AAE
DISCUSSION
PAPER

MEETING THE CHALLENGE OF AGEING IN THE EU

MARCH 2019

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actuarial association of europe

Foreword

Ageing is one of the big challenges for our European society and actually around the world.

The change will happen gradually, but with certainty. That is why it is important to discuss the potential developments and consequences on the basis of an objective assessment.

It is equally important to discuss the financial implications and to look at the impact of various socio-economic scenarios (EU Ageing Report) and to discuss the impact on households (EU Adequacy Report).

The Actuarial Association of Europe (AAE) can help interpret the results and clarify what it would mean for society as a whole and what it would mean for individual households. The ageing of society is therefore an area where the actuarial profession can contribute to the welfare of society. And contributing to the well-being of society is perhaps the most important element in our Vision.

In this paper we summarise the findings of both the EU Ageing report and the EU Adequacy report. This means for you a simple introduction to both long reports.
We have included comments and suggestions on how the work can be further improved and developed.

The AAE wants to contribute to the discussion by striving for the best possible information and interpretation of that information and to help policymakers and society in general to come to sensible conclusions about what they need to do now to create a bright future for the next generations.

The exact future is uncertain but the trend is fairly certain. Possible future scenarios must be examined in a scientifically sound way. This is the field of actuaries. We can help determine the appropriate methodology to assess the future.

The AAE is ready to work with the European Commission, the European Parliament and other stakeholders to assist in further developing the necessary conditions for a sustainable European pension environment.

Esko Kivisaari
AAE Chairperson

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This paper is prepared by the Social Security Sub-Committee
of the Pensions Committee of the AAE

CONTRIBUTORS

CHRIS DAYKIN (LEAD AUTHOR),
Social Security Sub Committee - SSSC

COSTAS STAVRAKIS (CYPRUS),
SSSC - Task Force Projection & Methodology (Chairperson)

DAVID BOGATAJ (SLOVENIA),
SSSC - TF Mortality (Chairperson)

ISMO RISKU (FINLAND),
SSSC - TF Adequacy

JEROEN VAN DEN BOSCH (THE NETHERLANDS),
SSSC

JOHN WOODALL (UK),
TF Adequacy

MARIA ECONOMOU (GREECE),
SSSC (Chairperson)

MARIANNA PAPAMICHAIL (GREECE),
SSSC - TF Adequacy

PETER GATENBY (UK),
SSSC

RAFFAELLO MARCELLONI (ITALY),
TF Adequacy

TIBOR PÁRNICZKY (HUNGARY),
SSSC - TF Adequacy (Chairperson)

MANAGEMENT SUMMARY

Key messages from the Actuarial Association of Europe

The actuarial profession in Europe welcomes the thorough analysis that lies behind the 2018 Ageing Report and the Pension Adequacy report 2018. We also welcome the publication for the first time of disclosures in the supplementary Table 29 of the national accounts of the pension entitlements of households or pension obligations of contributory social security pension schemes.

From an actuarial perspective, the Actuarial Association of Europe would regard the following messages as important:

- For achieving a financially sustainable pension system:
  Public pension costs should be a relatively affordable percentage of GDP and not growing significantly over the long term.
  Some form of sustainability factor or automatic adjustment mechanism at retirement age could be introduced to offset increasing length of life.

- For securing pensions adequacy and minimising risk of poverty:
  Significant element of social protection for vulnerable groups, such as those on low incomes, interrupted career or non-standard form of employment, could be achieved through minimum guarantees in the public pension system.

- Robust funded second and third pillar pension arrangements could potentially enhance adequacy, contributing towards the key policy objective of maintaining the standard of living post-retirement.

- Regular actuarial reviews of long-term financial outcomes of social security pension schemes is an essential financial governance tool .

- In assessing the current and future adequacy of pensions in terms of level of income, gender, and type and length of career, the distributional effect of different profiles of individuals needs to be considered.

- The ‘open group’ approach which includes the effect of new entrants and based on which the cash-flow projections exercise of the 2018 Ageing Report is undertaken, is recommended for the assessment of the financial sustainability of EU social security pension schemes.

- Actuarial modelling approaches and methodologies should be used to project future cash flows and assess the short, medium and long-term impact of pension policies and reforms on adequacy and sustainability of pension system provision in an integrated way. This is not being done consistently across the EU at present.

The International Actuarial Association has published a model standard of actuarial practice (ISAP2) on Financial Analysis of Social Security Programs, developed in cooperation with the International Labour Office (ILO) and the ISSA. The non-binding ISSA-ILO Guidelines on Actuarial Work for Social Security were adopted in 2006. We recommend that these should be followed in the EU, both for actuarial work in individual countries and for EU level exercises such as the Ageing Report.

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MEETING THE CHALLENGE OF AGEING IN THE EU

Executive Summary

1. This report from the Actuarial Association of Europe (AAE) responds to the recent publication by the EU Commission of The Ageing Report 2018 (AR18) and the Pension Adequacy Report 2018 (PAR18). We also respond to the publication for the first time of disclosures in the supplementary Table 29 of the national accounts of the pension entitlements of households or pension obligations of contributory social security pension schemes.

2. The demographic structure of most European countries is projected to age significantly over the period to 2070, with fertility remaining below replacement rate and steadily improving expectations of life. Outwards migration at working ages will exacerbate the problem of ageing for some countries, leading to substantial reduction of the working population in absolute terms, as well as in relation to the population as a whole.

3. However, in spite of the ageing of the population, pension reform measures taken in recent years are expected to result in fairly modest growth in pension costs (as a percentage of GDP) for the EU as a whole up to 2040, with a reduction thereafter to 2070. But there are significant differences in the evolution, only five countries remaining in close range of their initial positions, others considerably increasing or decreasing their pension expenditure. Only eleven countries are projected to have falling pension costs in the period to 2040 and fourteen countries in the period 2040 to 2070.

4. Member states have continued to take measures to reform pension systems, with a number of changes to pensionable age and qualifying conditions. Automatic adjustment mechanisms have become more common and may help to make pension systems more robust against ageing and other changes in the future. However, the other side of the coin to more financially sustainable pension costs is a projected reduction in benefit ratios and coverage ratios, leading to concerns that pension adequacy will decline. To offset this, a number of countries are introducing reforms to strengthen minimum pensions, so that those with low income in retirement may be protected to some extent from the reductions in pensions.

5. Analysis of pension adequacy needs to focus particularly on vulnerable groups, with women being at higher risk of poverty and social exclusion than men, because they are more likely to have broken careers and to have spent some or all of their careers in lower paid employment. The self-employed and those in non-standard work are also vulnerable groups and the numbers in these categories are increasing.

6. There remains a great deal of uncertainty about the long-term sustainability of pensions. International studies of sustainability rank only a small number of EU countries highly in terms of sustainability and many EU countries come quite far down the list. The Eurostat projections are highly dependent on a large number of assumptions and the actual outcome may be very different. In particular, some key assumptions reflect a belief that pension reforms already enacted will deliver in the ways expected. This may prove not to be the case and, moreover, future reversals of reforms or future changes to pension systems to combat the risk of inadequate pension outcomes may in turn lead to costs rising again.

7. Meanwhile costs are projected to rise in every country on health and long-term care spending. These projections depend not only on the population projections but also on how life expectancy increases translate into healthy life expectancy and how demand for health and long-term care services may evolve. It is also difficult to predict how much the costs of health care outcomes may rise relative to general price increases. The impact on countries may vary according to the relative balance of public and private health care costs. In the case of long-term care, which has the potential for substantial increase in costs in some scenarios, a critical factor will be how much care continues to be provided informally by family and friends. As family dynamics continue to change in the future, it is likely that a larger proportion of care will need to be paid for out of public funds.

8. It is important to understand that the pension cost projections are not forecasts. They are the result of applying agreed assumptions to the models. In view of the uncertainty it is desirable to consider a range of different sets of projection assumptions.

9. A new development has been the publication in the Supplementary Table 29 of the national accounts of public pension liabilities accrued to date. As actuaries we have concerns that this information may be misinterpreted, as it makes the unrealistic assumption that no further benefits accrue in future and no credit is taken for future contributions. Such disclosures provide no information about the capacity of governments to meet future pension liabilities and there also significant issues about comparability between Member States. We will be working with Eurostat and other interested parties to improve comparability and to make suggestions about how better to communicate the results of the Supplementary Table 29 disclosures. From an actuarial perspective we believe that the pension cost projections in AR18 are more useful for understanding the fiscal sustainability of public pension systems, while regular actuarial reviews of a social security pension scheme, often required by legislation, are more useful for assessing its long-term financial viability, i.e., the ability of the scheme to raise financial resources necessary to meet all of its future pension costs.

