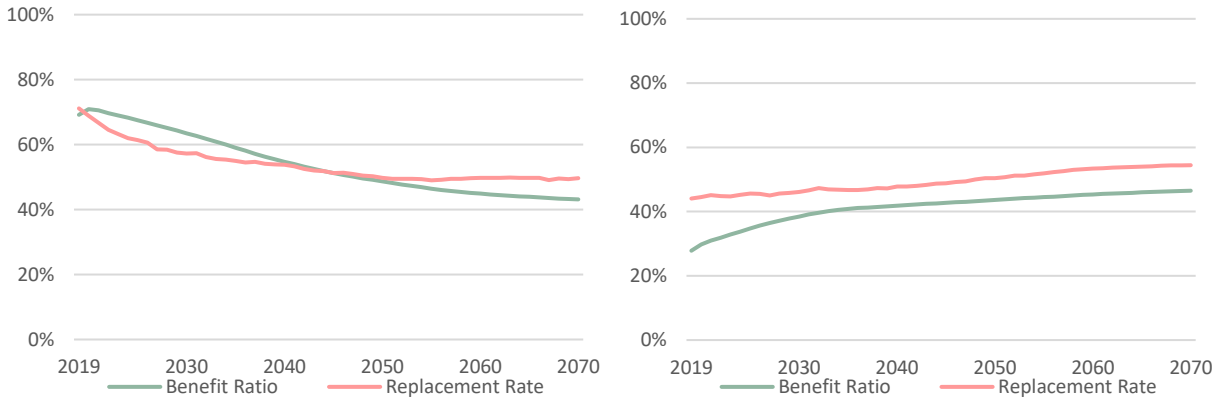
For a better understanding of the reported progress of the benefit ratio and the replacement rate presented in Table 12, it is convenient to disaggregate residents and non-residents.

Three different factors come into play:

- Incomplete careers becoming more and more complete
- Gradual evolution of the annual pension formula parameters until 2052
- Indexation of pensions in payment (only affects the benefit ratio)

Considering resident workers (Graph 6, 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. In the beginning of the projection period, this effect is even more pronounced since the average working career in Luxembourg declines for new pensioners, which is a corollary of the growing proportion of both females and migrants in the resident workforce. Careers become longer from the early 2030s onwards as people entering the national labour market at a young age are assumed to stay there until retirement, whence the reform effect is slightly counterbalanced during these years. The same observations hold for the benefit ratio. However, the reduction to 25% of the readjustment mechanism as of 2027 causes the decline to happen at an increasing pace.

Graph 6 – Evolution of the replacement rate at retirement and benefit ratio - RESIDENTS (left) and NON-RESIDENTS (right)



In contrast, the replacement rate increases for non-resident workers (Graph 6, right part). 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, it is assumed that commuters enter the labour market at young ages and then stay in the national labour market until retirement. The resulting strong increase in the average contributory period surpasses the attenuating effect of the annual decreases in the accrual rate. The benefit ratio follows a similar path, showing a continuous growth over the projection period. Yet again, it is the setting in of the reduction of the readjustment mechanism inducing a deflection of the trajectory, this time slowing down the reported increase.

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. This causes a slight decrease of the relative proportion of pensioners aged between 55 and 59 in the first projection

years, 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 pensioner is reported for the second half of the projection period. This is a corollary of the longer contributory periods in particular of cross-border and, to a lesser extent, female resident workers entering the national labour market at a young age, who then have careers that are complete enough to be eligible for an early old-age pension at age 60.

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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*
0-54	3%	3%	3%	3%	3%	3%
55-59	22%	19%	19%	18%	19%	18%
60-64	74%	75%	75%	82%	86%	88%
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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*
0-54	4%	4%	5%	5%	4%	4%
55-59	25%	22%	20%	20%	21%	20%
60-64	75%	77%	77%	83%	87%	90%
65+	100%	100%	100%	100%	100%	100%

A closer look at new public pension expenditure reveals that its trajectory is mainly driven by an increase in the number of pensioners and the average contributory period, while a gradual decline of the average accrual rate slightly counterbalances these effects.

As explained above, current active scheme members from the period of remarkable economic growth starting in the late 1980s retire in the beginning of the projection period, causing a strong increase in the number of new pensioners. The figures continue to grow until the 2050s, reflecting the steady economic growth observed until the beginning of the projection. The average contributory period passes from roughly 28 years in 2019 to just above 35 years in 2070. Again, this is the result of cross-border and resident female workers having more and more complete careers in the national labour market.

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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*
Projected new pension expenditure (million EUR)*	273.1	468.4	715.6	1191.7	1733.9	2394.8
I. Number of new pensions (1000)	7.6	12.8	14.2	16.8	16.3	15.4
II. Average contributory period (years)	27.7	27.4	29.0	31.3	33.9	35.2
III. Average accrual rate (%)	1.8	1.8	1.7	1.6	1.6	1.6
IV. Monthly average pensionable earnings (1000 EUR)	6.0	6.3	8.6	11.6	16.3	23.0
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)	1.3	1.2	1.1	1.1	1.1	1.1

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

3.4 FINANCING OF THE PENSION SYSTEM

As described in Section 1.1.1, the general pension scheme for the private sector is financed by contributions, the global contribution rate amounting 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 1.1.2). 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) only 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

As discussed in Section 3.2, income from contributions is projected to remain almost constant at 9.9% of GDP. By design, there is barely any fluctuation, as GDP and contributions both evolve according to the same macroeconomic assumptions. The number of contributors grows in line with national employment growth and includes cross border workers. Hence, a strong increase in the first half of the projection period is followed by a very prudent evolution in the second half. Towards the end of the projection, a slight decline is reported.

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

	2019	*2030*	*2040*	*2050*	*2060*	*2070*	*Change 2019-70*
Public pension contributions (%GDP)	9.9	9.9	9.9	9.9	9.9	9.9	0.0
Employer contributions	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*0.0*
Employee contributions	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*0.0*
*State contribution**	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*0.0*
*Other revenues**	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Number of contributors (1000)	487.3	605.8	659.2	679.7	683.0	677.1	189.7

3.5 PENSION ASSETS AND RETURN ON ASSETS

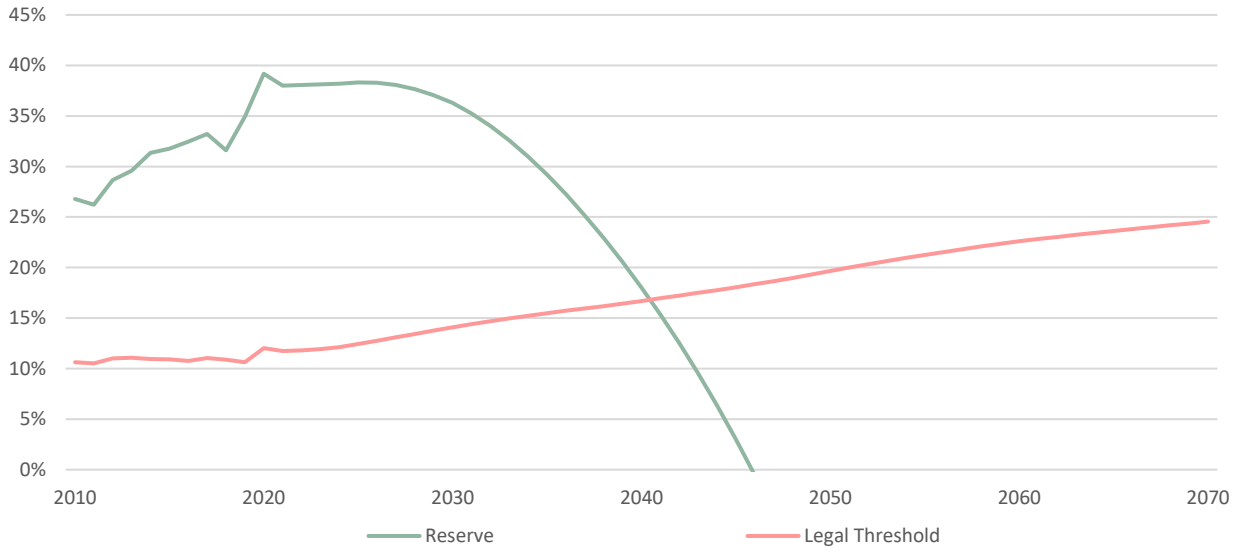
The reserve fund of the general pension scheme has been constantly rising in the past 30 years. Currently, it amounts to about 35% of GDP, which equals about 4.8 times the annual pension expenditure and hence by far exceeds the legal threshold of 1.5 times the annual pension expenditure. It is projected to increase further until the early 2030s and decline afterwards. As percentage of GDP however, the peak is attained in the early 2020s. After 2040, the reserve is projected to fall below the legal threshold, before being exhausted a few years later.

