

Republic of Cyprus



Country Fiche on public pensions for the 2021 Ageing Report

December, 2020

1. Introduction

The present country fiche of the Cyprus public pension system has been prepared in accordance with the requirements of the Ageing Working Group of the Economic Policy Committee (the “AWG”) based on a common set of assumptions and methodologies¹. It presents the financial situation of the national public pensions as at 31 December 2019.

1.1 Aims of the actuarial valuation

In accordance with the requirements of the AWG, the main aims of this valuation are to:

- Assess the impact of ageing population on public pensions by reviewing the current and projected financial situation of the public pension system as at 31 December 2019; and
- Assess the sensitivity of the long-term projected public pension expenditure to changes in demographic and economic environments.

1.2 Scope of the report

Section 2 gives a general overview of the public pension system in Cyprus. The demographic and labour market framework used in producing the actuarial projection estimates included in this report is described in Section 3. The actuarial projection results as well as the results of the sensitivity analysis are presented in Section 4. Finally, Section 5 gives a general overview of the methodology used in producing the actuarial projection results included in this report.

¹ European Commission and Economic Policy Committee (2020) “[The 2021 Ageing Report: Underlying assumptions and projection methodologies](#)”, European Commission, European Economy, Institutional Paper 142.

2. Overview of the pension system

2.1 Description

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.

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 (EUROPOP2019).

Table [1]: Qualifying conditions and legislated increase in the standard pensionable age under GSIS for new retirees

Year	Pre-2012 reform			Post-2012 reform		
	Insurance conditions	Standard pensionable age	Insurance conditions	Standard pensionable age	Insurance conditions (**)	Standard pensionable age
2020	(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;	65.5
2030	(2) paid	65.0	(2) paid	63.0	(2) paid	66.0
2035	insurance	65.0	insurance	63.0	insurance	66.4
2040	points = 10;	65.0	points = 10;	63.0	points = 15;	66.9
2045	and	65.0	and	63.0	and	67.3
2050	(3) paid or	65.0	(3) paid or	63.0	(3) paid or	67.8
2055	credited	65.0	credited	63.0	credited	68.2
2060	insurance	65.0	insurance	63.0	insurance	68.6
2065	points = 30% of	65.0	points = 70% of	63.0	points = 30% of	69.0
2070	insurance	65.0	insurance	63.0	insurance	69.4
	period (*).		period.		period.	

(*) 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.

2.2 Recent reforms of the pension system included in the projections

The projections incorporate the December 2012 reform measures of the following two public pension schemes:

- The General Social Insurance Scheme (GSIS), the compulsory earnings-related scheme which covers every person gainfully employed in Cyprus, both in public and private sector, including self-employed; and
- The Government Employees Pension Scheme (GEPS), the occupational pension plan that provides supplementary pensionable benefits to civil servants.

2.2.1 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.

2.2.2 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.

3. Demographic and labour market framework

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.

3.1 Demographic development

A projection of the general population of the country is the basis for determining the number of contributors and beneficiaries of a pension system. EUROPOP2019, Eurostat's current population projection with base year 2019, 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 2019-2070.

Table [2]: Main demographic variables evolution 2019-2070

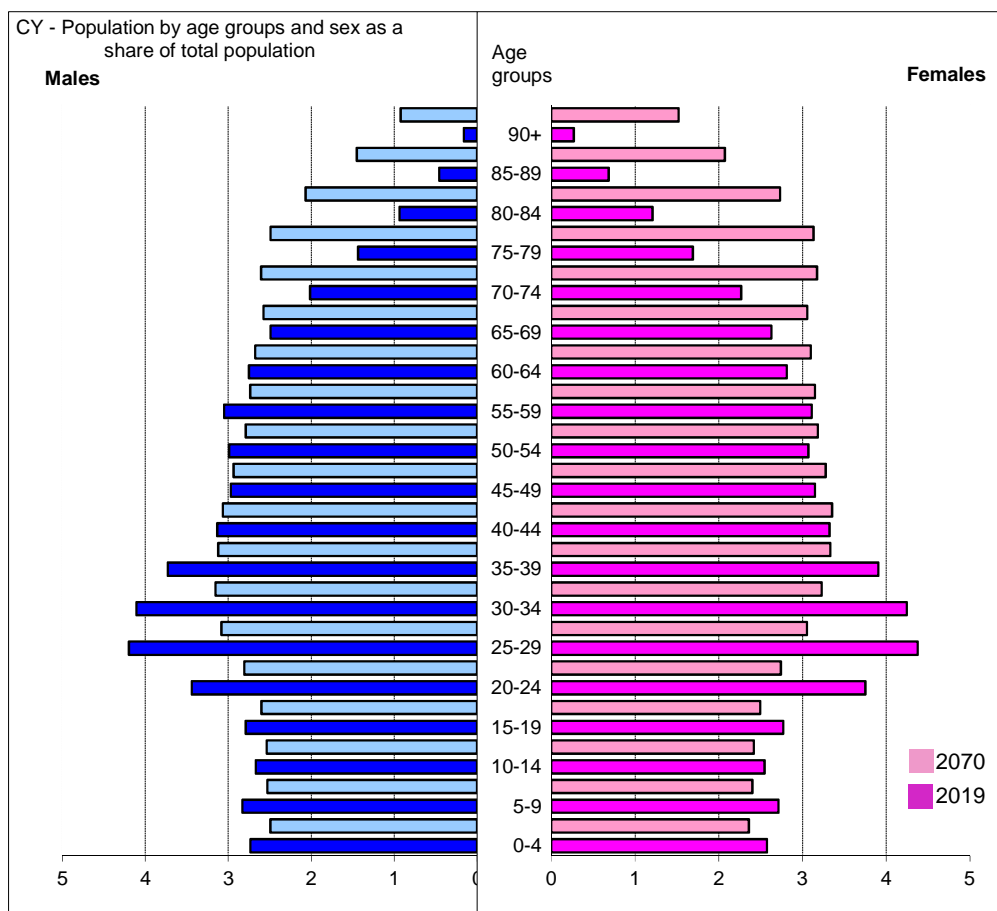
Demographic variable	2019	2030	2040	2050	2060	2070	Peak value	Peak year*	Change 2019-70
Population (thousand)	882	966	1,015	1,048	1,075	1,099	1,099	2070	217
Population growth rate	1.3	0.7	0.4	0.3	0.3	0.2	1.3	2019	-1.2
Old-age dependency ratio (pop 65+ / pop 20-64)	26.2	33.0	35.6	38.8	45.3	50.7	50.7	2070	24.6
Old-age dependency ratio (pop 75+ / pop 20-74)	9.6	13.8	17.1	17.9	20.2	24.7	24.7	2070	15.2
Ageing of the aged (pop 80+ / pop 65+)	22.9	28.2	34.5	35.8	34.4	38.7	38.7	2070	15.8
Men - Life expectancy at birth	80.8	82.1	83.3	84.5	85.6	86.6	86.6	2070	5.8
Women - Life expectancy at birth	85.1	86.1	87.2	88.3	89.3	90.2	90.2	2070	5.1
Men - Life expectancy at 65	19.2	20.1	21.0	21.9	22.7	23.5	23.5	2069	4.3
Women - Life expectancy at 65	22.1	22.9	23.8	24.7	25.6	26.4	26.4	2070	4.3
Men - Survivor rate at 65+	90.8	92.1	93.1	93.9	94.7	95.3	95.3	2070	4.5
Women - Survivor rate at 65+	95.1	95.7	96.2	96.7	97.1	97.4	97.4	2070	2.3
Men - Survivor rate at 80+	65.5	69.9	73.5	76.7	79.5	82.1	82.1	2070	16.5
Women - Survivor rate at 80+	78.5	81.7	84.2	86.4	88.3	89.9	89.9	2070	11.4
Net migration (thousand)	7.8	3.4	3.0	2.7	2.4	2.3	7.8	2019	-5.5
Net migration over population change	0.7	0.5	0.8	0.9	0.9	1.2	1.2	2070	0.5

* Peak year represents the year in which the particular variable reaches its maximum over the projection period 2019 to 2070.

