

Republic of Cyprus



Economic Policy Committee - Ageing Working Group

2024 Ageing Report

Cyprus - Country Fiche

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Introduction

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

Technical input towards the preparation of this fiche was provided by the International Labour Organisation (the “ILO”) on behalf of the Ministry of Labour and Social Insurance. The pension projections presented in this fiche incorporate the macroeconomic assumptions and methodologies agreed within the *Ageing Working Group* of the *Economic Policy Committee*. The projections have been peer reviewed by the other Member States and the European Commission within the *Ageing Working Group*. The projections were finalised in the autumn of 2023 and represent the situation of the pension system on 01/12/2023.

Section 1 provides a general overview of the pension system in Cyprus. Section 2 describes the demographic and labour market assumptions underlying the pension expenditure projections presented in Section 3, which also discusses the sensitivity scenarios around the baseline. Finally, Section 4 gives an overview of the model used to produce the pension projections.

1. Overview of the pension system¹

1.1 Description of the pension system

The current public pension system in Cyprus comprises of:

- The General Social Insurance Scheme (GSIS), a compulsory earnings-related scheme which covers every person gainfully employed in Cyprus, both in public and private sector, including self-employed;
- The Social Pension Scheme, an income-tested scheme, which covers residents of Cyprus with no or low pension income; and
- The Government Employees Pension Scheme (GEPS), which is closed to new members since 2011 and provide supplementary (2nd pillar) pensionable benefits to their members (civil servants).

Appendix 1 gives an overview of the public pension system including the main provisions to pension benefits provided under the above three schemes. Aside from the GEPS which grants pension benefits to government employees, the Cypriot public pension system does not have any other special pension schemes, targeted to beneficiaries with a special status.

Table 1 shows the qualifying conditions and the legislated increase in the standard pensionable age for new retirees before and after the adoption of the December 2012 pension reform measures. Standard pensionable age is defined as the earliest age at which an insured person is entitled to a GSIS old-age pension without any exit penalty (or actuarial reduction). Following the 2012 pension reform, the statutory retirement age under GSIS is the same as the standard pensionable age.

The evolution of standard pensionable age is in line with the changes in life expectancy at the statutory retirement age, based on Eurostat's latest population projection (EUROPOP2023).

¹ For an exhaustive description of pension schemes, please consult the [PENSREF database](#).

Table 1 - Qualifying conditions for retirement

Year	Pre-2012 reform				Post-2012 reform	
	Insurance conditions	Standard pensionable age	Insurance conditions	Standard pensionable age	Insurance conditions (**)	Standard pensionable age
2022	(1) Insured for	65.0	(1) Insured for	63.0	(1) Insured for	65.0
2025	520 weeks;	65.0	520 weeks;	63.0	780 weeks;	65.1
2030	(2) paid	65.0	(2) paid	63.0	(2) paid	65.6
2035	insurance	65.0	insurance	63.0	insurance	66.1
2040	points = 10;	65.0	points = 10;	63.0	points = 15;	66.6
2045	and	65.0	and	63.0	and	66.6
2050	(3) paid or	65.0	(3) paid or	63.0	(3) paid or	67.1
2055	credited	65.0	credited	63.0	credited	67.6
2060	insurance	65.0	insurance	63.0	insurance	68.0
2065	points = 30% of	65.0	points = 70% of	63.0	points = 30% of	68.5
2070	insurance	65.0	insurance	63.0	insurance	69.0
	period (*).	65.0	period.	63.0	period.	69.4

(*) The number of years over the period between 5 October, 1964 (or the first day of the year of attainment of age 16, if later) and the week before the week of old-age pension entitlement.

(**) Effective 2.1.2017 onwards.

Source: Ministry of Labour and Social Insurance

1.2 Recent reforms of the pension system included in the projections

The projections incorporate the measures taken as part of the 2009 GSIS reform as well as the 2012 GSIS and GEPS reforms. Following are the two major measures of the above reforms, which are being implemented gradually and have a significant impact on the financial sustainability of the public pension system:

- *2009 GSIS reform*: Future increases in GSIS pension contributions of 1.3 percentage points (p.p.) every 5 years – first: 1.1.2009, next: 1.1.2024 and last: 1.1.2039; and
- *2012 GSIS and GEPS reforms*: Introduction of an automatic adjustment of the statutory retirement age every 5 years in line with changes in life expectancy at the statutory retirement age, to be applied as of 2018, with the first revision covering the period 2018-2023.

A detailed overview of 2012 reform measures of the public pension system is provided in Section 4.3.

In addition, the projections incorporate a more recent amendment of the Social Insurance Law, N. 126(I) of 2019, which was enacted on 5 August 2019 and stipulates the introduction of payment of widower's pensions to men under the same conditions as for women who lose their husbands.

1.3 Description of the actual 'constant policy' assumptions used in the projection

All provisions of the above enacted pension reforms have been fully applied in the present pension projection exercise and there are no deviations from the standard constant policy assumptions.

2. Overview of the demographic and labour force projections²

Since the main aim of this projection exercise is to review the financial position of the public pension system until 2070, the assumptions should reflect a long-term perspective. In setting the assumptions, historical trends, present economic environment, current public pension system situation and likely future trends should be taken into account. More emphasis should be put on historical long-term trends than on more recent short-term trends.

2.1 Demographic projections

A projection of the general population of the country is the basis for determining the number of contributors and beneficiaries of a pension system. EUROPOP2023, Eurostat's current population projection with base year 2022, was the demographic basis for the present exercise. In particular, projections of total population by age, sex and projection year, including detailed assumptions on fertility, mortality and migration, were used. Table [2] shows the expected evolution of population, life expectancy, surviving probabilities and net migration for selected years over the period 2022-2070.

Table 2 - Main demographic variables

Demographic variable	2022	2030	2040	2050	2060	2070	Peak value	Peak year*	Change 2022-70
Population (thousand)	915	959	974	983	993	997	997	2069	81
Population growth rate	1.7%	0.2%	0.1%	0.1%	0.1%	0.0%	1.7%	2023	-1.7%
Old-age dependency ratio (pop 65+ /pop 20-64)	26.7	32.1	36.7	42.1	51.5	55.5	55.5	2070	28.8
Old-age dependency ratio (pop 75+ /pop 20-74)	10.0	12.8	16.6	18.6	22.0	27.9	27.9	2070	17.9
Ageing of the aged (pop 80+/pop 65+)	23.9	26.5	31.7	34.3	33.4	40.4	40.4	2070	16.5
Men - Life expectancy at birth	80.5	81.8	83.2	84.4	85.6	86.8	86.8	2070	6.3
Women - Life expectancy at birth	84.6	85.8	87.0	88.1	89.2	90.3	90.3	2070	5.7
Men - Life expectancy at 65	19.1	19.9	20.9	21.9	22.8	23.7	23.7	2070	4.6
Women - Life expectancy at 65	21.8	22.6	23.6	24.6	25.5	26.4	26.4	2070	4.6
Men - Survivor rate at 65+	89.3	90.9	92.2	93.3	94.2	94.9	94.9	2070	5.7
Women - Survivor rate at 65+	94.2	95.1	95.7	96.3	96.8	97.2	97.2	2070	2.9
Men - Survivor rate at 80+	61.9	66.0	70.3	74.1	77.5	80.5	80.5	2070	18.6
Women - Survivor rate at 80+	76.9	80.1	82.9	85.4	87.5	89.3	89.3	2070	12.4
Net migration (thousand)	18.2	0.0	1.0	1.7	2.1	2.3	18.2	2022	-15.9
Net migration over population change	2.0%	0.0%	0.1%	0.2%	0.2%	0.2%	2.0%	2022	-1.8%

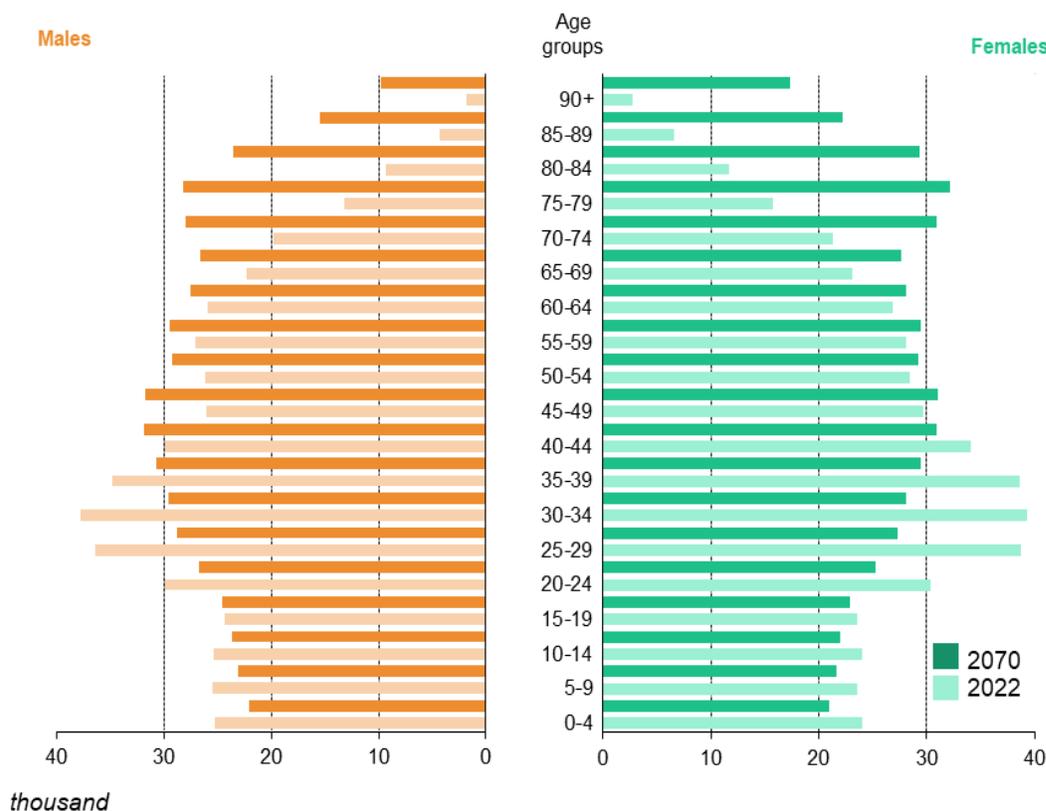
* Peak year represents the year in which the particular variable reaches its maximum over the projection period 2022 to 2070.

² For more details, see European Commission and EPC (2023), '[2024 Ageing Report: Underlying assumptions and projection methodologies](#)', European Economy, Institutional Paper 257.

It follows from Table [2] that the population of Cyprus is projected to increase from its present level of 915,000 persons in 2022 to 997,000 in 2070. Over the same period, the old-age dependency ratio, i.e., the ratio of the number of people aged 65 and over to those aged 20-64, which provides a demographic measure of population ageing, is projected to increase continuously from 26.7% in 2022 to 55.5% in 2070. In other words, in 2070, it is expected to have less than two working-age people for every person aged 65 and over.

The ageing of the Cypriot population is illustrated in Figure [1], which compares the population age structure by gender in 2022 with the one projected in 2070.