Table 18 – The reserve fund of the general pension scheme

	2019	*2030*	*2040*	*2050*	*2060*	*2070*
in billions EUR	22.2	34.9	26.0	0.0	0.0	0.0
in % of GDP	34.9	36.3	18.0	0.0	0.0	0.0

In view of average returns (excluding unrealized capital gains) ranging at 4.3% in recent years, and considering the assumed long-term interest rate of 4%, the return rate has been fixed at a constant nominal 4% throughout the projection.

Graph 7 – Evolution of the reserve fund of the general pension scheme (% of GDP)



3.6 SENSITIVITY ANALYSIS

3.6.1 AWG sensitivity tests

Four demographic sensitivity scenarios are discussed. Each alternative is deduced from variations of the EUROPOP 2019 baseline scenario provided by EUROSTAT that tackle 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 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, because, clearly, the impact on pension expenditure is even more delayed and hence barely noticeable until towards the end of the projection.

Three economic scenarios are presented, one altering the employment rate assumption of older workers, the remaining two acting on the TFP assumption.

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 vanishes.

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 altered in a comparable way when modifying the TFP assumption. However, the readjustment mechanism is to be applied only at a rate of 25% from 2027 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.

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 by 4.5 years 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. 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 2027 onwards, this quota is adapted at an annual pace once the benefit ratio has fallen by 10% with respect to the base year. From then on, the coefficient of the readjustment mechanism is set to the precise value ensuring that the benefit ratio of old-age pensions remains constant for the remainder of the projection. It is clear that in practice, it is to be expected that a multitude of tailored political measures would be adopted instead.

Finally, two scenarios addressing the potential implications of the ongoing pandemic are discussed.

As expected, the lagged recovery scenario barely affects the ratio of pension expenditure to GDP in the long term. A denominator effect caused by a lower GDP growth is visible in the beginning of the projection, but since that short period is followed by a quick economic recovery, the deviation from the baseline scenario is fully absorbed after 10 projection years.

A different outcome is reported for the adverse structural scenario. Here, the economic repercussions of the pandemic are assumed to persist over the full projection period, causing lower employment and productivity, thus yielding a lower GDP growth. Again, pension expenditure is slightly reduced when compared with the baseline scenario due to the readjustment mechanism having a less pronounced impact. However, this only has an attenuating effect regarding the considerable denominator effect that is caused by the lower GDP figures.

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

Public pension expenditure	*2019*	*2030*	*2040*	*2050*	*2060*	*2070*	*change 2019-70*
Baseline (% GDP)	9.2	11.4	13.0	14.8	16.7	18.0	8.7
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*	*-0.4*	*-0.7*	*-1.1*	*-1.2*	*-1.1*	*-1.1*
Lower migration (-33%)	*0.0*	*0.4*	*0.8*	*1.3*	*1.6*	*1.5*	*1.5*
Lower fertility (-20%)	*0.0*	*0.0*	*0.1*	*0.5*	*1.3*	*2.2*	*2.2*
Higher employment rate of older workers (+10 pp.)	*0.0*	*-0.3*	*-0.5*	*-0.6*	*-0.6*	*-0.1*	*-0.1*
Higher TFP growth (convergence to 1.2%)	*0.0*	*0.0*	*-0.2*	*-0.5*	*-0.7*	*-0.9*	*-0.9*
TFP risk scenario (convergence to 0.8%)	*0.0*	*0.1*	*0.3*	*0.5*	*0.6*	*0.7*	*0.7*
Policy scenario: linking ret. age to change in life exp.	*0.0*	*-0.5*	*-0.8*	*-1.1*	*-1.5*	*-1.6*	*-1.6*
Policy scenario: unchanged retirement age	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Policy scenario: offset declining pension BR	*0.0*	*0.0*	*0.0*	*1.0*	*1.6*	*2.0*	*2.0*
Lagged recovery scenario	*0.0*	*0.0*	*0.0*	*0.0*	*-0.1*	*0.0*	*0.0*
Adverse structural scenario	*0.0*	*0.3*	*0.7*	*1.0*	*1.2*	*1.3*	*1.3*

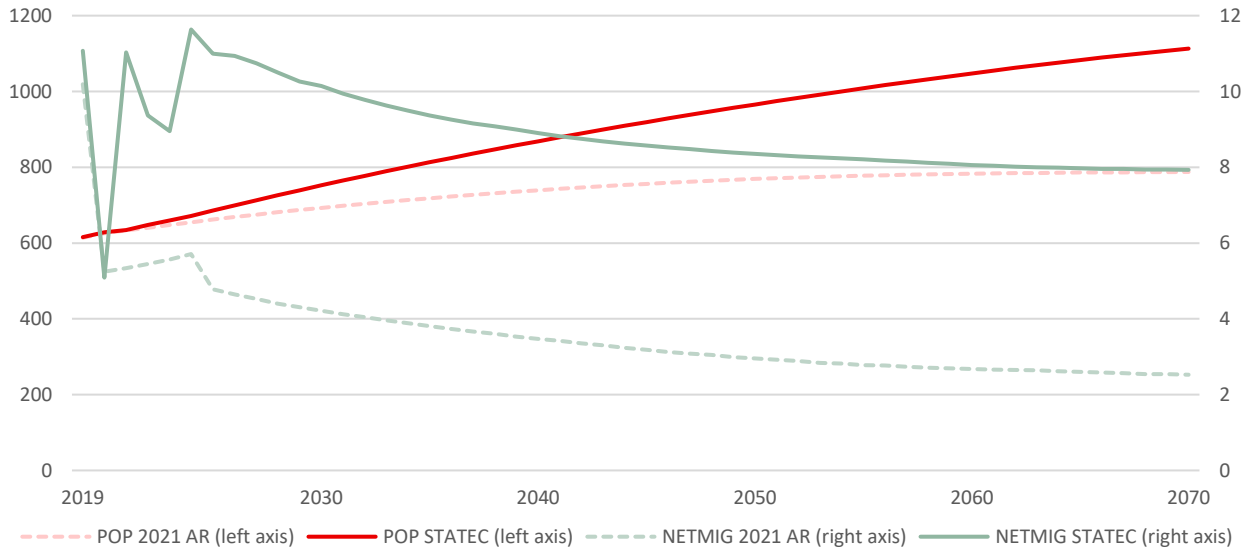
3.6.2 An alternative macroeconomic scenario by STATEC

As discussed in Section 2.1, the new EUROPOP 2019 population projections by EUROSTAT that provide the basis for the macroeconomic scenario used for the current projection exercise account for a substantial downward revision of the projected population for Luxembourg. At the origin of this outcome is a new migration model, which projects net migration for Luxembourg to drop by about 50% in the year 2020 and to decrease further afterwards. Such a strong immediate decrease has never been observed in Luxembourg, and the corresponding low net migration levels has not been recorded for 15 years. This makes it difficult to put the projection results into context with current and recent macroeconomic developments at national level.