It follows from Table [2] that the population of Cyprus is projected to increase from its present level of 882,000 persons in 2019 to 1,099,000 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 26.2% in 2019 to 50.7% in 2070. In other words, in 2070, it is expected to have approximately two working-age people for every person aged 65 and over.

The ageing of the Cypriot population is illustrated in Chart [2], which compares the population age structure by gender in 2019 with the one projected in 2070.

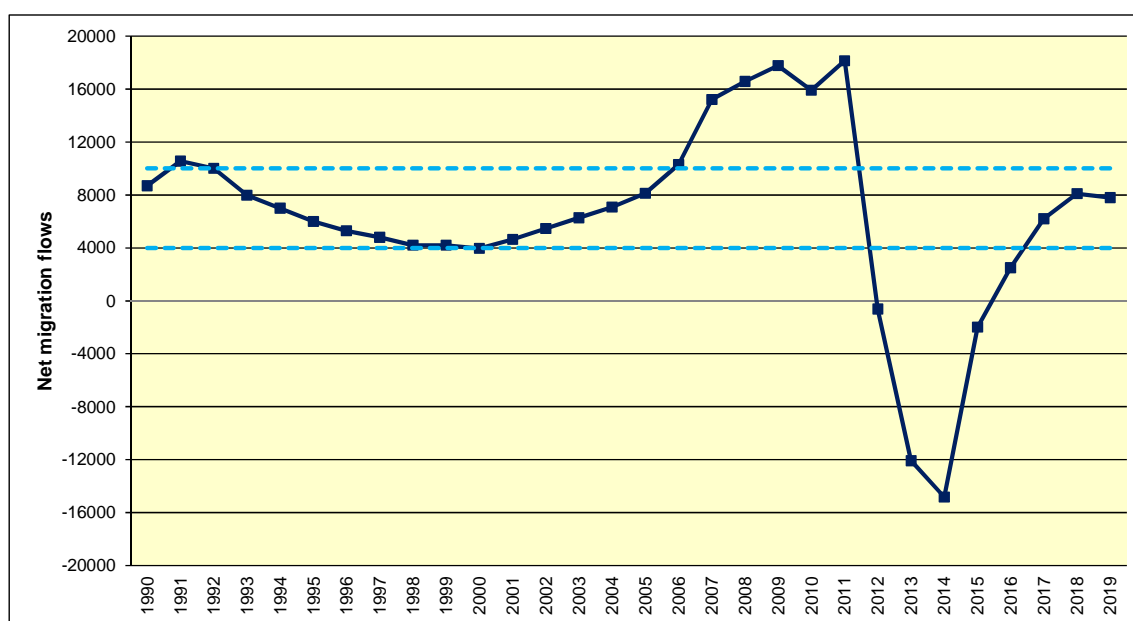
Chart [2]: Age pyramid comparison: 2019 versus 2070



The above pace of population ageing, as shown in Table [2] and Chart [1], is greatly affected by Eurostat's projected net migration flows for Cyprus, which are considerably lower than historical longer-term trends. As it is illustrated from Chart [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 last three years (2017-2019), the net migration has been at normal levels and averaged at around 7,300.

Chart [2]: Historical annual net migration flows, 1990-2019



According to this round of Eurostat projections, net migration in the medium and long-term (2020-70) is projected to average at around 3,000², which is lower than historical longer-term trends, averaging to 6,700 during the stable economic period of 1990-2006. Eurostat's current projected migration flows over the period 2020-70 is approximately 55% lower than the historical trend figure of 6,700.

² 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".

3.2 Labour force and employment

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.

Table [3]: Participation rate, employment rate and share of workers for the age groups 20-64, 20-74, 55-64 and 65-74

	2019	2030	2040	2050	2060	2070	Peak value	Peak year*	Change 2019-70
Labour force participation rate 20-64	80.9	83.7	84.4	84.6	85.4	85.9	85.9	2070	4.9
Employment rate of workers aged 20-64	75.1	76.8	78.1	78.9	79.6	80.1	80.1	2070	5.0
Share of workers aged 20-64 in the labour force 20-64	92.8	91.8	92.5	93.2	93.3	93.3	93.3	2070	0.5
Labour force participation rate 20-74	72.1	73.6	75.2	75.1	74.6	75.4	75.4	2070	3.2
Employment rate of workers aged 20-74	67.0	67.7	69.7	70.2	69.8	70.5	70.5	2070	3.5
Share of workers aged 20-74 in the labour force 20-74	92.9	92.0	92.7	93.5	93.6	93.6	93.6	2070	0.6
Labour force participation rate 55-64	65.3	68.6	72.0	75.0	77.7	80.1	80.1	2070	14.8
Employment rate of workers aged 55-64	61.2	63.6	67.2	70.6	73.1	75.4	75.4	2070	14.2
Share of workers aged 55-64 in the labour force 55-64	93.7	92.8	93.3	94.0	94.1	94.1	94.2	2058	0.5
Labour force participation rate 65-74	13.8	13.5	17.2	21.1	23.4	24.9	24.9	2070	11.1
Employment rate of workers aged 65-74	13.6	13.2	16.9	20.8	23.1	24.6	24.6	2070	10.9
Share of workers aged 65-74 in the labour force 65-74	98.8	98.1	98.5	98.7	98.7	98.8	98.8	2068	0.0
Median age of the labour force	38.0	38.0	40.0	41.0	41.0	41.0	41.0	2042	3.0

* Peak year represents the year in which the particular variable reaches its maximum over the projection period 2019 to 2070.