Figure 1 - Age structure: 2022 vs 2070

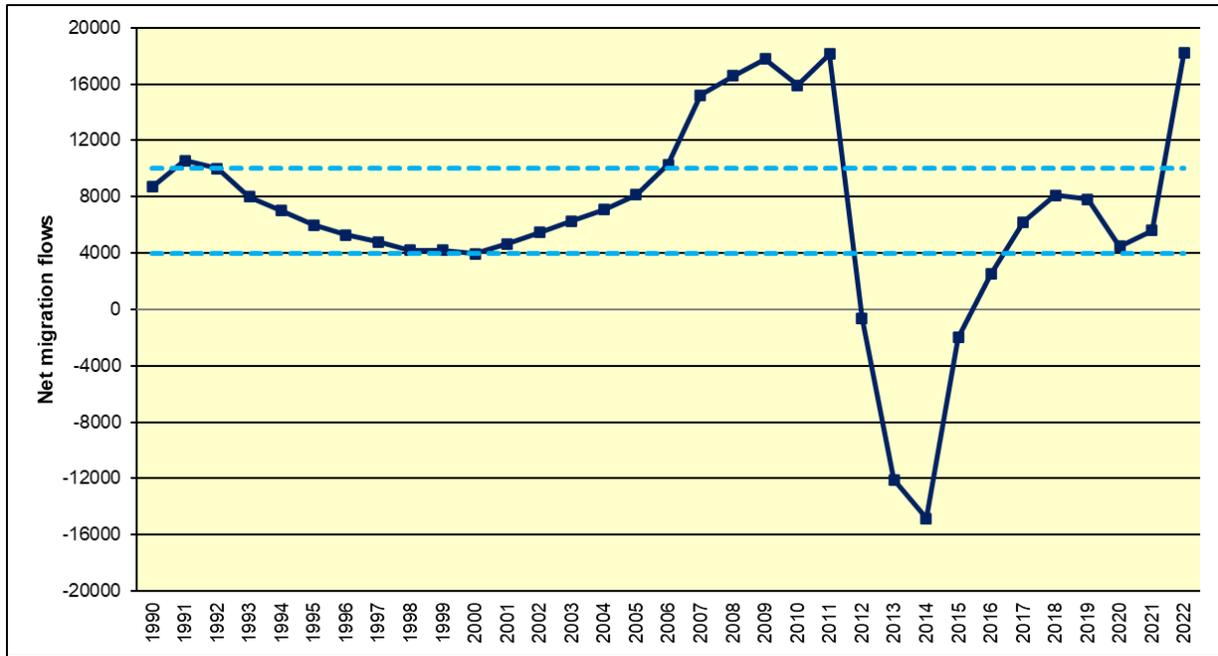


The above pace of population ageing, as shown in Table [2] and Figure [1], is greatly affected by Eurostat's projected net migration flows for Cyprus, which are significantly lower than historical longer-term trends. As it is illustrated from Figure [2] below, net migration in Cyprus has been relatively stable over the period 1990-2006, fluctuating between 4,000 and 10,000 net migrants per year. Over the above period, net migration averaged at around 6,700.

Over the period 2007-2014, net migration levels were unusual. In particular, during the period 2007-2011, the number of net migrants was exceptionally high, reaching 18,142 in 2011, while in years 2012-2014, the number of net migrants dropped significantly and became negative, primarily due to labour oversupply in certain sectors of the economy resulting from the economic crisis. Since 2015, the net migration is rapidly reversing back to normal, from

historical perspective, levels. Over the 5-year period 2017-2021, the net migration has been at normal levels and averaged at 6,440, despite the relatively small drop in migration in 2020 due to COVID-19 pandemic, which appeared in March 2020. In year 2022, the net migration experienced a strong increase reaching at around 18,200, primarily reflecting the positive macroeconomic and labour market developments and at a lesser extent reflecting the relatively large inflow of migrants as a result of the war between Russia and Ukraine, which started in February 2022.

Figure 2: Historical annual net migration flows, 1990-2022



According to this round of Eurostat projections, net migration over the projection period (2023-70) is projected to average at around 1,500³, which is significantly lower than historical longer-term trends, averaging to 6,700 during the stable economic periods of 1990-2006 and 2017-2021. Eurostat’s current projected migration flows over the period 2023-70 only represents approximately 20% of the historical trend figure of 6,700.

2.2 Labour force projections

In the long-run, labour supply is basically determined by the development of the population and its structure, and by changes in labour market behaviour of private households.

³ In accordance with the International Standard of Actuarial Practice for Financial Analysis of Social Security Programs (ISAP 2) of the International Actuarial Association, this is lower than what would be considered as a neutral assumption, reflecting longer-term trends. In accordance with paragraph 2.3 of the ISAP2, “neutral assumptions are such the actuary expects that the resulting projection of the Social Security Program experience is not a material underestimate or overestimate”.

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

	2022	2030	2040	2050	2060	2070	Peak value	Peak year*	Change 2022-70
Labour force participation rate 20-64	83.2	84.0	84.3	84.2	85.4	86.1	86.1	2070	3.0
Employment rate of workers aged 20-64	77.5	77.4	78.2	78.9	80.1	80.8	80.8	2070	3.3
Share of workers aged 20-64 in the labour force 20-64	93.2	92.2	92.7	93.7	93.8	93.8	94.0	2024	0.6
Labour force participation rate 20-74	74.4	73.6	74.0	73.3	72.8	75.0	75.0	2070	0.6
Employment rate of workers aged 20-74	69.4	67.9	68.8	68.8	68.4	70.5	70.5	2070	1.1
Share of workers aged 20-74 in the labour force 20-74	93.3	92.3	92.9	93.9	94.0	94.0	94.1	2024	0.7
Labour force participation rate 55-64	68.0	65.4	69.2	70.4	72.8	76.1	76.1	2070	8.1
Employment rate of workers aged 55-64	64.6	61.5	65.4	67.1	69.4	72.5	72.5	2070	7.9
Share of workers aged 55-64 in the labour force 55-64	95.0	94.0	94.5	95.4	95.3	95.2	95.5	2024	0.3
Labour force participation rate 65-74	16.5	13.0	14.3	18.3	20.7	23.4	23.4	2070	6.9
Employment rate of workers aged 65-74	16.2	12.6	14.0	18.0	20.3	22.9	22.9	2070	6.7
Share of workers aged 65-74 in the labour force 65-74	98.0	97.5	97.7	97.9	97.9	97.9	98.2	2025	-0.1
Median age of the labour force	38.0	39.0	41.0	41.0	41.0	42.0	42.0	2069	4.0

* *Peak year* represents the year in which the particular variable reaches its maximum over the projection period 2022 to 2070.

As shown in Table [3] above, over the period 2022-2070 the average labour force participation rate for the age group 20-64 is assumed to increase by 3% from its current level of 83.2% to 86.1% in 2070, while for the age group 65-74 is projected to increase even higher by a factor of 1.4, i.e., from 16.5% in 2019 to 23.4% in 2070.

Changes in the average participation rate mainly result from the anticipated increase in the average labour force exit age due to the 2012 GSIS and GEPS reforms, as illustrated in Tables [4a] and [4b], and to a lesser extent from changes in the structure of the active population over time (changing weight of different age groups in the total population) and thus reflect the general ageing process of the Cypriot population.

Tables [4] summarizes the estimated evolution of the average effective working career, as derived from the labour Cohort Simulation Model (CSM), and the life spent at retirement for men and women respectively. It also provides evidence of the effectiveness of active labour market policies and penalties on early retirement on prolonging working career.

Table 4 - Labour market exit behavior

Total	2022	2030	2040	2050	2060	2070	Peak value	Peak year	Change 2022-70
Average effective retirement age (administrative data) *	63.7	65.2	65.7	66.6	67.7	68.4	68.4	2070	4.8
Average labour market exit age (CSM)**	63.7	64.0	64.6	65.2	65.9	66.7	66.7	2070	3.0
Duration of retirement***	21.9	22.2	22.7	23.3	23.3	23.2	23.9	2067	1.4
Percentage of adult life spent in retirement****	33%	33%	34%	34%	34%	33%	34%	2052	0%
Early/late exit*****	2.3	2.8	2.2	2.3	2.0	7.1	7.1	2070	4.8
Men	2022	2030	2040	2050	2060	2070	Peak value	Peak year	Change 2022-70
Average effective retirement age (administrative data) *	63.5								
Average labour market exit age (CSM)**	64.0	64.3	64.8	65.4	66.0	66.7	66.7	2070	2.7
Duration of retirement***	20.0	20.8	20.9	21.9	21.9	21.9	22.5	2067	1.9
Percentage of adult life spent in retirement****	31%	32%	32%	33%	32%	32%	33%	2052	1%
Early/late exit*****	1.5	2.2	1.9	2.1	1.8	5.6	5.6	2070	4.1
Women	2022	2030	2040	2050	2060	2070	Peak value	Peak year	Change 2022-70
Average effective retirement age (administrative data) *	63.8								
Average labour market exit age (CSM)**	63.5	63.8	64.4	65.1	65.9	66.7	66.7	2070	3.2
Duration of retirement***	23.7	23.5	24.5	24.6	24.6	24.5	25.2	2067	0.8
Percentage of adult life spent in retirement****	35%	35%	36%	35%	35%	34%	36%	2040	-1%
Early/late exit*****	3.2	3.4	2.6	2.6	2.2	8.6	8.6	2070	5.4

* The 'average effective retirement age' is the age at which people start receiving a pension benefit (old-age, early or disability). It is calculated on the basis of the administrative data on new pensioners for 2022, showing projected data for the other years for the total. ** 'Average labour market exit age (Cohort Simulation Model)' refers to 2023 instead of 2022. *** 'Duration of retirement' is the remaining life expectancy at the average labour market exit age. **** The 'percentage of adult life spent in retirement' is calculated as the ratio between the duration of retirement and the life expectancy minus 20 years. ***** 'Early/late exit' is the ratio between those who exit the labour market before reaching the statutory retirement age and those who exit at or beyond the statutory retirement age. For 2022, the value refers to 2023.

3. Pension projection results

3.1 Coverage of the pension projections

As it was the case with the 2021 Ageing Report, the projections of the 2024 AWG pension exercise cover the pension expenditure of the General Social Insurance Scheme (GSIS), Government Employees Pension Scheme (GEPS) and Social Pension Scheme (SPS). Table [5] compares the AWG public pension expenditure with the corresponding expenditure as defined by Eurostat.

Table 5 - ESSPROS and AWG definition of pension expenditure (% GDP)

	2013	2014	2015	2016	2017	2018	2019	2020	2021	Change 2013-22
Eurostat total pension expenditure	9.3	10.0	10.1	9.8	9.3	9.1	8.8	9.5	:	0.2
Eurostat public pension expenditure (A)	8.9	9.6	9.6	9.3	8.9	8.7	8.5	9.1	:	0.3
Public pension expenditure (AWG: outcome) (B)	8.9	9.5	9.5	9.2	8.8	8.5	8.2	8.9	8.6	-0.3
Difference Eurostat/AWG: (A)-(B)	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.2	:	0.2

It follows from Table [5] that the AWG public pension expenditure represents almost 100% of the total public pension expenditure as defined by Eurostat (ESSPROS) in all years over the period 2013 to 2020, with a small discrepancy in recent years.

3.2 Overview of projection results

Table [6] shows the aggregate results of the projections for public pension expenditure, representing pension spending under GSIS, GEPS and SPS, as well as contributions over the period 2022-2070. All pension expenditure and contributions figures are gross of tax and expressed in percentage of GDP.

Table 6 - Projected gross and net pension spending and contributions (% of GDP)

Public pension	2022	2030	2040	2050	2060	2070	Peak value	Peak year*	Change 2022-70
Expenditure	8.2	9.3	10.4	11.0	12.0	11.8	12.5	2065	3.6
Contributions**	8.2	9.0	10.0	10.0	10.0	10.0	10.1	2068	1.9
Balance of the public pension system (% GDP)***	0.0%	-0.3%	-0.5%	-1.0%	-2.0%	-1.8%	-2.4%	2065	-1.8%

* *Peak year* represents the year in which the particular variable reaches its maximum over the projection period 2022 to 2070.