In Luxembourg, relative economic attractiveness with respect to other European countries has proven to be the main determinant of migrations. Unfortunately, however, the EUROSTAT projection model does not take into account any macroeconomic effects on migrations, which implies that its demographic projection for Luxembourg is not consistent with the projected economic growth.

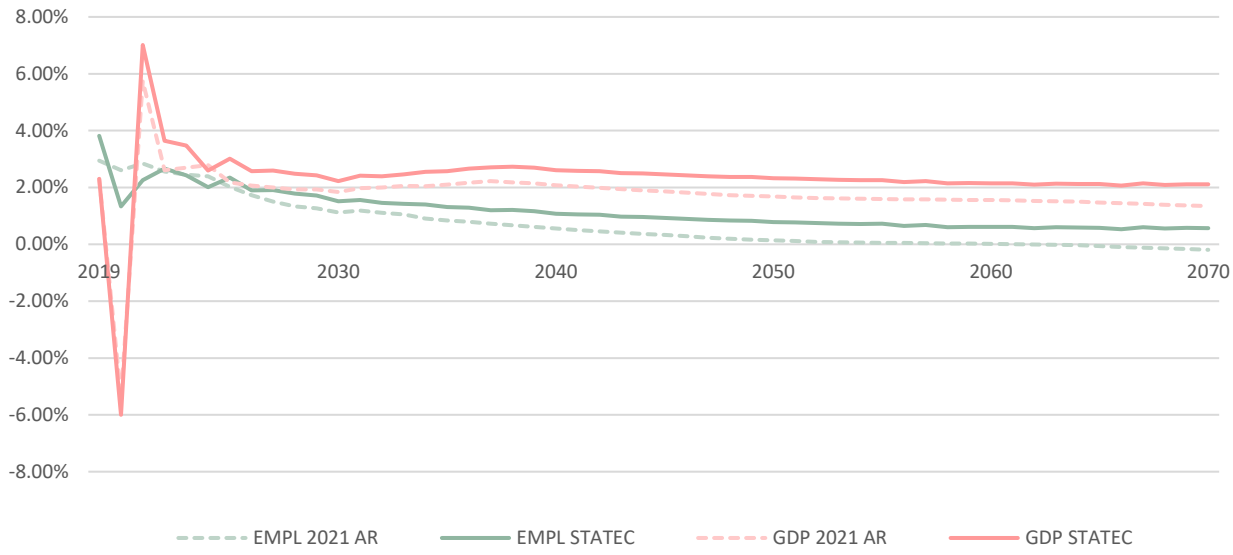
In this context, STATEC, Luxembourg's national statistical institute, has agreed to provide an alternative macroeconomic scenario based on population projections that rely on the bidirectional relation between GDP and population. Clearly, this yields employment growth trajectories that contrast those given in the baseline scenario. In terms of productivity, the most recent medium term projections are incorporated, but in the long term, the convergence assumption from the baseline scenario is applied. More precisely, migration flows in the long run are driven by wages attractiveness, which directly follows from TFP growth assumptions for Luxemburg and the Eurozone as foreseen by the AWG.

Graph 8 – Evolution of projected population and net migration (in 1000)



Graph 8 depicts the projected evolution of net migration and the resulting population. It is remarkable that both scenarios project the same abrupt drop of net migration in 2020, even though STATEC is actually taking into account the COVID pandemic (and the temporary closure of borders by some countries) while EUROPOP is not. Thereafter, migrations as projected by STATEC follow GDP growth (and vice versa) and therefore evolve 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 STATEC calculations, based on TFP assumptions from the AWG, population will cross the 1 000 000 mark in the mid-2050s, before eventually reaching about 1 100 000 residents in 2070.

Graph 9 – Evolution of projected employment growth and real GDP growth



It is to be noted that STATEC is not explicitly modelling the housing market in Luxembourg and its border region and therefore assumes that the additional foreign workers that are attracted each year are split in equal parts into commuters and immigrants. This implies that the relative proportion of cross border workers in national employment is not projected to exceed 50% in the long term, which means that the discrepancy between the STATEC and baseline scenarios is not as pronounced for employment as for population. Still, an average 0.6 pp. difference in employment growth is reported from 2030 onwards, and the same holds for GDP growth since the productivity assumptions essentially coincide during that period.

Table 20 - Public pension expenditure in the baseline and STATEC scenarios (% of GDP)

	2019	*2030*	*2040*	*2050*	*2060*	*2070*
2021 AR	9.2	11.4	13.0	14.8	16.7	18.0
STATEC	9.2	11.0	12.1	13.0	13.9	14.5
DIFF (pp of GDP)	0.0	-0.4	-0.9	-1.8	-2.8	-3.5

Now, the evolution of pension expenditure in terms of GDP is just a corollary of the above. As the 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, the denominator effect induced by the higher GDP figures is predominant. It follows that the divergence between the STATEC and baseline scenarios is steadily increasing. At the end of the projection interval, the relative pension expenditure accounts for 14.5% of GDP in the STATEC scenario, which is equivalent to a difference of 3.5 pp. of GDP with respect to the baseline.

3.7 DESCRIPTION OF THE CHANGES IN COMPARISON WITH THE 2006, 2009, 2012, 2015, AND 2018 PROJECTIONS

Comparing former and current projection exercises using the reduced decomposition of the increase of public pension expenditure as share of GDP into the dependency and benefit ratio effects, it becomes apparent that, in each projection exercise, the main driver behind the reported expenditure increases is the change in the dependency ratio, which is expressed as the ratio between pensioners and contributors in the case of Luxembourg.

A closer look at the changes 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 current projections. At comparable productivity assumptions, these changes are induced

by corresponding revisions of the assumed employment growth rates. The latter, in turn, are directly affected by variations in population growth, as has been discussed in Section 2.1. Hence, the variations of pension expenditure as share of GDP in relation with the dependency ratio component all come down to fluctuations between the population projections provided by EUROSTAT.