As shown in Table [3] above, over the period 2019-2070 the average labour force participation rate for the age group 20-64 is assumed to increase significantly from its current level of 80.9% to 85.9% in 2070, while for the age group 65-74 is projected to increase even higher by a factor of 1.8, i.e. from 13.8% in 2019 to 24.9% 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 [4a] and [4b] summarise 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 [4a]: Labour market effective exit age and expected duration of life spent at retirement – Men

	2020	2030	2040	2050	2060	2070	Peak value	Peak year	Change 2020-70
Average effective retirement age (administrative data)*	63.5								
Average labour market exit age (CSM)**	64.4	65.3	66.1	66.7	67.3	67.7	67.7	2067	3.3
Contributory period	:	:	:	:	:	:	:	:	:
Duration of retirement***	20.0	20.1	20.2	20.2	21.0	20.9	21.2	2063	0.9
Duration of retirement/contributory period	:	:	:	:	:	:	:	:	:
Percentage of adult life spent in retirement****	30.1	29.8	29.6	29.3	29.9	29.6	30.2	2021	-0.5
Early/late exit*****	1.7	1.7	1.0	1.4	1.7	3.2	3.2	2068	1.5

Table [4b]: Labour market effective exit age and expected duration of life spent at retirement – Women

	2020	2030	2040	2050	2060	2070	Peak value	Peak year	Change 2020-70
Average effective retirement age (administrative data)*	64.2								
Average labour market exit age (CSM)**	63.4	64.2	65.1	65.8	66.3	66.8	66.8	2068	3.4
Contributory period	:	:	:	:	:	:	:	:	:
Duration of retirement***	23.8	23.8	23.8	23.8	24.6	24.5	24.9	2063	0.7
Duration of retirement/contributory period	:	:	:	:	:	:	:	:	:
Percentage of adult life spent in retirement****	34.4	34.0	33.6	33.3	33.7	33.4	34.4	2021	-1.0
Early/late exit*****	3.5	2.8	1.9	2.2	3.1	6.8	7.1	2068	3.3

* 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 A2.9 and A2.10); ** 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 18 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.

4. Pension projection results

4.1 Extent of the coverage of the pension schemes in the projections

As it was the case with the 2018 Ageing Report, the projections of the 2021 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]: Eurostat (ESSPROS) vs. Ageing Working Group definition of pension expenditure (% GDP)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	Change 2009-17
1. Eurostat total pension expenditure	6.6	7.1	7.5	8.2	9.3	10.1	10.1	9.8	9.5	2.9
2. Eurostat public pension expenditure	6.3	6.8	7.2	7.9	8.9	9.6	9.6	9.4	9.1	2.8
3. Public pension expenditure (AWG)*	6.3	6.8	7.2	7.8	8.9	9.6	9.6	9.3	8.9	2.6
4. Difference (2) – (3)	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.2	0.2

* It includes GEPS retirement lump-sum expenditure.

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 2009 to 2017, with a small discrepancy in recent years.

4.2 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 2019-2070. All pension expenditure and contributions figures are gross of tax and expressed in percentage of GDP.

Table [6]: Projected public pension spending and contributions (% of GDP)

Public pension	2019	2030	2040	2050	2060	2070	Peak value	Peak year*	Change 2019-70
Expenditure	8.8	10.0	10.2	10.1	10.7	10.9	11.2	2067	2.1
Contributions**	8.4	9.2	10.1	10.1	10.0	10.0	10.2	2049	1.6

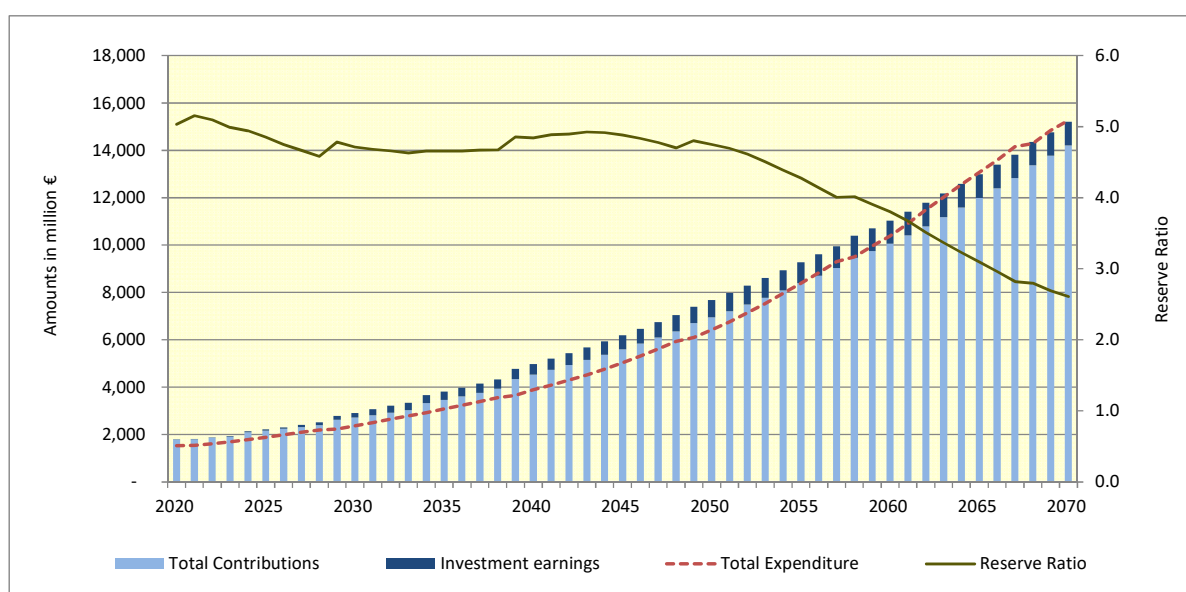
* *Peak year* represents the year in which the particular variable reaches its maximum over the projection period 2019 to 2070.

** 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.

The results indicate that over the period 2019-70, the public pension spending, as percentage of GDP, is expected to increase by 2.1 percentage points, i.e. from 8.8 per cent to 10.9, with a peak of 11.2 per cent in 2067. Over the same period, the pension contributions increase by 1.6 percentage points from 8.4 per cent in 2019 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 ratio³ is calculated. Chart [3] presents, for each year until 2070, the total revenues of the GSIS, consisting of the amount of contributions and investment earnings⁴, the GSIS pension expenditures and the reserve ratio.

Chart [3]: Projected GSIS revenues and expenditure and reserve ratio, 2020-2070 (in million €)



It follows from Chart [3] that 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.

³ The ratio of the level of reserves at the end of one year to the level of expenditures for the same year.

⁴ 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 0.2 per cent in 2019 to 2.5 per cent in 2030, and remain constant thereafter.

Table [7] shows how the overall evolution of pension expenditure over the period 2019-70 is disaggregated, among the following four types of pension, namely “Earnings-related old-age and early”, “Non-earnings related old-age and early”, “Disability” and “Survivors”.

Table [7]: Projected gross public pension spending by scheme (% of GDP)

Public pension	2019	2030	2040	2050	2060	2070	Peak value	Peak year*	Change 2019-70
Total public pensions	8.8	10.0	10.2	10.1	10.7	10.9	11.2	2067	2.1
Old age and early pensions	7.4	8.2	8.3	8.3	8.9	9.0	9.4	2067	1.6
<i>Earnings-related:</i>	7.1	7.9	8.0	8.1	8.8	8.9	9.3	2067	1.9
<i>Non-contributory:</i>	0.3	0.3	0.3	0.2	0.2	0.1	0.4	2020	-0.2
Disability pensions	0.2	0.2	0.3	0.3	0.2	0.3	0.3	2045	0.1
Survivors' pensions	1.2	1.7	1.7	1.6	1.5	1.5	1.7	2036	0.3

* *Peak year* represents the year in which the particular variable reaches its maximum over the projection period 2019 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 7.1 per cent of GDP in 2019 to 8.9 per cent of GDP in 2070.