10. Actuarial modelling approaches and methodologies should be used to project future cash flows and assess the short, medium and long-term impact of pension policies and reforms on adequacy and sustainability of pension system provision in an integrated way. The AAE has interacted with DGEcfin and the Ageing Working Group to suggest improvements in the methodology and disclosures in order to meet international standards for social security actuaries.

11. A number of countries have a statutory requirement for regular actuarial reporting on the finances of social security and this can be an important factor in ensuring sustainability of social security pension promises, as it helps to place the political pressures for more generous social security into a firm financial monitoring environment. The International Actuarial Association has published a model standard of actuarial practice (ISAP2) on Financial Analysis of Social Security Programs, developed in cooperation with the International Labour Office (ILO) and the ISSA. ISSA-ILO Guidelines on Actuarial Work for Social Security have also been published recently and we recommend that these should be followed in the EU, both for actuarial work in individual countries and for EU level exercises such as AR18.

12. Actuaries are professionals with expertise in the quantification and management of long-term risks which are susceptible to mathematical modelling. This includes all types of social security, as well as complementary workplace pensions or mandatory pensions, whether funded or not. The member associations of the AAE have robust educational and professionalism requirements for those who are qualified actuaries and the AAE issues model standards of actuarial practice for the associations to adopt for some specifically EU applications. Actuaries are well-placed to play an active role in analysing the impact of future changes on pension and social security provision and to advise EU and national institutions.

13. The AAE hopes that this publication will provide insights for governments, politicians and officials and for other interested parties and will make available the excellent content of AR18 and PAR18 in a more succinct form, accompanied by actuarial commentary and analysis.

BRUSSELS
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1. INTRODUCTION

1.1 The EU is getting older, both because people are living longer and because there have not been enough births. Migration is another significant factor in the evolution of the population of the EU. The old-age dependency ratio[1] is projected to rise from 29% in 2015 to 52% in 2080. This means a transition from roughly three working age people per person over 65 to only two. The population aged from 15 to 64, which accounts for most workers, is projected to fall by 17% for the EU27[2] as a whole and by more than 25% in 12 Member States (and by 40% or more in seven of them). Only four Member States are projected to have more than 10% growth in this working age group.

1.2 These dramatic changes in the demography of the EU will present significant challenges for financing retirement income and will also have a major impact on the affordability of health care systems and of long-term care for the elderly.

1.3 Every three years the European Commission (DGEcfin), in collaboration with the Ageing Working Group of the Economic Policy Committee of the EU Council, publishes a comprehensive set of projections of age-related public expenditure for all EU Member States (and Norway). AR18[3] was published in May 2018, accompanied by Council conclusions on age-related spending[4]. The focus is on fiscal sustainability over the period to 2070.

1.4 By way of counter-balance, another part of the European Commission (DGEmployment), in collaboration with the Working Group on Ageing Issues of the Social Protection Committee of the Council (SPC WG-AGE) published at around the same time the PAR18. This looks at similar issues over a long time-frame but from the other end of the telescope, trying to measure the success of EU pension systems in meeting objectives of relieving poverty and achieving income replacement at retirement.

1.5 The present paper from the AAE provides analysis and insight into some of the important issues raised by the Commission's recent publications. The actuarial profession in Europe welcomes the thorough analysis that lies behind the AR18 and the PAR18[5]. Long-term cash-flow projections provide a valuable tool for understanding possible future outcomes and represent a standard actuarial methodology.

1 Defined as the ratio of the population aged 65 and over to the population aged from 15 to 64.

2 EU27 is the whole of the current EU but excluding the UK, which is expected to leave the EU in 2019.

3 The 2018 Ageing Report. Economic & Budgetary Projections for the 28 EU Member States (2016-2070). European Commission Institutional Paper 079. Can be downloaded from https://ec.europa.eu/info/publications/economic-and-financial-affairs-publications_en.

4 Public finances: Conclusions on age-related spending. Council of the EU Press Release 295/18 on 25 May 2018. Can be downloaded from: http://www.consilium.europa.eu/en/press/press-releases/2018/05/25/public-finances-conclusions-on-age-related-spending/pdf.

5 The 2018 Pension Adequacy Report: Current and Future Income Adequacy in Old Age in the EU. Joint Report prepared by the Social Protection Committee (SPC) and the European Commission (DG EMPL). Can be downloaded from: http://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8084&furtherPubs=yes.

In a number of countries such projections are carried out by government actuaries and we would encourage all Member States to develop core actuarial capability within government to facilitate the preparation of these and other projections of public spending, not only on pensions and social security but also for health care and long-term care.

2. OVERVIEW

2.1 Total strictly age-related public spending[6], for the EU as whole, is projected in AR18 to rise from 24.1% of GDP [7]in 2016 to 26.1% in 2040 and then drop slightly to 25.9% by 2070. Just under half of this relates to pensions. However, pension spending is projected to fall a little over the period to 2070, after reaching a high point in 2040, and the growth in age-related spending to 2070 is dominated by health care (0.9% of GDP increase from 6.8% of GDP in 2016) and long-term care (1.2% of GDP increase from 1.6% of GDP in 2016).
The other area of expenditure regarded as 'strictly age-related' is education, which for the EU as a whole is projected to remain steady at 4.5% of GDP from 2016 to 2070. Unemployment benefits are also covered in the projections and are included in the broader total of age-related items, but represents less than 1% of GDP, falling over the projection period.

2.2 Table 1 summarises the total costs of pensions, health care and long-term care as a percentage of GDP[8], in descending order of change over the period 2016 to 2070.

Table 1: Total cost of pensions, health and long-term care as % of GDP

	Change 16-70	2016	2040	2070
LU	12.9	14.2	18.0	27.1
MT	6.9	14.5	16.3	21.5
NO	6.8	22.1	25.6	28.9
SI	5.9	17.5	22.3	23.4
CZ	5.4	14.9	17.5	20.3
BE	5.0	20.4	23.9	25.4
IE	4.5	10.5	13.7	15.0
UK	4.4	17.2	19.5	21.6
NL	3.8	17.1	20.7	20.9
AT	3.8	22.7	25.2	26.5
DE	3.8	18.7	21.7	22.5
FI	3.4	21.6	24.2	25.0
SK	3.0	15.1	15.7	18.1
CY	2.9	13.3	14.9	16.2
HU	2.8	15.3	15.9	18.1
RO	1.9	12.5	13.3	14.5
BG	1.8	15.0	15.8	16.7
DK	1.3	19.4	19.4	20.7
SE	1.3	18.3	18.3	19.6
PT	1.1	20.0	23.2	21.0
PL	0.6	16.0	16.5	16.6
ES	0.4	19.0	22.1	19.4
IT	0.2	23.6	27.9	23.8
LT	-0.2	11.9	13.4	11.7
EE	-1.1	14.4	13.7	13.3
LV	-1.9	11.5	11.2	9.7
FR	-2.2	24.6	25.7	22.4
HR	-2.7	16.7	15.2	13.9
EL	-5.4	22.3	18.9	17.0
EU28	1.8	19.6	21.7	21.5
EU27	1.3	20.1	22.2	21.4

Source AR18

6 Public spending on pensions, health care, long-term care and education

7 Gross Domestic Product

8 AWG Reference Scenario

2.3 Within the broad EU totals there is a great deal of variation by Member State. At the extremes pension spending in Luxembourg is projected to rise from 9.0% of GDP in 2016 to 17.9% in 2070, whilst in Greece it is projected to fall from 17.3% of GDP in 2016 to 10.6% in 2070. Significant growth in pension spending (more than 2% of GDP) is projected for Belgium, Czech Republic, Germany, Cyprus, Luxembourg, Malta and Slovenia, with a significant fall in pension spending (fall of 2% or more of GDP) projected for France, Croatia, Greece, Latvia and Portugal. However, spending on health care is projected to grow in all Member States, and spending on long-term care is projected to almost double in many countries. Table 2 shows separately the projected costs to 2070 as a % of GDP for pensions, health care and long-term care.