Table 21 – Change in public pension expenditure to GDP under the2006, 2009, 2012, 2015, and 2018 projection exercises

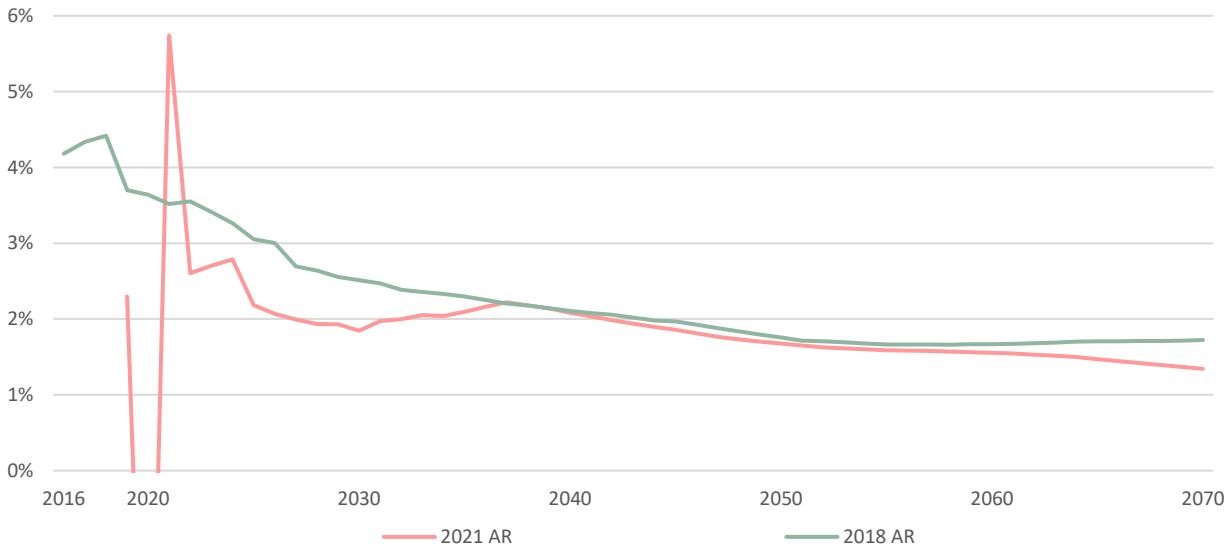
	*pp. change**	*dependency ratio*	*benefit ratio*	*residual*
2006 AR	7.7	5.6	1.8	0.2
2009 AR	13.5	11.1	1.9	0.5
2012 AR	8.8	9.7	-0.8	-0.1
2015 AR	4.0	3.6	0.3	0.1
2018 AR	8.9	9.2	-0.1	-0.1
2021 AR	8.7	11.7	-1.3	-1.7

* Between 2010 and 2050 for the 2006, 2009 and 2012 projections, between 2013 and 2060 for the 2015 projection, between 2016 and 2070 for the 2018 projection, between 2019 and 2070 for the 2021 projection.

In the 2006 and 2009 projection exercises, an increasing benefit ratio 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 projection. As reported in Table 21, this phenomenon is observable in the current projection exercise as well. However, in all projections from 2012 onwards, this effect is counterbalanced by the partial application of the readjustment mechanism and the annually decreasing accrual rate introduced in the 2012 pension reform. In the current exercise, the benefit ratio is further impacted by the lower rate of application of the readjustment mechanism described in Section 1.3.

Towards a more detailed analysis of the differences in pension expenditure as share of GDP between the last and current projection exercises, it is reasonable to have a closer look at the projected GDP growth rates. Graph 10 compares the related trajectories throughout the projection interval, leaving aside the outlier at -5.8% in 2020 caused by the pandemic for increased legibility.

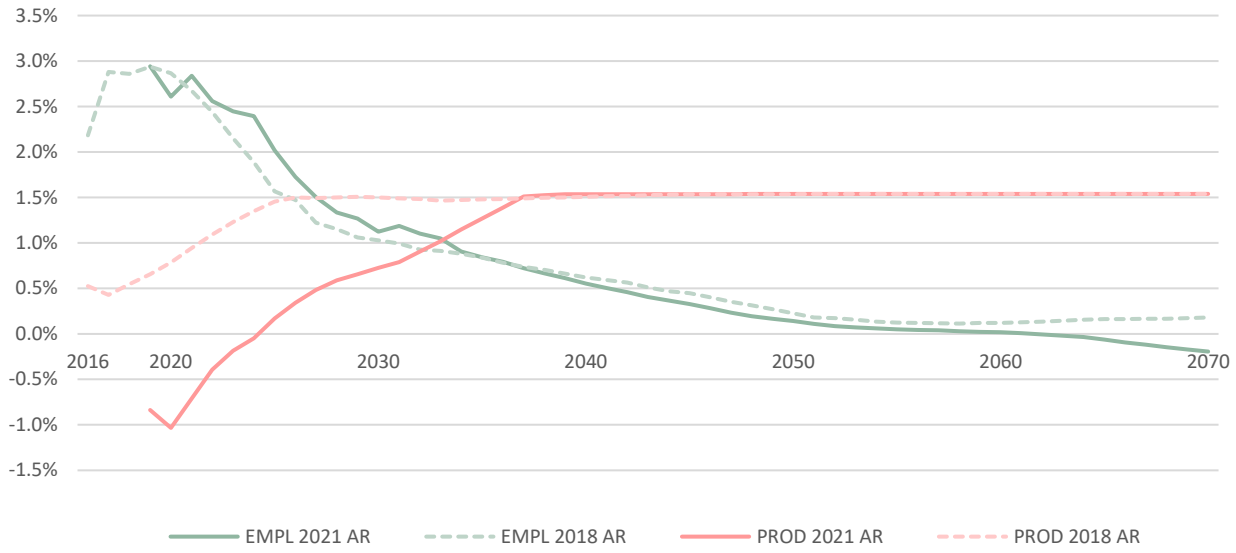
Graph 10 – Evolution of projected GDP growth



Since it is assumed that the relative proportion of commuters in national employment will cross the 50% mark in the long term (Section 2.2), employment growth rates are rather comparable between the exercises in spite of the significant contrast between the respective EUROPOP releases of population projections. Indeed, current employment growth rates are above their 2018 counterparts until the mid-2030s and then evolve marginally below the 2018 rates until towards the end of the projection period, when the divergence is accentuated again.

A more pronounced deviation is observed on the productivity side. Even though a convergence to 1.5% is reported in both exercises, current figures start at lower rates and reach the target value 10 years later.

Graph 11 – Evolution of projected productivity and employment growth



Thus, it follows that the differences in projected economic growth are driven by more prudent productivity assumptions until the mid-2030s and by slightly lower employment growth rates thereafter.

Clearly, the aforementioned change in macroeconomic assumptions induces a denominator effect on the ratio of pension expenditure to GDP, causing the ratio of pension expenditure to GDP to increase. It is only towards the end of the projection that the assumed lower early economic growth rates translate to pension expenditure, thus attenuating the denominator effect.

Table 22 – Breakdown of the difference between the 2018 and the new public pension projection (% of GDP)

	2019	***2030***	***2040***	***2050***	***2060***	***2070***
2018 AR	9.0	10.2	11.5	13.0	16.0	17.9
Improvement in the coverage/modelling (pp of GDP)	*0.0*	*0.2*	*0.5*	*1.0*	*0.2*	*-0.4*
Change in assumptions (pp of GDP)	*0.3*	*1.1*	*1.3*	*1.5*	*1.4*	*1.6*
Change in the interpretation of constant policy (pp of GDP)	*0.0*	*0.0*	*-0.3*	*-0.7*	*-0.9*	*-1.1*
2021 AR	9.2	11.4	13.0	14.8	16.7	18.0

The reduction of the readjustment mechanism from 50% to 25% accounts for the change in the interpretation of constant policy (Section 1.3). Indeed, the restrained indexation of pensions in payment causes pension expenditure to stay below the 2018 figures from the late 2020s onwards.

Finally, improvements in the projection model explain the remainder of the observed differences. Most notably, a reprogramming of the module responsible for the distribution of new contributors allows for a smoother transition between observed data and assumptions. This yields slight divergences in the number of pensioners that translate to a higher pension expenditure in the middle of the projection and a lower pension expenditure towards the end.