The second largest category of total pension spending is “Survivors’ pensions”, which slightly increases over the same period, from 1.2 per cent of GDP in 2019 to 1.5 per cent of GDP in 2070. The main driver of the projected increase in “Survivors’ pensions” spending over the period from 2019 to 2030, which is estimated to increase by 36 per cent (from 1.22 to 1.65 per cent of GDP), is the evolution of the GSIS earnings-related old-age and early pensions over the same period due to demographic pressures.

The “Disability” and “Non-contributory old-age and early” pension spending represent very small proportions of total pension spending; their level is around 0.2-0.3 per cent and 0.1-0.3 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 2019 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, 97% 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.

4.3 Main driving forces behind the projection results

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:

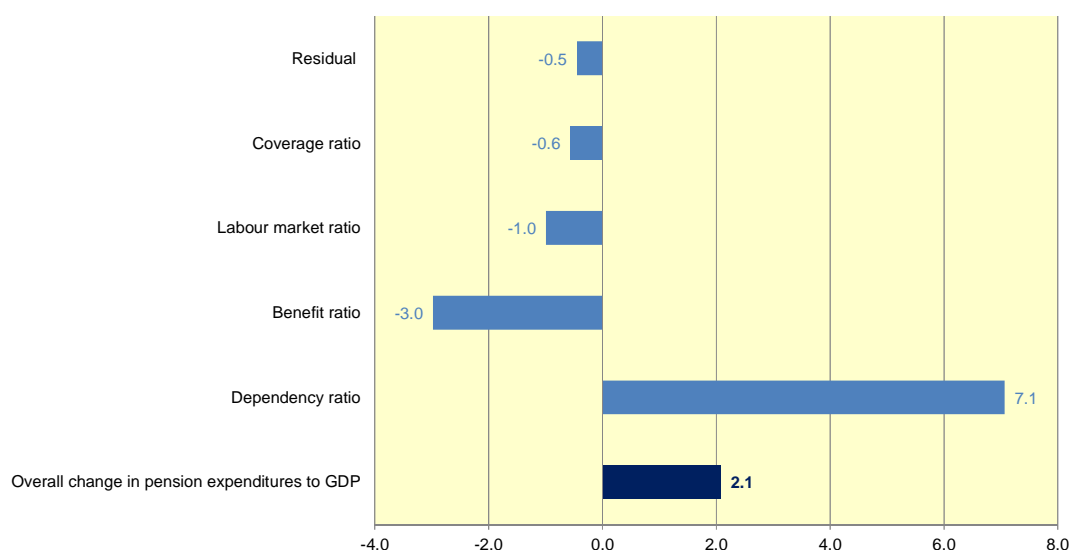
$$\frac{\text{pension expenditure}}{\text{GDP}} = \overset{\text{dependency ratio}}{\downarrow} \frac{\text{population } 65+}{\text{population } 20-64} \times \overset{\text{coverage ratio}}{\downarrow} \frac{\text{number of pensioners}}{\text{population } 65+} \times \overset{\text{benefit ratio}}{\downarrow}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

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

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

Chart [4] shows the contribution of each of the above factors to the overall change of 2.1 per cent of GDP in the public pension expenditures between 2019 and 2070, based on data on pensioners.

Chart [4]: Factors behind the overall change in public pension expenditures between 2019 and 2070 (as % of GDP)



Section A2.1 in Appendix 2 shows in detail the drivers of the ratio of public pension expenditures to GDP between 2019 and 2070, as well as during the five 10-year sub-periods over the projection period, using both data on pensions and pensioners.

Following are the main points from Chart [4]:

- The expected increase in total public pension expenditure of 2.1 per cent over the period 2019-70 is driven by the significant deterioration of the old-age dependency ratio (+7.1).
- Partially offsetting this upward pressure on pension expenditure from demographics, is the impact of a decrease in the benefit ratio (-3.0), 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.

Table [8] shows the evolution of the benefit ratio, while Table [9] shows the evolution of the ratio of the average first GSIS pension for new old-age pensioners in a given year over the level of the previous year's gross average wage⁵, which is defined as the average economy-wide gross wage including employer's social security contributions.

⁵ 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.

Table [8]: Benefit ratio (BR) and coverage rate (in per cent)

	2019	2030	2040	2050	2060	2070	Change 2019-2070 (pps)
Public scheme (BR) – All types of pension and all schemes	59%	57%	52%	46%	43%	44%	-15
Coverage	100.0	100.0	100.0	100.0	100.0	100.0	0.0
Public scheme old-age earnings related (BR) - GSIS and GEPS	64%	57%	50%	42%	39%	40%	-24
Public scheme old-age earnings related (BR) - GSIS	46%	46%	43%	40%	39%	40%	-6
Coverage	75.1	78.8	81.7	86.6	89.5	90.3	15.2

Table [9]: Ratio of newly-awarded GSIS old-age pension to average economy-wide wage and coverage rate (in per cent)

	2019	2030	2040	2050	2060	2070	Change 2019-2070 (pps)
Ratio of new GSIS old-age pension to average wage	40%	46%	43%	39%	43%	44%	+4
Coverage	75.1	78.8	81.7	86.6	89.5	90.3	15.2

Table [9] illustrates that over the decade 2019-30, as the supplementary part of the GSIS matures, the ratio of newly-awarded GSIS old-age pension to average wage is projected to increase from 40 per cent in 2019 to 46 per cent in 2030. From 2030 onwards, that ratio is anticipated to decrease gradually, to 39 per cent in 2050. In the final two decades 2050-70, the ratio is projected to gradually increase reaching 44 per cent in 2070. The projected evolution of the above ratio is largely driven by the development of the average newly-awarded old-age pension, which is analysed in Table [12].

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

	2019	2030	2040	2050	2060	2070	Change 2019-70
Number of pensioners (I)	160	202	242	282	319	315	155
Employment (II)	427	458	484	505	508	506	79
Pension System Dependency Ratio (SDR) (I)/(II)	37.4	44.1	49.9	55.8	62.7	62.2	24.9
Number of people aged 65+ (III)	143	189	212	235	270	298	155
Working age population 15-64 (IV)	548	574	594	606	596	588	40
Old-age Dependency Ratio (ODR) (III)/(IV)	26.2	33.0	35.6	38.8	45.3	50.7	24.6
System efficiency (SDR/ODR)	1.4	1.3	1.4	1.4	1.4	1.2	-0.2

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 2, i.e., from 160,000 in 2019 to 319,000 in 2060, and thereafter remain relatively constant.

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

Table [11]: Pensioners (public scheme) to inactive population ratio by age group (%)

	2019	2030	2040	2050	2060	2070
Age group -54	1.6	1.9	2.2	2.0	1.9	1.9
Age group 55-59	18.3	25.0	28.6	33.6	31.5	34.7
Age group 60-64	51.2	27.5	27.3	31.5	33.6	34.6
Age group 65-69	107.7	110.0	145.6	133.3	79.6	42.7
Age group 70-74	111.2	111.9	127.8	154.3	148.5	115.4
Age group 75+	105.7	103.5	103.3	112.5	131.0	125.5

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.

Section A2.2 of Appendix 2 presents the ratios of total number of pensioners to the inactive population and total population respectively, by age group. Separate ratios are presented for total and female population.