Table 2: PROJECTED COST OF PENSIONS, HEALTH AND LONG-TERM CARE AS % OF GDP

	Pensions			Health care			Long-term care		
Country	Ch 16-70	2016	2070	Ch 16-70	2016	2070	Ch 16-70	2016	2070
BE	2.9	12.1	15.0	0.4	5.9	6.3	1.7	2.3	4.0
BG	1.4	9.6	10.9	0.3	5.0	5.2	0.1	0.4	0.5
CZ	2.8	8.2	10.9	1.1	5.4	6.5	1.6	1.3	2.9
DK	-1.9	10.0	8.1	1.0	6.9	7.9	2.2	2.5	4.7
DE	2.4	10.1	12.5	0.7	7.4	8.1	0.6	1.3	1.9
EE	-1.8	8.1	6.4	0.3	5.3	5.6	0.5	0.9	1.4
IE	1.6	5.0	6.6	1.0	4.1	5.1	1.9	1.3	3.3
EL	-6.6	17.3	10.6	1.2	5.0	6.2	0.1	0.1	0.2
ES	-1.5	12.2	10.7	0.5	5.9	6.4	1.3	0.9	2.2
FR	-3.3	15.0	11.8	0.5	7.9	8.3	0.6	1.7	2.4
HR	-3.8	10.6	6.8	0.7	5.2	5.9	0.3	0.9	1.2
IT	-1.7	15.6	13.9	0.7	6.3	7.0	1.2	1.7	3.0
CY	2.3	10.2	12.4	0.4	2.8	3.2	0.3	0.3	0.6
LV	-2.6	7.4	4.7	0.6	3.7	4.3	0.1	0.4	0.6
LT	-1.7	6.9	5.2	0.4	4.1	4.5	1.0	1.0	2.0
LU	8.9	9.0	17.9	1.2	3.9	5.1	2.8	1.3	4.1
HU	1.5	9.7	11.2	0.8	4.9	5.7	0.4	0.7	1.1
MT	2.9	8.0	10.9	2.7	5.6	8.3	1.4	0.9	2.3
NL	0.6	7.3	7.9	0.8	6.2	7.0	2.5	3.5	6.0
AT	0.5	13.8	14.3	1.3	7.0	8.3	1.9	1.9	3.8
PL	-1.0	11.2	10.2	0.8	4.3	5.2	0.8	0.5	1.3
PT	-2.2	13.5	11.4	2.4	5.9	8.3	0.9	0.5	1.4
RO	0.7	8.0	8.7	0.9	4.3	5.2	0.3	0.3	0.6
SI	3.9	10.9	14.9	1.0	5.6	6.7	0.9	0.9	1.8
SK	1.2	8.6	9.8	1.2	5.6	6.8	0.6	0.9	1.5
FI	0.6	13.4	13.9	0.8	6.1	6.9	2.1	2.2	4.2
SE	-1.2	8.2	7.0	0.7	6.9	7.7	1.7	3.2	4.9
UK	1.7	7.7	9.5	1.4	7.9	9.4	1.3	1.5	2.8
NO	2.1	10.7	12.8	1.2	7.7	8.9	3.4	3.7	7.1
EU28	-0.2	11.2	11.0	0.9	6.8	7.7	1.2	1.6	2.7
EU27	-0.5	11.9	11.4	0.7	6.6	7.2	1.1	1.6	2.7

Source AR18

2.4 With such projections there are of course many uncertainties. In the next section we discuss the Eurostat 2015 population projections in more detail. However, other critical assumptions include economic growth, employment levels and real growth in the costs of health care and long-term care. GDP for the EU as a whole is projected to grow on average at 1.4% a year between 2016 and 2070 (1.2% up to 2040 and 1.5% thereafter) but assumptions for individual countries vary from an average as low as 0.8% a year up to 2.1% a year. Since the reducing size of the working population is a negative influence on growth, the source of positive growth is almost entirely labour productivity.

2.5 In order to understand better the sensitivity of the projections to the assumptions, results are also shown in the Executive Summary of AR18 on two variant sets of assumptions, lower economic growth (average of 1.1% a year instead of 1.4%) and higher growth of health care and long-term care costs. The first of these variants mainly affects the pension costs, whereas the second has quite a large impact on health and long-term care costs. However, within the chapter on pension costs details are given of results on a number of other variants, looking at alternative fertility, migration and longevity assumptions, higher and lower employment levels, productivity growth and linking retirement age to increases in life expectancy.

2.6 *In view of the uncertainties about many of the assumptions, particularly over as long a time period as up to 2070, we would urge caution in drawing strong policy conclusions from the projections.*

The pension projections in particular in many cases assume the outworking of numerous pension reforms implemented in recent years, including behavioural changes, such as with regard to age of retirement. Health and long-term care cost projections are sensitive to changes in behaviour, as well as to developments in technology and evolution of family and household structures.

One of the virtues of the combined set of projections is that they aim to achieve consistency across the EU, but this also has the downside that some country-specific features may not be captured.

The projections also explicitly reflect a 'no policy change' scenario, and, realistically, much will change in the future, so the projections should not be thought of as forecasts.

2.7 The EU Commission conclusions on age-related spending give a welcome to recent pension reforms, whilst noting that the scale of reforms in several countries may still be insufficient and expressing concern that some reforms have been reversed. It is suggested that further steps need to be taken to raise the effective age of retirement, including strengthening incentives to remain in the labour market and by linking retirement age or pension benefits to life expectancy. We discuss pension reforms in a later section but note here that, in the aftermath of the global financial crisis in 2008, several recent pension reforms have been aimed more at improvement in adequacy than in the previous period. The Council conclusions also highlight the importance of a holistic view covering both financial sustainability and adequacy of pension systems.

2.8 Pension spending as a percentage of GDP is projected to fall over the period to 2060 in 12 Member States, reflecting pension reforms implemented in recent years.
It is instructive to look back at the projected spending on pensions in 2060 given in the 2012 Ageing Report - AR12. This is shown in Table 3. Apart from the fall in pension spending currently projected by 2060, this also shows how much the projected spending in 2060 has fallen, for almost all countries, compared to projections made only six years ago, as a result mainly of the considerable level of pension reform activity that there has been.

2.9 Since there is considerable underlying pressure on pension spending as a result of demographic ageing, much of the reduction expected over the projection period (or by comparison with earlier projections) is to be achieved by falling benefit ratios (average pension divided by average wage). The contribution of various factors is explored in AR18 and will be considered in more detail in section 4. However, widespread falls in benefit ratios may herald reductions in adequacy. One conclusion is that minimum levels of pension benefit are not seeing commensurate reductions, so there may be some protection against higher poverty levels, whilst income replacement for higher earners is being eroded.

TABLE 3: PROJECTED COST OF PENSIONS TO 2060 AS % OF GDP AND COMPARISON WITH AR12

	Pensions			AR12	Change AR12 to AR18
Country	Change 16-60	2016	2060	2060	
EL	-5.8	17.3	11.5	14.6	-3.1
HR	-3.5	10.6	7.0	N/A	N/A
FR	-2.5	15.0	12.5	15.1	-2.6
DK	-2.4	10.0	7.5	9.5	-2.0
LV	-1.7	7.4	5.6	5.9	-0.3
PT	-1.6	13.5	12.0	12.7	-0.7
EE	-1.2	8.1	6.9	7.7	-0.8
SE	-1.2	8.2	7.0	10.2	-3.2
LT	-0.8	6.9	6.0	12.1	-6.1
ES	-0.8	12.2	11.4	13.7	-2.3
IT	-0.5	15.6	15.1	14.4	0.7
PL	-0.1	11.2	11.1	9.6	1.5
FI	0.1	13.4	13.5	15.2	-1.7
NL	0.6	7.3	7.9	10.4	-2.5
AT	0.9	13.8	14.7	16.1	-1.4
RO	0.9	8.0	8.9	13.5	-4.6
UK	1.2	7.7	8.9	9.2	-0.3
SK	1.3	8.6	9.9	13.2	-3.3
HU	1.4	9.7	11.1	14.7	-3.6
NO	1.8	10.7	12.5	14.2	-1.7
CY	1.8	10.2	12.0	16.4	-4.4
BG	2.0	9.6	11.6	11.1	0.5
IE	2.2	5.0	7.2	11.7	-4.5
MT	2.4	8.0	10.5	15.9	-5.4
DE	2.5	10.1	12.5	13.4	-0.9
BE	2.7	12.1	14.9	16.6	-1.7
CZ	3.5	8.2	11.6	11.8	-0.2
SI	4.3	10.9	15.2	18.3	-3.1
LU	6.9	9.0	16.0	18.6	-2.6
EU28	0.1	11.2	11.3	12.9	
EU27	-0.1	11.9	11.4		

Source AR18 and AR12

2.10 In seven Member States spending on pensions is projected to continue growing right up to 2070, whereas six are currently at their high point and expecting falling expenditure throughout the projection period. For the others spending peaks sometime between 2030 and 2060, with the average peak for the EU as a whole in 2040.