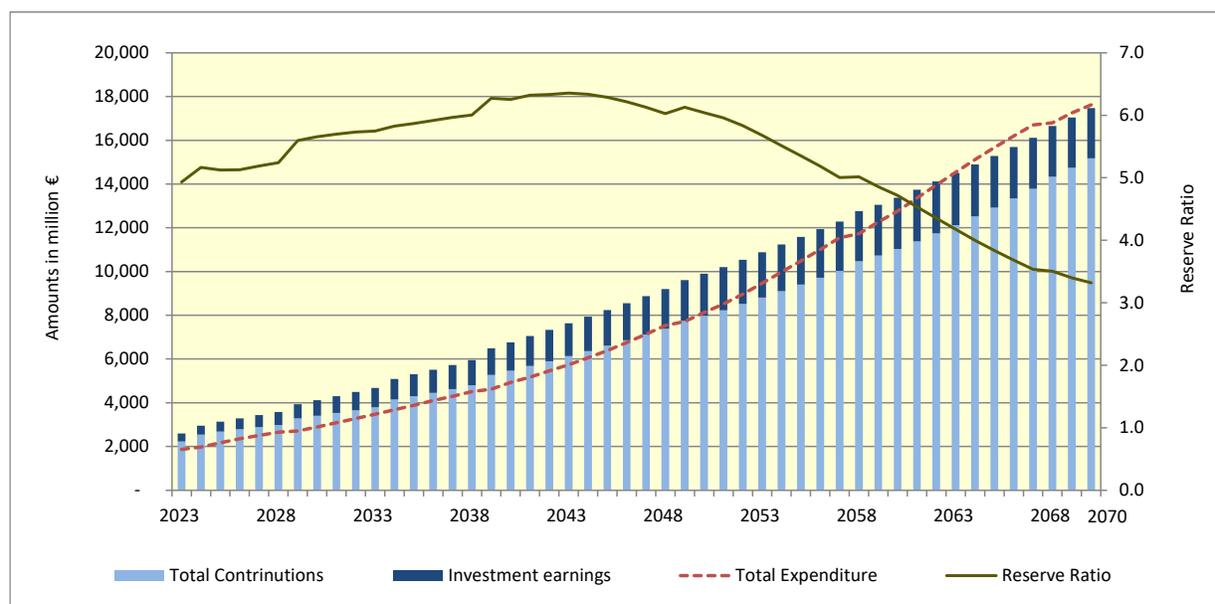
** Contributions arising from employee, employer and state GSIS legislated schedule of contribution rates, allocated to the long-term benefits (pensions) branch of the GSIS, and employee GEPS contribution rate.

*** Contributions minus Expenditure.

The results indicate that over the period 2022-70, the public pension spending, as percentage of GDP, is expected to increase by 3.6 percentage points, i.e., from 8.2 per cent to 11.8, with a peak of 12.0 per cent in 2060. Over the same period, the pension contributions increase by 1.9 percentage points from 8.2 per cent in 2022 to 10 per cent of GDP in 2070, primarily due to the legislated future increases in the GSIS contribution rate over the period until 2039.

For the purposes of measuring the financial position of the GSIS over the projection period, the reserve ratio⁴ is calculated. Figure [3] presents, for each year until 2070, the total revenues of the GSIS, consisting of the amount of contributions and investment earnings⁵, the GSIS pension expenditures and the GSIS reserve ratio.

Figure 3 - Projected GSIS revenues and expenditure and reserve ratio, 2023-2070 (in million €)



It follows from Figure [3] that GSIS contributions are sufficient to support the scheme’s expenditures for most of the projection period and that investment earnings help compensate for small contribution insufficiencies towards the end of the projection period, thus ensuring the maintenance of a constantly positive reserve.

Table [7] shows how the overall evolution of pension expenditure over the period 2022-70 is disaggregated, among the following four types of pensions, namely “Earnings-related old-age and early”, “Non-earnings related old-age and early”, “Disability” and “Survivors”.

⁴ The ratio of the level of reserves at the end of one year to the level of expenditures for the same year.

⁵ Investment income is based on the rate of return on GSIS assets. The annual nominal rate of return on GSIS assets is projected to gradually increase from its current level of 2.96 per cent in 2022 to 4.7 per cent in 2032, then decrease to 4 per cent in 2051, and remain constant thereafter.

Table 7 - Gross public spending by scheme (% of GDP)

Public pension	2022	2030	2040	2050	2060	2070	Peak value	Peak year*	Change 2022-70
Total public pensions	8.2	9.3	10.4	11.0	12.0	11.8	12.5	2065	3.6
Old-age and early pensions	6.9	7.5	8.4	8.9	9.8	9.6	10.2	2065	2.7
Flat component	:	:	:	:	:	:	:	:	:
Earnings-related	6.6	7.2	8.1	8.6	9.6	9.5	10.0	2065	2.9
Minimum pensions (non-contributory)	0.3	0.3	0.3	0.2	0.2	0.1	0.3	2026	-0.2
Disability pensions	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2045	0.0
Survivor pensions	1.2	1.6	1.9	2.0	2.1	2.1	2.1	2068	0.9

* *Peak year* represents the year in which the particular variable reaches its maximum over the projection period 2022 to 2070.

It is clear from Table [7] that “Earnings-related old-age and early pensions” spending represents the largest category of total spending and is projected to increase over the projection period, from 6.6 per cent of GDP in 2022 to 9.5 per cent of GDP in 2070.

The second largest category of total pension spending is “Survivors’ pensions”, which significantly increases over the same period, from 1.2 per cent of GDP in 2022 to 2.1 per cent of GDP in 2070. The main driver of the projected increase in “Survivors’ pensions” spending over the period from 2022 to 2040, which is estimated to increase by 58 per cent (from 1.2 to 1.9 per cent of GDP), is the recent amendment in the social insurance law. That amendment stipulates the payment of survivors’ pensions to men under the same conditions as for women who lost their husbands, thus resulting to a gradually increase in the number of male surviving beneficiaries until 2040, when this benefit provision is projected to mature.

The “Disability” and “Non-contributory old-age and early” pension spending represents very small proportions of total pension spending; their level is around 0.1 per cent of GDP respectively throughout the projection period.

The “Non-contributory old-age and early” pension spending, which represents the social pension expenditure, is projected to decrease from 0.3% in 2022 to 0.1% of GDP in 2070. The above decrease over the projection period is primarily due to the estimated decline in the number of social pension beneficiaries, 96% of whom are women. In turn, the expected decline in the number of female social pension beneficiaries stem from the increasing share of women who are projected to be entitled to an old-age pension from the GSIS primarily as a result of the continued increasing female labour force participation rates.

3.3 Description of main driving forces behind the projection results and their implications

The equation below shows a standard arithmetic breakdown of the pension expenditure-to-GDP ratio into the dependency, coverage, benefit ratio and labour market effects, as shown in the equations below:

$$\frac{\text{pension expenditure}}{\text{GDP}} = \overset{\text{dependency ratio}}{\downarrow} \frac{\text{population } 65+}{\text{population } 20-64} \times \overset{\text{coverage ratio}}{\downarrow} \frac{\text{number of pensioners}}{\text{population } 65+} \times \overset{\text{benefit ratio}}{\downarrow} \frac{\text{average pension income}}{\frac{\text{GDP}}{\text{hours worked } 20-74}} \times \overset{\text{labour market effect}}{\downarrow} \frac{\text{population } 20-64}{\text{hours worked } 20-74} \quad [1]$$

$$\frac{\text{number of pensioners}}{\text{population } 65+} = \overset{\text{coverage ratio old-age}}{\downarrow} \frac{\text{number of pensioners } 65+}{\text{population } 65+} + \left(\overset{\text{coverage ratio early-age}}{\downarrow} \frac{\text{number of pensioners } \leq 65}{\text{population } 50-64} \times \overset{\text{cohort effect}}{\downarrow} \frac{\text{population } 50-64}{\text{population } 65+} \right) \quad [2]$$

$$\frac{\text{population } 20-64}{\text{hours worked } 20-74} = \overset{1/\text{employment rate}}{\downarrow} \frac{\text{population } 20-64}{\text{employed people } 20-64} \times \overset{1/\text{labour intensity}}{\downarrow} \frac{\text{employed people } 20-64}{\text{hours worked by people } 20-64} \times \overset{1/\text{career shift}}{\downarrow} \frac{\text{hours worked by people } 20-64}{\text{hours worked by people } 20-74} \quad [3]$$

Figure [4] shows the contribution of each of the above factors to the overall change of 3.6 per cent of GDP in the public pension expenditures between 2022 and 2070, based on data on pensioners.

Figure 4 - Factors behind the overall change in public pension expenditures between 2022 and 2070 (as % of GDP)

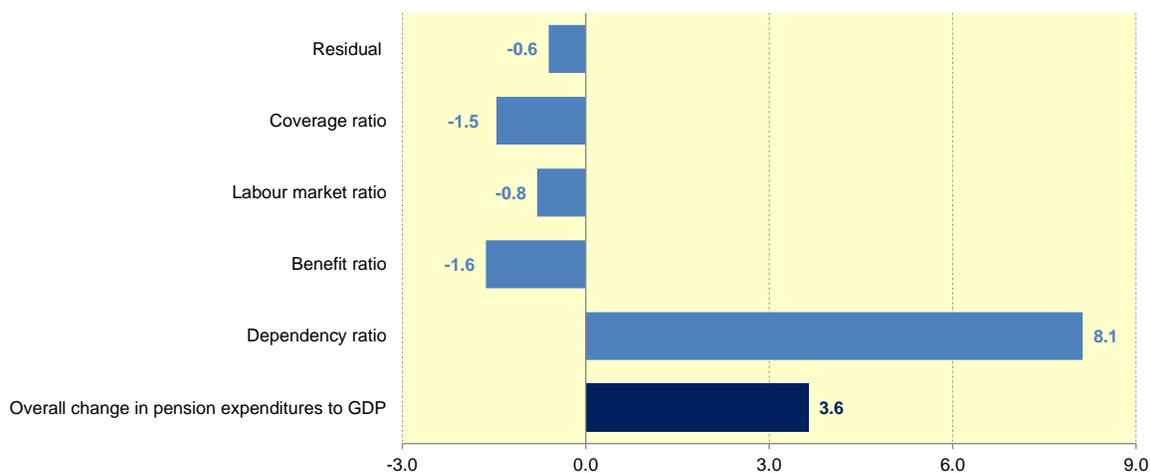


Table [8] shows in detail the drivers of the change in the public pension expenditure-to-GDP ratio between 2022 and 2070, as well as during the intervening decades, using data on pensioners.

Table 8 - Factors behind the change in public pension expenditure between 2022 and 2070 (pps of GDP) – pensioners⁶

Public pension	2022-30	2030-40	2040-50	2050-60	2060-70	2022-70
Public pensions to GDP	1.1	1.1	0.6	1.0	-0.2	3.6
Dependency ratio effect	1.7	1.3	1.5	2.4	0.9	7.8
Coverage ratio effect*	-0.2	0.4	0.2	-0.6	-1.4	-1.6
<i>Coverage ratio old-age</i>	0.2	0.5	0.3	-0.5	-1.4	-0.8
<i>Coverage ratio early-age</i>	-3.2	-1.7	-0.6	-0.7	-1.2	-7.5
<i>Cohort effect</i>	-1.5	0.1	-0.7	-3.0	-0.7	-5.8
Benefit ratio effect	-0.4	-0.5	-0.8	-0.4	0.5	-1.5
Labour market effect	0.1	-0.1	-0.2	-0.4	-0.1	-0.8
<i>Employment ratio effect</i>	0.0	-0.1	-0.1	-0.2	-0.1	-0.5
<i>Labour intensity effect</i>	0.0	0.0	0.0	0.0	0.0	0.0
<i>Career shift effect</i>	0.0	0.0	-0.1	-0.2	0.0	-0.3
Residual	-0.1	0.0	-0.1	-0.1	-0.1	-0.3

*Subcomponents of the coverage ratio effect do not sum up necessarily

Following are the main points from Figure [4] and Table [8]:

- The expected increase in total public pension expenditure of 3.6 per cent over the period 2022-70 is driven by the significant deterioration of the old-age dependency ratio (+8.1).
- Partially offsetting this upward pressure on pension expenditure from demographics, is the impact of:
 - ✓ a decrease in the benefit ratio (-1.6), primarily due to the closure of GEPS to new members effective 2011, as well as the price indexation of GEPS pension benefits in the longer term; and
 - ✓ a decrease in coverage ratio (-1.5), mainly caused by the linkage of statutory retirement age under GSIS and GEPS with changes in life expectancy.

⁶ For the disaggregation based on the number of pensions, see Table A2.2 in Appendix 2.

Table [9] shows the evolution of the benefit ratio (BR) and the replacement rate at retirement (RR). The RR represents the average amount of newly-awarded old-age pension in a given year over the level of the previous year's gross average wage⁷, which is defined as the average economy-wide gross wage including employer's social security contributions.