4 DESCRIPTION OF THE PENSION PROJECTION MODEL AND ITS BASE DATA

4.1 INSTITUTIONAL CONTEXT

The General Inspectorate of Social Security (Inspection générale de la sécurité sociale – IGSS) uses a customized version of the International Labour Organization (ILO) generic pension-modelling tool to perform the financial projections of the pension schemes. In order to take account of the particularities of the labour market in Luxembourg in terms of a high proportion of cross-border workers, the ILO 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). The model thus makes a difference between total labour force and 'national' labour force.

As explained in Section 1.1.11.1.1, 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 states that “the global contribution rate is to be fixed for each coverage period based on a technical report and accompanying actuarial forecasts established by the IGSS”. Furthermore, “in the middle of each coverage period, the IGSS provides an actualization of the report and the forecasts”. In this context, the tool is used by the IGSS to provide for a regular evaluation of the financial situation of the general pension scheme.

4.2 ASSUMPTIONS AND METHODOLOGIES APPLIED

The modified ILO pension model includes two components. A demographic component projects the number of contributors and pensioners, and a financial component evaluates income and expenditure of the pension systems. All model components are calibrated in order to comply with AWG assumptions.

Fertility rate, life expectancy, and migration are in line with the population projections provided by EUROSTAT. In turn, AWG employment growth assumptions are used for the projections based on national account labour series.

The total number of civil servants is supposed to increase in line with general employment. Since civil servants schemes apply the same pension formula as the general pension scheme from 1999 onwards, the relative share of civil servants within the employed does not have a major impact on pension expenditure in the medium and long run.

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.

4.3 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 social security institutions in Luxembourg.

Main administrative data relates to protected people monthly income declarations, which are at the basis of the computation of the contributions. Other important administrative data is related to monthly benefits paid out by the institutions. Both sources are essential to gather information on disposable income of protected people.

4.4 REFORMS INCORPORATED IN THE MODEL

No reforms have been enacted since the last projection exercise.

4.5 GENERAL DESCRIPTION OF THE MODEL

The national pension model used for providing actuarial estimates of future expenditure and contributions base of the general and special pension schemes in Luxemburg in line with the economic and demographic framework used in the AWG projections exercise 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 local social insurance legislation in Luxembourg and captures national pension peculiarities.

It is based on macro simulation techniques, whence the projections rely on grouped data. Under the model, each status of an insured person (active person, inactive person, and pensioner) is explicitly modelled, distinguishing new persons from initial stock, and associated values (average salary, average pension, etc.) are projected year by year.

The national pension model satisfies the following key methodological features:

- The model is based 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 an insured person (active person, inactive person and pensioner) from a given year onto the next year's status.
- The development of the active insured population is linked to the evolution of total employed population and earnings assumptions, which, in turn, are explicitly linked to the assumptions on macroeconomic growth and the wage share of GDP.
- 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 readable models.

In terms of structure, the model is organized as follows:

- The input files regroup all exogenous data that is needed to run the model. Common demographic and macro-economic assumptions are stored by projection year. For each population grouping, separate input files contain the initial population data for the base year as well as distributions of, e.g., average insurable salaries, past contributory income, or entry rates into disability.
- 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 respective amount of contributions are provided as well as the total number of pensioners and the corresponding amount of pension benefit expenditure. Additional result files provide a disaggregation of the above output results at a detailed level by population grouping, (sex and residency status) age, and categories of pension benefits.

5 ANNEX: REPORTING TABLES

Table 1	Qualifying conditions for retirement							
			2019	2030	2040	2050	2060	2070
Qualifying condition for retiring with a full pension	Statutory retirement age - men		:	:	:	:	:	:
	Statutory retirement age - women		:	:	:	:	:	:
	Minimum requirements	Contributory period - men	:	:	:	:	:	:
		Retirement age - men	:	:	:	:	:	:
		Contributory period - women	:	:	:	:	:	:
		Retirement age - women	:	:	:	:	:	:
	Early retirement age - men		:	:	:	:	:	:
	Early retirement age - women		:	:	:	:	:	:
Qualifying condition for retirement *without* a full pension	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								
	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Population (thousand)	620	695	741	770	783	788	787.5	2070	167.6
Population growth rate	2.0	0.8	0.5	0.3	0.1	0.0	2.0	2019	-1.9
Old-age dependency ratio (pop 65+ / pop 20-64)	22.6	29.6	37.8	45.5	52.8	56.1	56.1	2070	33.6
Old-age dependency ratio (pop 75+ / pop 20-74)	9.2	11.3	15.7	20.3	24.1	27.9	27.9	2070	18.7
Ageing of the aged (pop 80+ / pop 65+)	27.5	26.2	29.2	34.9	37.2	41.5	41.5	2070	14.0
Men - Life expectancy at birth	80.3	81.7	83.1	84.4	85.5	86.6	86.6	2070	6.3
Women - Life expectancy at birth	85.0	86.3	87.5	88.7	89.8	90.8	90.8	2070	5.8
Men - Life expectancy at 65	19.1	20.1	21.1	22.0	22.9	23.7	23.7	2070	4.6
Women - Life expectancy at 65	22.5	23.5	24.5	25.4	26.3	27.1	27.1	2070	4.6
Men - Survivor rate at 65+	88.1	89.9	91.3	92.5	93.6	94.5	94.5	2070	6.4
Women - Survivor rate at 65+	93.5	94.5	95.3	96.0	96.5	97.0	97.0	2070	3.5
Men - Survivor rate at 80+	61.3	66.4	70.6	74.3	77.6	80.5	80.5	2070	19.2
Women - Survivor rate at 80+	76.6	80.2	83.0	85.5	87.6	89.3	89.3	2070	12.7
Net migration (thousand)	10.2	4.2	3.5	3.0	2.7	2.5	10.2	2019	-7.7
Net migration over population change	0.8	0.8	0.9	1.4	3.5	12.1	12.1	2070	11.2

Table 3	Participation rate, employment rate and share of workers								
	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Labour force participation rate 20-64	76.8	77.7	78.1	77.5	77.9	77.5	78.2	2037	0.8
Employment rate of workers aged 20-64	72.7	74.2	74.6	74.0	74.4	74.1	74.7	2037	1.4
Share of workers aged 20-64 in the labour force 20-64	94.7	95.5	95.5	95.5	95.5	95.5	95.5	2066	0.8
Labour force participation rate 20-74	68.7	67.4	66.2	64.8	64.0	64.2	69.0	2020	-4.5
Employment rate of workers aged 20-74	65.1	64.3	63.2	61.9	61.1	61.4	65.1	2023	-3.7

Share of workers aged 20-74 in the labour force 20-74	94.7	95.5	95.5	95.5	95.5	95.5	95.5	2065	0.8
Labour force participation rate 55-64	45.2	42.9	45.1	44.9	45.0	45.2	45.7	2066	0.0
Employment rate of workers aged 55-64	43.3	41.3	43.5	43.3	43.4	43.6	44.0	2066	0.3
Share of workers aged 55-64 in the labour force 55-64	95.7	96.3	96.4	96.4	96.4	96.4	96.4	2063	0.7
Labour force participation rate 65-74	2.9	4.1	3.8	3.9	3.9	3.9	4.1	2029	1.0
Employment rate of workers aged 65-74	2.8	4.1	3.7	3.9	3.8	3.9	4.1	2029	1.0
Share of workers aged 65-74 in the labour force 65-74	97.8	98.5	98.7	98.8	98.8	98.8	98.8	2065	0.9
Median age of the labour force	38.0	39.0	40.0	40.0	40.0	40.0	40.0	2031	2.0

TABLE 4a **Labour market effective exit age and expected duration of life spent at retirement - MEN**