Table [12] 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 [12]: Projected and disaggregated new public pension expenditure - GSIS: old-age and early earnings-related pensions

New old-age earnings-related pensions	2019	2030	2040	2050	2060	2070
Projected new pension expenditure (mil EUR)*	50.5	114.3	178.0	251.6	430.3	482.6
I. Number of new pensions (1000)	7.0	9.6	11.3	12.1	13.5	10.0
II. Point value (EUR/month)	703.6	907.0	1259.7	1851.1	2690.1	3855.2
III. Average accrual rate	1.31%	1.33%	1.29%	1.26%	1.25%	1.22%
IV. Total insurance points at retirement	60.4	76.1	74.7	68.8	72.8	79.0
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.

Following are the main points from Table [12]:

- 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 recent reform of the GSIS, 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 not typically entitled to a dependents' increase in their basic pension. 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 2030, 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 2030-2050, 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.

4.4 Financing of the pension system

Table [13] 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 [13]: Financing of the GSIS

	Public employees*	Private employees	Self-employed
Contribution base	Gross earnings		Insurable income per occupational category
Contribution rate/contribution			
Employer	12.4%	8.3%	15.6%
Employee	4.2%	8.3%	
State	4.9%	4.9%	4.9%
Other Revenues	Reserve fund	Reserve fund	Reserve fund
Maximum contribution	Paid on Maximum Insurable Earnings (€54,648 for 2019)		
Minimum Contribution	Not applicable		

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

Table [14] 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 [14]: Revenue from contribution (% of GDP), number of contributors in the public scheme (in 1000), total employment (in 1000) and related ratios (%)

	2019	2030	2040	2050	2060	2070	Change 2019-70
Public contribution	8.4	9.2	10.1	10.1	10.0	10.0	1.6
<i>Employer contribution</i>	3.1	3.5	3.8	3.8	3.8	3.8	0.7
<i>Employee contribution</i>	3.4	3.6	3.9	3.8	3.8	3.8	0.4
<i>State contribution</i>	1.9	2.2	2.4	2.5	2.5	2.5	0.5
Number of contributors (I) (1000)	518	572	608	626	608	585	67
Employment (II) (1000)	427	458	484	505	508	506	79
Ratio of (I)/(II)	1.2	1.2	1.3	1.2	1.2	1.2	-0.1

The ratio of contributors (as per social security administrative database) to the employed population (as per Labour Force Survey) is 120% in the base year (2019) and it is projected to remain relatively stable at that level throughout the projection period. It is important to note that in the base year the above ratio is 130% for the middle-age cohort, such as the age group 40-49. The above cohort, which is projected to retire over the period 2035-2050, directly affects the evolution of the coverage ratio (number of pensioners/ population 65+), as it is illustrated by Table [A2.2] of Appendix 2 which shows that the coverage ratio has a positive contribution towards pension

expenditure by 0.7 and 0.5 percentage points of GDP over the decades 2030-40 and 2040-50 respectively.

4.5 GSIS reserves and return on assets

Table [15] shows the evolution of GSIS reserves, as percentage of GDP, as well as the assumed rate of return on GSIS assets. This assumption is based on the projection of the rate of return on GSIS assets, which are currently invested to a great extent in non-tradeable government deposits (96 per cent) while the remaining assets are invested in medium-term government bonds and cash deposits held with commercial banks in Cyprus.

The interest rate of the Social Insurance Fund on non-tradeable government deposits is calculated as the marginal lending facility rate of the European Central Bank less 0.25 per cent. The initial rate of return, 0.2%, reflects observed rates of returns on GSIS assets for 2019, whereas the assumed ultimate real rate of return on GSIS assets is derived from the historical real rates of return on the European Central Bank's marginal lending facility rate over the 20-year period since the introduction of the euro currency on 1 January 1999.

Table [15]: GSIS reserves (as % of GDP) and return on assets (%)

	Average 1999-2008	Average 2009-2018	2019	2030	2040	2050	2060	2070	Average 2019-70
GSIS									
Reserves			34	37	42	44	39	28	39
Nominal rate of return			0.2	2.5	2.5	2.5	2.5	2.5	2.2

4.6 Sensitivity analysis

Table [16] presents the projected public pension expenditure under different sensitivity scenarios in terms of its deviation in percentage points from the baseline scenario.

Table [16]: Public pension expenditures under different scenarios - percentage point deviation from the baseline

	2019	2030	2040	2050	2060	2070	Change 2019-70 (pps)
Baseline (% GDP)	8.8	10.0	10.2	10.1	10.7	10.9	2.1
Higher life expectancy at birth (+2y)	0.0	0.1	0.0	0.0	0.1	0.3	0.3
Higher migration (+33%)	0.0	-0.2	-0.4	-0.6	-0.8	-0.8	-0.8
Lower migration (-33%)	0.0	0.2	0.4	0.7	1.0	1.0	1.0
Lower fertility (-20%)	0.0	0.0	0.1	0.4	0.7	1.2	1.2
Higher employment rate of older workers (+10 pps.)	0.0	-0.3	-0.2	-0.3	-0.4	-0.2	-0.2
Higher TFP growth (convergence to 1.2%)	0.0	-0.1	-0.2	-0.1	-0.1	-0.1	-0.1
TFP risk scenario (convergence to 0.8%)	0.0	-0.1	0.1	0.2	0.3	0.3	0.3
Policy scenario: unchanged retirement age	0.0	0.1	0.4	1.4	2.2	2.2	2.2
Policy scenario: offset declining pension benefit ratio	0.0	0.2	1.2	3.0	4.1	4.0	4.0
Lagged recovery scenario	0.0	0.1	0.0	0.0	0.0	-0.1	-0.1
Adverse structural scenario	0.0	0.3	0.5	0.5	0.4	0.3	0.3

Following are the main points from Table [16]:

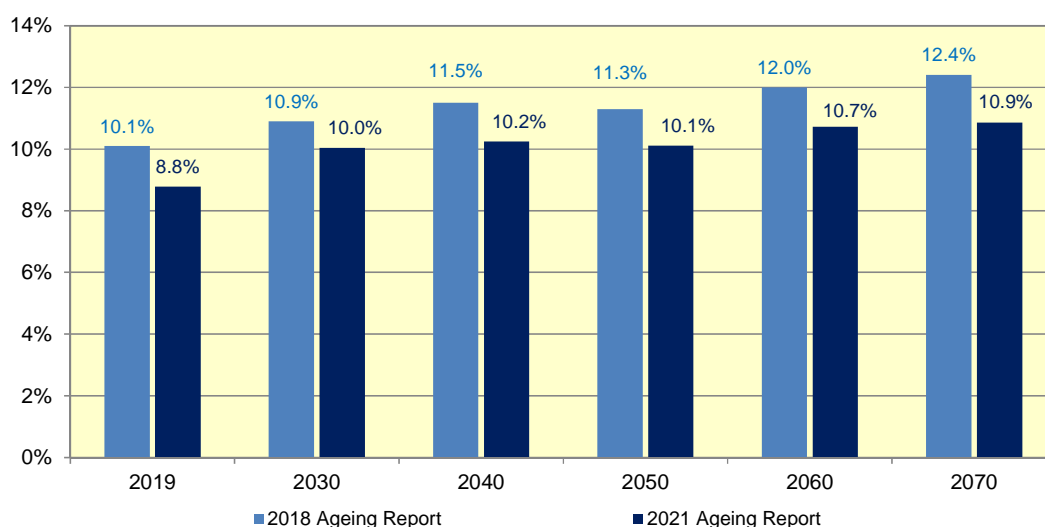
- *Higher life expectancy* – the sensitivity of the results to an increase of life expectancy at birth of two years by 2070 seems relatively small. Higher number of pensions and increased duration of pension payments in retirement, caused by increases in life expectancy, contribute positively to the 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 0.8/ 1.0 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”.