Table 9 – Benefit ratio (BR), replacement rate at retirement (RR) and coverage by pension scheme (in %)

	2022	2030	2040	2050	2060	2070	Change 2022-2070 (pps)
Public scheme (BR) – All types of pension and all schemes	57%	56%	53%	49%	47%	49%	-8%
Coverage	100%	100%	100%	100%	100%	100%	0%
Public scheme: old-age earnings related (BR)	60%	55%	50%	44%	42%	44%	-16%
Public scheme: old-age earnings related (RR)	38%	47%	45%	41%	48%	49%	11%
Coverage	76%	79%	82%	87%	90%	90%	14%
Total benefit ratio	57%	56%	53%	49%	47%	49%	-8%
Total replacement rate (earnings-related benefits)	38%	47%	45%	41%	48%	49%	11%

Table [9] illustrates that the benefit ratio (BR) of the old-age earnings related part of the public pension system drops by 16 percentage points over the projection period 2022-2070, primarily explained by the closure of the GEPS since 2011. In addition, it shows that the replacement rate at retirement (RR) of the old-age earnings related part of the public pension system increases by 11 percentage points over the projection period 2022-2070, primarily due to the maturity of the supplementary part of the GSIS over the decade 2022-2030. The projected evolution of the average newly-awarded GSIS old-age pension is analysed in detail in Table [13].

Table [10] presents pension system dependency ratio (SDR) and old-age dependency ratio (ODR) for a better understanding of the impact of demographic factors on financial sustainability of public pension schemes.

Table 10 - System dependency ratio and old-age dependency ratio

	2022	2030	2040	2050	2060	2070	Change 2022-70
Number of pensioners (I)	173	204	243	280	310	291	119
Employment (II)	459	459	464	469	459	454	-4
Pension System Dependency Ratio (SDR) (I)/(II)	0.4	0.4	0.5	0.6	0.7	0.6	0.3
Number of people aged 65+ (III)	152	184	209	237	276	291	139

⁷ Such a ratio is useful to assess the projected evolution of the average newly-awarded pension amount in comparison with the development of productivity. However, it should not be considered as replacement ratio because the denominator "average economy-wide wage" does not represent the average wage just before retirement and it differs from the average contributory earnings.

Working age population 15-64 (IV)	568	572	569	563	535	525	-43
Old-age Dependency Ratio (ODR) (III)/(IV)	0.3	0.3	0.4	0.4	0.5	0.6	0.3
System efficiency (SDR/ODR)	1.4	1.4	1.4	1.4	1.3	1.2	-0.3

It follows from Table [10] that the number of pensioners is expected to grow significantly over the projection period due to population ageing. In particular, the number of pensioners is projected to grow by a factor of 1.8, i.e., from 173,000 in 2022 to 310,000 in 2060, and thereafter slightly decrease to 291,000 in 2070.

Table [11] shows the evolution of the total number of public pensioners as percentage of inactive population and total population by various age groups.

Table 11 - Public pensioners to (inactive) population by age group (%)

Pensioners/inactive population	2022	2030	2040	2050	2060	2070
Age group -54	1.5	1.6	1.7	1.6	1.4	1.4
Age group 55-59	17.6	18.8	20.4	19.0	19.9	18.7
Age group 60-64	54.7	21.9	18.4	18.9	18.7	18.5
Age group 65-69	123.0	103.9	129.8	118.4	68.3	37.7
Age group 70-74	105.0	139.1	126.7	152.8	137.9	105.4
Age group 75+	111.3	103.7	111.6	115.2	129.4	119.7

Pensioners/total population	2022	2030	2040	2050	2060	2070
Age group -54	0.6	0.6	0.7	0.6	0.5	0.5
Age group 55-59	4.2	4.4	4.4	4.1	3.8	3.3
Age group 60-64	22.0	10.0	7.6	7.2	6.4	5.6
Age group 65-69	96.1	83.9	99.8	84.2	44.8	22.0
Age group 70-74	93.8	131.2	120.3	143.9	129.3	98.5
Age group 75+	111.3	103.7	111.6	115.2	129.4	119.7

Table [11] clearly indicates the impact on the number of pensioners of the increase in the statutory retirement age in line with changes in life expectancy, particularly for the age group 65-69 as well as for the period after 2040, when the effect of the linkage of retirement age and life expectancy dominates.

Table [12] shows the evolution of the number of female public pensioners as percentage of inactive population and total population by various age groups.

Table 12 - Female pensioners to (inactive) population by age group (%)

Female pensioners/inactive population	2022	2030	2040	2050	2060	2070
Age group -54	1.8	1.9	2.2	2.0	1.7	1.8
Age group 55-59	16.5	18.9	19.6	18.9	20.5	18.3
Age group 60-64	38.2	22.3	18.3	19.6	19.9	18.8
Age group 65-69	115.0	104.1	131.1	112.4	69.9	42.2
Age group 70-74	96.1	130.0	126.0	138.8	130.5	100.0
Age group 75+	111.2	104.2	112.1	115.2	123.9	116.4

Female pensioners/total population	2022	2030	2040	2050	2060	2070
Age group -54	0.7	0.8	0.9	0.8	0.7	0.7
Age group 55-59	5.5	5.6	5.1	5.0	4.8	4.0
Age group 60-64	20.4	11.6	8.6	8.3	7.7	6.4
Age group 65-69	97.6	89.2	105.5	83.6	48.5	26.2
Age group 70-74	92.8	124.7	120.8	131.8	123.3	94.3
Age group 75+	111.2	104.2	112.1	115.2	123.9	116.4

Similarly, Table [12] indicates the impact on the number of female pensioners of the increase in the statutory retirement age in line with changes in life expectancy, again for the age group 65-69 for the period after 2040.

Table [13] shows the evolution of the GSIS pension expenditure for new old-age pensioners and its disaggregation into the factors of 'Number of new pensions', 'Average number of insurance points at retirement', 'Average accrual rate' and 'Point value'.

Table 13 - Breakdown of new public pension expenditure - GSIS: old-age and early earnings-related pensions)

New old-age earnings-related pensions - TOTAL	2022	2030	2040	2050	2060	2070
Projected new pension expenditure (million EUR)*	68	145	234	331	575	527
I. Number of new pensions (1000)	8.1	10.0	11.6	12.5	13.4	8.6
II. Point value (EUR/month)	769.8	1148.2	1639.3	2354.1	3326.6	4630.1
III. Average accrual rate (points/year) (IV/V)	1.28%	1.29%	1.24%	1.24%	1.24%	1.20%
IV. Total pension points at retirement	66	75	76	70	81	85
V. Average contributory period (years)						
VI. Sustainability/adjustment factors	1.0	1.0	1.0	1.0	1.0	1.0
VII. Correction coefficient	1.0	1.0	1.0	1.0	1.0	1.0
VIII. Average number of months paid the first year	13.0	13.0	13.0	13.0	13.0	13.0

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

Following are the main points from Table [13]:

- The average accrual rate slightly decreases over the projection period, mainly due to the abolishment of the increase of pensions for a working dependent spouse under the GSIS since 1 January 2013, following the 2012 GSIS reform, and the increasing share of female insured persons, who, compared to male pensioners, are entitled to a lower effective accrual rate under the basic part of the GSIS since they are entitled to a dependents' increase in their basic pension at lower rate. In addition, effective accrual rate decreases as the insurance period in basic insurance increases in line with the expected increase in statutory retirement age.
- The average number of insurance points, which represents the overall paid or credited insurance points under both the basic and supplementary part of the GSIS, increases significantly over the period until 2040, primarily due to the maturity of the supplementary part of the GSIS and the increasing number of contributory years for females as a result of their increasing participation in the labour market. Over the period 2040-2050, the average number of insurance points slightly decreases primarily due to a cohort effect stemming from the increasing share of insured persons with lower level of insurable earnings, who accumulate lower number of insurance points in the supplementary part of the GSIS. Over the last two decades 2050-2070, there is a strong increase in the average number of insurance points primarily due to the fact that the cohort effect fades out while the anticipated increase in the effective retirement age resulting from the linkage of retirement age and life expectancy dominates.

In section A2.3 of Appendix 2, the above information with respect to the projected and disaggregated new GSIS old-age pension expenditure is provided for males and females.

3.4 Financing of the pension system

Table [14] shows the current contribution rate paid by or on behalf of GSIS insured persons. Section A1.3 of Appendix 1 provides more details on the GSIS financing.

Table 14 - Financing of the public pension system

	Public employees*	Private employees	Self-employed	
Contribution base	Gross earnings		Insurable income per occupational category	
Contribution rate/contribution				
	Employer	8.3%	8.3%	15.6% of insurable income
	Employee	8.3%	8.3%	
	State	4.9%	4.9%	4.9%
	Other Revenues	Reserve fund	Reserve fund	Reserve fund
Maximum contribution	Paid on Maximum Insurable Earnings (€58,080 for 2022)			
Minimum Contribution	Not applicable			

* Public employees, who are covered by the GEPS, an occupational pension scheme which is integrated with the GSIS, i.e., GEPS pension includes GSIS supplementary pension, subject to a lower contribution rate.

Table [15] shows the projected development of revenue from contributions arising from employee, employer and state GSIS legislated schedule of contribution rates and employee GEPS contribution rate.

Table 15 - Revenue from contributions (as % of GDP), number of contributors in the public scheme (in 1000), total employment (in 1000) and related ratio (%)

	2022	2030	2040	2050	2060	2070	Change 2022-70
Public contribution	8.2	9.0	10.0	10.0	10.0	10.0	1.9
<i>Employer contribution</i>	3.0	3.4	3.8	3.8	3.8	3.8	0.7
<i>Employee contribution</i>	3.2	3.5	3.8	3.8	3.8	3.8	0.5
<i>State contribution</i>	1.9	2.1	2.4	2.4	2.5	2.5	0.6
Number of contributors (I) (1000)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Employment (II) (1000)	556	543	544	550	538	531	-25
Ratio of (I)/(II)	459	459	464	469	459	454	-4

It follows from Table [15] that the revenue from public contributions is projected to increase by 1.9 percentage points over the projection period 2022-2070, which reflects the legislated future increases in the GSIS contribution rate over the period until 2039. In particular, there are four remaining future increases - the next increase is due on 01/01/2024, subsequent increases as of 01/01/2029 and 01/01/2034, and the last increase is legislated to take place on 01/01/2039. In addition, Table [15] illustrates that the ratio of contributors (as per social security administrative database) to the employed population (as per Labour Force Survey) is projected to remain relatively stable at around 120% throughout the projection period, ensuring the consistency in the development of contributors versus employment.

3.5 Public pension funds

Table [16] shows the evolution of GSIS reserves, as percentage of GDP, as well as the assumed rate of return on GSIS assets.

Table 16 - Pension funds' position and reserves (%GDP) and return on assets (%)

	2022	2030	2040	2050	2060	2070	Average 2022-2070
Stock of assets (end-of-year; %GDP)	31.4	42.7	55.9	61.4	54.6	38.7	50.5
Fund balance (million EUR)	312.9	1222.1	1835.2	1779.7	612.8	-147.3	
Fund expenditure	1674.7	2893.1	4926.1	8122.1	12765.5	17618.5	
Disbursements (to pension scheme)	1674.7	2893.1	4926.1	8122.1	12765.5	17618.5	
Other expenditure (incl. admin. costs)	0.0	0.0	0.0	0.0	0.0	0.0	
Fund revenues	1987.6	4115.2	6761.3	9901.9	13378.2	17471.2	
Return on assets	46.8	708.1	1295.0	1922.4	2348.9	2297.6	
Other income (incl. pension contributions)	1940.8	3407.1	5466.4	7979.4	11029.4	15173.6	
Nominal rate of return (%)	4.2%	4.6%	4.4%	4.1%	4.0%	4.0%	4.1%
Change in asset valuation (million EUR)	0.0	0.0	0.0	0.0	0.0	0.0	

3.6 Sensitivity analysis

Table [17] presents the projected public pension expenditure under different sensitivity scenarios in terms of its deviation in pps. from the baseline scenario.

