

Republic of Cyprus



Country Fiche on public pensions for the Ageing Report 2018

December, 2017

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 2016.

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 2016; 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 (2017) “The 2018 Ageing Report: Underlying assumptions and projection methodologies”, European Commission, European Economy, Institutional Paper 065.

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.

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 the Eurostat's current population projection.

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 |
| 2016 | | 65.0 | | 63.0 | | 65.0 |
| 2020 | (1) Insured for 520 weeks; | 65.0 | (1) Insured for 520 weeks; | 63.0 | (1) Insured for 780 weeks; | 65.0 |
| 2025 | (2) paid | 65.0 | (2) paid | 63.0 | (2) paid | 65.5 |
| 2030 | insurance | 65.0 | insurance | 63.0 | insurance | 65.9 |
| 2035 | points = 10; | 65.0 | points = 10; | 63.0 | points = 15; | 66.4 |
| 2040 | and | 65.0 | and | 63.0 | and | 66.8 |
| 2045 | (3) paid or | 65.0 | (3) paid or | 63.0 | (3) paid or | 67.3 |
| 2050 | credited | 65.0 | credited | 63.0 | credited | 67.7 |
| 2055 | insurance | 65.0 | insurance | 63.0 | insurance | 68.2 |
| 2060 | points = 30% of | 65.0 | points = 70% of | 63.0 | points = 30% of | 68.6 |
| 2065 | insurance | 65.0 | insurance | 63.0 | insurance | 69.0 |
| 2070 | period (*). | 65.0 | period. | 63.0 | period. | 69.3 |

(*) 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.

2.1 Administrative data of new pensioners

Table [2] shows the actual number of new pensioners by age group and pension type for the year 2015.

Table [2]: Administrative data on number of new pensioners by age group and pension type for 2015

| Age group | All | Old age* | Disability | Survivor | Other (including minimum) |
|-----------|-------|----------|------------|----------|---------------------------|
| 0 - 49 | 333 | 0 | 122 | 211 | 0 |
| 50 - 54 | 125 | 0 | 60 | 65 | 0 |
| 55 - 59 | 263 | 0 | 132 | 131 | 0 |
| 60 - 64 | 5,296 | 5,033 | 93 | 170 | 0 |
| 65 - 69 | 2,721 | 1,235 | 0 | 241 | 1,245 |
| 70 - 74 | 272 | 0 | 0 | 272 | 0 |
| 75+ | 867 | 0 | 0 | 867 | 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.

2.3 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 which provide supplementary pensionable benefits to civil servants.

2.3.1 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 in 2018 and the first revision will cover the period 2018-2023.

2.3.2 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 in 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 COLA indexation over the previous year.

3. Demographic and labour market framework

Since the main aim of this valuation 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 pension system. Eurostat's current population projection with the base year 2016 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 [3] shows the expected evolution of population, life expectancy, surviving probabilities and net migration for selected years over the period 2016-2070.

Table [3]: Main demographic variables evolution 2016-2070

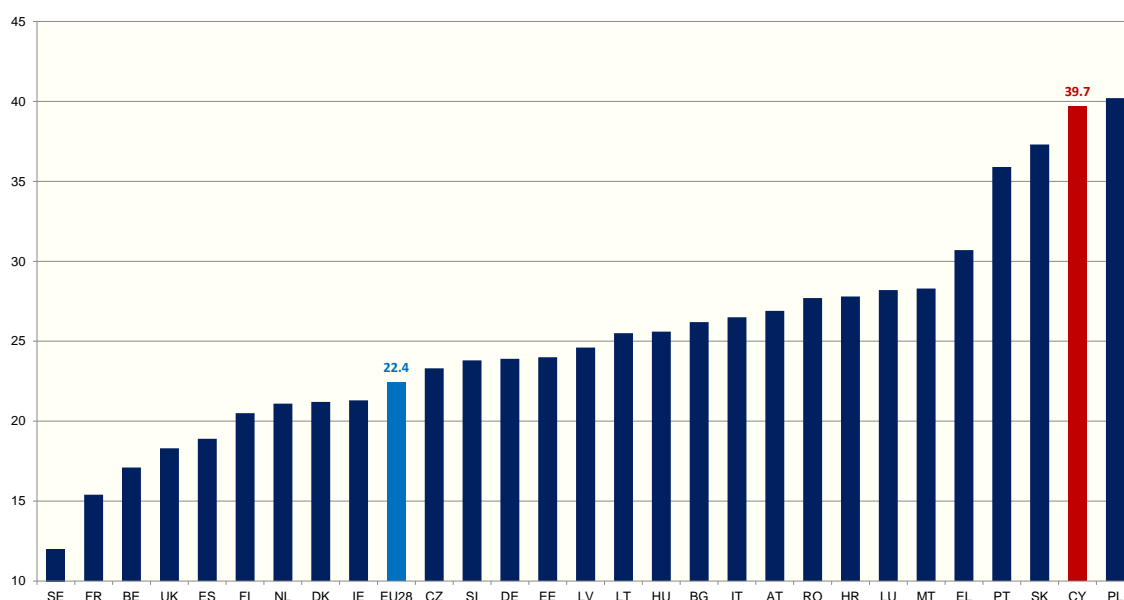
| Demographic variable | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | Peak year* |
|---|------|------|------|------|------|-------|-------|------------|
| Population (in '000s) | 851 | 872 | 922 | 956 | 986 | 1,013 | 1,019 | 2067 |
| Population growth rate | 0.4 | 0.6 | 0.5 | 0.3 | 0.3 | 0.2 | 0.0 | 2021 |
| Old-age dependency ratio (pop65/pop15-64) | 22.2 | 24.6 | 30.8 | 34.9 | 42.7 | 55.7 | 61.0 | 2070 |
| Ageing of the aged (pop80+/pop65+) | 22.0 | 23.5 | 28.1 | 32.7 | 33.2 | 32.6 | 41.7 | 2070 |
| Men - Life expectancy at birth | 80.6 | 81.4 | 82.7 | 83.8 | 84.9 | 86.0 | 87.0 | 2070 |
| Men - Life expectancy at 65 | 19.0 | 19.6 | 20.5 | 21.4 | 22.2 | 23.0 | 23.8 | 2070 |
| Women - Life expectancy at birth | 84.3 | 85.0 | 86.2 | 87.2 | 88.3 | 89.3 | 90.2 | 2070 |
| Women - Life expectancy at 65 | 21.3 | 21.9 | 22.8 | 23.7 | 24.6 | 25.4 | 26.3 | 2070 |
| Men - Survivor rate at 65+ | 90.2 | 90.9 | 92.1 | 93.1 | 93.9 | 94.7 | 95.3 | 2070 |
| Men - Survivor rate at 80+ | 63.6 | 66.0 | 69.9 | 73.5 | 76.7 | 79.5 | 82.1 | 2070 |
| Women - Survivor rate at 65+ | 94.8 | 95.1 | 95.7 | 96.2 | 96.7 | 97.1 | 97.4 | 2070 |
| Women - Survivor rate at 80+ | 77.1 | 78.8 | 81.7 | 84.2 | 86.4 | 88.3 | 89.9 | 2070 |
| Net migration | 1.0 | 1.7 | 2.9 | 3.9 | 4.9 | 4.4 | 3.7 | 2051 |
| Net migration over population change | 0.3 | 0.3 | 0.7 | 1.3 | 1.5 | 2.3 | -8.0 | 2068 |

* Peak year represents the year in which the particular variable reaches its maximum over the projection period 2016 to 2070.

It follows from Table [3] that the population of Cyprus is projected to increase from its present level of 851,000 persons in 2016 to 1,019,000 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 15-64, which provides a demographic measure of population ageing, is projected to increase continuously from 22.2% in 2016 to 61.0% in 2070. In other words, in 2070, it is expected to have approximately 5 working-age people for every 3 persons aged 65 and over.

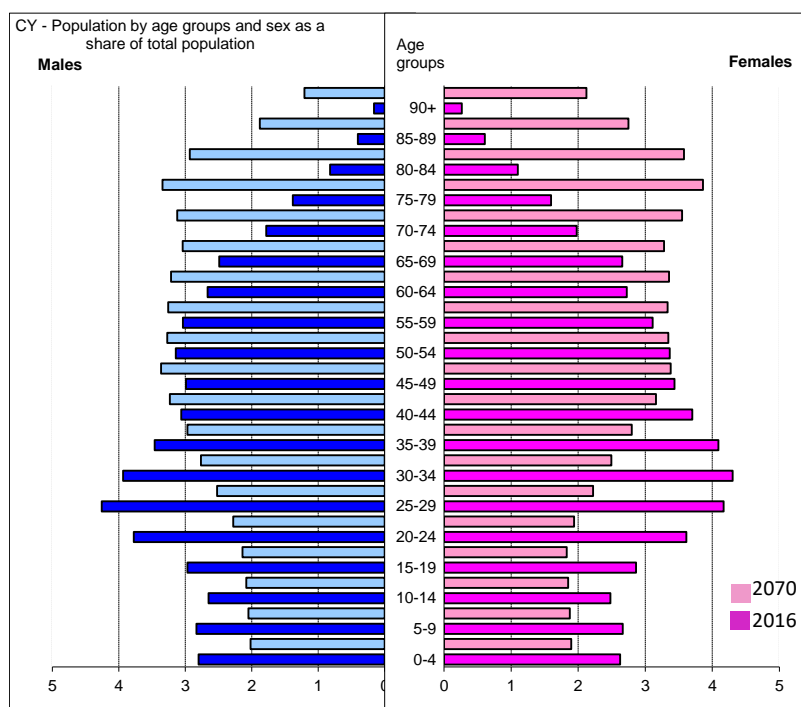
Such a dramatic increase in the old-age dependency ratio for Cyprus over the period 2015 to 2070 (39.7 percentage points), which is the second highest in the EU, is illustrated in Chart [1] below.

Chart [1]: Old age dependency ratio, net change 2015-2070



The ageing of population in Cyprus is illustrated in Chart [2], which compares the population age structure by gender in 2016 with the one of 2070.