- *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 2040 onwards. In particular, the deviation from the baseline is 0.1 p.p. in 2040, rising to 1.2 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 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 1.2%) leads to a constant decrease of the expenditure to GDP ratio.
- *TFP Risk scenario* – The impact of this scenario, where TFP growth converges to 0.8%, 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 2.2 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 4.0 p.p. higher level in 2070. This scenario highlights the potential costs of preventing the adequacy of pension benefits from declining too much.
- *Lagged recovery scenario* - the long-term effect on pension expenditure is small.
- *Adverse structural scenario* - leads to a small increase in expenditure of 0.5 p.p. of GDP in the medium term, falling back to 0.3 p.p. in 2070.

4.7 Description of changes in comparison with previous projections

Chart [6] compares the projected public pension expenditure figures under the AWG 2021 and AWG 2018 projections exercise.

Chart [6]: Public pension expenditure (as % GDP) over the period 2019-2070 - AWG 2021 vs AWG 2018 projection exercise



The pension expenditure (as % GDP) under the 2021 AWG exercise is consistently lower than that of the 2018 AWG exercise throughout the projection period by a margin of 1.0-1.5 percentage points of GDP. This downward revision is mainly caused by the lower starting point because of the better than expected economic performance in recent years: actual pension expenditure in 2019 was 8.8% of GDP, compared with a projected 10.1% in the 2018 exercise.

Under the present 2021 AWG exercise, the change in pension expenditure over the projection period through 2070 is 2.1 percentage points of GDP (from 8.8% in 2019 to 10.9% in 2070). This projected increase represents a small improvement compared with the 2018 AWG pension projection exercise, under which the change in pension expenditure over the same period was 2.3 percentage points of GDP.

Table [17] provides a comparison of the decomposition of the change in public pension expenditure during the projection period among the 2021 AWG projection exercise and previous (2006, 2009, 2012, 2015 and 2018) AWG exercises.

Table [17]: Overall change in public pension expenditure to GDP under the 2006, 2009, 2012, 2015, 2018 and 2021 projection exercises

	Public pension expenditure	Dependency ratio effect	Coverage ratio effect	Benefit ratio effect	Labour market effect	Residual (incl. interaction effect)
2006 *	12.8	10.2	1.2	2.5	-1.2	0.1
2009 **	11.4	10.8	1.6	-0.3	-0.5	-0.2
2012 ***	2.8	9.5	-2.4	-2.6	0.0	-1.1
2015****	-0.1	8.7	-2.1	-3.8	-2.2	-0.6
2018*****	2.3	11.6	-2.4	-4.1	-2.1	-0.8
2021*****	2.1	7.1	-0.6	-3.0	-1.0	-0.5

- The projection horizon has been extended over consecutive Ageing Reports, limiting comparability over time: * 2004-2050; ** 2007-2060; *** 2010-2060; **** 2013-2060; ***** 2016-2070; and *****2019-2070:

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

Following are the main points from Table [17]:

- The difference in the percentage point increase of public pension expenditure over the projection period between the present 2021 AWG exercise and previous 2018 AWG exercise, amounts to 0.2 percentage points of GDP lower (2.3 in 2018 exercise vs 2.1 in 2021 exercise).
- A much more favourable dependency ratio effect (4.5 percentage points lower), reflecting the differences in the demographic framework, is primarily offset by the less favourable coverage ratio (amounting to 1.8 percentage points higher) due to a cohort effect – as it is illustrated in Section 4.4 of this report, the less favourable coverage ratio stems from the fact that the number of contributors exceeds the employed population for middle age groups in the base year, people who are projected to retire over the period 2030-2050.

Table [18]: Breakdown of the difference between 2018 and the new public pension projection (% of GDP)

	2019	2030	2040	2050	2060	2070
Ageing report 2018	10.1	10.9	11.5	11.3	12.0	12.4
<i>Change in assumptions</i>	-1.3	-0.9	-1.3	-1.2	-1.3	-1.5
<i>Improvement in the coverage or in the modelling</i>	-	-	-	-	-	-
<i>Change in the interpretation of constant policy</i>	-	-	-	-	-	-
<i>Policy related changes</i>	-	-	-	-	-	-
New projection	8.8	10.0	10.2	10.1	10.7	10.9

Table [18] shows the results of the reconciliation of the public pension expenditure (as percentage of GDP) of the present 2021 AWG projection exercise with that of the 2018 exercise. The more favourable macroeconomic assumptions used in the new projection explain the decrease of 1.0-1.5 percentage points in the public pension expenditure throughout the projection period between the new (AR2021) and previous (AR2018) round of projections.

5. Pension projection methodology

5.1 Institutional context in which those projections are made

The present 2021 AWG projections for Cyprus were undertaken by the actuarial unit of the Ministry of Labour, Welfare and Social Insurance. The projection results of the GSIS are produced directly from the actuarial pension model of the Ministry of Labour, Welfare and Social Insurance 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 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. Muhanna & Co, Actuaries and Consultants.

5.2 Assumptions and methodologies applied

5.2.1 Methodologies applied

Chart [6] presents graphically the methodology used for calculating GSIS revenue from contributions, while Chart [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.