Table 17 – Public expenditure projections under different scenarios (pps deviation from baseline)⁸

	2022	2030	2040	2050	2060	2070	Change 2022-70 (pps)
Baseline (%GDP)	8.2	9.3	10.4	11.0	12.0	11.8	3.6
Higher life expectancy at birth (+2y)	0.0	0.0	0.0	0.0	0.2	0.1	0.1
Higher migration (+33%)	0.0	-0.3	-0.6	-1.0	-1.3	-1.2	-1.2
Lower migration (-33%)	0.0	0.3	0.7	1.2	1.7	1.8	1.8
Lower fertility (-20%)	0.0	0.0	0.0	0.2	0.5	0.8	0.8
Higher inflation scenario (2% by 2052)	0.0	-0.2	-0.3	-0.1	-0.1	0.0	0.0
Higher employment rate of older workers (+10 pps)	0.0	-0.2	-0.3	-0.4	-0.5	-0.3	-0.3
Higher productivity (TFP converges to 1%)	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1
Lower productivity (TFP converges to 0.6%)	0.0	0.0	0.1	0.2	0.3	0.4	0.4
Policy scenario: constant retirement age	:	:	:	:	:	:	:
Policy scenario: constant benefit ratio	0.0	0.1	0.4	1.4	2.4	2.5	2.5

Following are the main points from Table [17]:

- *Higher life expectancy* – the sensitivity of the results to an increase of life expectancy at birth of two years by 2070 seems relatively small. Higher number of pensions and increased duration of pension payments in retirement, caused by increases in life expectancy, contribute positively to the above pension expenditure variation. Offsetting this positive contribution is a negative contribution stemming from the anticipated increase in the effective retirement age resulting from the linkage of retirement age and life expectancy.
- *Higher/lower migration* – A scenario with net migration being 33% higher/lower than in the baseline scenario, leads to a lower/higher ratio of pension expenditure to GDP of 1.2/1.8 p.p. in 2070. In fact, higher/lower migration increases/decreases employment and output, whereas pension expenditure gradually increase/decrease over the projection period – in other words, the “denominator effect” dominates the “numerator effect”.

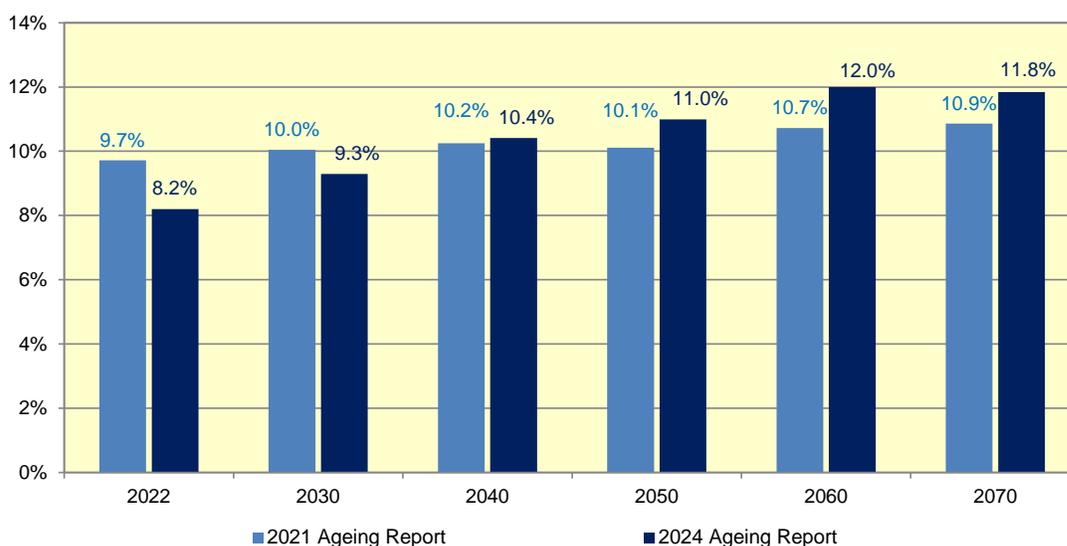
⁸ For more information on the design of the sensitivity scenarios, see Chapter 5 of Part I in European Commission and EPC (2023), [‘2024 Ageing Report: Underlying assumptions and projection methodologies’](#), European Economy, Institutional Paper 257.

- *Lower fertility* - A scenario with the fertility rate being 20% lower than in the baseline scenario, gradually increases the ratio of pension expenditure to GDP from 2050 onwards. In particular, the deviation from the baseline is 0.2 p.p. in 2050, rising to 0.8 p.p. in 2070. In fact, lower fertility decreases employment and output in the longer term, whereas pension expenditure decreases only marginally – in other words, the “denominator effect” dominates the “numerator effect”.
- *Higher employment rate of older workers* - A scenario with an employment rate of older workers (55-74), 10 p.p. above that of the baseline scenario, leads to a constant decrease of the expenditure-to-GDP ratio, particularly in the medium and long term, due to a constant increase in the effective retirement age and a continuous increase of employment, resulting to higher potential output over the projection period.
- *Higher TFP* - A scenario with higher TFP (convergence to 1.0%) leads to a constant decrease of the expenditure to GDP ratio from 2050 onwards.
- *TFP Risk scenario* – The impact of this scenario, where TFP growth converges to 0.6%, leads to an increase in expenditure from 2040 onwards.
- *Policy scenario – unchanged retirement age* – leads to a significant increase in expenditure, particularly from 2040 onwards, reaching a 2.5 p.p. higher level in 2070. This underscores the impact the link to life expectancy has on public pension expenditure.
- *Policy scenario - offset declining pension benefit ratio* - leads to a significant increase in expenditure, particularly from 2040 onwards, reaching to 2.1 p.p. higher level in 2070. This scenario highlights the potential costs of preventing the adequacy of pension benefits from declining too much.
- *High inflation* - the long-term effect on public pension expenditure is very insignificant. The deviation of expenditure in 2070 from baseline is close to 0.

3.7 *Changes in comparison with previous Ageing Report projections*

Figure [5] compares the projected public pension expenditure figures under the AWG 2024 and AWG 2021 projections exercise.

Figure 5 - Public pension expenditure (as % GDP) over the period 2022-2070 - AWG 2024 vs AWG 2021 projection exercise



The 2024 AWG pension expenditure in base year 2022 (8.2 per cent of GDP) stands at a lower level than that of the 2021 AWG exercise (9.7 per cent of GDP) by a considerable margin of 1.5 percentage points of GDP, primarily due to the better-than-expected performance of the economy in recent years⁹.

Over projection period 2022-2070, the 2024 AWG pension expenditure (as per cent of GDP) is projected to grow at a faster rate compared to that of the 2021 AWG exercise, reaching at the level of 11.8 per cent of GDP in 2070, which is 0.9 percentage points higher than that of the 2021 AWG exercise (10.9 per cent of GDP). The above higher growth rate is primarily due to less favourable demographics, mainly caused by lower migration levels, as well as lower GDP growth rate over the projection period.

In addition, under the present 2024 AWG exercise, the change in pension expenditure over the projection period through 2070 is 3.6 percentage points of GDP (from 8.2% in 2022 to 11.8% in 2070). This projected increase represents a deterioration compared with the 2021 AWG pension projection exercise, under which the change in pension expenditure over the same period was 2.1 percentage points of GDP.

Table [18] provides a comparison of the decomposition of the change in public pension expenditure during the projection period among the 2024 AWG projection exercise and previous (2006, 2009, 2012, 2015, 2018, 2021 and 2024) AWG exercises.

⁹ The level of GDP in nominal terms in year 2022 under the AWG exercise is 23% higher than the respective level under the AWG 2021 exercise.

Table 18 - Disaggregation of the change in the public pension expenditure-to-GDP ratio in consecutive Ageing Reports (pps of GDP)

	Public pension expenditure	Dependency ratio effect	Coverage ratio effect	Benefit ratio effect	Labour market effect	Residual (incl. interaction effect)
2006 Ageing Report (2004-2050)	12.8	10.2	1.2	2.5	-1.2	0.1
2009 Ageing Report (2007-2060)	11.4	10.8	1.6	-0.3	-0.5	-0.2
2012 Ageing Report (2010-2060)	2.8	9.5	-2.4	-2.6	0.0	-1.1
2015 Ageing Report (2013-2060)	-0.1	8.7	-2.1	-3.8	-2.2	-0.6
2018 Ageing Report (2016-2070)	2.3	11.6	-2.4	-4.1	-2.1	-0.8
2021 Ageing Report (2019-2070)	2.1	7.1	-0.6	-3.0	-1.0	-0.5
2024 Ageing Report (2022-2070)	3.6	7.8	-1.6	-1.5	-0.8	-0.3

- 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.

Following are the main points from Table [18]:

- The difference in the percentage point increase of public pension expenditure over the projection period between the present 2024 AWG exercise and previous 2021 AWG exercise, amounts to 1.5 percentage points of GDP higher (2.1 in 2021 exercise vs 3.6 in 2024 exercise).
- A less favourable dependency ratio effect (1.0 percentage point higher), reflecting the differences in the demographic framework, as well as a less favourable benefit ratio effect (1.4 percentage points lower), primarily explained by higher indexation of pensions in payment¹⁰, are partially offset by the more favourable coverage ratio (amounting to 0.9 percentage points lower) due to a cohort effect.

Table [19] compares the projections of the 2021 Ageing Report with actual public pension expenditure between 2019 (the previous base year) and 2022 (the new base year).

¹⁰ The pension indexation under the AWG2024 exercise is on average 0.5% per annum higher than of the AWG2021 over the projection period 2022-2070.

Table 19 - Disaggregation of the difference between the 2021 projections and actual public pension expenditure in 2019-2022 (%GDP)

	2019	2020	2021	2022
Ageing report 2021 projections (% GDP)	8.8	10.2	9.6	9.7
<i>Assumptions (pps of GDP)</i>	-0.6	-1.3	-1.0	-1.5
<i>Coverage of projections (pps of GDP)</i>				
<i>Constant policy impact (pps of GDP)</i>				
<i>Policy-related impact (pps of GDP)</i>				
Actual public pension spending (% GDP)	8.2	8.9	8.6	8.2

Table [20] shows the results of the reconciliation of the public pension expenditure (as percentage of GDP) of the present 2024 AWG projection exercise with that of the 2021 exercise.

Table 20 - Disaggregation of the difference between the 2021 and the new public pension projections (%GDP)

	2022	2030	2040	2050	2060	2070
Ageing Report 2021 projection	9.7	10.0	10.2	10.1	10.7	10.9
<i>Change in assumptions (pps of GDP)</i>	-1.5	-0.9	-0.2	0.4	0.7	0.5
<i>Improvement in the coverage or in the modelling (pps of GDP)</i>						
<i>Change in the interpretation of constant policy (pps of GDP)</i>						
<i>Policy related changes (pps of GDP)</i>	0.0	0.2	0.4	0.5	0.6	0.4
New projections	8.2	9.3	10.4	11.0	12.0	11.8

The starting point, year 2022, is lower by -1.5 percentage points from the one projected in 2021 exercise (8.2% of GDP compared with a projected 9.7% in the 2021 exercise) due to better-than-expected economic performance in recent years. The difference of 0.9 percentage points in 2070 between the new (AR2024) and previous (AR2021) round of projections is explained by: (i) the less favourable demographic assumptions, mainly the significant lower net migration assumption applied in the new projection, which explains the increase of 0.5 percentage points in the public pension expenditure in 2070 and (ii) the recent amendment in the social insurance law, stipulating the payment of survivors' pensions to men under the same conditions as for women who lost their husbands, which explains the increase of 0.4 percentage points in the public pension expenditure in 2070.

4. Description of the pension projection model and the base data

4.1 Institutional context in which those projections are made

The present 2024 AWG projections for Cyprus were undertaken by the ILO on behalf of the Ministry of Labour, Welfare and Social Insurance. The projection results of the GSIS are produced directly from the national actuarial pension model, using an agreed set of demographic and economic assumptions, and based on internationally accepted actuarial projection methodologies and input starting data, including data on GSIS' contributors and pensioners. The present national actuarial model is a fully customised version of the International Labour Organisation (ILO) generic pension modelling tool and it now incorporates a number of enhancements to better reflect the parameters of the social security system in Cyprus.

With respect to GEPS, the actuarial projection results were produced by an external consulting firm, i.e., AON Hewitt.

4.2 Data used to run the model

Data used to run the GSIS actuarial model was provided by the Statistics department of the Social Insurance Services of the Ministry of Labour, Welfare and Social Insurance. The database included the insured population by active and inactive status, the distribution of insurable wages among contributors, the distribution of past credited service and pensions in-payment. Data are disaggregated by age and sex.

For the purposes of the GEPS actuarial valuation, it is assumed that GEPS pensions are indexed 50% of COLA, in accordance with the revised COLA framework as stipulated existing legislation.

4.3 Reforms incorporated in the model

The pension reform measures incorporated in the modeling exercise, which refer to both the GSIS and GEPS, are described below.