	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Average effective retirement age (administrative data)*	60.9								
Average labour market exit age (CSM)**	60.4	60.4	60.4	60.4	60.4	60.4	63.7	2019	0.0
Contributory period	27.7	27.1	28.4	30.7	33.7	35.0	35.0	2070	7.4
Duration of retirement***	23.1	24.2	25.3	26.3	27.3	28.2	28.2	2070	5.1
Duration of retirement/contributory period	0.8	0.9	0.9	0.9	0.8	0.8	0.9	2034	0.0
Percentage of adult life spent in retirement****	35.3	36.3	37.4	38.3	39.2	40.0	40.0	2070	4.7
Early/late exit*****	5.6	3.2	3.2	3.2	2.9	2.9	5.9	2021	-2.6

TABLE 4b **Labour market effective exit age and expected duration of life spent at retirement - WOMEN**

	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Average effective retirement age (administrative data)*	61.6								
Average labour market exit age (CSM)**	60.1	60.1	60.1	60.1	60.1	60.1	60.1	2026	0.0
Contributory period	28.5	27.9	29.9	32.3	34.3	35.3	35.3	2070	6.8
Duration of retirement***	26.8	27.9	29.0	30.0	30.9	31.8	31.8	2070	5.0
Duration of retirement/contributory period	0.9	1.0	1.0	0.9	0.9	0.9	1.0	2033	0.0
Percentage of adult life spent in retirement****	38.9	39.9	40.8	41.6	42.3	43.0	43.0	2070	4.1
Early/late exit*****	8.8	4.3	4.6	4.1	3.6	3.5	8.8	2020	-5.3

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

TABLE 5 **Eurostat (ESSPROS) vs. Ageing Working Group definition of pension expenditure (% GDP)**

	2009	2010	2011	2012	2013	2014	2015	2016	2017
Eurostat total pension expenditure	9.6	9.2	9.2	9.6	9.6	9.3	9.3	9.1	9.4
Eurostat public pension expenditure (A)	:	:	:	9.6	9.6	9.3	9.3	9.1	9.4
Public pension expenditure (AWG: outcome) (B)	:	8.9	8.8	9.2	9.2	9.1	9.2	9.1	9.3
Difference Eurostat/AWG: (A)-(B)	:	:	:	-0.8	-0.7	-0.7	-0.5	-0.5	-0.3
Expenditure categories not considered in the AWG definition	*:*	*:*	*:*	*:*	*:*	*:*	*:*	*:*	*:*
- [please specify]	*:*	*:*	*:*	*:*	*:*	*:*	*:*	*:*	*:*
- [please specify]	*:*	*:*	*:*	*:*	*:*	*:*	*:*	*:*	*:*
- …	*:*	*:*	*:*	*:*	*:*	*:*	*:*	*:*	*:*

TABLE 6	Projected gross and net pension spending and contributions (% of GDP)								
Expenditure	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Gross public pension expenditure	9.2	11.4	13.0	14.8	16.7	18.0	18.0	2070	8.7
Private occupational pensions	:	:	:	:	:	:	:	:	:
Private individual mandatory pensions	:	:	:	:	:	:	:	:	:
Private individual non-mandatory pensions	:	:	:	:	:	:	:	:	:
Gross total pension expenditure	9.2	11.4	13.0	14.8	16.7	18.0	18.0	2070	8.7
Net public pension expenditure*	7.8	9.7	11.0	12.6	14.1	15.2	15.2	2070	7.4
Net total pension expenditure*	7.8	9.7	11.0	12.6	14.1	15.2	15.2	2070	7.4
Contributions	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Public pension contributions	9.9	9.9	9.9	9.9	9.9	9.9	10.7	2020	0.0
Total pension contributions	9.9	9.9	9.9	9.9	9.9	9.9	10.7	2020	0.0

TABLE 7	Projected gross public pension spending by scheme (% of GDP)								
Pension scheme	2019	2030	2040	2050	2060	2070	peak value	peak year	change 2019-2070
Total public pensions	9.2	11.4	13.0	14.8	16.7	18.0	18.0	2070	8.7
Old-age and early pensions	7.0	8.8	10.2	11.8	13.5	14.8	14.8	2070	7.7
Flat component	:	:	:	:	:	:	:	:	:
Earnings-related	7.0	8.8	10.2	11.8	13.5	14.8	14.8	2070	7.7
Minimum pensions (non-contributory) i.e. minimum income guarantee for people above 65	:	:	:	:	:	:	:	:	:
Disability pensions	0.65	0.97	1.05	1.13	1.14	1.14	1.1	2070	0.5
Survivors' pensions	1.54	1.67	1.81	1.94	2.02	2.07	2.07	2070	0.5
Other pensions	:	:	:	:	:	:	:	:	:
Special pension schemes	2019	2030	2040	2050	2060	2070	Peak value	Peak year	change 2019-2070
Country-specific scheme 1 [please specify]									
Country-specific scheme 2 [please specify]									
…									

TABLE 8	Factors behind the change in public pension expenditures between 2019 and 2070 (in percentage points of GDP) - pensioners					
	2019-30	2030-40	2040-50	2050-60	2060-70	2019-70
Public pensions to GDP	2.2	1.6	1.8	1.8	1.3	8.7
Dependency ratio effect	3.0	3.1	2.6	2.4	1.0	12.1
Coverage ratio effect*	0.7	0.4	0.6	0.5	0.4	2.5
Coverage ratio old-age	0.9	1.0	0.8	0.9	0.9	4.4
Coverage ratio early-age	2.2	0.6	2.2	1.6	-0.7	5.8
Cohort effect	-2.0	-2.0	-2.1	-2.4	-0.8	-9.3
Benefit ratio effect	-1.0	-1.6	-1.4	-0.9	-0.2	-5.1
Labour market effect	-0.2	0.0	0.1	-0.1	0.1	-0.2
Employment ratio effect	-0.2	-0.1	0.1	-0.1	0.1	-0.2
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	-0.1
Residual	-0.2	-0.2	-0.1	-0.1	0.0	-0.6

** 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 %)						
	2019	2030	2040	2050	2060	2070	change 2019-

							2070 (pps)
Public scheme (BR)	53%	54%	49%	47%	45%	45%	-8%
Coverage	100.0	100.0	100.0	100.0	100.0	100.0	0.0
Public scheme: old-age earnings related (BR)	59%	58%	53%	50%	48%	48%	-11%
Public scheme: old-age earnings related (RR)	67%	56%	56%	55%	59%	60%	-7%
Coverage	68.3	71.3	73.2	74.8	76.4	77.3	9.0
Private occupational scheme (BR)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Private occupational scheme (RR)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Coverage	:	:	:	:	:	:	:
Private individual schemes (BR)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Private individual schemes (RR)	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Coverage	:	:	:	:	:	:	:
Total benefit ratio	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Total replacement rate	61%	52%	51%	50%	52%	52%	-9%

TABLE 10	**System dependency ratio and old-age dependency ratio**						
	2019	2030	2040	2050	2060	2070	change 2019-2070
Number of pensioners (thousand) (I)	207.2	312.8	419.9	524.1	609.3	654.0	446.7
Employment (thousand) (II)	294.5	326.7	334.4	329.6	321.9	316.3	21.8
Pension system dependency ratio (SDR) (I)/(II)	70.4	95.7	125.6	159.0	189.3	206.8	136.4
Number of people aged 65+ (thousand) (III)	89.8	127.3	165.7	197.7	222.9	233.6	143.8
Working age population 20-64 (thousand) (IV)	397.8	430.7	438.4	434.6	421.7	416.2	18.4
Old-age dependency ratio (OADR) (III)/(IV)	22.6	29.6	37.8	45.5	52.8	56.1	33.6
System efficiency (SDR/OADR)	3.1	3.2	3.3	3.5	3.6	3.7	0.6