Chart [6]: Methodology – GSIS contribution income

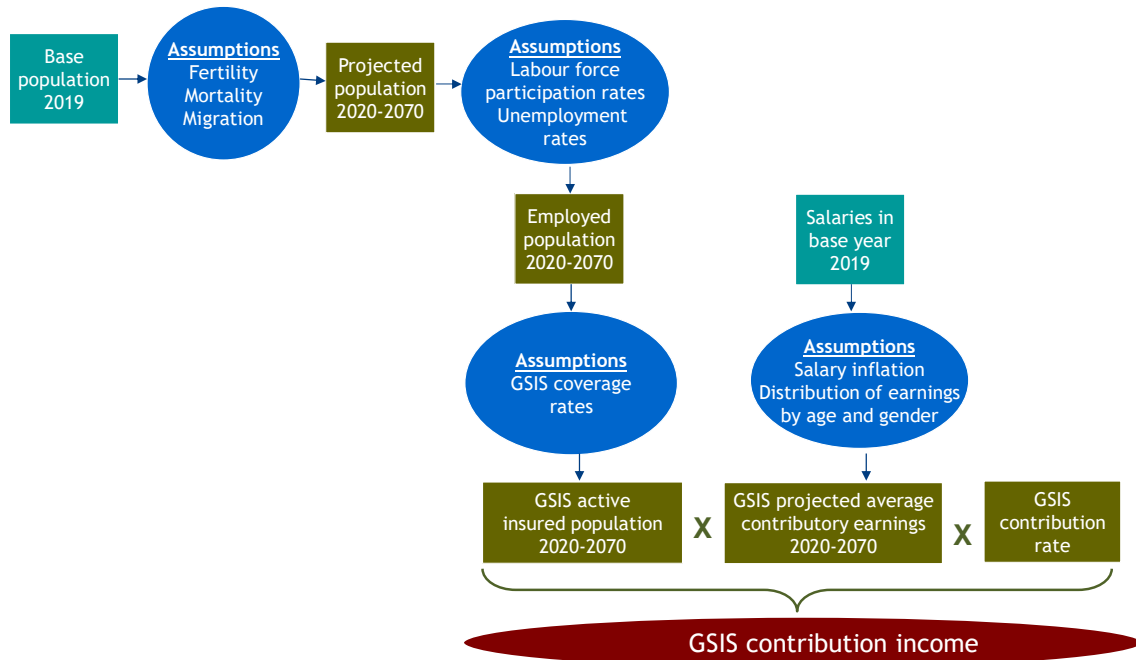
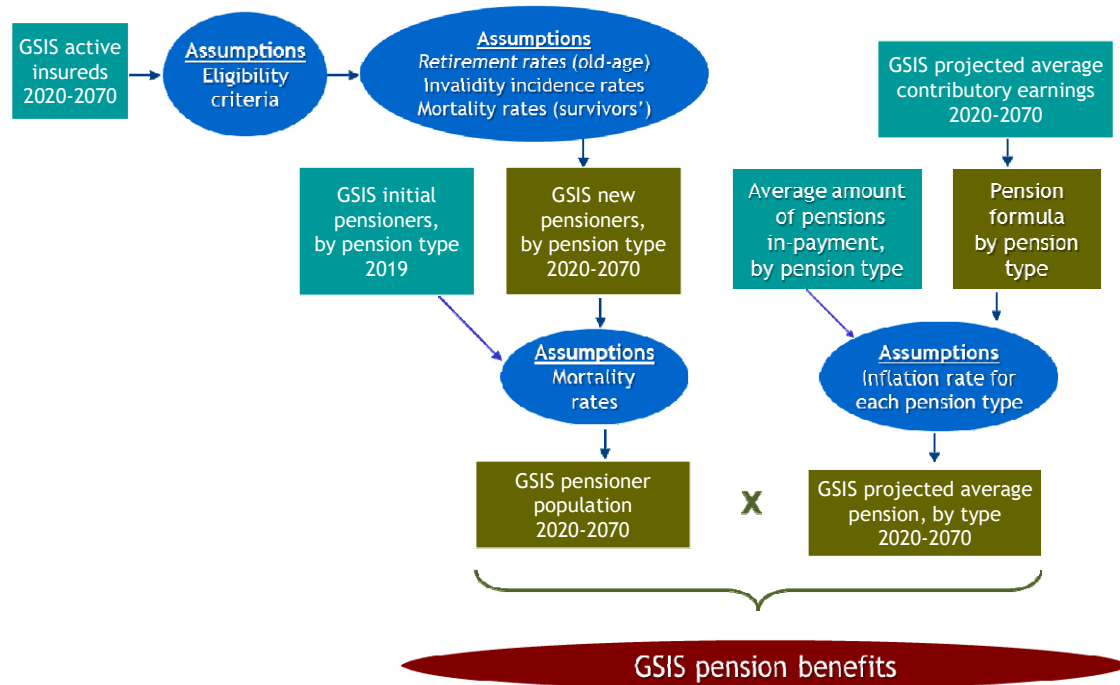


Chart [7]: Methodology – GSIS pension benefits



Details of the methodologies applied for the purposes of conducting the present actuarial valuation for the GSIS are provided in Appendix 3.

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 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 are projected from one year to the next, based on the survival of the existing members and the new pensioners/widows 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 2021 macroeconomic framework.

5.2.2 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.

5.3 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.

5.4 Reforms incorporated in the model

The pension reform measures incorporated in the modeling exercise, which refer to both the GSIS and GEPS, are those described in section 1.2 of this report.

5.5 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 Chief Actuarial Officer of the Ministry of Labour, Welfare and Social Insurance who is certified to use it. 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. A 75-year projection horizon is adopted for the actuarial valuation.

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 2019, basic insurable earnings are fixed at €175.90 per week, or €9,147 per year. The maximum insurable earnings for contribution purposes in 2019 are €54,648.

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 2019, one point is credited for every €9,106 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] shows the current contribution rate paid by or on behalf of insured persons.

Table [A1.1]: Contribution rate as at 1.1.2019

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, who was in receipt of widow's pension, remarried.

The widow's pension consists of the:

- basic pension, which is equal to:
 - ✓ if the husband 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 husband 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 husband 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 husband 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 2019 was €357.22 (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 97%), especially of older generations with relatively low labour force participation rates. The rate of the Social Pension is equivalent to 81% of the full basic pension under the GSIS, and as a consequence, is automatically indexed to earnings. The monthly amount of social pension for 2019 was €340.41. 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

A2.1 Pension spending decomposition

Tables [A2.1] and [A2.2] show in detail the drivers of the ratio of public pension expenditures to GDP between 2019 and 2070, as well as during the five 10-year sub-periods over the projection period, using data on pensions and pensioners respectively.

Table [A2.1]: Factors behind the change in public pension expenditures between 2019 and 2070 using pensions data (in percentage points of GDP)

	2019-30	2030-40	2040-50	2050-60	2060-70	2019-2070
Public pensions to GDP	1.3	0.2	-0.1	0.6	0.1	2.1
Dependency ratio effect	2.3	0.9	1.0	2.2	1.8	8.3
Coverage ratio effect	-0.5	0.5	0.4	-0.4	-1.0	-0.9
<i>Coverage ratio old-age*</i>	0.0	0.6	0.6	-0.3	-1.1	-0.3
<i>Coverage ratio early-age*</i>	-2.6	-0.2	-0.8	-0.4	-0.1	-4.2
<i>Cohort effect*</i>	-2.2	0.2	0.0	-1.1	-0.6	-3.7
Benefit ratio effect	-0.2	-0.8	-0.9	-0.2	0.2	-1.9
Labour Market effect	-0.2	-0.2	-0.2	-0.2	-0.1	-0.8
<i>Employment ratio effect</i>	-0.2	-0.1	-0.1	-0.1	-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	-0.1	0.0	-0.3
Residual	-0.2	-0.2	-0.5	-0.8	-0.8	-2.6

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

Table [A2.2]: Factors behind the change in public pension expenditures between 2019 and 2070 using pensioners data (in percentage points of GDP)

	2019-30	2030-40	2040-50	2050-60	2060-70	2019-2070
Public pensions to GDP	1.3	0.2	-0.1	0.6	0.1	2.1
Dependency ratio effect	2.4	0.8	0.9	1.7	1.3	7.1
Coverage ratio effect	-0.4	0.7	0.5	-0.2	-1.2	-0.6
<i>Coverage ratio old-age*</i>	0.1	0.8	0.6	-0.1	-1.2	0.2
<i>Coverage ratio early-age*</i>	-2.7	-0.5	-0.2	-0.7	-0.3	-4.4
<i>Cohort effect*</i>	-2.7	0.4	0.0	-1.7	-1.2	-5.3
Benefit ratio effect	-0.3	-1.0	-1.3	-0.6	0.2	-3.0
Labour Market effect	-0.2	-0.2	-0.2	-0.2	-0.1	-1.0
<i>Employment ratio effect</i>	-0.2	-0.2	-0.1	-0.1	-0.1	-0.7
<i>Labour intensity effect</i>	0.0	0.0	0.0	0.0	0.0	0.0
<i>Career shift effect</i>	0.0	-0.1	-0.1	-0.1	0.0	-0.4
Residual	-0.2	-0.1	-0.1	-0.1	-0.1	-0.5

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

A2.2 Evolution of pensioners to population ratio by age group

Tables [A2.3] and [A2.4] show the total number of pensioners, by age group, as percentage to the inactive population in the same age group and to the population by age group respectively. The same analysis is done on female in Table [A2.5] and Table [A2.6].