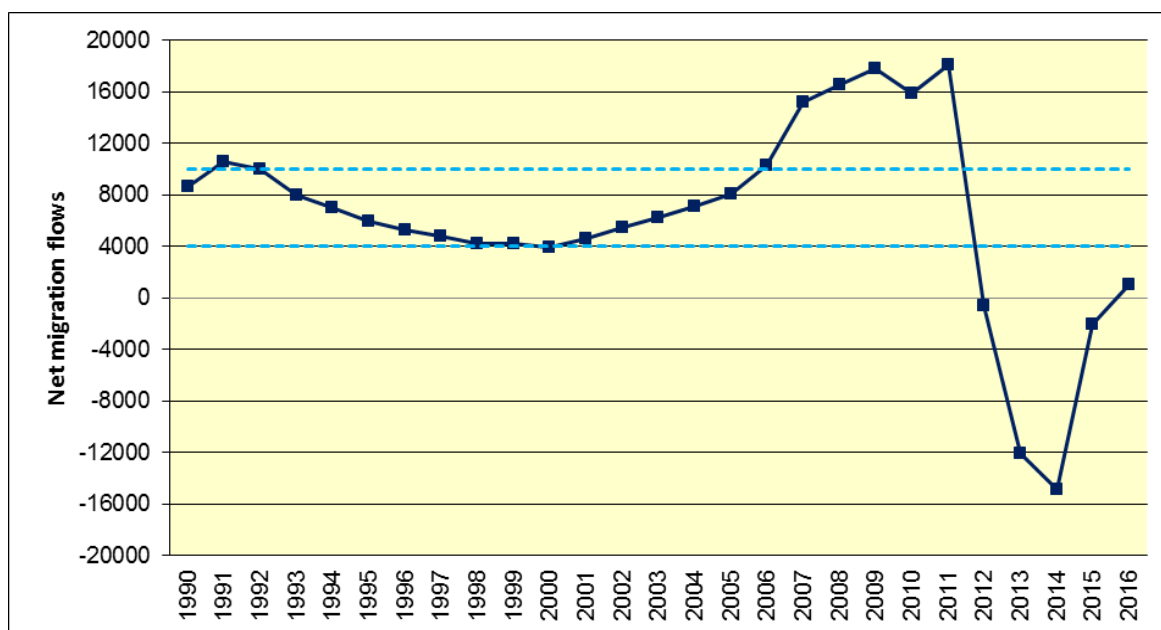
Chart [2]: Age pyramid comparison: 2016 versus 2070



The above pace of population ageing, as shown in Table [3] and Chart [2], is greatly affected by the Eurostat's projected net migration flows for Cyprus, which are considerably lower when compared with historical longer-term trends. As it is illustrated from Chart [3] 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.

Chart [3]: Historical net migration flows, 1990-2016



According to this round of Eurostat’s projections, net migration in the medium and long-term (2020-70) is projected to average at around 3,750², 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 45% lower than the historical trend figure of 6,700. Furthermore, this round’s projected migration figures are, on average, approximately 30% lower than those of previous round of Eurostat’s projections (EUROPOP 2013), under which the average number of net migrants over the period 2020-60 was set at around 5,300.

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.

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”.

Table [4]: Participation rate, employment rate and share of workers for the age groups 55-64 and 65-74

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | Peak year* |
|---|------|------|------|------|------|------|------|------------|
| Labour force participation rate 55-64 | 59.0 | 61.7 | 66.9 | 69.8 | 72.5 | 74.6 | 76.8 | 2070 |
| Employment rate for workers aged 55-64 | 52.3 | 55.8 | 63.3 | 66.1 | 68.7 | 70.7 | 72.7 | 2070 |
| Share of workers aged 55-64 on the total labour force | 88.7 | 90.4 | 94.6 | 94.7 | 94.7 | 94.8 | 94.8 | 2057 |
| Labour force participation rate 65-74 | 11.0 | 11.0 | 13.1 | 14.5 | 18.4 | 22.8 | 28.1 | 2070 |
| Employment rate for workers aged 65-74 | 10.8 | 10.9 | 13.0 | 14.5 | 18.3 | 22.7 | 27.9 | 2070 |
| Share of workers aged 65-74 on the total labour force | 98.8 | 99.4 | 99.5 | 99.6 | 99.6 | 99.5 | 99.5 | 2043 |
| Median age of the labour force | 38.0 | 38.0 | 41.0 | 43.0 | 44.0 | 44.0 | 44.0 | 2042 |

* *Peak year* represents the year in which the particular variable reaches its maximum over the projection period 2016 to 2070.

As shown in Table [4] above, over the period 2016-2070 the average labour force participation rate for the age group 55-64 is assumed to significantly increase from its current level of 59.0% to 76.8% in 2070, while for the age group 65-74 is projected to increase even higher by a factor of 2.6 - from 11.0% in 2016 to 28.1% in 2070.

Changes in the average participation rate result at a great extent from the anticipated increase in the average labour force exit age due to the 2012 GSIS and GEPS reform, as illustrated in Tables [5a] and [5b], and at 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 [5a] and [5b] summarise the estimated evolution of average effective working career, as derived from the labour cohort simulation model, and life spent at retirement. It also provides evidence of the effectiveness of active labour market policies and penalties on early retirement on prolonging working career.

Table [5a]: Labour market entry age, exit age and expected duration of life spent at retirement – Men

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | Peak year* |
|--|------|------|------|------|------|------|------|------------|
| Average effective exit age (CSM) | 66.4 | 64.9 | 65.7 | 66.1 | 66.6 | 67.5 | 68.4 | 2070 |
| Average effective working career (CSM)** | 43.1 | 42.9 | 43.7 | 44.1 | 44.6 | 45.5 | 46.4 | 2070 |
| Duration of retirement *** | 18.2 | 19.6 | 19.7 | 20.5 | 20.5 | 20.4 | 21.1 | 2048 |
| Duration of retirement/average working career | 0.4 | 0.5 | 0.5 | 0.5 | 0.5 | 0.4 | 0.5 | 2048 |
| Percentage of adult life spent in retirement**** | 27.3 | 29.5 | 29.2 | 29.9 | 29.6 | 29.2 | 29.5 | 2048 |
| Early/late exit***** | 5.1 | 1.1 | 0.7 | 1.1 | 1.5 | 1.0 | 3.0 | 2016 |

* *Peak year* represents the year in which the particular variable reaches its maximum over the projection period 2016 to 2070.

** *Average effective working career* is the difference between the average effective exit age and the average effective entry age.

*** *Duration of retirement* is the difference between the life expectancy at average effective exit age and the average effective exit age itself.

**** *The percentage of adult life spent at retirement* is calculated as the ratio between the duration of retirement and the life expectancy diminished by 18 years.

***** *Early/late exit*, in the specific year, is the ratio of those who retired and aged less than the statutory retirement age and those who retired and are aged more than the statutory retirement age.

Table [5b]: Labour market entry age, exit age and expected duration of life spent at retirement – WOMEN

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | Peak year* |
|--|------|------|------|------|------|------|------|------------|
| Average effective exit age (CSM) | 59.8 | 63.3 | 63.7 | 64.4 | 65.2 | 66.2 | 67.1 | 2070 |
| Average effective working career (CSM)** | 36.2 | 41.0 | 41.3 | 42.1 | 42.9 | 43.9 | 44.8 | 2070 |
| Duration of retirement *** | 25.9 | 23.7 | 23.7 | 24.6 | 24.6 | 24.5 | 24.4 | 2016 |
| Duration of retirement/average working career | 0.7 | 0.6 | 0.6 | 0.6 | 0.6 | 0.6 | 0.5 | 2016 |
| Percentage of adult life spent in retirement**** | 38.2 | 34.3 | 34.2 | 34.6 | 34.3 | 33.7 | 33.2 | 2016 |
| Early/late exit***** | 1.6 | 2.0 | 2.4 | 2.8 | 3.0 | 1.9 | 6.7 | 2069 |

* *Peak year* represents the year in which the particular variable reaches its maximum over the projection period 2016 to 2070.

** *Average effective working career* is the difference between the average effective exit age and the average effective entry age.

*** *Duration of retirement* is the difference between the life expectancy at average effective exit age and the average effective exit age itself.

**** *The percentage of adult life spent at retirement* is calculated as the ratio between the duration of retirement and the life expectancy diminished by 18 years.

***** *Early/late exit*, in the specific year, is the ratio of those who retired and aged less than the statutory retirement age and those who retired and are aged more than the statutory retirement age.

4. Pension projection results

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

As it was the case with the 2015 Ageing Report, the projections of the 2018 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 [6] compares the AWG public pension expenditure with the corresponding expenditure as defined by Eurostat.

Table [6]: Eurostat (ESSPROS) vs. Ageing Working Group definition of pension expenditure (% GDP)

| | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|--|------|------|------|------|------|------|-------|-------|
| 1. Eurostat total pension expenditure | 6.0 | 6.1 | 6.6 | 7.5 | 7.9 | 8.6 | 9.8 | 10.5 |
| 2. Eurostat public pension expenditure | 5.7 | 5.9 | 6.3 | 7.2 | 7.6 | 8.3 | 9.4 | 10.1 |
| 3. Public pension expenditure (AWG) | 5.7 | 5.8 | 6.3 | 7.1 | 7.6 | 8.3 | 10.2* | 10.4* |
| 4. Difference (2) - (3) | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.8 | 0.3 |

* It includes GEPS retirement lump-sum expenditure.

It follows from Table [6] that the AWG public pension expenditure represents almost 100% of the total public pension expenditure as defined by Eurostat (ESSPROS) in all years up to 2012. For the years 2013 and 2014, the AWG public pension expenditure figures are higher than those under the Eurostat definition by 0.8 and 0.3 percentage points of GDP respectively. This is due to the inclusion of lump-sum benefit expenditure granted to retirees under the GEPS.

4.2 Overview of projection results

Table [7] 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 2016-2070. All pension expenditure and contributions figures are gross of tax and expressed in percentage of GDP.