2.11 In later sections we look in more detail at the projected costs separately for pensions, health care and long-term care and discuss noteworthy features.

2.12 We discuss the PAR18 in a later section and consider in particular whether past reforms to improve fiscal sustainability are having a significant adverse impact on current and future adequacy. The 2018 PAR concludes that 17.3 million (or 18.2%) of those aged 65 and over in the EU currently remain at risk of poverty or social exclusion, although this is 1.9 million less than a decade earlier.

2.13 On average in the EU the time spent in retirement is currently about half of that spent in employment. However, this ratio is expected to rise slowly in future.

2.14 *The risk of poverty increases with age and affects women more than men. Even for those not at risk of poverty there is a significant pension gap between men and women. The gap is gradually narrowing but is likely to persist for a long time. It is exacerbated by career breaks, especially relating to looking after children and dependent family members. Although some pension systems have measures to offset this inherent gender disadvantage, not all do and the measures may not be sufficient, particularly in earnings-related systems. Particular issues also arise with pension adequacy for the self-employed and those in non-standard employment.*

3. DEMOGRAPHIC PROJECTIONS

3.1 The population projections which are used as the basis for AR18 are the ESSPOP2015 projections prepared by Eurostat and published in February 2017[9]. Eurostat is independent of the political processes associated with the European Council of Ministers and the European Commission but has produced these projections for use by the Commission in preparing AR18. Some countries argued that previous projections were unreasonable and Eurostat appears to have adopted a more collegiate approach to these projections, involving National Statistical Institutions of the EU Member States more actively in the process (hence the change in terminology from EUROPOP to ESS). However, notwithstanding the extensive consultation, Eurostat appear to have made only relatively minor changes to their methodology for these projections. Some of the differences are the result of taking into account the most recent trends.

3.2 *It is important to note that the Eurostat projections may differ materially from the population projections prepared by each country's own statistical authorities. This means that some caution should be exercised in interpreting results based on the Eurostat projections, although a major virtue of them is that they adopt consistent methodology across all countries, which would not be the case if individual countries' projections were used as the reference point. Furthermore, from an actuarial perspective it is important to note that the demographic assumptions, and in fact any other assumption used in an actuarial pension projection exercise of a social security scheme, should be realistic or neutral. In particular, in accordance with paragraph 2.3 of the International Standard of Actuarial Practice for Financial Analysis of Social Security Programs (ISAP 2) of the International Actuarial Association, "neutral assumptions are such the actuary expects that the resulting projection of the social security program experience is not a material underestimate or overestimate". Given that ESSPOP2015 projections were undertaken based on the same methodologies and models for all member states in order to ensure cross-country comparability and consistency, the resulting population projections for some member states are not necessarily realistic or neutral.*

3.3 The projections seek to blend short-term trends with long-term assumptions and reflect some quite strong assumptions about how the population of the EU will develop in the very long-term future, in particular the following:

- Fertility rates for all member states are assumed broadly to converge to similar levels in the very long term (2150). However, some countries are assumed to change quite quickly relative to others and not all countries converge to the same long-term level. Most countries are projected to have the same or slightly lower fertility in 2060 than in the previous 2013-based projections, although Spain and Slovakia have significantly

9 More details of the projections are given in AR18: Underlying Assumptions and Projection Methodologies, Institutional Paper 065, published in November 2017 and found at: https://ec.europa.eu/info/publications/economy-finance/2018-ageing-report-underlying-assumptions-and-projection-methodologies_en. Eurostat's summary of the methodology is in Annexes to the Population Projections metadata at http://ec.europa.eu/eurostat/cache/metadata/en/proj_esms.htm

higher projected fertility, bringing them now more into line with other countries.

- Expectation of life for member states is projected to increase throughout the projection period, with differentials between countries, and between males and females, narrowing and converging in the very long term to the mortality of a 'leading group' of 12 countries. Most countries are projected to have slightly higher period expectation of life at age 65 in 2060 than in the previous projections.

- Migration is assumed to converge to a long-term position of zero net migration between member states (for the total population). Different approaches are used for modelling the short, medium and long term, with time series modelling for the medium term and convergence for the longer term, modified by a modest feed-back adjustment for countries with strongly falling working population. Net migration is a particularly uncertain and politically sensitive assumption, especially in the light of the quite large migratory movements in the last few years, e.g. asylum seekers from outside the EU, which makes projections based on the experience of the recent past hazardous.

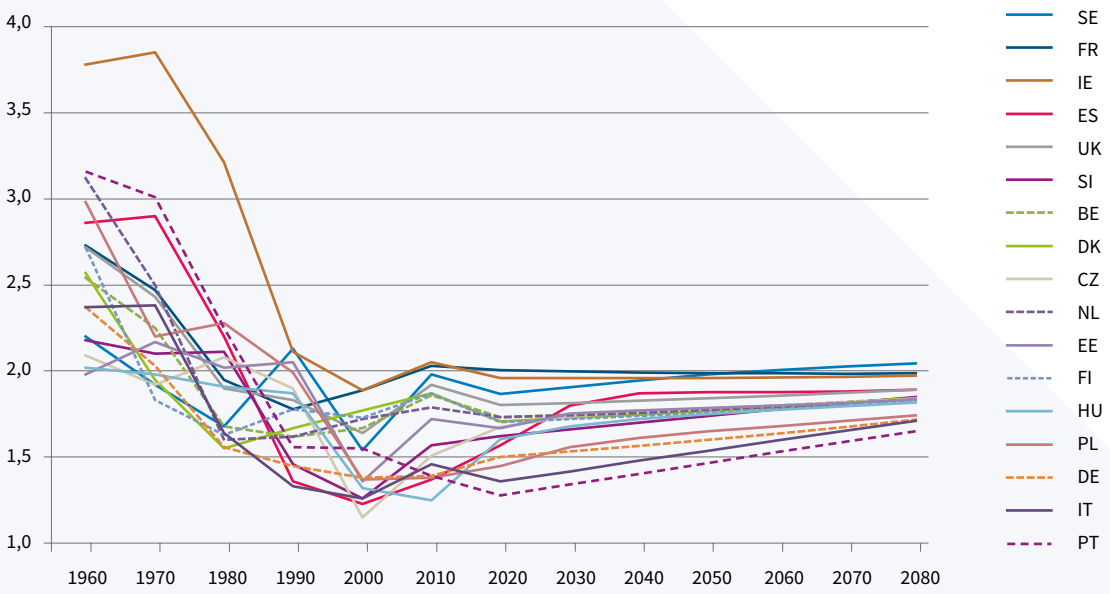
3.4 *Even though the methodology has not changed dramatically, there are quite large differences in the results produced by ESSPOP2015 compared to EUROPOP2013 used for AR15. We draw attention to some of the most significant of these in this report. There is considerable uncertainty about the future evolution of the population and the magnitude of some of the forecast changes raises serious questions over whether the assumptions are sustainable. Indeed the trends on which the projections rely may change in response to actions taken in response to what the projections show.*

FERTILITY

3.5 Fertility is assumed to be converging over the very long term to a total fertility rate [10] between 1.9 and 2.1. The long-term convergent position is represented by the expected fertility developments in a group of countries considered to be "forerunners", which are taken to be Belgium, Denmark, France, the Netherlands, Finland and the UK. For this purpose, a separate fertility projection run is undertaken for this group of countries. Member states are not all assumed to converge fully to the same level or at the same speed, although we understand that these differences are driven by extrapolation of recent trends for the short-term. Spain, Romania, Poland, Hungary, Slovakia and Bulgaria are assumed to experience particularly strong increases in total fertility rates between 2015 and 2030, with the increase slowing down thereafter. It is not altogether clear why some countries which were at the same fertility level in 2015 are assumed to experience very different growth patterns of fertility in the future.

10 Total fertility rate (TFR) is an aggregate measure of fertility for a particular population and a particular year. It is the sum of the individual age-specific fertility rates over the child-bearing years.