4.3.1 General Social Insurance Scheme (GSIS)

The Social Insurance Law N.193(I)/ 2012, which was enacted on 21 December, 2012, refers to the following reform measures that are to be phased in gradually and aim to secure the long-term viability of the GSIS:

1. As of January 1st 2013, actuarial reduction of pension entitlements from the GSIS by 0.5% per month for retirements earlier than the statutory retirement age in line with the planned increase in the minimum age for entitlement to an unreduced pension to reach 65 (by 6 months per year), between 2013 and 2016;
2. Freeze of pensions (all types) under the GSIS for the period 2013-2016;
3. Abolishment of the increase of pensions for a working dependent spouse under the GSIS as of 1 January 2013 (this applies only to new pensioners);

4. Stricter eligibility conditions to old-age pension - as of 1 April, 2013 gradual extension of the minimum required insurance points earned from paid contributions (one point per year), from 10 to 15 points over the period 2013-17;
5. Increase of contributions, as of 1.1.2014, of salaried employees and employers to the GSIS by an additional 1 percentage point (p.p.) of the increase which was legislated to take effect in 2014 as per 2009 GSIS reform – the above increase is shared as follows: 0.5 p.p. from salaried employees and 0.5 p.p. from employers and 1 p.p. in the case of self-employed persons; and
6. Introduction of an automatic adjustment of the statutory retirement age every 5 years in line with changes in life expectancy at the statutory retirement age, to be applied as of 2018, with the first revision covering the period 2018-2023.

4.3.2 Government Employee Pension Scheme (GEPS)

The projections incorporate a series of GEPS amendments as a result of the enactment of the Pension Law N.216(I)/2012 in December, 2012 which refer to the following reform measures aiming at the containment of the future increase in the GEPS:

- Pension Benefit - the pension calculated for any service after the 1st of January 2013, will be based on the career average salary, revalued based on the changes of the Basic Insurable Earnings under the GSIS;
- Lump Sum Benefit - the factor for calculating the lump sum benefit for service after the 1st of January 2013, will be based on a factor of 14/3, irrespective of the total period of service;
- Normal Retirement Ages - early and normal retirement ages are gradually increased. Normal retirement age is gradually extended by 2 years;
- Early Retirement Reduction Factors - early retirement pensions are actuarially reduced by certain factors, but only the part that corresponds to the service after 1.1.2013 is affected;
- Taxation of Lump Sum Benefit - the portion of the lump sum benefit which corresponds to the service after 1.1.2013 is taxable; and
- Commutation of Lump Sum Benefit - members have the option to commute part or all of their lump sum benefit into an annuity.

Furthermore, as it is stipulated by the Budget Law, future increases of GEPS pensions in payment will be awarded in a rate being set at 50% of the rate of increase of the cost-of-living adjustment (COLA) indexation over the previous year.

4.4 General description of the model

With respect to GSIS pension benefits, this actuarial valuation makes use of an actuarial pension model, which is a fully customised version of the ILO generic pension modelling tool. The model has been customised in order to closely comply with local social insurance legislation and capture national pension peculiarities. In addition, methodological enhancements to the projection model are introduced on a regular basis in the context of

continued improvement of the accuracy of the projection results. Following are the key methodological enhancements introduced in the current version of the model:

- The active and inactive insured populations are disaggregated by insurance level (basic only/basic and supplementary) and the following two key variables, which affect the accumulation of basic and supplementary insurance points of the active and inactive insured populations by insurance level, are explicitly modelled:
 - ✓ Distribution of past insurance points (for both active and inactive insured persons) in base year; and
 - ✓ Acquisition of new insurance points (for active insured persons) in subsequent years.
- The projected cost of the minimum pension supplement is projected by the model with higher degree of accuracy since the distribution of pensioners by level of pension is produced by the model. The estimation of the distribution of pensioners by level of pension is possible through the insured population grouping by insurance level (basic only/ basic and supplementary) and the modelling of the distribution of past insurance points and insurable earnings.

The model is operated under the supervision of the ILO. This model is used primarily for:

- conducting the actuarial valuation of the GSIS, every three years in accordance with the Social Insurance Law; and
- assessing the long-term financial impact of various pension reform alternatives.

The pension model is a standard deterministic cohort-based projection model performing long-term projections of income and expenditure for the public pension schemes.

With respect to GEPS pension benefits, the actuarial projection model used for the valuation is internally developed by the external actuarial consulting firm to be in line with the legal provisions of the GEPS in particular. The actuarial model is a standard deterministic cohort-based projection model performing long-term projections of income and expenditure for the GEPS.

Appendix 1

Overview of the pension system

The current public pension system in Cyprus comprises of:

- The General Social Insurance Scheme (GSIS), a compulsory earnings-related scheme which covers every person gainfully employed in Cyprus, both in public and private sector, including self-employed;
- The Social Pension Scheme, an income-tested scheme, which covers residents of Cyprus with no or low pension income; and
- The Government Employees Pension Scheme (GEPS), which provide supplementary pensionable benefits to their members.

Main GSIS provisions with respect to pension benefits

A1.1 Introduction

The General Social Insurance Scheme (GSIS) was introduced in 1957 and since the 1964 reform extends compulsory insurance to every person gainfully employed in Cyprus, including all categories of self-employed. A major reform in 1980 introduced an earnings-related insurance scheme, replacing the previous scheme of flat-rate contributions and benefits. The GSIS, in its current form, consists of two tiers: the basic and supplementary part. It provides comprehensive benefits, which include:

- Unemployment benefit;
- Other short-term benefits, such as sickness benefit and maternity allowance;
- Employment injury benefits; and
- Long-term benefits, i.e., old age, invalidity and survivors' pension benefits.

A1.2 Coverage

The GSIS covers compulsorily every person gainfully occupied in Cyprus, either employed or self-employed. Employed persons are entitled to all benefits. Self-employed persons are not entitled to unemployment and employment injury benefits.

A1.3 Contributions

Insurable earnings

Insurable earnings, on which contributions are paid, are the gross earnings up to a maximum of six times the basic insurable earnings. In 2022, basic insurable earnings are fixed at €186.20 per week, or €10,008 per year. The maximum insurable earnings for contribution purposes in 2022 are € 58,080.

The total annual insurable earnings of every insured person are converted into insurance points. The conversion of insurable earnings into insurance points is done by dividing the earnings of a given year by the annual basic insurable earnings of the following year (in 2022, one point is credited for every €10,008 of earnings). The first insurance point represents basic insurance and insurance points in excess of one represent supplementary insurance.

For self-employed persons, insurable earnings are fixed by regulations according to occupational category. For each category, a compulsory minimum insurable income is prescribed, but the individual self-employed person has the right to opt for a higher income up to the maximum insurable earnings.

Contribution rate

Table A1.1 - Contribution rate as at 1.1.2022

Employed persons	16.6 per cent of insurable earnings, shared equally between the employer and the employee
Self-employed persons	15.6 per cent of insurable income
State contribution	4.9 per cent of the insurable earnings of employed persons and self-employed

The above contribution rate is used to finance all benefits provided by the GSIS. Out of the total 21.5 per cent contribution rate, 19.2 percentage points are currently allocated to the long-term (pensions) benefits branch of the GSIS and the remaining 2.3 percentage points to the short-term benefits branch, which include unemployment benefits as well as other short-term benefits.

Table [A1.2] shows the legislated future contribution rate paid on behalf of an employed person. It is noted that all future increases in the contribution rate will be allocated to the long-term benefits branch of the GSIS.

Table A1.2 - Legislated future contribution rate (as % of insurable earnings) for employed persons

Period	Employee	Employer	State	Total
2019-2023	8.3	8.3	4.9	21.5
2024-2028	8.8	8.8	5.2	22.8
2029-2033	9.3	9.3	5.5	24.1
2034-2038	9.8	9.8	5.8	25.4
2039+	10.3	10.3	6.1	26.7

A1.4 Benefits

Benefit structure

The basic benefit is related to basic insurance. It includes increases for dependants. The supplementary benefit is related to supplementary insurance. No increases for dependants are payable on the supplementary benefit.

Invalidity pension

An invalidity pension is payable to a person who has been incapable of work for at least 156 days and who is expected to remain permanently incapable for work, i.e., unable to earn from work more than 1/2 of the sum usually earned by a healthy person of the same occupation or category and education in the same area.

The insurance conditions are that:

1. the person has been insured for at least 156 weeks and has basic insurance up to the date of invalidity at least 3 insurance points, earned from paid contributions;
2. the total number of insurance points in the basic insurance, earned from paid or credited contributions, is equal to at least 25 per cent of the number of years over the period between 5 October, 1964 (or the first day of the year of attainment of age 16, if later) and the week of invalidation; and
3. the person has paid or been credited with contributions which provided him/her with at least 0.39 of insurance point within the relevant contributions year. This condition is also satisfied if the average number of insurance points earned from paid or credited contributions over the last two years is equal to at least 0.39 of insurance point.

The amount of the pension is equal to the old-age pension in case of full invalidity (100%). When the loss of earnings is partial, the following percentages are payable:

Loss of earning capacity	Percentage of the full pension
50% to 66 ² / ₃ % (ages 60-63)	60 %
66 ² / ₃ % to 75 %	75 %
75 % to 99 %	85 %

Old-age pension

As a general rule, the old-age pension is payable at the age of 65 for men and women, provided that the following insurance conditions are met:

1. the person has been insured for at least 780 weeks and has basic insurance up to the date of old-age pension entitlement at least 15 insurance points, earned from paid contributions; and
2. the total number of insurance points in the basic insurance, earned from paid or credited contributions, is equal to at least 30 per cent of the number of years over the period between 5 October, 1964 (or the first day of the year of attainment of age 16, if later) and the week before the week of old-age pension entitlement.

Old-age pension could be paid at an earlier age on certain conditions:

- At age 63 if the insured person satisfies the above two insurance conditions and the total number of insurance points in the basic insurance, earned from paid or credited contributions, is equal to at least 70 per cent of the number of years over the period between 5 October, 1964 (or the first day of the year of attainment of age 16, if later) and the week before the week of old-age pension entitlement.
- Miners are entitled to the old-age pension one month earlier than the pensionable age of 63 for every 5 months of work in a mine, but in no case before the age of 58, provided that they have at least three years of work in a mine.

An insured person in receipt of the invalidity pension immediately before reaching the age of 63 is eligible to the old-age pension. Also eligible to the old-age pension is the person above the age of 63 who would be entitled to an invalidity pension if the person had not completed the age of 63.

The old-age pension consists of the:

- basic pension, which is equal to 60 per cent of the weekly value of the annual average number of insurance points earned in the basic insurance over the period between 5 October, 1964 (or the first day of the year of attainment of age 16, if later) and the week before the week of old-age pension entitlement, increased to 80%, 90% or 100% for one, two or three qualified dependants respectively; and
- supplementary pension, which is equal to 1.5 per cent of the weekly value of the total number of insurance points earned in the supplementary insurance.

The old-age pension amount is subject to an actuarial reduction 0.5 per cent for every month included in the period between the date the person chooses to claim the pension beyond the age of 63 and the age of 65 (max. 12 per cent actuarial reduction).

A person may ask for postponement of the payment of the pension until the age of 68. In this case, the pension amount is increased by 0.5 per cent for each month of postponement. No deferment possible from age 63 up to age 65.

Survivors' benefits

The survivors' benefits include widow/ widower's pension and orphan's benefit. The widow's pension is payable to the widow (or widower under certain conditions of dependence) of a person who, at the time of death:

- had not reached the pensionable age and satisfied the insurance conditions (1) and (2) for the invalidity pension; or
- was in receipt of old-age pension.

The orphan's benefit is payable for a minor:

1. when both parents are dead and at least one of the parents was an insured person; or
2. when the parent who was taking care of the minor died in case where the parents were separated provided that the parent who died was an insured person; or
3. when one of the parents died and the surviving parent is not entitled to a widow's pension provided that the deceased parent fulfills the insurance conditions for a widow's pension; or
4. when the widowed mother/father, who was in receipt of widow's pension, remarried.