Table [7]: Projected public pension spending and contributions (% of GDP)

| Public pension | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | Peak year* |
|-----------------|------|------|------|------|------|------|------|------------|
| Expenditure | 10.2 | 10.2 | 10.9 | 11.5 | 11.3 | 12.0 | 12.4 | 2070 |
| Contributions** | 7.8 | 8.3 | 9.4 | 10.4 | 10.4 | 10.5 | 10.3 | 2059 |

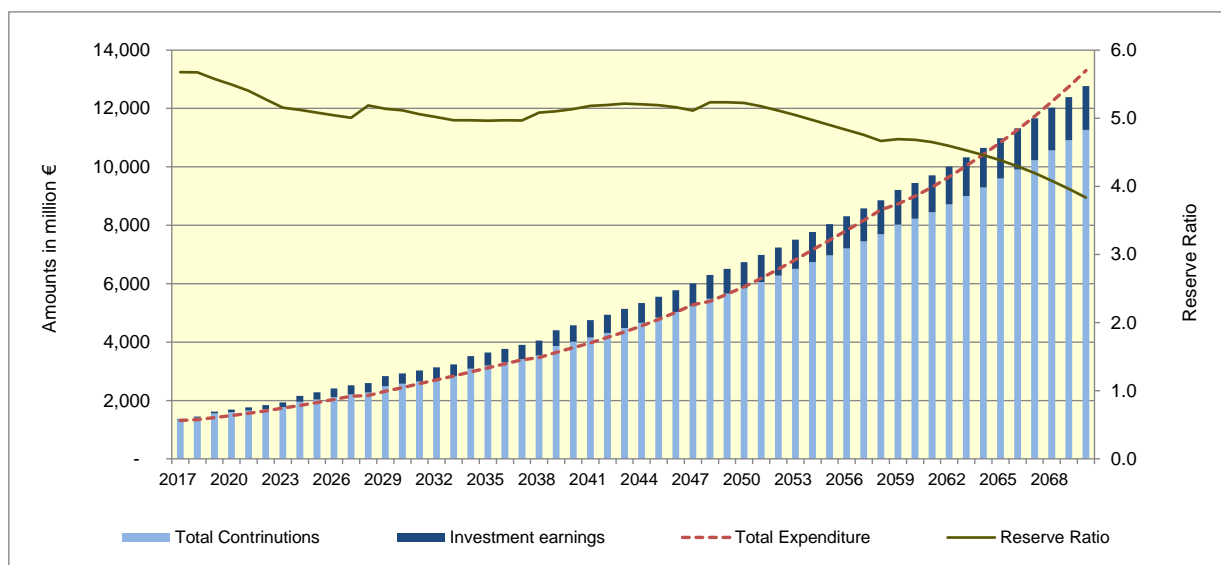
* *Peak year* represents the year in which the particular variable reaches its maximum over the projection period 2016 to 2070.

** 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 2016-70, the public pension spending, as percentage of GDP, is expected to increase by 2.2 percentage points, i.e., from 10.2 per cent to 12.4 per cent. Over the same period, the pension contributions increase significantly by 2.5 percentage points from 7.8 per cent in 2016 to 10.3 per cent of GDP in 2060, 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 [4] 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 [4]: Projected GSIS revenues and expenditure and reserve ratio, 2017-2070 (in million €)



It follows from Chart [4] that contributions are almost sufficient to support the scheme’s expenditures for the whole projection period and that investment earnings help compensate for small contribution insufficiencies in certain years, 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 2016 to 3.0 per cent in 2026, and remain constant thereafter.

Table [8] shows how the overall evolution of pension expenditure over the period 2016-70 is decomposed, 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 [8]: Projected gross public pension spending by scheme (% of GDP)

| Public pension | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 | Peak year* |
|---------------------------------------|------|------|------|------|------|------|------|------------|
| Total public pensions | 10.2 | 10.2 | 10.9 | 11.5 | 11.3 | 12.0 | 12.4 | 2070 |
| Of which | | | | | | | | |
| Old age and early pensions | 8.5 | 8.4 | 8.8 | 9.4 | 9.3 | 10.0 | 10.4 | 2070 |
| <i>of which earnings related:</i> | 8.1 | 8.0 | 8.5 | 9.1 | 9.0 | 9.6 | 10.1 | 2070 |
| <i>of which non-earnings related:</i> | 0.4 | 0.4 | 0.3 | 0.3 | 0.3 | 0.4 | 0.3 | 2063 |
| Disability pensions | 0.2 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 0.3 | 2065 |
| Survivors' pensions | 1.5 | 1.6 | 1.8 | 1.8 | 1.7 | 1.7 | 1.7 | 2037 |

* Peak year represents the year in which the particular variable reaches its maximum over the projection period 2016 to 2070.

It is clear from Table [8] 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 8.5 per cent of GDP in 2016 to 10.4 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 1.5 per cent of GDP in 2016 to 1.7 per cent of GDP in 2070. The “Disability” and “Non-earnings related old-age and early” pension spending represent very small proportion of total pensions spending and remain relatively stable over the projection period at around 0.2-0.3 per cent and 0.3-0.4 per cent of GDP respectively.

4.3 Main driving forces behind the projection results

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

$$\begin{aligned}
 \frac{\text{Pension Exp}}{\text{GDP}} &= \overbrace{\frac{\text{Population 65+}}{\text{Population 20-64}}}^{\text{Dependency Ratio}} \times \overbrace{\frac{\text{Number of Pensioners(Pensions)}}{\text{Population 65+}}}^{\text{Coverage Ratio}} \\
 &\quad \times \overbrace{\frac{\text{Average income from pensions (Average Pension)}}{\text{GDP}}}^{\text{Benefit Ratio}} \times \overbrace{\frac{\text{Population 20-64}}{\text{Hours Worked 20-74}}}^{\text{Labour Market / Labour Intensity}} \quad [1]
 \end{aligned}$$

where 'Average income from pensions' = pension expenditure divided by the number of pensioners

In the above equation [1], the coverage ratio could be further split with the scope of investigating the take-up ratios for old-age pensions and early pensions:

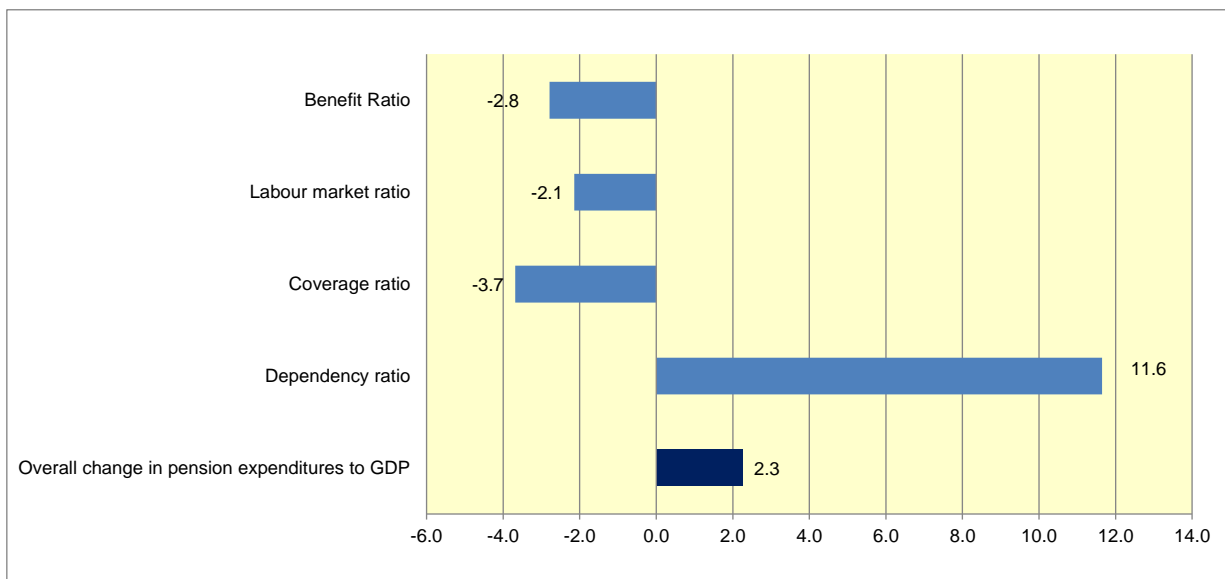
$$\begin{aligned} & \overbrace{\frac{\text{Number of Pensioners}}{\text{Population 65+}}}^{\text{Coverage Ratio}} = \\ & = \overbrace{\frac{\text{Number of Pensioners 65+}}{\text{Population 65+}}}^{\text{Coverage Ratio Old-Age}} + \left(\overbrace{\frac{\text{Number of Pensioners } \leq 65}{\text{Population 50-64}}}^{\text{Coverage Ratio Early-Age}} \times \overbrace{\frac{\text{Population 50-64}}{\text{Population 65+}}}^{\text{Cohort effect}} \right) \end{aligned}$$

Furthermore, in the above equation [1], the labour market indicator could be further decomposed into employment rate and labour intensity:

$$\begin{aligned} & \overbrace{\frac{\text{Population 20-64}}{\text{Hours Worked 20-74}}}^{\text{Labour Market / Labour Intensity}} = \\ & = \overbrace{\frac{\text{Population 20-64}}{\text{Working People 20-64}}}^{1/\text{Employment Rate}} \times \overbrace{\frac{\text{Working People 20-64}}{\text{Hours Worked 20-64}}}^{1/\text{Labour intensity}} \times \overbrace{\frac{\text{Hours Worked 20-64}}{\text{Hours Worked 20-74}}}^{1/\text{Career shift}} \end{aligned}$$

Chart [5] shows the contribution of each of the above factors to the overall change of 2.3 per cent of GDP in the public pension expenditures between 2016 and 2070.

Chart [5]: Factors behind the overall change in public pension expenditures between 2016 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 2016 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 [5]:

- The expected increase in total public pension expenditure of 2.3 per cent over the period 2016-70 is driven from the significant deterioration of the old-age dependency ratio (+11.6).
- Partially offsetting the above negative contribution from demographics towards the aforementioned increase in total public pension expenditure of 2.3 per cent, is a positive contribution primarily resulting from:
 - ✓ a decrease in coverage ratio (-3.7), mainly caused by the linkage of statutory retirement age under GSIS with changes in life expectancy and the tightening of the eligibility conditions to GSIS old-age pension, following the December 2012 reform of the GSIS; and
 - ✓ a decrease in the benefit ratio (-2.8), primarily due to the closure of GEPS to new members effective 2011, as well as the price indexation on GEPS pension benefits in the longer-term.