FIGURE 1: TOTAL FERTILITY RATES 1960-2080 FOR SELECTION OF EU MEMBER STATES



Source: ESSPOP2015, Eurostat

3.6 For some it may be an attempt to correct for what are seen as anomalously low fertility rates in 2015, although the same 'correction' does not seem to have been applied to Greece, Italy and Portugal. By 2080 the total fertility rate in Sweden is assumed to have risen to 2.04, whilst that for Portugal has increased only to 1.65. Poland, which shows a very low TFR similar to Portugal in 2015, is expected, on the other hand, to increase to 1.74 and Greece, Croatia and Italy to around 1.70. Apart from Sweden, only France and Ireland are expected to have TFR over 1.90 in all years from 2030 onwards. Figure 1 illustrates this for 17 of the countries, which together account for about 90% of the total population of the EU at ages 15-64. A full table of the underlying figures for all EU countries is shown at Annex Table A.1.

3.7 *Although the assumption about convergence of the fertility levels of all member states is a strong one, there is a fair degree of consensus that fertility levels will remain below the theoretical replacement level of 2.1 children per woman for the foreseeable future, although there are different views on whether current differentials between countries will narrow as much as is projected.*

Only Sweden is projected to have fertility levels rising above 2.0 in the later years of the projection, although France, which currently has the highest levels of fertility in the EU, is projected to have fertility at or just above 2.0 between 2020 and 2030 and then to fall back slightly. The ESSPOP2015 projections are reasonably consistent with the previous projections for most countries, with TFR in 2060 projected to be no more than 0.1 higher or lower than in the EUROPOP 2013 projections. Notable exceptions are Spain and Slovakia, which had fairly low projected fertility in the 2013 projections but have had their projected TFR for 2060 increased by more than 0.25.

3.8 *Overall the assumptions are probably relatively uncontroversial in broad terms and give a reasonable estimate of future births, although in practice it is likely that fertility will vary from year to year, as it has in the past, and differences will remain between countries, reflecting different social, economic and employment situations and different experience of inwards and outwards migration, which can materially affect fertility levels.*

Member states are not explicitly assumed to adopt different policies to encourage higher levels of fertility, such as higher levels of family benefits, although some policy changes may be implicit to achieve the assumed level of convergence.

3.9 Nevertheless, the assumption that all countries will have fertility below replacement level (2.1) for the next sixty years has a significant impact on the ageing of the population. The combination of this assumption with the migration assumptions can be expected to have a dramatic effect on the future size and structure of the population in many countries. If fertility does not rise as much as is projected, the potential working population in the later years of the projection could be materially lower than indicated by these projections.

MIGRATION

3.10 The migration assumptions are more controversial, both because the past experience has been quite volatile and because it is likely to change in the future in ways which are not readily predictable. Although the starting date of the ESSPOP2015 projections is 1 January 2015, actual migration figures were used for 2015 and country estimates for 2016, based on known migration for part of the year. Past migration experience is then taken into account using autoregressive (ARIMA) modelling to extrapolate past trends. ARIMA models are chosen by an automatic process for each country and parametrized on the basis of past migration for 1960 to 2016 with minor modifications to remove the highest and the lowest values over this period. Future migration is then projected using the ARIMA models for the period 2017 to 2080. These trend-based projections are then combined by a linear interpolation process with projections based on an assumption of convergence to zero migration in the very long term, the weights applied to the convergence projections increasing from zero in 2017 to one in 2080. Since for some countries these assumptions give rise to a steady shrinking of the working population, a 'feed-back' correction factor is applied to limit the extent of the shrinkage.

3.11 As we have seen recently, migration can vary a great deal, and is very sensitive to differences in economic conditions between member states and to external factors (such as the heavy migration into the EU in recent months from Africa and the Middle East as a result of wars and difficult economic conditions in the migrants' home countries). In 2015 alone net inwards migration into Germany was 1.2 million (1.4% population growth), into Austria 112,000 (1.3%) and into Sweden 80,000 (0.8%). Luxembourg had net inwards migration of almost 2% of the population.

3.12 The projection assumptions moderate this recent experience of very high migration and net migration into Germany over the whole period up to 2060 is projected only to increase the population by 11.2%.

3.13 Table 4 below shows a selection of figures from the migration projections. A more complete table is given in Annex Table A.2. Thirteen countries are projected to experience cumulative immigration of more than 10% of the total 2020 population over a period of forty years, with Luxembourg much higher than the others with a 46.8% increase.
At the other extreme, Lithuania is projected to lose 11.6% of its entire population through emigration, with Latvia and Romania also projected to lose a significant proportion of their population. Taking into account that the losses are mostly suffered to the working age population, and combining this migration effect with the impact of low fertility, a substantial majority of EU member states are projected to have quite significant reductions in the size of the working population, as is discussed further in 3.26 and 3.27.

Whether or not these are realistic projections only time will tell, but they do have a significant influence on the population projections and hence on the projections of expenditure, as reductions in numbers of contributors to social security (or tax-payers) combined with rising numbers of elderly, will create additional challenges for sustainability.

TABLE 4: PROJECTION OF NET MIGRATION FLOWS, 2010 AND 2020 TO 2060							
	Cumulative net migration		Projection of net migration flows (000s)			Cumulative net migration	
	2001-2015	2001-15 as % of 2016 population	2020	2040	2060	2020-2060	2020-60 as % of 2016 population
LT	-423.3	-14.6%	-23.8	-6.3	0.2	-328.9	-11.3%
LV	-240.9	-12.0%	-8.0	-1.5	0.0	-98.5	-4.9%
RO	-1951.0	-9.9%	-65.1	-8.9	1.6	-814.5	-4.1%
BG	-405.7	-5.7%	-11.9	0.5	0.7	-98.0	-1.4%
PL	-203.6	-0.5%	0.0	16.2	11.6	483.5	1.3%
EL	1.7	0.0%	-16.8	7.9	10.5	148.9	1.4%
EE	-43.4	-3.3%	2.3	1.2	0.1	46.5	3.6%
HR	48.5	1.2%	-1.7	5.0	5.2	174.4	4.2%
SK	5.8	0.1%	5.9	6.8	3.8	226.7	4.2%
FR	1584.1	2.4%	77.0	77.3	62.2	3035.9	4.5%
PT	81.6	0.8%	2.4	18.2	14.6	559.4	5.4%
CZ	336.3	3.2%	21.5	20.5	8.8	650.8	6.1%
HU	205.5	2.1%	19.9	20.8	13.8	681.8	7.0%
SI	72.2	3.4%	4.2	4.3	2.8	154.2	7.3%
FI	181.5	3.3%	15.8	10.7	7.8	444.2	8.1%
IE	251.4	5.3%	9.9	11.4	12.2	430.2	9.2%
NL	287.4	1.7%	66.9	43.7	28.6	1808.2	10.6%
UK	3746.0	5.7%	251.5	181.0	121.1	7235.5	11.0%
DE	3828.3	4.6%	327.3	206.0	175.0	9243.9	11.2%
ES	4681.2	10.1%	51.2	163.4	153.8	5570.8	12.0%
IT	4307.9	7.1%	161.2	217.7	176.7	7919.1	13.0%
DK	248.1	4.4%	33.4	18.9	11.4	789.2	13.8%
BE	755.8	6.7%	53.2	41.5	29.5	1643.6	14.5%
CY	95.9	10.7%	1.7	3.9	4.4	148.3	16.5%
NO	457.1	8.8%	27.3	23.7	18.1	928.4	17.9%
SE	732.2	7.4%	67.9	44.7	27.4	1803.3	18.2%
AT	644.6	7.4%	67.8	40.3	24.8	1683.4	19.3%
MT	30.6	7.7%	3.2	2.0	1.3	83.1	20.8%
LU	108.8	18.1%	10.2	7.0	4.5	280.8	46.8%
EU	18967.2	3.7%	976.3	1363.8	1036.7	43905.8	8.6%

Source AR18 cross-country tables

MORTALITY

3.14 Expectations of life in all member states have increased significantly in recent years, some by rather more than others. However, there are still material differences between member states. For example, male expectation of life at birth in 2015 ranged from 69.2 in Lithuania to 80.4 in Sweden and female expectation of life at birth ranged from 78.2 in Bulgaria to 85.8 in Spain. Expectation of life may also differ considerably between local areas of individual countries and between sub-populations with different characteristics.

3.15 Expectations of life are projected to continue to improve, with convergence towards the 'forerunner' countries, mortality for which is in turn projected to continue improving on the basis of a modified version of the Lee-Carter model.

Most projections of mortality improvement in recent years, whether by actuaries or demographers, have proved too conservative regarding the extent of future improvement and expectations of life have continued to rise faster than expected.