The widow's pension consists of the:

- basic pension, which is equal to:
 - ✓ if the spouse was not in receipt of an old-age pension, 100 per cent of the basic invalidity pension to which the deceased would have been entitled on his death; or
 - ✓ if the spouse was in receipt of an old-age pension, 100 per cent of the basic old-age pension which was payable; and
- supplementary pension, which is equal to:
 - ✓ if the spouse was not in receipt of an old-age pension, 60 per cent of the supplementary invalidity pension to which the deceased would have been entitled on his death; or
 - ✓ if the spouse was in receipt of an old-age or invalidity pension, 60 per cent of the supplementary old-age or invalidity pension which was payable.

The amount of the benefit for cases (1) and (2) above consists of the:

- Basic benefit, which is equal to 40 per cent of the basic insurable earnings for each orphan; and
- Supplementary benefit, which is equal to 50 per cent of the supplementary widow's pension which was or would have been payable for each orphan (calculated for a maximum of two orphans).

The amount of the benefit for cases (3) and (4) is equal to 20 per cent of the basic insurable earnings for each orphan, and is payable for up to three orphans. The orphan's benefit is payable until the orphan attains age 15, or age 23 for a female in full-time education and 25 for male in full time education or in military service.

Pension indexation

The basic pension is reviewed at the beginning of each year in accordance with the percentage change of average earnings and the supplementary pension is indexed to the consumer price index.

Minimum pension

A minimum pension is paid to insured persons who are eligible for a pension and their total basic and supplementary pension is less than that amount of minimum pension. The minimum pension is equal to 85 per cent of the full basic pension. The monthly amount of minimum pension for 2022 was €379.85 (pensioner with no dependants). The minimum pension is paid 13 times a year and is adjusted every year in the same way as the basic pension.

Overview of the Social Pension Scheme

The Social Pension Scheme (SPS) closes the gap in accessibility to pensions by providing income-tested pensions to those residents, of 65 years or more who, for any reason did not participate enough in the labour market and as a consequence have no or low old-age pension income. For the purposes of the test, the total individual pension income coming from the GSIS or any other source is taken into account. The SPS ensures universality in pension provision.

SPS is financed by the Consolidated Fund. The beneficiaries are mostly women (about 96%), especially of older generations with relatively low labour force participation rates. The rate of the Social Pension is equivalent to 80% of the full basic pension under the GSIS, and as a consequence, is automatically indexed to earnings. The monthly amount of social pension for 2022 was €361.97. The social pension is paid 13 times a year.

Overview of the Government Employees Pension Scheme

The Government Employees Pension Scheme (GEPS) provides retirement and survivors pensions to civil servants, members of the educational service, the police and the armed forces. It is financed by employee contributions of 5 per cent of pensionable emoluments and the remaining by general taxation on a pay-as-you-go basis. Effective October 1, 2011, GEPS became closed to newcomers of the public sector.

Prior to the December 2012 reform, GEPS compulsory retirement age was 63 years, with early retirement allowed from the age of 58 without any actuarial reduction of benefits. Following the recent reform, the normal retirement age gradually increases from 63 to 65 over the period 2013-2016 (different increases apply for different types of public servants). Corresponding

gradual increases are also applied to the early retirement age, i.e., the minimum age from which the member becomes eligible to a pension.

Furthermore, prior to the December 2012 reform, pensions were calculated on the final salary at an accrual rate of 1.5% per annum that produced a retirement pension equal to 50 per cent of that salary after $33 \frac{1}{3}$ years of service. Post-reform, for benefits accrued based on service after the 1st of January 2016, the pensionable salary used for calculating benefits is the career average of the salaries for the whole period of service (from the day joining the scheme until retirement). This is adjusted using an index based on the change of the basic insurable earnings (BIE) as determined by the GSIS.

Appendix 2

Pension Projection Results

Table A2.1 - Economy-wide average wage at retirement (1000 EUR)

	2022	2030	2040	2050	2060	2070
Economy-wide average gross wage at retirement	22.4	31.1	44.6	63.8	90.0	124.8
Economy-wide average gross wage	22.4	31.1	44.6	63.8	90.0	124.8

A2.2 Pension spending decomposition

Table [A2.2] show in detail the drivers of the ratio of public pension expenditures to GDP between 2022 and 2070, as well as during the five 10-year sub-periods over the projection period, using data on pensions and pensioners respectively.

Table A2.2 - Factors behind the change in public pension expenditure between 2022 and 2070 (percentage points of GDP) – pensions

	2022-30	2030-40	2040-50	2050-60	2060-70	2022-2070
Public pensions to GDP	1.1	1.1	0.6	1.0	-0.2	3.6
Dependency ratio effect	1.5	1.3	1.5	2.4	0.9	7.7
Coverage ratio effect	-0.3	0.4	0.3	-0.8	-1.4	-1.9
<i>Coverage ratio old-age*</i>	0.0	0.5	0.4	-0.7	-1.4	-1.2
<i>Coverage ratio early-age*</i>	-3.3	-1.5	-2.2	-1.4	-1.2	-9.6
<i>Cohort effect*</i>	-1.4	0.1	-0.7	-3.0	-0.7	-5.7
Benefit ratio effect	-0.2	-0.5	-0.9	-0.1	0.5	-1.2
Labour Market effect	0.1	-0.1	-0.2	-0.4	-0.1	-0.7
<i>Employment ratio effect</i>	0.1	-0.1	-0.1	-0.2	-0.1	-0.4
<i>Labour intensity effect</i>	0.0	0.0	0.0	0.0	0.0	0.0
<i>Career shift effect</i>	0.0	0.0	-0.1	-0.2	0.0	-0.3
Residual	0.0	0.0	-0.1	-0.1	-0.1	-0.2

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

A2.3 Projected and disaggregated new public old-age pension expenditure

Tables [A2.3] and [A2.4] show the evolution of the GSIS pension expenditure for new old-age male and female pensioners respectively, as well as their disaggregation into the factors of 'Number of new pensions', 'Average number of insurance points at retirement', 'Average accrual rate' and 'Point value'.

Table A2.3 - Projected and disaggregated new public pension expenditure - GSIS: old-age and early earnings-related pensions - MEN

New old-age earnings-related pensions - MEN	2022	2030	2040	2050	2060	2070
Projected new pension expenditure (mil EUR) *	42	87	129	188	318	296
I. Number of new pensions (1000)	4.6	5.5	6.0	6.6	6.9	4.5
II. Point value (EUR/month)	769.8	1148.2	1639.3	2354.1	3326.6	4630.1
III. Average accrual rate	1.30	1.32	1.27	1.26	1.25	1.23
IV. Total insurance points at retirement	70	80	80	74	85	90
V. Sustainability/adjustment factors	1.0	1.0	1.0	1.0	1.0	1.0
VI. Correction coefficient	1.0	1.0	1.0	1.0	1.0	1.0
VII. Average number of months paid the first year	13.0	13.0	13.0	13.0	13.0	13.0

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

Table A2.4 - Projected and disaggregated new public pension expenditure - GSIS: old-age and early earnings-related pensions - WOMEN

New old-age earnings-related pensions - WOMEN	2022	2030	2040	2050	2060	2070
Projected new pension expenditure (mil EUR) *	26	58	105	143	256	231
I. Number of new pensions (1000)	3.5	4.5	5.7	5.9	6.5	4.2
II. Point value (EUR/month)	769.8	1148.2	1639.3	2354.1	3326.6	4630.1
III. Average accrual rate	1.25	1.25	1.20	1.19	1.18	1.15
IV. Total insurance points at retirement	61	69	73	66	78	80
V. Sustainability/adjustment factors	1.0	1.0	1.0	1.0	1.0	1.0
VI. Correction coefficient	1.0	1.0	1.0	1.0	1.0	1.0
VII. Average number of months paid the first year	13.0	13.0	13.0	13.0	13.0	13.0

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

Appendix 3

GSIS methodology of the present actuarial valuation

A3.1 Introduction

This actuarial valuation, as it was the case in previous actuarial review exercises, makes use of the comprehensive methodology developed at the Financial and Actuarial Service of the Social Protection Department of ILO for reviewing the long-term actuarial and financial status of national pension schemes. This valuation has been undertaken using an actuarial pension model, which is a fully customised version of the ILO generic pension modelling tools in order to fit the situation of Cyprus and to closely comply with the legal provisions of GSIS in particular. These modelling tools include a population model, an economic model, a labour force model, a wage model, a long-term benefits model and a short-term benefits model.

The actuarial valuation starts with a projection of the future demographic and economic environment of Cyprus. Next, projection factors specifically related to the GSIS are determined and used in combination with the demographic and economic frameworks.

A3.2 Methodologies applied

Figure [6] presents graphically the methodology used for calculating GSIS revenue from contributions, while Figure [7] shows the methodology used for calculating GSIS pension expenditure.

The valuation starts with a projection of the general population of Cyprus. The projected population, based on the number of persons in each age group, serves to determine both the working population which contributes to the GSIS and the population eligible for the GSIS various pension benefits.

The revenue includes both contributions and investment income. For each year in the projection period, total contributions are derived from the total insurance earnings and the contribution rate prescribed by law. The total amount of insurable earnings is estimated on the basis of the projected rates of participation in the GSIS and future level of insurable earnings.

Expenditures include the pension benefits paid out, which are projected using assumptions based on the population's eligibility rates for the various benefits, the probability of the occurrence of an event giving entitlement to a pension and the historical record of contributors' insurable earnings.

Figure 6 - Methodology – GSIS contribution income

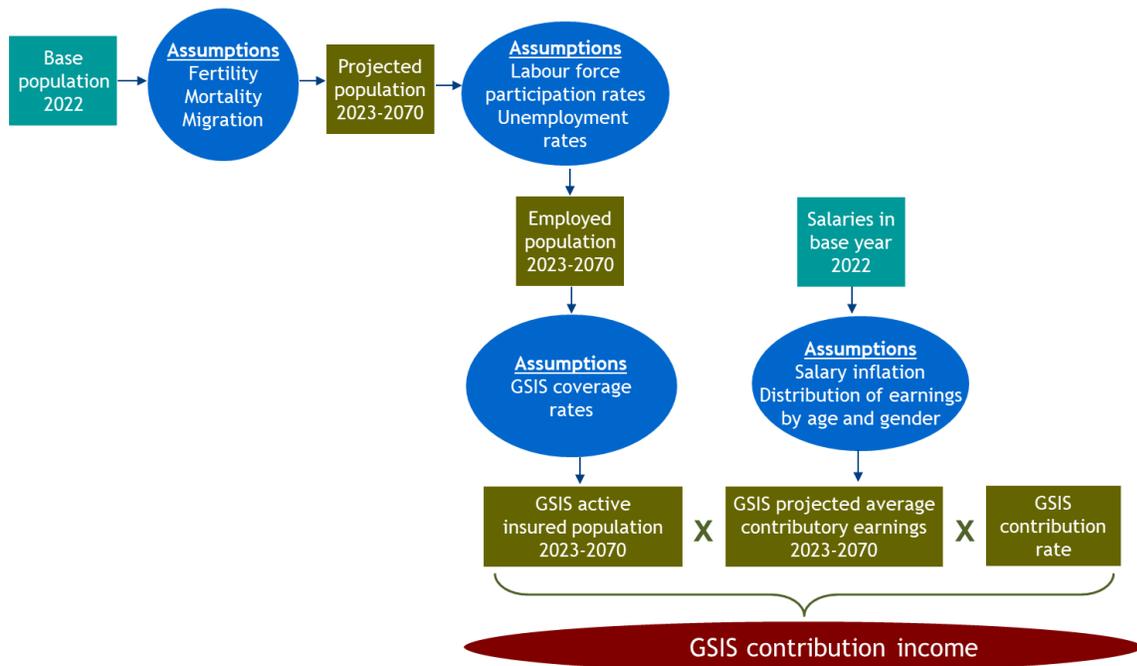
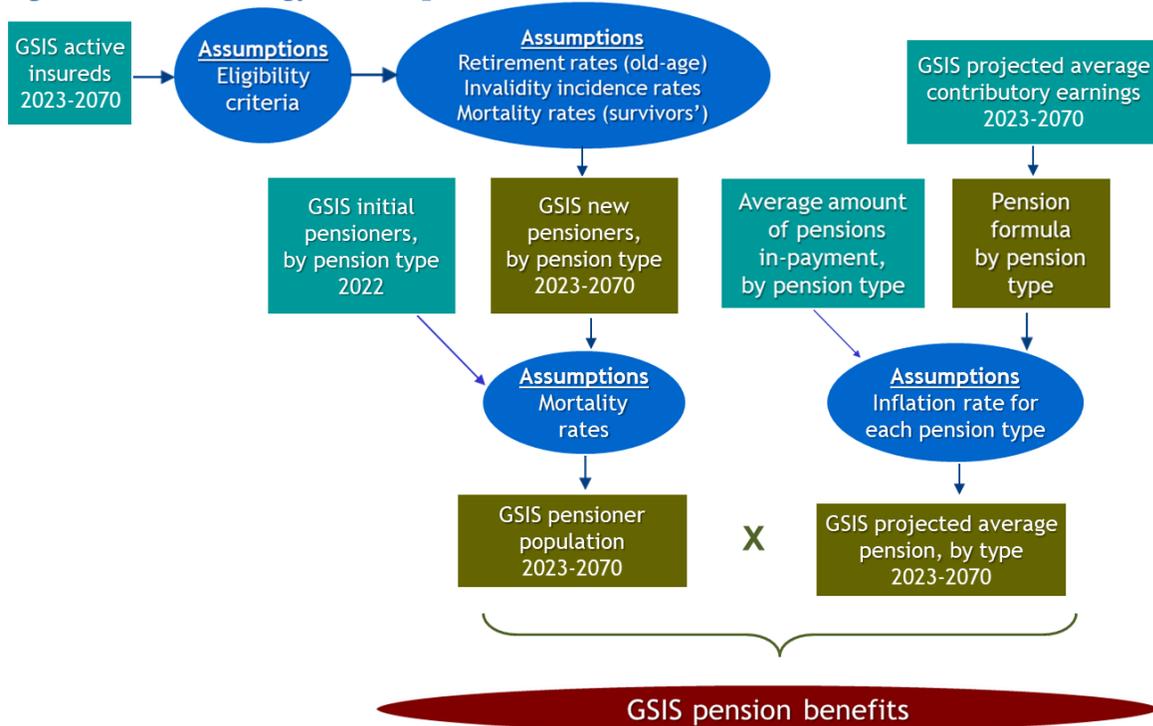