Table [9] shows the evolution of the benefit ratio, while Table [10] 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.

Table [9]: Benefit ratio (BR) and coverage rate (in per cent)

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|-------|-------|-------|-------|-------|-------|-------|
| Public scheme (BR) - All types of pension and all schemes | 63% | 58% | 56% | 53% | 44% | 40% | 41% |
| Coverage | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 |
| Public scheme old-age earnings related (BR) - GSIS and GEPS | 69% | 62% | 57% | 52% | 43% | 40% | 41% |
| Public scheme old-age earnings related (BR) - GSIS | 47% | 47% | 48% | 46% | 42% | 40% | 41% |
| Coverage | 72.6 | 73.8 | 76.6 | 80.9 | 81.2 | 80.7 | 81.0 |

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

| | 2017 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|------|------|------|------|------|------|------|
| Ratio of new GSIS old-age pension to average wage | 41% | 46% | 48% | 43% | 42% | 43% | 51% |
| Coverage | | 73.8 | 76.6 | 80.9 | 81.2 | 80.7 | 81.0 |

Table [10] illustrates that over the decade 2017-30, 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 41 per cent in 2017 to 48 per cent in 2030. From 2030 onwards that ratio is anticipated to decrease gradually reaching to the level of 42 per cent in 2050. In the final two decades 2050-70, the ratio is projected to gradually increase reaching to 51 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 [13].

Table [11] 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 [11]: System dependency ratio and old-age dependency ratio

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|--|-------|-------|-------|-------|-------|-------|-------|
| Number of pensioners (I) | 152.1 | 168.8 | 205.7 | 239.0 | 283.9 | 323.5 | 323.7 |
| Employment (II) | 376.6 | 404.0 | 451.1 | 467.0 | 472.6 | 460.0 | 449.4 |
| Pension System Dependency Ratio (SDR) (I)/(II) | 40.4 | 41.8 | 45.6 | 51.2 | 60.1 | 70.3 | 72.0 |
| Number of people aged 65+ (III) | 129.8 | 145.6 | 187.3 | 217.8 | 261.8 | 321.0 | 342.0 |
| Working age population 15 - 64 (IV) | 584.4 | 592.0 | 607.3 | 624.2 | 613.6 | 575.9 | 561.1 |
| Old-age Dependency Ratio (ODR) (III)/(IV) | 22.2 | 24.6 | 30.8 | 34.9 | 42.7 | 55.7 | 61.0 |
| System efficiency (SDR/ODR) | 1.8 | 1.7 | 1.5 | 1.5 | 1.4 | 1.3 | 1.2 |

It follows from Table [11] that the number of pensioners is expected grow significantly over the projection period due to population ageing. In particular, the number of pensioners is projected to grow by a factor of 2.1, i.e., from 152,100 in 2016 to 323,500 in 2060, and thereafter remain constant, primarily due to the increased demographic effect and the strong decrease in the share of social pension beneficiaries reflecting the increasing female participation in the labour market.

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

Table [12]: Pensioners (public scheme) to inactive population ratio by age group (%)

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|-----------------|-------|-------|-------|-------|-------|-------|-------|
| Age group -54 | 1.9 | 2.0 | 2.1 | 2.5 | 2.6 | 2.5 | 2.3 |
| Age group 55-59 | 18.7 | 19.8 | 20.8 | 21.3 | 22.4 | 29.8 | 27.5 |
| Age group 60-64 | 49.5 | 33.8 | 27.1 | 23.6 | 23.1 | 28.8 | 33.6 |
| Age group 65-69 | 107.4 | 124.6 | 109.7 | 120.2 | 104.9 | 97.4 | 95.8 |
| Age group 70-74 | 112.7 | 108.4 | 112.6 | 121.5 | 125.5 | 106.0 | 100.6 |
| Age group 75+ | 108.0 | 106.3 | 108.7 | 102.8 | 110.1 | 111.5 | 102.1 |

Table [12] clearly indicates the impact of the reform measure of the increase in the statutory retirement age in line with changes in the life expectancy on the number of pensioners, 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 [13] shows the evolution of the GSIS pension expenditure for new old-age pensioners and its disaggregation into the factors of 'Number of new pensioners', 'Average number of insurance points', 'Average accrual rate' and 'Point value'.

Table [13]: Projected and disaggregated new public pension expenditure - GSIS: old-age and early earnings-related pensions

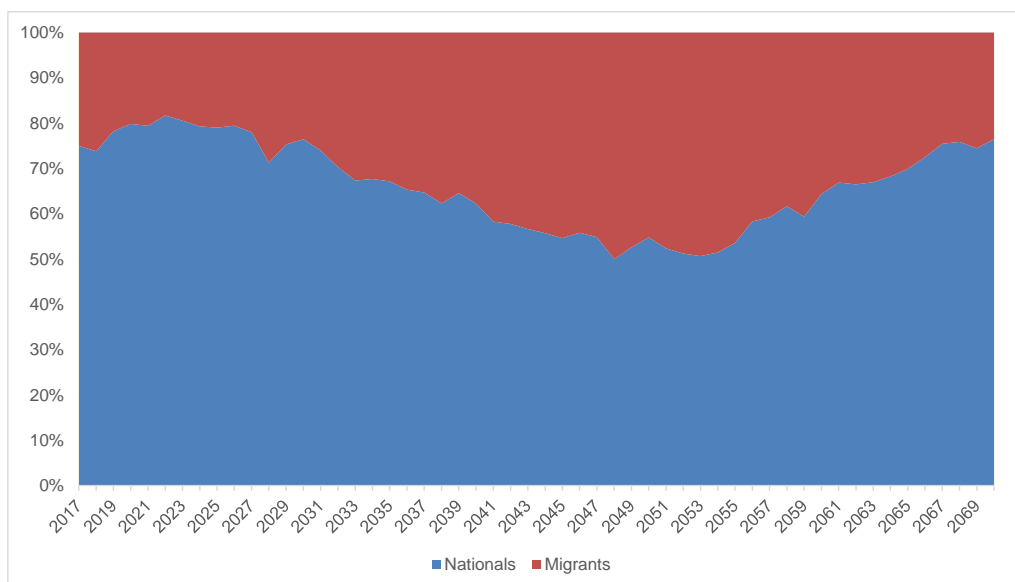
| New pension | 2017 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|-------|-------|--------|--------|--------|--------|--------|
| I. Projected new pension expenditure (mil €) | 52.6 | 71.8 | 123.4 | 160.4 | 264.9 | 267.5 | 636.6 |
| II. Number of new pensions (in 1000) | 6.7 | 7.6 | 9.8 | 10.6 | 12.7 | 8.5 | 12.2 |
| III. Average new annual pension (1000 €)* | 7.9 | 9.5 | 12.6 | 15.1 | 20.8 | 31.5 | 52.2 |
| IV. Average number of insurance points | 65.5 | 75.9 | 80.7 | 76.1 | 74.7 | 79.1 | 91.3 |
| V. Average accrual rate | 1.33% | 1.34% | 1.34% | 1.28% | 1.26% | 1.25% | 1.26% |
| VI. Point value | 9,068 | 9,316 | 11,692 | 15,509 | 22,092 | 31,803 | 45,411 |
| VII. Sustainability/adjustment factors | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Number of months paid the first year | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 |
| Average new pension/ Economy-wide average wage | | 0.46 | 0.48 | 0.43 | 0.41 | 0.43 | 0.51 |

* In order to get the average monthly pension, the annual pension is divided by 13.

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 as of 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 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, such as migrants (illustrated in Chart [6]), 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.

Chart [6]: Number of new GSIS old-age pensioners over the period 2017-2070:
share of nationals and migrants



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 [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 GSIS

| | Public employees* | Private employees | Self-employed |
|--------------------------------|---|-------------------|--|
| Contribution base | Gross earnings | | Insurable income per occupational category |
| Contribution rate/contribution | | | |
| | Employer | 11.65% | 7.80% |
| | Employee | 3.95% | 7.80% |
| | State | 4.60% | 4.6% |
| | Other Revenues | Reserve fund | Reserve fund |
| Maximum contribution | Paid on Maximum Insurable Earnings (€54,396 for 2016) | | |
| 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 [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 contribution (million), number of contributors in the public scheme (in 1000), total employment (in 1000) and related ratios (%)

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|------------------------------|--------|--------|--------|--------|--------|--------|---------|
| Public contribution | 1389.2 | 1651.8 | 2611.1 | 4024.4 | 5847.5 | 8221.9 | 11267.8 |
| <i>Employer contribution</i> | 508.3 | 609.2 | 978.7 | 1523.9 | 2212.9 | 3099.1 | 4246.3 |
| <i>Employee contribution</i> | 559.5 | 658.3 | 1018.8 | 1538.5 | 2213.5 | 3099.1 | 4246.3 |
| <i>State contribution</i> | 321.4 | 384.2 | 613.6 | 962.0 | 1421.1 | 2023.7 | 2775.3 |
| Number of contributors (I) | 440.6 | 468.0 | 530.3 | 555.7 | 563.7 | 549.8 | 532.4 |
| Employment (II) | 376.6 | 404.0 | 451.1 | 467.0 | 472.6 | 460.0 | 449.4 |
| Ratio of (I)/(II) | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 | 1.2 |

4.5 Sensitivity analysis

Table [16] presents the projected public pension expenditure under 10 different sensitivity scenarios in terms of its deviation in percentage points from the baseline scenario.