Along with most national projections, the Eurostat projections assume there will be a slowing down of improvement in the future. To the extent that this proves to be a false assumption, the numbers in the older age groups could turn out to be higher, and perhaps significantly so, than the projections indicate. There has been relatively little change between the EUROPOP2013 projections and the ESSPOP2015 projections, with expectation of life at birth for the whole EU in 2016 increasing by only 0.2 for both males and females. However, the changes have been more significant for some individual countries, for example an increase of about a year for Cyprus and Malta, where a higher degree of variation is typically exhibited due to their smaller population size.

3.16 A few countries have recently seen a moderation in the rate of improvement for several years but it is unclear whether they will experience slower improvement in future or whether the previous relatively rapid rate of improvement will resume. It is important for decision-makers to be aware of the considerable uncertainty that there is with all such long-term projections. The published ESSPOP2015 projections include a lower mortality (high life expectancy) variant as well as the main projection.

3.17 Figure 2 shows projected period expectations of life at age 65 for males for a selection of member states and Figure 3 the same data for females. Although a projection of expectation of life at 65 as high as 28.2 for females in France in 2080 and 24.8 for males seems impressive, there is projected to be a range of expectations of life down to as low as 25.8 for females and 22.7 for males across the different EU member states. It is worth noting that current period expectations of life in Japan are already about a year higher than in France.

3.18 Expectations of life at age 65 are shown for all countries in Annex Table A.3. The projected improvements to 2070 are greatest for those countries with the lowest expectations of life now, resulting in quite a narrowing of the range of results. In 2016 expectations of life at 65 for males ranged from 14.0 in Latvia to 19.5 in France whereas in 2070 they are projected to range from 21.5 in Bulgaria to 24.0 in France. Expectations of life at 65 for females in 2016 ranged from 17.9 in Bulgaria to 23.5 in France whereas in 2070 they are projected to range from 24.7 in Bulgaria to 27.5 in France.

3.19 *These expectations of life are calculated based on the individual age mortality rates in the particular calendar years (known as a period expectation of life). They are a measure of mortality levels in that year but they do not provide an estimate of how long those attaining a particular age are expected to live. Cohort expectation of life, by contrast, includes an estimate of projected mortality improvement in the future years through which that generation will live, with the mortality rates assumed at each age in each future year*

incorporating an allowance for the anticipated reduction in mortality rates from the base year to the year for which an estimate of the mortality rate is required.

Thus for someone aged 65 in year 1, the mortality rates used are those for age 65 in year 1, age 66 in year 2, age 67 in year 3 and so on, with the mortality rate in year 2 having one year's improvement, that for year 3 having two years' improvement and so on. The resulting mortality table for this example is a projection of the likely experience of a cohort of people aged 65 in the base year, following them through the rest of their lifespan. The resulting *cohort expectation of life* represents the average number of years which someone aged 65 in the base year can expect to live, allowing for the projected improvements in mortality over the rest of their lifetime.

FIGURE 2: MALE EXPECTATION OF LIFE AT AGE 65 TO 2080 FOR SELECTED MEMBER STATES

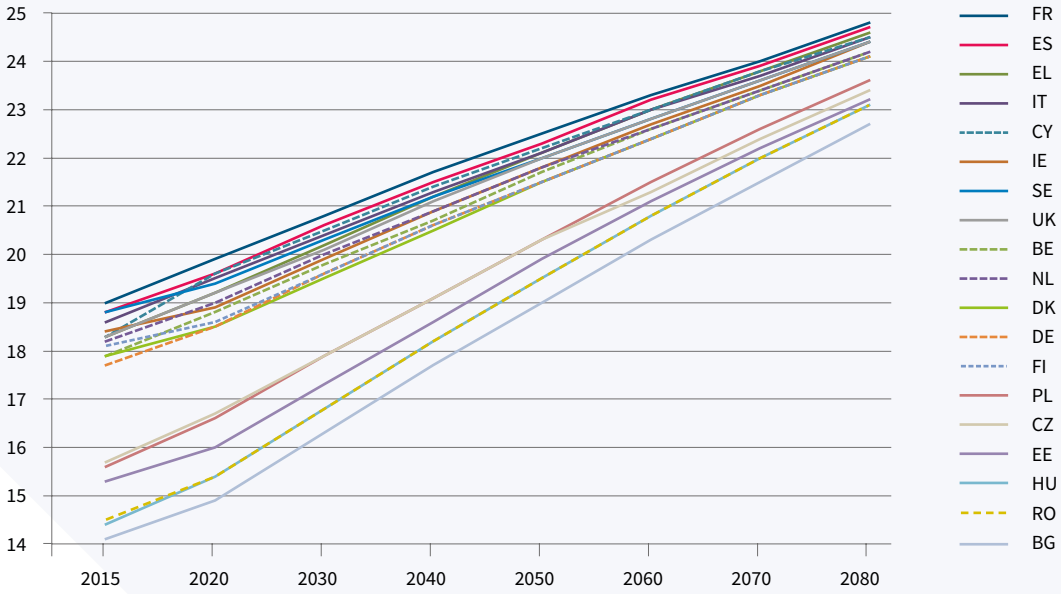
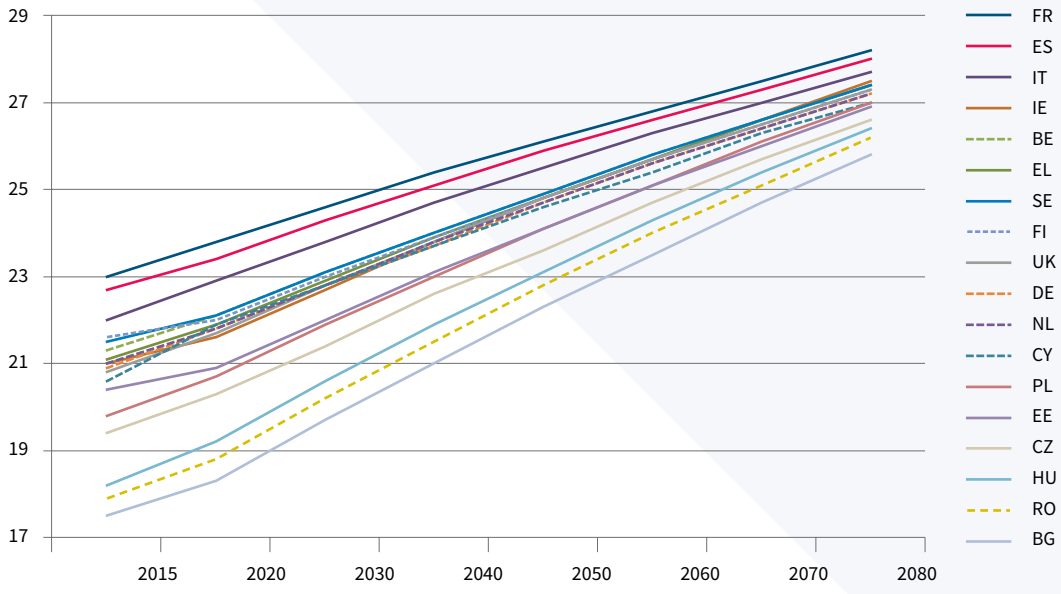


FIGURE 3: FEMALE EXPECTATION OF LIFE AT AGE 65 TO 2080 FOR SELECTED MEMBER STATES



Source: ESSPOP2015, Eurostat

3.20 For a male aged 65 in 2015 the most recent UK national population projections estimate 18.4 as the period expectation and 20.4 as the cohort expectation for those attaining age 65 in 2015. The equivalent figures for females are 20.8 as the period expectation of life and 22.6 as the cohort expectation of life. Cohort and period expectations of life at various ages in 2015 and 2060 (for the UK) are shown in Table 5. It is important to emphasize the considerable uncertainty implicit in cohort expectations for 2060, which take into account projected mortality up to 2110.

TABLE 5: COHORT AND PERIOD EXPECTATIONS OF LIFE FOR 2015 AND 2060 IN THE UK

Age	Males 2015		Males 2060		Females 2015		Females 2060	
	Cohort	Period	Cohort	Period	Cohort	Period	Cohort	Period
60	24.9	22.4	29.9	27.7	27.3	25.0	32.0	29.7
65	20.4	18.4	25.1	23.3	22.6	20.8	27.0	25.1
70	16.1	14.6	20.4	19.1	18.0	16.7	22.1	20.7
75	12.2	11.2	16.1	15.2	13.8	12.9	17.6	16.6
80	8.8	8.2	12.2	11.6	10.0	9.5	13.4	12.7

Source: Principal 2016-based population projections of the United Kingdom

3.21 Cohort expectations at age 65 are not published by Eurostat in the results of the ESSPOP2015 projections, or referred to in the Commission's paper on assumptions and methodology, even though they are more useful for determining the true expectation of life for a group of pensioners. However, projected mortality rates by single year of age are published[11] and we have used these to estimate consistent cohort expectations of life at 65. The results for a selection of member states are shown in Tables 6 and 7 (see also paragraph 5.22 for our recommendation to use cohort instead of period expectations of life in the context of proposals to raise the eligibility age for social security pensions).