Table [A2.3]: Total pensioners (public scheme) to inactive population ratio by age group (%)

	2019	2030	2040	2050	2060	2070
Age group -54	1.6	1.9	2.2	2.0	1.9	1.9
Age group 55-59	18.3	25.0	28.6	33.6	31.5	34.7
Age group 60-64	51.2	27.5	27.3	31.5	33.6	34.6
Age group 65-69	107.7	110.0	145.6	133.3	79.6	42.7
Age group 70-74	111.2	111.9	127.8	154.3	148.5	115.4
Age group 75+	105.7	103.5	103.3	112.5	131.0	125.5

Table [A2.4]: Total pensioners (public schemes) to total population ratio by age group (%)

	2019	2030	2040	2050	2060	2070
Age group -54	0.6	0.7	0.8	0.8	0.7	0.7
Age group 55-59	4.8	5.4	6.0	6.0	5.2	5.2
Age group 60-64	22.6	11.3	9.9	10.3	9.4	8.6
Age group 65-69	89.2	84.6	102.8	88.0	49.3	24.8
Age group 70-74	100.2	108.5	122.2	144.7	137.5	106.0
Age group 75+	105.7	103.5	103.3	112.5	131.0	125.5

Table [A2.5]: Female pensioners (public scheme) to inactive population ratio by age group (%)

	2019	2030	2040	2050	2060	2070
Age group -54	2.2	2.4	2.7	2.5	2.2	2.2
Age group 55-59	16.4	25.2	26.5	30.3	28.6	30.0
Age group 60-64	37.4	26.8	26.7	30.0	31.2	31.6
Age group 65-69	97.9	111.6	144.7	122.1	75.1	44.1
Age group 70-74	100.6	110.0	131.1	146.3	137.1	106.8
Age group 75+	105.9	101.3	104.5	114.1	128.3	121.8

Table [A2.6]: Female pensioners (public scheme) to total population ratio by age group (%)

	2019	2030	2040	2050	2060	2070
Age group -54	0.9	1.0	1.0	1.0	0.9	0.9
Age group 55-59	6.2	6.9	6.9	6.8	6.1	5.8
Age group 60-64	20.6	13.8	11.8	11.8	10.6	9.5
Age group 65-69	89.1	92.2	109.4	87.3	50.9	28.3
Age group 70-74	96.1	106.2	125.3	138.3	129.0	99.9
Age group 75+	105.9	101.3	104.5	114.1	128.3	121.8

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

Table [A2.7]: Projected and disaggregated new public pension expenditure -
GSIS: old-age and early earnings-related pensions - MEN

New old-age earnings-related pensions	2019	2030	2040	2050	2060	2070
Projected new pension expenditure (mil EUR)*	31.6	69.7	99.2	145.1	234.2	251.7
I. Number of new pensions (1000)	4.0	5.3	5.7	6.3	6.7	4.6
II. Point value (EUR/month)	703.6	907.0	1259.7	1851.1	2690.1	3855.2
III. Average accrual rate	1.33%	1.36%	1.32%	1.29%	1.28%	1.26%
IV. Total insurance points at retirement	64.8	82.6	79.9	74.2	78.1	86.4
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 [A2.8]: Projected and disaggregated new public pension expenditure -
GSIS: old-age and early earnings-related pensions - WOMEN

New old-age earnings-related pensions	2019	2030	2040	2050	2060	2070
Projected new pension expenditure (mil EUR)*	19.1	44.6	78.8	107.3	196.1	229.3
I. Number of new pensions (1000)	3.0	4.3	5.5	5.8	6.8	5.4
II. Point value (EUR/month)	703.6	907.0	1259.7	1851.1	2690.1	3855.2
III. Average accrual rate	1.28%	1.29%	1.25%	1.22%	1.21%	1.18%
IV. Total insurance points at retirement	55.1	68.0	69.6	63.5	67.8	72.1
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.

A2.4 Administrative data of new pensioners

Tables [A2.9], [A2.10] and [A2.11] show the actual number of new pensioners by age group and pension type for the year 2018 for men, women and total number respectively.

Table [A2.9]: Administrative data on number of new pensioners by age group and pension type for 2019 - MEN

Age group	All	Old age*	Disability	Survivor	Other (including minimum)
15 - 49	89	0	64	25	0
50 - 54	37	0	30	7	0
55 - 59	80	0	70	10	0
60 - 64	3,126	3,057	55	14	0
65 - 69	1,007	991	0	16	0
70 - 74	27	0	0	27	0
75+	118	0	0	118	0

* It refers to the age at which old-age pension commences and not the effective retirement age. A large number of old-age pensioners continue working after the pensionable age.

Table [A2.10]: Administrative data on number of new pensioners by age group and pension type for 2019 - WOMEN

Age group	All	Old age*	Disability	Survivor	Other (including minimum)
15 - 49	126	0	31	95	0
50 - 54	85	0	17	68	0
55 - 59	151	0	28	123	0
60 - 64	1,868	1,671	34	163	0
65 - 69	2,364	2,137	0	227	0
70 - 74	370	0	0	370	0
75+	913	0	0	913	0

* It refers to the age at which old-age pension commences and not the effective retirement age. A large number of old-age pensioners continue working after the pensionable age.

Table [A2.11]: Administrative data on number of new pensioners by age group and pension type for 2019 - TOTAL

Age group	All	Old age*	Disability	Survivor	Other (including minimum)
15 - 49	215	0	95	120	0
50 - 54	122	0	47	75	0
55 - 59	231	0	98	133	0
60 - 64	4,994	4,728	89	177	0
65 - 69	3,371	3,128	0	243	0
70 - 74	397	0	0	397	0
75+	1,031	0	0	1,031	0

* It refers to the age at which old-age pension commences and not the effective retirement age. A large number of old-age pensioners continue working after the pensionable age.

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 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.

A3.3 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.

A3.4 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 Chief Actuarial Officer of the Ministry of Labour, Welfare and Social Insurance who is certified to use it.

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 (mortality rates, incapacity rates, retirement rates, exit rates, etc) which are used to map the transition of an insured person (active person⁶, inactive person⁷ 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.

⁶ Active insured person refers to an individual who has made at least one contribution to the social security scheme during a given year.

⁷ 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.

- 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);
 - ✓ 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 2016. 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 Invalidation incidence

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

Table [A4.1]: Rates of entry into invalidity

Age	Males	Females
22	0.00028	0.00014
27	0.00048	0.00020
32	0.00045	0.00030
37	0.00070	0.00044
42	0.00091	0.00058
47	0.00150	0.00093
52	0.00276	0.00198
57	0.00554	0.00466
62	0.00900	0.00711

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 or 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