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

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|------|------|------|------|------|------|------|
| Baseline | 10.2 | 10.2 | 10.9 | 11.5 | 11.3 | 12.0 | 12.4 |
| Higher life expectancy (2 extra years) | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | -0.1 | -0.2 |
| Higher Total Factor Productivity growth (+0.4 p.p.) | 0.0 | 0.0 | 0.0 | -0.2 | -0.4 | -0.5 | -0.5 |
| Lower Total Factor Productivity growth (-0.4 p.p.) | 0.0 | 0.0 | 0.0 | 0.2 | 0.4 | 0.6 | 0.6 |
| Higher emp. rate (+2 p.p.) | 0.0 | -0.1 | -0.3 | -0.3 | -0.3 | -0.3 | -0.1 |
| Lower emp. rate (-2 p.p.) | 0.0 | 0.1 | 0.3 | 0.3 | 0.3 | 0.3 | 0.1 |
| Higher emp. of older workers (+10 p.p.) | 0.0 | -0.1 | -0.5 | -0.6 | -0.7 | -0.8 | -0.3 |
| Higher migration (+33%) | 0.0 | -0.1 | -0.3 | -0.6 | -0.8 | -1.1 | -0.9 |
| Lower migration (-33%) | 0.0 | 0.1 | 0.4 | 0.6 | 0.9 | 1.3 | 1.3 |
| Lower fertility | 0.0 | 0.0 | 0.0 | 0.2 | 0.5 | 0.9 | 1.5 |
| Risk scenario | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.3 | 0.3 |

Following are the main points from Table [16]:

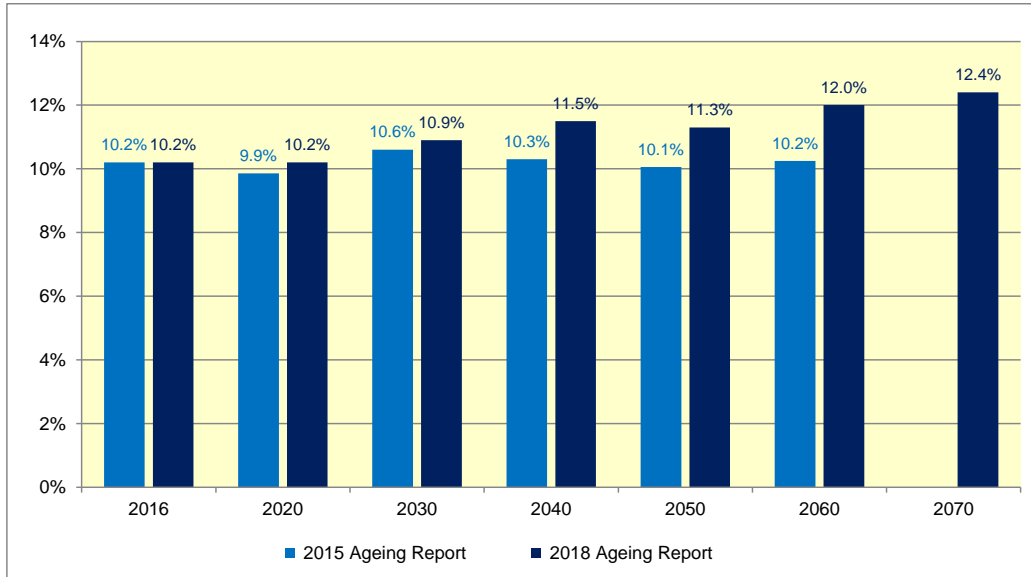
- *Higher life expectancy* - the sensitivity of the results to an increase of life expectancy at birth of two years by 2070 seems relatively very limited. Higher number of pensions and increased duration of pension payments in retirement, caused by increases in life expectancy, contribute positively 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 labour productivity* - Symmetrical changes in labour productivity growth rate of plus/minus 0.4 p.p., compared to the baseline scenario, produce symmetrical deviations from the baseline pension expenditure projection results in 2070 of minus/plus 0.5 p.p. of GDP respectively. An upward/downward change in labour productivity mainly acts on the denominator and consequently, an increased/decreased level of GDP leads to a lower/higher ratio of pension expenditure to GDP in the long run, compared to that of the baseline.

- *Higher/ lower employment rate* – A scenario with an employment rate of 2 p.p. higher/ lower than that of baseline scenario reduces/ increases slightly the ratio of pension expenditure to GDP in the medium term by plus/minus 0.3 p.p. when compared to baseline. Indeed, high employment would have fiscal, but also real effects. It would imply a higher employed population and higher economic growth rates.
- *Higher employment rate of older workers* - A scenario with an employment rate of older workers (55-74) of 10 p.p. higher than that of 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/ 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 0.9/ 1.3 p.p. in 2070. In fact, higher/ lower migration increases/ decreases employment and output, whereas pension expenditure increase/ decrease only marginally – in other words, the “denominator effect” dominates the “numerator effect”.
- *Lower fertility* - A scenario with 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 baseline is 0.2 p.p. in 2040 rising to 1.5 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”
- *Risk scenario* – The impact of this scenario, where total factor productivity (TFP) growth converges to 0.8% rather than 1% (baseline) in 2045, is similar to that of lower labour productivity scenario (see above).

4.6 Description of changes in comparison with previous projections

Chart [7] compares the projected public pension expenditure figures under the AWG 2018 and AWG 2015 projections exercise.

Chart [7]: Public pension expenditure (as % GDP) over the period 2016-2070 - AWG 2018 vs AWG 2015 projection exercise



When compared with the 2015 AWG pension projection exercise, the present 2018 AWG exercise represents a relatively small deterioration in pension expenditure over the projection period through 2060 of the order of 1.8 percentage points of GDP (2018 AWG exercise - 12.0 per cent *versus* 2015 AWG exercise - 10.2 per cent).

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

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

| | Public pensions to GDP | Dependency ratio | Coverage ratio | Employment effect | Benefit ratio | Labour intensity | Residual (incl. interaction effect) |
|-----------|------------------------|------------------|----------------|-------------------|---------------|------------------|-------------------------------------|
| 2006 * | 12.8 | 10.2 | 1.2 | -1.2 | 2.5 | : | 0.1 |
| 2009 ** | 11.4 | 10.8 | 1.6 | -0.5 | -0.3 | : | -0.2 |
| 2012 *** | 2.8 | 9.5 | -2.4 | -0.6 | -2.6 | 0.0 | -1.1 |
| 2015**** | -0.1 | 9.5 | -2.8 | -1.9 | -3.7 | 0.0 | -1.3 |
| 2018***** | 2.3 | 11.6 | -3.7 | -1.4 | -2.8 | 0.0 | -1.5 |

* 2004-2050; ** 2007-2060; *** 2010-2060; **** 2013-2060; and ***** 2016-2070

Following are the main points from Table [17]:

- The difference in the percentage points increase of public pension expenditure over the projection period between the present 2018 AWG exercise and previous 2015 AWG exercise, amounts to 2.4 percentage points of GDP.
- A less favourable dependency ratio (amounting to 2.1 percentage points higher), reflecting the differences in the demographic framework used in the above two exercises, primarily explains the above difference.
- A more favourable coverage ratio (amounting to 0.9 percentage points lower), reflecting the lower projected number of invalids due to lower assumed incidence rates (reflecting recent GSIS experience) and the additional increase in the statutory retirement age over the last decade of projection period (2060-70), offsets the less favourable benefit ratio (amounting to 0.9 percentage points lower), reflecting the freezing of pensions 2013-16 and the anticipated significant reduction of the GEPS expenditure over the first few years of its closure (particularly over 2012-2016).

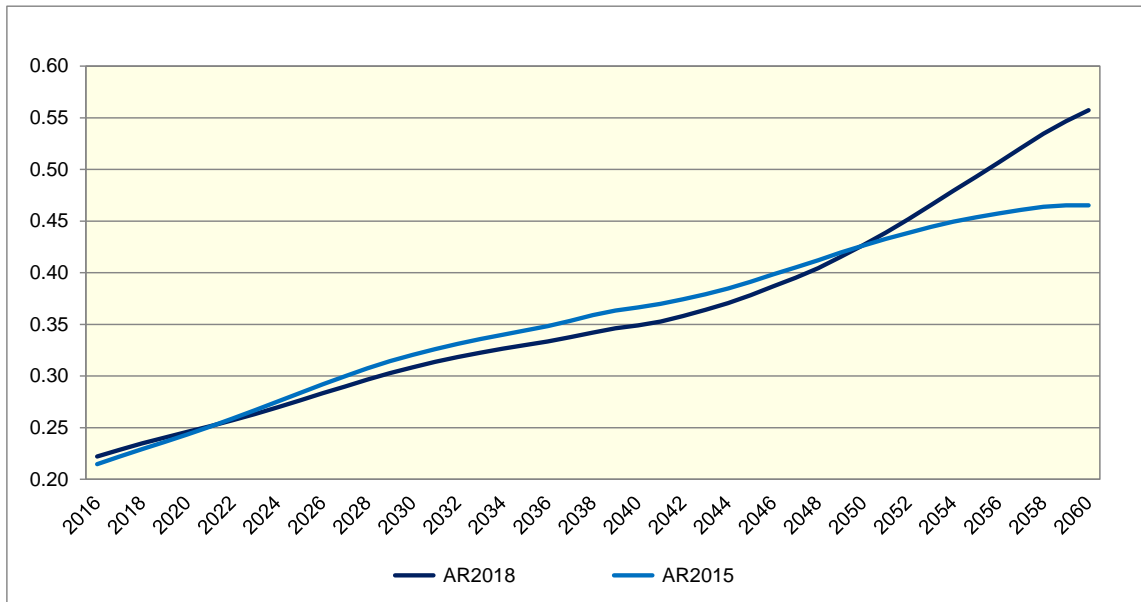
It is concluded from Table [17] that the assumed low migration as provided by the Eurostat in their latest projection exercise (see Section 3.1), compared with their previous projection leads to a significantly higher old-age dependency ratio which in turn leads to considerably higher estimate of the ratio of pension expenditure to GDP by approximately 2 percentage points of GDP over the projection period. In fact, lower migration decreases employment and economic output, whereas pension expenditure decreases only marginally.