11 Up to age 100

TABLE 6: PERIOD AND COHORT EXPECTATIONS LIFE AT 65, MALES, 2015-2045								
	Period expectation of life			Cohort expectation of life				Difference
	2015	2020	2045	2015	2025	2035	2045	2015
Bulgaria	14.1	14.9	18.4	15.6	17.2	18.7	20.1	1.5
Hungary	14.4	15.4	18.9	16.1	17.7	19.2	20.6	1.7
Poland	15.6	16.6	19.7	17.3	18.7	20.1	21.3	1.7
Czech Rep.	15.7	16.7	19.7	17.4	18.8	20.1	21.3	1.7
Germany	17.7	18.5	21.1	19.4	20.5	21.5	22.5	1.7
Belgium	17.9	18.8	21.2	19.6	20.7	21.7	22.7	1.7
Portugal	17.9	18.6	21.1	19.4	20.5	21.5	22.5	1.5
Finland	18.1	18.6	21.1	19.4	20.5	21.5	22.5	1.3
Netherlands	18.2	19.0	21.4	19.9	20.9	21.9	22.8	1.7
Greece	18.3	19.2	21.7	19.9	21.0	22.1	23.0	1.6
Cyprus	18.3	19.6	21.8	20.4	21.5	22.4	23.2	2.1
UK	18.3	19.2	21.6	20.0	21.1	22.0	23.0	1.7
Italy	18.6	19.5	21.7	20.3	21.3	22.3	23.1	1.7
Spain	18.8	19.6	21.9	20.4	21.4	22.4	23.3	1.6
Sweden	18.8	19.4	21.6	20.3	21.2	22.2	23.0	1.5
France	19.0	19.9	22.1	20.6	21.6	22.5	23.4	1.6

Source: AR18 cross-country tables

TABLE 7: PERIOD AND COHORT EXPECTATIONS LIFE AT 65, FEMALES, 2015-2045								
	Period expectation of life			Cohort expectation of life				Difference
	2015	2020	2045	2015	2025	2035	2045	2015
Bulgaria	17.5	18.3	21.7	19.6	21.1	22.5	23.8	2.1
Hungary	18.2	19.2	22.5	20.4	21.9	23.2	24.5	2.2
Poland	19.4	20.3	23.1	21.5	22.8	23.9	25.0	2.1
Czech Rep.	19.8	20.7	23.6	22.1	23.5	24.6	25.4	2.3
Germany	20.6	21.9	24.2	23.1	24.1	25.0	25.9	2.5
Belgium	20.8	21.7	24.3	22.9	24.0	25.0	26.0	2.1
Portugal	20.9	21.8	24.2	22.9	24.0	25.0	25.9	2.0
Netherlands	21.0	21.8	24.3	22.9	24.0	25.0	26.0	1.9
Greece	21.1	21.9	24.4	23.1	24.2	25.1	26.1	2.0
Cyprus	21.3	22.1	24.5	23.2	24.3	25.2	26.1	1.9
UK	21.5	22.1	24.5	23.3	24.3	25.2	26.1	1.8
Finland	21.6	22.0	24.4	23.2	24.2	25.2	26.1	1.4
Italy	21.6	22.2	24.3	23.4	24.4	25.4	26.2	1.8
Spain	22.0	22.9	25.1	24.0	25.0	25.8	26.6	2.0
Sweden	22.7	23.4	25.5	24.6	25.4	26.2	27.0	1.9
France	23.0	23.8	25.8	24.8	25.7	26.4	27.2	1.8

Source: AR18 cross-country tables

3.22 In general member states rank in the same order of increasing expectation of life on both the period and the cohort measures, with cohort expectations of life averaging about 1.7 years higher for males and 2.0 years higher for females.

3.23 A useful measure of the ageing of the population from improving expectation of life (apart from the changing structure arising from low fertility and from migration) is given by the increase in the pension entitlement age which would be necessary to maintain a constant cohort expectation of life after that age for successive cohorts or generations. Table 8 shows the way in which the pension entitlement age would change for the UK (for which the cohort expectations at all ages in all years are readily available) in order to maintain expectations of life at the entitlement age of 22.6 for females and 20.4 for males.

TABLE 8: EVOLUTION OF PENSION ENTITLEMENT AGE FOR THE UK TO MAINTAIN THE COHORT LIFE EXPECTANCY AT THAT AGE (20.4 FOR MALES AND 22.6 FOR FEMALES)

Year	Pension entitlement age for males	Pension entitlement age for females
2015	65.0	65.0
2020	65.6	65.6
2030	66.8	66.6
2040	67.9	67.6
2050	69.0	68.6
2060	70.0	69.5

Source: Own calculations based on Principal 2016-based UK population projections

3.24 This is equivalent to an increase of the pension entitlement age of 1.0 years per decade for females and 1.1 years per decade for males. These estimates are based on the Principal 2016-based population projections for the UK. However, there is considerable uncertainty about future mortality improvement and the UK also publishes High Life Expectancy and Low Life Expectancy projections to give a range around the Principal projections.

POPULATION

3.25 Overall the population of the current member states of the EU is projected to grow from 508 million in 2015 to 529 million in 2050 and then to fall back a little. Leaving out the UK reduces the total population of the EU in 2015 to 444 million, which is projected to rise to 451 million in 2050, falling thereafter to 436 million in 2080. A summary of the projections by member state is given at Annex Table A.4. About half of the member states are expected to grow in overall population size and half to reduce, with three countries (Bulgaria, Latvia and Lithuania) projected to experience a reduction of more than a third by 2080, whereas three countries (Ireland, Luxembourg and Sweden) are projected to grow by more than a third by 2080. The population of the largest seven countries in 2013 and 2060, accounting for about 75% of the total EU population, is projected to change as follows:

TABLE 9: MEMBER STATES WITH THE LARGEST POPULATIONS IN 2015 AND 2080

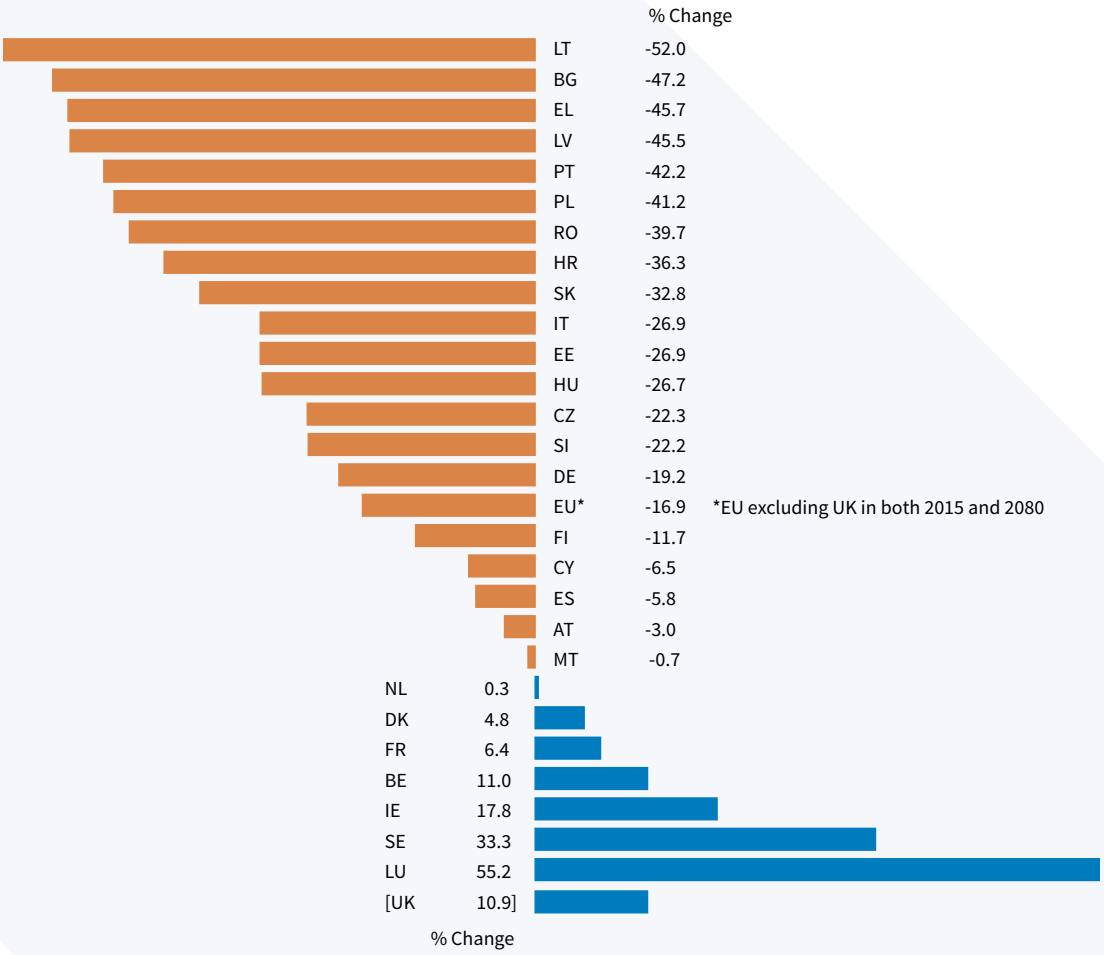
2015 (millions)		2080 (millions)		Increase 2015-2080
Germany	81.2	France	78.7	+18.5%
France	66.4	Germany	77.8	-4.2%
UK	64.9	Italy	53.8	-11.5%
Italy	60.8	Spain	51.0	9.8%
Spain	46.4	Poland	29.0	-23.6%
Poland	38.0	Netherlands	19.7	16.7%
Romania	19.9	Romania	14.5	-26.9%
Total EU	508.4	Total EU	436.4	-14.2%