TABLE 11a	**Pensioners (public scheme) to inactive population ratio by age group (%)**					
	2019	2020	2030	2040	2050	2070
Age group -54	6.8	7.0	9.8	11.9	12.2	11.9
Age group 55-59	83.2	78.8	78.9	86.5	94.9	91.8
Age group 60-64	128.3	131.9	151.2	164.0	189.2	211.2
Age group 65-69	170.3	169.3	177.9	197.4	201.4	224.5
Age group 70-74	168.5	170.8	172.0	192.7	198.2	223.0
Age group 75+	166.4	168.2	195.2	204.4	221.5	241.3

TABLE 11b	**Pensioners (public schemes) to total population ratio by age group (%)**					
	2019	2030	2040	2050	2060	2070
Age group -54	2.7	3.6	4.3	4.5	4.4	4.5
Age group 55-59	29.9	30.8	31.6	34.0	37.7	32.8
Age group 60-64	100.1	114.5	122.6	141.3	164.2	156.7
Age group 65-69	163.5	167.0	185.8	189.2	203.6	210.7
Age group 70-74	166.1	169.3	189.8	195.0	202.6	219.5
Age group 75+	166.4	195.2	204.4	221.5	232.7	241.3

TABLE 12a	**Female pensioners (public scheme) to inactive population ratio by age group (%)**					
	2019	2030	2040	2050	2060	2070
Age group -54	7.4	11.4	13.9	14.2	13.5	13.5
Age group 55-59	63.8	70.7	78.8	90.6	101.1	88.0
Age group 60-64	100.6	131.6	145.1	165.8	197.4	188.6
Age group 65-69	141.2	158.0	177.3	177.7	195.5	204.0
Age group 70-74	141.8	157.4	181.8	182.6	187.7	206.8
Age group 75+	155.0	191.0	208.1	229.3	240.6	248.5

TABLE 12b	Female pensioners (public scheme) to total population ratio by age group (%)					
	2019	2030	2040	2050	2060	2070
Age group -54	3.2	4.3	5.1	5.3	5.1	5.1
Age group 55-59	28.2	31.5	30.4	33.4	37.2	32.3
Age group 60-64	83.0	105.5	112.3	127.8	150.9	143.9
Age group 65-69	137.4	150.4	168.7	168.2	184.8	192.8
Age group 70-74	140.9	155.5	179.5	180.0	185.1	203.9
Age group 75+	155.0	191.0	208.1	229.3	240.6	248.5

TABLE 13a	Projected and disaggregated new public pension expenditure (old-age and early earnings-related pensions)					
New old-age earnings-related pensions	2019	2030	2040	2050	2060	2070
Projected new pension expenditure (million EUR)*	273.1	468.4	715.6	1191.7	1733.9	2394.8
I. Number of new pensions (1000)	7.6	12.8	14.2	16.8	16.3	15.4
II. Average contributory period (years)	27.7	27.4	29.0	31.3	33.9	35.2
III. Average accrual rate (%)	1.8	1.8	1.7	1.6	1.6	1.6
IV. Monthly average pensionable earnings (1000 EUR)	6.0	6.3	8.6	11.6	16.3	23.0
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)	133%	116%	114%	109%	108%	107%

TABLE 13b	Disaggregated new public pension expenditure (old-age and early earnings-related pensions) - MEN					
New old-age earnings-related pensions	2019	2030	2040	2050	2060	2070
Projected new pension expenditure (million EUR)*	184.1	293.5	444.4	781.7	1121.5	1561.0
I. Number of new pensions (1000)	4.6	7.7	8.5	10.1	9.6	9.1
II. Average contributory period (years)	27.5	27.1	28.4	30.7	33.7	35.0
III. Average accrual rate (%)	1.8	1.8	1.7	1.6	1.6	1.6
IV. Monthly average pensionable earnings (1000 EUR)	6.6	6.7	9.2	13.0	18.1	25.5
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)	147%	123%	121%	122%	120%	118%

TABLE 13c	Disaggregated new public pension expenditure (old-age and early earnings-related pensions) - WOMEN					
New old-age earnings-related pensions	2019	2030	2040	2050	2060	2070
Projected new pension expenditure (million EUR)*	90.1	175.0	271.2	410.0	612.4	833.8
I. Number of new pensions (1000)	2.9	5.2	5.7	6.8	6.8	6.3
II. Average contributory period (years)	28.0	27.9	29.9	32.3	34.3	35.3
III. Average accrual rate (%)	1.8	1.8	1.7	1.6	1.6	1.6
IV. Monthly average pensionable earnings (1000 EUR)	5.0	5.8	7.9	9.7	13.7	19.4
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)	113%	106%	104%	91%	91%	90%

TABLE 14	Revenue from contribution (Millions), number of contributors in the public scheme (in 1000), total employment (in 1000) and related ratios (%)		
	Public employees	Private employees	Self-employed
Contribution base			
Contribution rate/contribution			
Employer			

Employee	
*State**	
*Other revenues**	
Maximum contribution	
Minimum contribution	
*only legislated contributions are reported	

TABLE 15	**Revenue from contribution (%GDP) number of contributors in the public scheme (in 1000), total employment (in 1000) and related ratios (%)**						
	2019	2030	2040	2050	2060	2070	change 2019-2070 (pps)
Public pension contributions (%GDP)	9.9	9.9	9.9	9.9	9.9	9.9	0.0
Employer contributions	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*0.0*
Employee contributions	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*0.0*
*State contribution**	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*3.3*	*0.0*
*Other revenues**	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Number of contributors (I) (1000)	487.3	605.8	659.2	679.7	683.0	677.1	189.7
Employment (II) (1000)	294.5	326.7	334.4	329.6	321.9	316.3	21.8
(I) / (II)	1.7	1.9	2.0	2.1	2.1	2.1	0.5

TABLE 16	**Pension assets and reserves (% GDP) and return on assets (%)**								
	average 1999-2008	average 2009-2018	2019	2030	2040	2050	2060	2070	average 2019-2070
Public pension scheme									
assets and reserves		#VALUE!	22184.4	34910.7	26011.5	-35587.0	-222711.0	-636650.4	-93171.2
average return		*#VALUE!*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Private occupational schemes									
assets and reserves		#VALUE!	0.0	0.0	0.0	0.0	0.0	0.0	0.0
average return		*#VALUE!*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Private individual mandatory schemes									
assets and reserves		#VALUE!	0.0	0.0	0.0	0.0	0.0	0.0	0.0
average return		*#VALUE!*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
Private individual non-mandatory schemes									
assets and reserves		#VALUE!	0.0	0.0	0.0	0.0	0.0	0.0	0.0
average return		*#VALUE!*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

TABLE17	**Public and total pension expenditure under different scenarios (p.p. deviation from the baseline)**						
Public pension expenditure	2019	2030	2040	2050	2060	2070	change 2019-2070 (pps)
Baseline (% GDP)	9.2	11.4	13.0	14.8	16.7	18.0	8.7
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	-0.4	-0.7	-1.1	-1.2	-1.1	-1.1
Lower migration (-33%)	0.0	0.4	0.8	1.3	1.6	1.5	1.5
Lower fertility (-20%)	0.0	0.0	0.1	0.5	1.3	2.2	2.2
Higher employment rate of older workers (+10 pps.)	0.0	-0.3	-0.5	-0.6	-0.6	-0.1	-0.1
Higher TFP growth (convergence to 1.2%)	0.0	0.0	-0.2	-0.5	-0.7	-0.9	-0.9
TFP risk scenario (convergence to 0.8%)	0.0	0.1	0.3	0.5	0.6	0.7	0.7