Table [18]: Decomposition of the difference between 2015 and the new public pension projection (% of GDP)

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 |
|--|------|------|------|------|------|------|
| Ageing report 2015 | 10.2 | 9.9 | 10.6 | 10.3 | 10.1 | 10.2 |
| <i>Change in assumptions</i> | 0.0 | 0.3 | 0.3 | 1.2 | 1.2 | 1.8 |
| <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 | 10.2 | 10.2 | 10.9 | 11.5 | 11.3 | 12.0 |

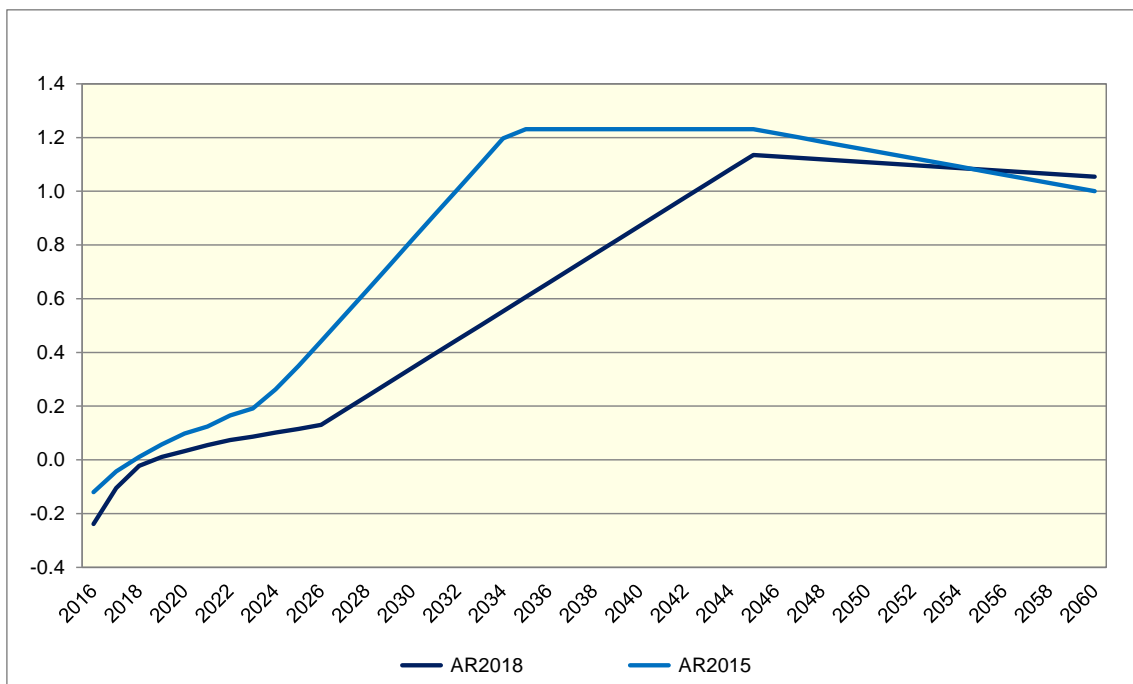
Table [18] shows the results of the reconciliation of the public pension expenditure (as percentage of GDP) of the present 2018 AWG projection exercise with that of the 2015 exercise. The less favourable demographic and macroeconomic assumptions used in the new projection, as illustrated in Chart [8], [9], [10] and [11] below, explain the increase of 1.8 percentage points in the public pension expenditure in the year 2060 between the new (AR2018) and previous (AR2015) round of projections.

Chart [8]: Old age dependency ratio (OADR), 2016-2060 - AR2015 *versus* AR2018



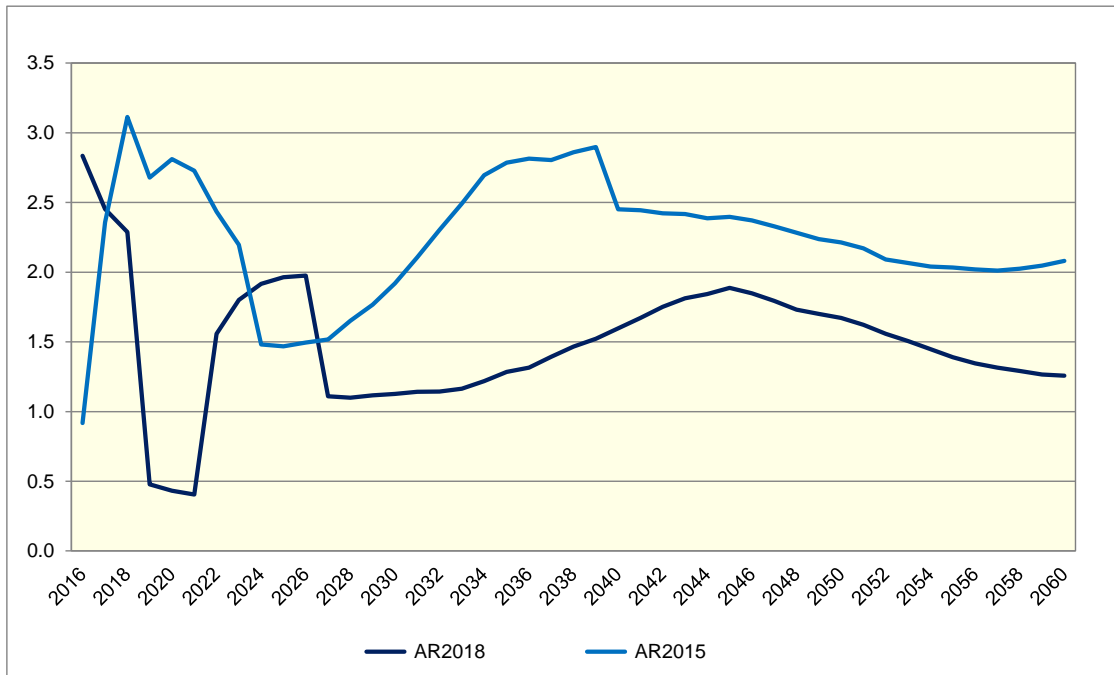
It is noted from Chart [8] that the OADR under the AR2018 is 20% higher than that of the AR2015 in 2060.

Chart [9]: TFP growth rates, 2016-2060 - AR2015 *versus* AR2018



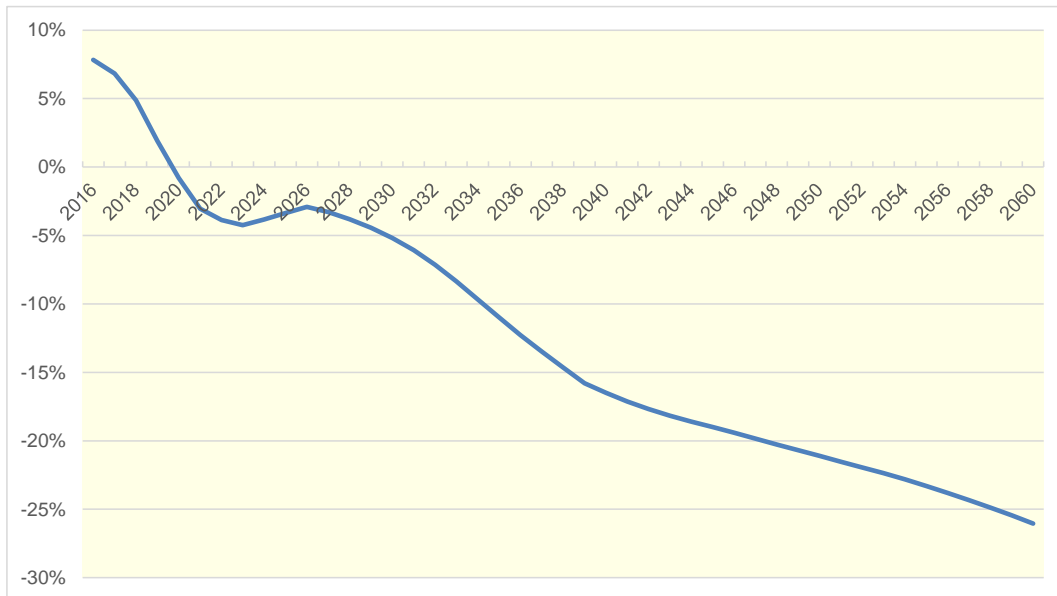
It is noted from Chart [9] that the average assumed TFP growth rate over the period 2026-2045 under the AR2018 was 0.6% whereas under the AR2015 was 1%.

Chart [10]: Real GDP growth rates, 2016-2060 - AR2015 *versus* AR2018



It is noted from Chart [10] that the average assumed real GDP growth rate over the period 2016-2060 under the AR2018 was 3.4% whereas under the AR2015 was 4.3%.

Chart [11]: Percent reduction in nominal GDP, 2016-2060 - ratio of GDP AR2018 to GDP AR2015



It is noted from Chart [11] that in 2060, the level of nominal GDP under the AR2018 was estimated to be 26% lower than that of the AR2015.

5. Pension projection methodology

5.1 Institutional context in which those projections are made

The present 2018 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 [12] presents graphically the methodology used for calculating GSIS revenue from contributions, while Chart [13] 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 [12]: Methodology - GSIS contribution income