Figure 7 - Methodology – GSIS pension benefits



Details of the methodologies applied for the purposes of conducting the present actuarial valuation for the GSIS are provided in the following sections.

Regarding the GEPS actuarial valuation, the actuarial model starts with the demographic projections and in particular the projection of the scheme participants/contributors, pensioners, widows/widowers and lump sum recipients. The cohort demographic model forecasts the future group of contributors, based on expected survivals and retirements. Following the 2011 Law amendments, the scheme rules do not allow for new entrants and therefore the model was adjusted accordingly. Similarly, the groups of pensioners and widows/widowers are projected from one year to the next, based on the survival of the existing members and the new pensioners/widows/widowers expected each year.

The next step of the model is the projection of salaries, period of past service and units earned to the supplementary part of the GSIS. Salaries are projected from one year to the next based on the assumptions for future increases for the cost-of-living allowance, general increases as well as due to changes in scales. The projections for past service and supplementary units are based on a cohort method.

The demographic and salary/past service/units projections are then used for the projection of benefits. The model projects pension and lump sum benefits. Pensions are based on the benefits paid to existing pensioners and the survival probabilities as well as on the benefits to be paid to members expected to qualify for pension. Benefit projections take into account the deduction of the GSIS supplementary pension.

The GEPS projections were carried out based on the agreed AWG 2024 macroeconomic framework.

Scheme-specific assumptions

In addition to the agreed demographic and economic assumptions made for the purposes of conducting the present actuarial valuation, a certain number of scheme-specific assumptions were also made. Appendix 4 presents the main GSIS scheme-specific assumptions used in this valuation, which include invalidity incidence rates and family structure statistics.

A3.3 Modelling the demographic and economic developments

The use of the ILO actuarial model requires the development of demographic and economic assumptions related to the general population, the economic growth, the labour market and the increase and distribution of wages. Other economic assumptions relate to the future rate of return on investments, the indexation of benefits and the adjustment of parameters like the earnings levels in the basic and supplementary part of the GSIS.

The selection of assumptions takes into account the recent experience of Cyprus to the extent this information was available. The assumptions are selected to reflect long-term trends rather than giving undue weight to recent experience.

General population

General population is projected starting with most current data on the general population, and applying appropriate mortality, fertility and migration assumptions.

Economic growth

Real rates of economic growth, labour productivity increases and inflation rates are exogenous inputs to the economic model.

Labour force, employment and insured population

The projection of the labour force, i.e., the number of persons available for work, is obtained by applying assumed labour force participation rates to the projected number of persons in the general population. Aggregate employment is projected by dividing the real GDP (total output) by the average labour productivity (output per worker). Unemployment is then measured as the difference between the projected labour force and the total employment.

The model assumes movement of participants between the groups of active and inactive insured persons.

Wages

Based on an allocation of total GDP to capital income and to labour income, a starting average wage is calculated by dividing the wage share of GDP by the total number of employed persons.

In the medium-term, real wage development is checked against the labour productivity growth. In specific labour market situations, wages might grow at a pace faster or slower than productivity. However, due to the long-term perspective of the present study, the real wage increase is assumed equal to the increase in real labour productivity. It is expected that wages will adjust to efficiency levels over time.

Wage distribution assumptions are also needed to simulate the possible impact of the social protection system on the distribution of income, for example through minimum and maximum pension provisions. Assumptions on the differentiation of wages by age and sex are established, as well as assumptions on the dispersion of wages between income groups. Average career wages, which are used in the computation of benefits, are also projected.

A3.4 Modelling the financial development of the GSIS

The present actuarial valuation addresses all revenue and expenditure items of the long-term pension benefits branch of GSIS.

Purpose of pension projections

The main purposes of the pension model are twofold. First, it is used to assess the financial viability of the long-term benefits branch of the GSIS in the context of the triennial actuarial valuation as required by the Social Insurance Law. This refers to the measure of the long-term

balance between revenue and expenditures of the GSIS. In case of imbalance, possible revision of the contribution rate and/or the benefit structure are recommended.

Second, the model may be used to examine the financial impact of different reform options, thus assisting policy makers in the design of benefit and financing provisions. More specifically, the pension model is used to develop long-term projections of expenditures and insurable earnings under the GSIS, for the purpose of:

- assessing the options to build up a contingency or a technical reserve;
- proposing schedules of contribution rates consistent with the funding objective; and
- testing how the system reacts to changing economic and demographic conditions.

Furthermore, the pension model is also used for:

- providing a solid quantitative framework to government authorities that guide future policy decision;
- long-term budgetary planning; and
- performing cash-flow projections between the Consolidated Fund and the Social Insurance Fund.

Pension data and assumptions

Pension projections require the demographic and macro-economic frame already described and, in addition, a set of assumptions specific to the GSIS.

The database as of the valuation date includes the insured population by active and inactive status, the distribution of insurable wages among contributors, the distribution of past credited service and pensions in-payment. Data are disaggregated by age and sex.

GSIS-specific assumptions such as the disability incidence rates and the distribution of retirement by age are determined with reference to the GSIS provisions and the historical experience under the GSIS.

The projection of the annual investment income requires information on the existing assets on the valuation date. An interest rate assumption is formulated on the basis of the nature of the GSIS's assets, the past performance of the fund, the GSIS's investment policy and assumptions on future economic growth and wage development.

Pension projection approach

Pension projections are performed following a year-by-year cohort methodology. The existing population is aged and gradually replaced by the successive cohorts of participants on an annual basis according to the demographic and coverage assumptions. The projection of insurable earnings and benefit expenditures are then performed according to the economic assumptions and the GSIS's provisions.

Pensions are long-term benefits. Hence the financial obligations that a society accepts when adopting financing provisions and benefit provisions for them are also of a long-term nature: participation in a pension scheme extends over the whole adult life, either as contributor or beneficiary, i.e. up to 70 years for someone entering the scheme at the age of 16, retiring at the age of 65 and dying some 20 or so years later. During their working years, contributors gradually build entitlement to pensions that will be paid even after their death, to their survivors. The objective of pension projections is not to forecast the exact development of revenue and expenditures of the GSIS, but to check its financial viability. This entails evaluating the GSIS with regard to the relative balance between future revenue and expenditures. This type of evaluation is crucial, especially in the case of the Cyprus GSIS, which has not yet reached its mature stage.

A3.5 Pension model

The actuarial pension model deployed for the purposes of this actuarial valuation is a standard deterministic cohort-based projection model performing long-term projections of income and expenditure for the GSIS. It is based on macro-simulation techniques, i.e., the projections rely on grouped data. Each status of an insured person (active person, inactive person and pensioner) is explicitly modelled, distinguishing new persons from initial stock.

The pension model is operated under the supervision of the ILO.

On a regular basis, the actuarial pension projection model is subject to methodological enhancements in the context of continued improvement of the accuracy of the projection results. The model, at its current version, satisfies the following key methodological features:

- The model is based on standard actuarial mathematics for social security schemes and on actuarially assumed transition probabilities (mortalities rates, incapacity rates, retirement rates, exit rates, etc.) which are used to map the transition of an insured person (active person¹¹, inactive person¹² and pensioner) in 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 is disaggregated into the following population groupings:
 - ✓ Age (by single age);
 - ✓ Gender (males/females);
 - ✓ Insurance level (basic only/basic and supplementary);

¹¹ Active insured person refers to an individual who has made at least one contribution to the social security scheme during a given year.

¹² Inactive insured person refers to an individual who has made no contribution during last year because was unemployed, or out of the labour force, or emigrant, but is registered in the social security scheme, i.e., made contributions during previous years.

- ✓ Community (Cypriots/EU nationals/ third-country nationals); and
- ✓ Income group (by earnings band).

- For the purposes of projecting insured population by community, the entry/ exit rates applied in the active insured population, as per pension model, are linked to the immigration/emigration rates applied in the Eurostat's population projections.

- Inactive insured persons are explicitly modelled.

Appendix 4

GSIS scheme-specific assumptions

A4.1 Mortality of insured persons

Mortality rates for the insured population have been assumed equal to the mortality rates of the general population, as per Eurostat's projection with base year 2022. This mortality pattern is also used to project survivors' benefits payable on the death of insured persons or pensioners. Mortality rates are assumed to decline continuously during the projection period.

A4.2 Invalidity incidence

Rates of entry into invalidity have been calculated from the GSIS experience over the period 2008-19. Invalidity incidence rates are kept constant for the whole projection period. The rates for selected ages are presented in Table [A4.1].

Table A4.2 - Rates of entry into invalidity

Age	Males	Females
22	0.00007	0.00009
27	0.00010	0.00006
32	0.00014	0.00011
37	0.00038	0.00021
42	0.00055	0.00042
47	0.00075	0.00086
52	0.00116	0.00126
57	0.00331	0.00183
62	0.00591	0.00407

A4.3 Retirement

The actuarially assumed retirement rates used in the pension model are consistent with the labour force exit rates produced by the DG Ecfm's labour force cohort simulation model.

A4.4 Family structure

Information on the family structure of the insured persons is necessary for the projection of survivors' benefits. In the case of the GSIS, these data are also used to project the dependents' supplement paid in the basic part of the GSIS. Assumptions have to be established on the probability of being married at death, the age difference between spouses, the average number of children possibly eligible to an orphan's benefit and the average age of orphans.

Data on the percentage of persons married were obtained from tables of the 2011 Census. The age differential between spouses was calculated from data of the Demographic Reports of the Cyprus Statistical Services. The average number of children has been assumed equal to 0.1, considering the stringent eligibility conditions for this benefit and the observed number of orphans' benefits in payment. The average age of orphans has been set with regard to age of the mother at first birth and with some margin for conservatism at older ages. These assumptions are presented in Table [A4.2].

Table A4.2 - Assumptions on the family structure (for male insured persons)

Age	Probability to be married at death	Average age of the spouse	Average age of orphans
17	0.01	17	1
22	0.05	20	1
27	0.28	24	2
32	0.58	29	4
37	0.73	34	7
42	0.79	39	10
47	0.84	44	13
52	0.87	49	16
57	0.90	54	17
62	0.91	59	18
67	0.90	64	19
72	0.89	69	20
77	0.84	74	20
82	0.74	80	20
87	0.61	85	20
92	0.47	91	20