Policy scenario: linking retirement age to change in life expectancy	0.0	-0.5	-0.8	-1.1	-1.5	-1.6	-1.6
Policy scenario: unchanged retirement age	:	:	:	:	:	:	#VALUE!
Policy scenario: offset declining pension benefit ratio	0.0	0.0	0.0	1.0	1.6	2.0	2.0
Lagged recovery scenario	0.0	0.0	0.0	0.0	-0.1	0.0	0.0
Adverse structural scenario	0.0	0.3	0.7	1.0	1.2	1.3	1.3

Total pension expenditure	2019	2030	2040	2050	2060	2070	change 2019-2070 (pps)
Baseline (% GDP)	9.2	11.4	13.0	14.8	16.7	18.0	8.7
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	-0.4	-0.7	-1.1	-1.2	-1.1	-1.1
Lower migration (-33%)	0.0	0.4	0.8	1.3	1.6	1.5	1.5
Lower fertility (-20%)	0.0	0.0	0.1	0.5	1.3	2.2	2.2
Higher employment rate of older workers (+10 pps.)	0.0	-0.3	-0.5	-0.6	-0.6	-0.1	-0.1
Higher TFP growth (convergence to 1.2%)	0.0	0.0	-0.2	-0.5	-0.7	-0.9	-0.9
TFP risk scenario (convergence to 0.8%)	0.0	0.1	0.3	0.5	0.6	0.7	0.7
Policy scenario: linking retirement age to change in life expectancy	0.0	-0.5	-0.8	-1.1	-1.5	-1.6	-1.6
Policy scenario: unchanged retirement age	:	:	:	:	:	:	#VALUE!
Policy scenario: offset declining pension benefit ratio	0.0	0.0	0.0	1.0	1.6	2.0	2.0
Lagged recovery scenario	0.0	0.0	0.0	0.0	-0.1	0.0	0.0
Adverse structural scenario	0.0	0.3	0.7	1.0	1.2	1.3	1.3

TABLE 18 **Overall change in public pension expenditure to GDP under the2006, 2009, 2012 and 2015 projection exercises**

	Public pension expenditure	*Dependency ratio effect*	*Coverage ratio effect*	*Benefit ratio effect*	*Labour market effect*	*Residual (incl. interaction effect)*
2006 Ageing Report (2004-2050)	**7.38**	*7.18*	*2.48*	*2.10*	*-4.38*	*0.00*
2009 Ageing Report (2007-2060)	**15.24**	*8.39*	*5.23*	*1.25*	*0.04*	*0.32*
2012 Ageing Report (2010-2060)	**9.44**	*11.25*	*0.28*	*-2.07*	*0.12*	*-0.13*
2015 Ageing Report (2013-2060)	**4.06**	*6.79*	*-2.41*	*0.10*	*-0.25*	*-0.17*
2018 Ageing Report (2016-2070)	**8.90**	*10.43*	*-0.76*	*-0.55*	*-0.07*	*-0.153*
2021 Ageing Report (2019-2070)	**8.75**	*12.06*	*2.52*	*-5.06*	*-0.19*	*-0.576*

- The disaggregation for 2006/2009/2012 is on the basis of pensions; for 2015/2018/2021 it is on the basis of pensioners.

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

TABLE 19a **Breakdown of the difference between the 2018 projections and outcome figures (% of GDP)**

	2016	2017	2018	2019
Ageing Report 2018 projections	9.0	9.0	9.0	9.0
Assumptions (pps of GDP)				
Coverage of projections (pps of GDP)				
Constant policy impact (pps of GDP)				
Policy-related impact (pps of GDP)				
Actual public pension expenditure	9.6	9.7	9.4	9.2

TABLE 19b **Breakdown of the difference between the 2018 and the new public pension projection (% of GDP)**

	2019	2030	2040	2050	2060	2070
Ageing Report 2018 projections	9.0	10.2	11.5	13.0	16.0	17.9
Change in assumptions (pps of GDP)						
Improvement in the coverage or in the modelling (pps of GDP)						

Change in the interpretation of constant policy (pps of GDP)						
Policy-related changes (pps of GDP)						
New projections	9.2	11.4	13.0	14.8	16.7	18.0

TABLE A1	**Economy wide average wage at retirement (1000 EUR)**						
	2019	2030	2040	2050	2060	2070	% change 2019-2070
Economy-wide average gross wage at retirement	58.1	66.3	90.4	133.1	190.1	274.0	371.5
Economy-wide average gross wage	53.8	65.5	90.6	127.9	181.3	259.1	381.5

TABLE A2	**Disability rates by age groups (%)**					
	2019	2030	2040	2050	2060	2070
Age group -54						
Age group 55-59						
Age group 60-64						
Age group 65-69						
Age group 70-74						
Age group 75+						

TABLE A3	**Factors behind the change in public pension expenditure between 2019 and 2070 (percentage points of GDP) – pensions**					
	2019-30	2030-40	2040-50	2050-60	2060-70	2019-70
Public pensions to GDP	2.2	1.6	1.8	1.8	1.3	8.7
Dependency ratio effect	2.9	3.4	3.1	3.0	1.3	13.7
Coverage ratio effect*	0.6	0.3	0.5	0.3	0.3	2.0
Coverage ratio old-age	0.8	0.9	0.7	0.7	0.6	3.7
Coverage ratio early-age	2.1	0.6	2.0	1.5	-0.7	5.5
Cohort effect	-1.7	-1.2	-0.9	-0.8	-0.2	-4.9
Benefit ratio effect	-0.9	-1.1	-0.7	-0.4	-0.1	-3.1
Labour market effect	-0.2	0.0	0.1	-0.1	0.0	-0.2
Employment ratio effect	-0.2	0.0	0.1	0.0	0.0	-0.2
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.0
Career shift effect	0.0	0.0	0.0	0.0	0.0	-0.1
Residual	-0.2	-0.9	-1.1	-1.1	-0.3	-3.6
** Subcomponents of the coverage ratio effect do not add up necessarily.*						

TABLE A4a	**administrative data on new pensioners (2019) - men**				
Age group	All	Old-age	Disability	Survivor	Other (including minimum)
15 - 49	268	0	105	163	0
50 - 54	162	0	141	21	0
55 - 59	1654	1402	245	7	0
60 - 64	2436	2320	92	24	0
65 - 69	943	920	0	23	0
70 - 74	39	2	0	37	0
75+	82	2	0	80	0

TABLE A4a	**administrative data on new pensioners (2019) - women**				
Age group	All	Old-age	Disability	Survivor	Other (including minimum)
15 - 49	358	0	99	259	0
50 - 54	158	0	97	61	0
55 - 59	876	570	162	144	0
60 - 64	1682	1437	56	189	0
65 - 69	1113	908	0	205	0
70 - 74	256	0	0	256	0

75+	726	0	0	726	0

TABLE A4a	**administrative data on new pensioners (2019) - total**				
Age group	All	Old-age	Disability	Survivor	Other (including minimum)
15 - 49	626	0	204	422	0
50 - 54	320	0	238	82	0
55 - 59	2530	1972	407	151	0
60 - 64	4118	3757	148	213	0
65 - 69	2056	1828	0	228	0
70 - 74	295	2	0	293	0
75+	808	2	0	806	0