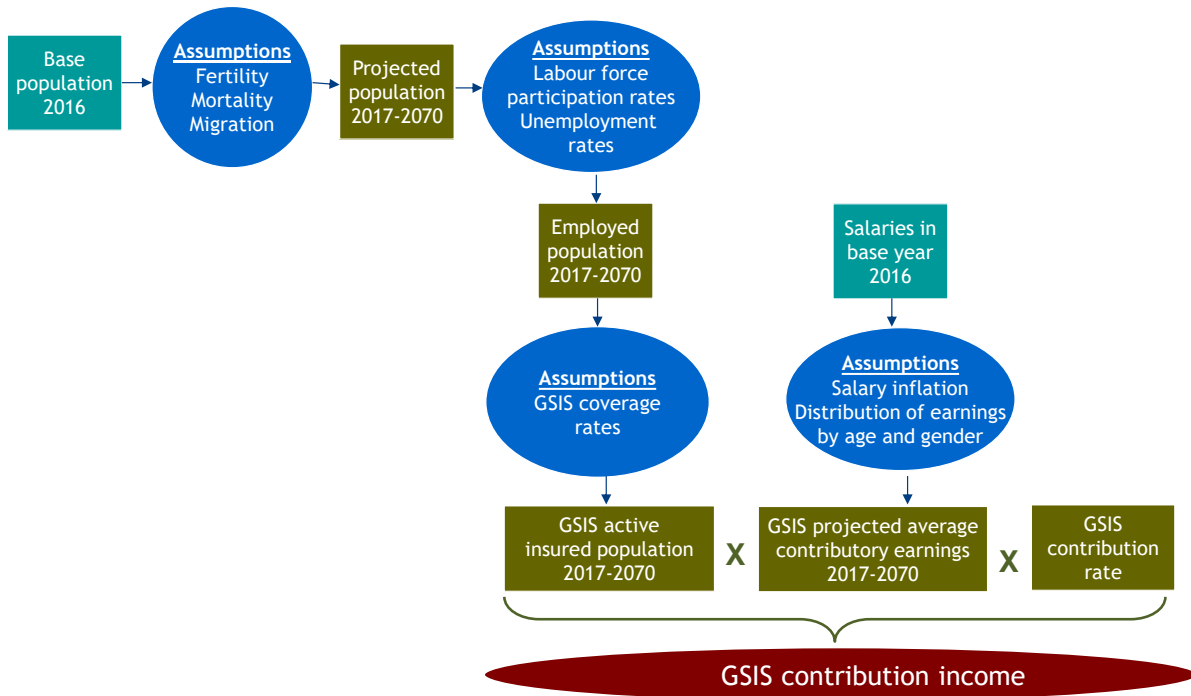
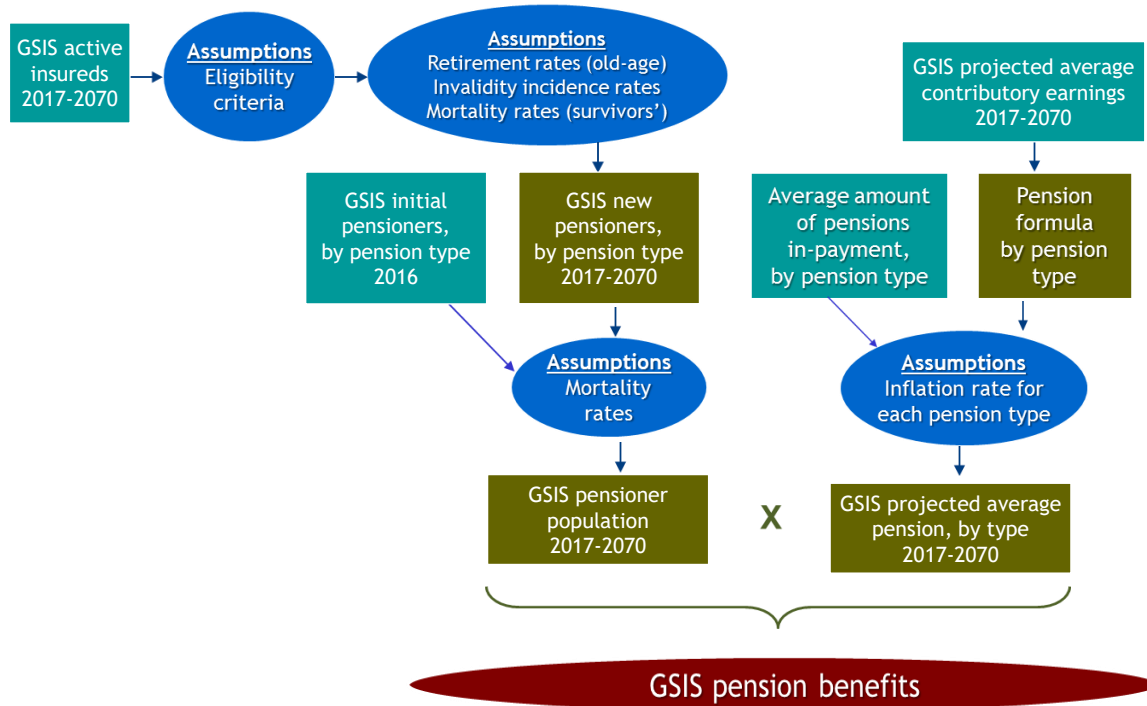


Chart [13]: Methodology - GSIS pension benefits



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 2018 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 2016, basic insurable earnings are fixed at €174.38 per week, or €9,068 per year. The maximum insurable earnings for contribution purposes in 2016 are €54,396.

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 2016, one point is credited for every €9,068 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 1.1.2016

| | |
|-----------------------|---|
| Employed persons | 15.6 per cent of insurable earnings, shared equally between the employer and the employee |
| Self-employed persons | 14.6 per cent of insurable income |
| State contribution | 4.6 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 20.2 per cent contribution rate, 17.9 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 |
|-----------|----------|----------|-------|-------|
| 2014-2018 | 7.8 | 7.8 | 4.6 | 20.2 |
| 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 x weeks and has basic insurance up to the date of old-age pension entitlement at least y insurance points, earned from paid contributions, where
 - ✓ x = 728 weeks and y = 14 insurance points as from 4.1.2016;
 - ✓ x = 780 weeks and y = 15 insurance points as from 2.1.2017; 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 2016 was €352.88 (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 2016 was €336.28. 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 2016 and 2070, as well as during the five 10-year sub-periods over the projection period, using data on pensions and pensioners respectively.

Tables [A2.3] and [A2.4] are equivalent tables to Tables [A2.1] and [A2.2], but they were produced under the assumption that no reduction in residual (interaction) effect in each sub-interval over the projection period 2016-70 is applied.

Table [A2.1]: Factors behind the change in public pension expenditures between 2016 and 2070 using pensions data (in percentage points of GDP)

| | 2016-20 | 2020-30 | 2030-40 | 2040-50 | 2050-60 | 2060-70 | 2016-70 | Average annual change |
|----------------------------------|---------|---------|---------|---------|---------|---------|---------|-----------------------|
| Public pensions to GDP | 0.0 | 0.7 | 0.6 | -0.2 | 0.7 | 0.5 | 2.3 | 0.042 |
| Dependency ratio effect | 1.0 | 2.4 | 1.4 | 2.3 | 3.4 | 1.2 | 11.6 | 0.209 |
| Coverage ratio effect | -0.2 | -0.7 | 0.0 | -0.5 | -1.3 | -1.1 | -3.7 | -0.070 |
| <i>Coverage ratio old-age*</i> | 0.3 | -0.4 | 0.1 | -0.3 | -1.2 | -1.0 | -2.6 | -0.050 |
| <i>Coverage ratio early-age*</i> | -2.2 | -2.5 | -1.5 | -2.5 | 1.1 | -0.3 | -7.9 | -0.156 |
| <i>Cohort effect*</i> | -0.8 | -1.8 | 0.9 | -1.3 | -3.7 | -1.0 | -7.6 | -0.149 |
| Benefit ratio effect | -0.2 | -0.1 | -0.7 | -1.6 | -0.6 | 0.5 | -2.8 | -0.053 |
| Labour Market effect | -0.5 | -0.8 | -0.1 | -0.2 | -0.5 | -0.1 | -2.1 | -0.041 |
| <i>Employment ratio effect</i> | -0.5 | -0.7 | 0.0 | 0.0 | -0.2 | 0.0 | -1.4 | -0.027 |
| <i>Labour intensity effect</i> | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000 |
| <i>Career shift effect</i> | 0.0 | -0.1 | 0.0 | -0.2 | -0.3 | -0.1 | -0.7 | -0.013 |
| Residual | -0.1 | -0.2 | 0.0 | -0.2 | -0.3 | -0.1 | -0.8 | -0.003 |

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

Table [A2.2]: Factors behind the change in public pension expenditures between 2016 and 2070 using pensioners data (in percentage points of GDP)

| | 2016-20 | 2020-30 | 2030-40 | 2040-50 | 2050-60 | 2060-70 | 2016-70 | Average annual change |
|----------------------------------|---------|---------|---------|---------|---------|---------|---------|-----------------------|
| Public pensions to GDP | 0.0 | 0.7 | 0.6 | -0.2 | 0.7 | 0.5 | 2.3 | 0.042 |
| Dependency ratio effect | 1.0 | 2.4 | 1.4 | 2.3 | 3.4 | 1.2 | 11.6 | 0.209 |
| Coverage ratio effect | -0.2 | -0.7 | 0.0 | -0.5 | -1.3 | -1.1 | -3.7 | -0.070 |
| <i>Coverage ratio old-age*</i> | 0.3 | -0.4 | 0.1 | -0.3 | -1.2 | -1.0 | -2.6 | -0.050 |
| <i>Coverage ratio early-age*</i> | -2.2 | -2.5 | -1.5 | -2.5 | 1.1 | -0.3 | -7.9 | -0.156 |
| <i>Cohort effect*</i> | -0.8 | -1.8 | 0.9 | -1.3 | -3.7 | -1.0 | -7.6 | -0.149 |
| Benefit ratio effect | -0.2 | -0.1 | -0.7 | -1.6 | -0.6 | 0.5 | -2.8 | -0.053 |
| Labour Market effect | -0.5 | -0.8 | -0.1 | -0.2 | -0.5 | -0.1 | -2.1 | -0.041 |
| <i>Employment ratio effect</i> | -0.5 | -0.7 | 0.0 | 0.0 | -0.2 | 0.0 | -1.4 | -0.027 |
| <i>Labour intensity effect</i> | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.000 |
| <i>Career shift effect</i> | 0.0 | -0.1 | 0.0 | -0.2 | -0.3 | -0.1 | -0.7 | -0.013 |
| Residual | -0.1 | -0.2 | 0.0 | -0.2 | -0.3 | -0.1 | -0.8 | -0.003 |

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

Table [A2.3]: Alternative decomposition - Factors behind the change in public pension expenditure between 2016 and 2070 using pension data (in p.p. of GDP)

| | 2016-20 | 2020-30 | 2030-40 | 2040-50 | 2050-60 | 2060-70 | 2016-70 |
|----------------------------------|---------|---------|---------|---------|---------|---------|---------|
| Public pensions to GDP | 0.0 | 0.7 | 0.6 | -0.2 | 0.7 | 0.5 | 2.3 |
| Dependency ratio effect | 1.0 | 2.8 | 1.8 | 3.3 | 5.9 | 2.5 | 17.3 |
| Coverage ratio effect | -0.2 | -0.7 | 0.0 | -0.4 | -0.9 | -0.7 | -2.9 |
| <i>Coverage ratio old-age*</i> | 0.3 | -0.4 | 0.1 | -0.3 | -1.0 | -0.8 | -2.1 |
| <i>Coverage ratio early-age*</i> | -2.2 | -1.8 | -0.8 | -1.1 | 0.4 | -0.1 | -5.6 |
| <i>Cohort effect*</i> | -0.8 | -1.5 | 0.7 | -0.9 | -2.2 | -0.4 | -5.3 |
| Benefit ratio effect | -0.2 | -0.1 | -0.6 | -1.2 | -0.4 | 0.3 | -2.3 |
| Labour Market effect | -0.5 | -0.7 | 0.0 | -0.2 | -0.4 | -0.1 | -1.9 |
| <i>Employment ratio effect</i> | -0.5 | -0.7 | 0.0 | 0.0 | -0.1 | 0.0 | -1.3 |
| <i>Labour intensity effect</i> | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| <i>Career shift effect</i> | 0.0 | -0.1 | 0.0 | -0.2 | -0.3 | 0.0 | -0.6 |
| Residual | -0.1 | -0.6 | -0.5 | -1.7 | -3.5 | -1.6 | -8.0 |

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

Table [A2.4]: Alternative decomposition - Factors behind the change in public pension expenditure between 2016 and 2070 using pensioners data (in p.p. of GDP)

| | 2016-20 | 2020-30 | 2030-40 | 2040-50 | 2050-60 | 2060-70 | 2016-70 |
|----------------------------------|---------|---------|---------|---------|---------|---------|---------|
| Public pensions to GDP | 0.0 | 0.7 | 0.6 | -0.2 | 0.7 | 0.5 | 2.3 |
| Dependency ratio effect | 1.0 | 2.8 | 1.8 | 3.3 | 5.9 | 2.5 | 17.3 |
| Coverage ratio effect | -0.1 | -0.5 | 0.0 | -0.1 | -0.7 | -0.5 | -2.0 |
| <i>Coverage ratio old-age*</i> | 0.3 | -0.2 | 0.1 | 0.0 | -0.6 | -0.6 | -1.1 |
| <i>Coverage ratio early-age*</i> | -2.1 | -1.7 | -1.0 | -0.1 | 0.7 | -0.1 | -4.4 |
| <i>Cohort effect*</i> | -0.8 | -1.5 | 0.7 | -0.9 | -2.2 | -0.4 | -5.3 |
| Benefit ratio effect | -0.3 | -0.2 | -0.6 | -1.5 | -0.7 | 0.1 | -3.2 |
| Labour Market effect | -0.5 | -0.7 | 0.0 | -0.2 | -0.4 | -0.1 | -1.9 |
| <i>Employment ratio effect</i> | -0.5 | -0.7 | 0.0 | 0.0 | -0.1 | 0.0 | -1.3 |
| <i>Labour intensity effect</i> | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| <i>Career shift effect</i> | 0.0 | -0.1 | 0.0 | -0.2 | -0.3 | 0.0 | -0.6 |
| Residual | -0.1 | -0.6 | -0.6 | -1.8 | -3.5 | -1.5 | -8.0 |

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

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

Tables [A2.5] and [A2.6] 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 [A2.7] and Table [A2.8].

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

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|-----------------|-------|-------|-------|-------|-------|-------|-------|
| Age group -54 | 1.9 | 2.0 | 2.1 | 2.5 | 2.6 | 2.5 | 2.3 |
| Age group 55-59 | 18.7 | 19.8 | 20.8 | 21.3 | 22.4 | 29.8 | 27.5 |
| Age group 60-64 | 49.5 | 33.8 | 27.1 | 23.6 | 23.1 | 28.8 | 33.6 |
| Age group 65-69 | 107.4 | 124.6 | 109.7 | 120.2 | 104.9 | 97.4 | 95.8 |
| Age group 70-74 | 112.7 | 108.4 | 112.6 | 121.5 | 125.5 | 106.0 | 100.6 |
| Age group 75+ | 108.0 | 106.3 | 108.7 | 102.8 | 110.1 | 111.5 | 102.1 |

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

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|-----------------|-------|-------|-------|-------|-------|-------|-------|
| Age group -54 | 0.8 | 0.8 | 0.8 | 0.9 | 0.9 | 0.9 | 0.9 |
| Age group 55-59 | 5.7 | 5.2 | 5.3 | 5.1 | 4.7 | 5.9 | 5.2 |
| Age group 60-64 | 26.2 | 17.4 | 11.3 | 8.9 | 7.9 | 8.8 | 9.3 |
| Age group 65-69 | 92.3 | 103.8 | 85.5 | 90.1 | 72.4 | 57.5 | 46.4 |
| Age group 70-74 | 105.2 | 103.6 | 109.4 | 117.8 | 121.6 | 101.6 | 94.7 |
| Age group 75+ | 108.0 | 106.3 | 108.7 | 102.8 | 110.1 | 111.5 | 102.1 |

Table [A2.7]: Female pensioners (public scheme) to inactive population ratio by age group (%)

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|-----------------|-------|-------|-------|-------|-------|-------|-------|
| Age group -54 | 2.5 | 2.6 | 2.8 | 3.3 | 3.4 | 3.1 | 2.8 |
| Age group 55-59 | 17.0 | 16.7 | 18.2 | 19.1 | 21.2 | 27.4 | 24.8 |
| Age group 60-64 | 39.1 | 30.1 | 23.2 | 20.2 | 21.5 | 26.8 | 30.5 |
| Age group 65-69 | 98.8 | 118.1 | 107.8 | 111.2 | 101.6 | 99.8 | 93.3 |
| Age group 70-74 | 110.3 | 103.4 | 112.2 | 118.6 | 115.5 | 104.5 | 100.9 |
| Age group 75+ | 106.4 | 108.4 | 110.8 | 104.6 | 113.2 | 110.2 | 105.9 |

Table [A2.8]: Female pensioners (public scheme) to total population ratio by age group (%)

| | 2016 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|-----------------|-------|-------|-------|-------|-------|-------|-------|
| Age group -54 | 1.0 | 1.0 | 1.0 | 1.2 | 1.2 | 1.2 | 1.1 |
| Age group 55-59 | 7.2 | 6.4 | 5.9 | 5.5 | 5.4 | 6.6 | 5.8 |
| Age group 60-64 | 25.1 | 18.6 | 12.4 | 9.4 | 8.9 | 9.8 | 10.2 |
| Age group 65-69 | 91.1 | 104.9 | 93.5 | 92.0 | 77.7 | 66.4 | 52.4 |
| Age group 70-74 | 105.1 | 101.2 | 110.3 | 116.3 | 112.9 | 101.5 | 95.9 |
| Age group 75+ | 106.4 | 108.4 | 110.8 | 104.6 | 113.2 | 110.2 | 105.9 |

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

Table [A2.9]: Projected and disaggregated new public pension expenditure -
GSIS: old-age and early earnings-related pensions - MEN

| New pension | 2017 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|-------|-------|-------|-------|-------|-------|-------|
| I. Projected new pension expenditure (mil €) | 31.3 | 48.4 | 75.5 | 90.0 | 147.2 | 141.6 | 353.7 |
| II. Number of new pensions (in 1000) | 3.5 | 4.6 | 5.4 | 5.5 | 6.5 | 4.1 | 6.2 |
| III. Average new annual pension (1000 €)* | 8.8 | 10.5 | 14.0 | 16.5 | 22.6 | 34.3 | 57.1 |
| IV. Average number of insurance points | 72.3 | 83.1 | 88.1 | 81.3 | 79.5 | 84.3 | 97.4 |
| V. Average accrual rate | 1.35% | 1.36% | 1.36% | 1.31% | 1.29% | 1.28% | 1.29% |
| VI. Point value | 9,068 | 9316 | 11692 | 15509 | 22092 | 31803 | 45411 |
| VII. Sustainability/adjustment factors | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Number of months paid the first year | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 |
| Average new pension/ Economy-wide average wage | | 0.51 | 0.54 | 0.47 | 0.45 | 0.47 | 0.55 |

* In order to get the average monthly pension, the annual pension is divided by 13.

Table [A2.10]: Projected and disaggregated new public pension expenditure -
GSIS: old-age and early earnings-related pensions - WOMEN

| New pension | 2017 | 2020 | 2030 | 2040 | 2050 | 2060 | 2070 |
|---|-------|-------|--------|--------|--------|--------|--------|
| I. Projected new pension expenditure (mil €) | 21.3 | 23.4 | 47.9 | 70.4 | 117.7 | 125.9 | 282.9 |
| II. Number of new pensions (in 1000) | 3.1 | 3.0 | 4.4 | 5.2 | 6.2 | 4.4 | 6.0 |
| III. Average new annual pension (1000 €)* | 6.8 | 7.8 | 11.0 | 13.6 | 18.9 | 28.8 | 47.2 |
| IV. Average number of insurance points | 58.3 | 65.3 | 72.1 | 70.9 | 70.0 | 74.1 | 85.2 |
| V. Average accrual rate | 1.29% | 1.29% | 1.30% | 1.24% | 1.22% | 1.22% | 1.22% |
| VI. Point value | 9,068 | 9,316 | 11,692 | 15,509 | 22,092 | 31,803 | 45,411 |
| VII. Sustainability/adjustment factors | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| Number of months paid the first year | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 | 13.0 |
| Average new pension/ Economy-wide average wage | | 0.38 | 0.42 | 0.39 | 0.37 | 0.40 | 0.46 |

* In order to get the average monthly pension, the annual pension is divided by 13.

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 Invalidity incidence

Rates of entry into invalidity have been calculated from the GSIS experience over the period 2008-16. Invalidity 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 | 0.00025 | 0.00016 |
| 27 | 0.00037 | 0.00023 |
| 32 | 0.00035 | 0.00030 |
| 37 | 0.00065 | 0.00054 |
| 42 | 0.00104 | 0.00086 |
| 47 | 0.00171 | 0.00126 |
| 52 | 0.00337 | 0.00236 |
| 57 | 0.00675 | 0.00542 |
| 62 | 0.01097 | 0.00826 |

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 Ecfín'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 |