Source ESSPOP2015, Eurostat

WORKING AGE POPULATION

3.26 The population of the EU between the aged from 15 to 64 is projected to fall by 17% between 2015 and 2080 (excluding the UK). A summary of the projections by member state is given at Annex Table A.6. 20 member states are projected to have a decline in the population aged from 15 to 64 by 2080, 12 of them by more than 25% and 8 by more than 35%. Only 7 member states are projected to have an increase in this age group, which characterises the potential working population, although in practice the younger part of this age group will have a significant proportion still in education and employment rates over age 55 are modest in some countries. Figure 4 shows the projected change in 'working age' population by member state and for the EU as a whole.

FIGURE 4: PROJECTED CHANGE IN POPULATION AGED FROM 15 TO 64, 2015 TO 2080



Source ESSPOP2015, Eurostat

3.27 While such changes are possible, they would represent a major diminution of the size of the potential working population in many countries, which could be expected to provide a significant headwind to economic growth. In practice the projected decline could be offset by increased levels of net inwards migration or by a significant increase in the proportion employed at younger and older ages and, in particular, over the age of 65. Another possibility is that fertility rates may increase in response to declining population, perhaps encouraged by family friendly employment policies, including higher family benefits and better child care arrangements.

YOUNGER POPULATION

3.28 The younger age population (defined as up to the age of 15) is also projected to decline for the EU as a whole (excluding the UK throughout), with a decrease of 3.1% between 2015 and 2080. A summary of the projections by member state is given at Annex Table A.5. 16 member states are projected to have a fall of more than one third in this section of the population and another 4 member states by more than one quarter. Whilst a fall in the younger population may result in cost savings on education, health care and financial support for dependants, the reduction in population at these ages does not bode well for the working population in years beyond the end of these projections.

OLDER POPULATION

3.29 On the other hand, the population aged 65 and over is projected to grow by more than 50% over the period to 2080 for the EU as a whole (excluding the UK), from 84.6 million to 128.1 million. A summary of the projections by member state is given at Annex Table A.7. The older population is projected to increase by more than 90% in 9 member states and by more than 150% in three member states (Ireland, Cyprus and Luxembourg). Clearly this represents a major increase in dependency at older ages, with the situation being exacerbated for old-age dependency ratios[12] by the fall in the working population, as we will see in later paragraphs.

3.30 The rates of growth of the very elderly are significantly higher. For the EU as a whole (excluding the UK) the population aged 80 and over is projected to grow over the period to 2080 by 135%, from 23.8 million to 56.1 million. A summary of the projections by member state is given at Annex Table A.8. The projections show 13 member states with increases of more than 150% and 4 with more than 300% (Ireland, Cyprus, Luxembourg and Malta). The growth in the numbers of the very elderly has important implications for the costs of healthcare and long-term care, for which utilisation rates typically rise quite steeply at ages 80 and above.

3.31 The population aged 90 and over is projected to grow even more dramatically. For the EU as a whole (excluding the UK) the population aged 90 and over is projected to grow over the period to 2080 by 388%, from 3.7 million to 18.0 million. A summary of the projections by member state is given at Annex Table A.9. The projections show 13 member states with increases of more than 500% and 6 with more than 750% (Cyprus, Luxembourg, Slovakia, Malta, Ireland and Poland).

3.32 At present there are relatively few centenarians in the EU, with an estimate of 108,326 in 2015 (excluding the UK). However, this number is projected to rise by 1262% over the 65 years to 2080, by which time the number is projected to be 1.48 million.

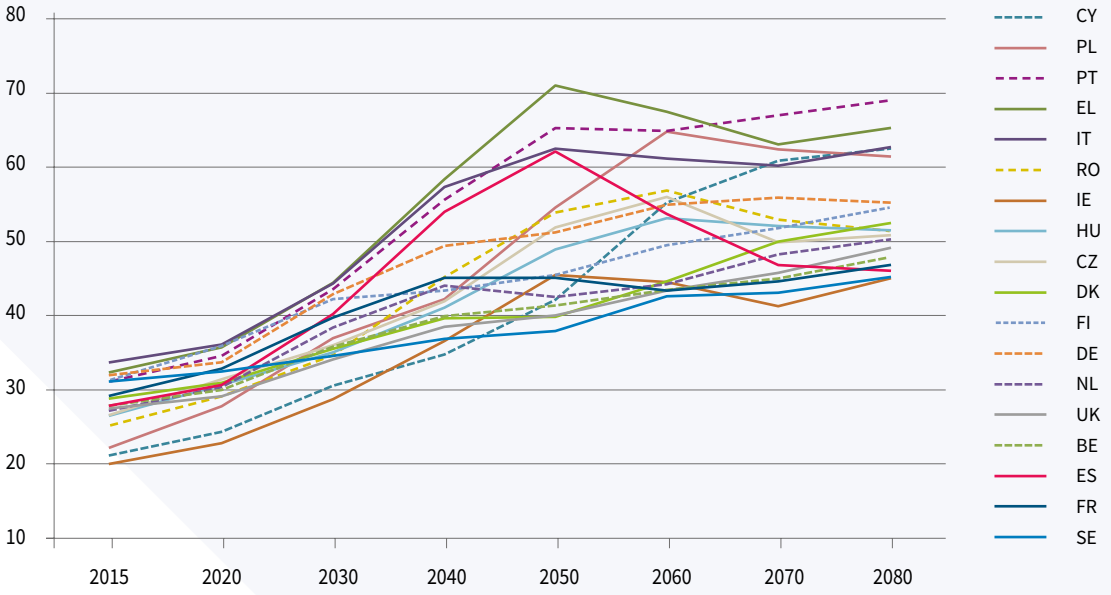
12 The old-age dependency ratio is traditionally taken to be the ratio of the population aged 65 and over divided by the population aged 15 to 64. However, with pension eligibility ages likely to rise, this may be a rather artificial measure (see paragraph 3.35 for a suggested modification of this measure).

A summary of the projections by member state is given at Annex Table A.10. For 5 countries the rise is projected to be more than 3000% (Luxembourg, Czech Republic, Slovakia, Malta and Bulgaria).

OLD-AGE DEPENDENCY RATIOS

3.33 Of more significance perhaps than total population is the shape of the population pyramid and the relationship between numbers in the productive working ages and numbers over retirement age. This can be measured using the old-age dependency ratio. Figure 5 shows the development of this ratio for a selection of member states. The data for all member states is given in Annex Table A.11.

FIGURE 5: RATIO OF PROJECTED POPULATION AGED 65 AND OVER TO PROJECTED POPULATION AGED 15 TO 64 FROM 2015 TO 2080 FOR SELECTED MEMBER STATES



Source: AR18 cross-country tables

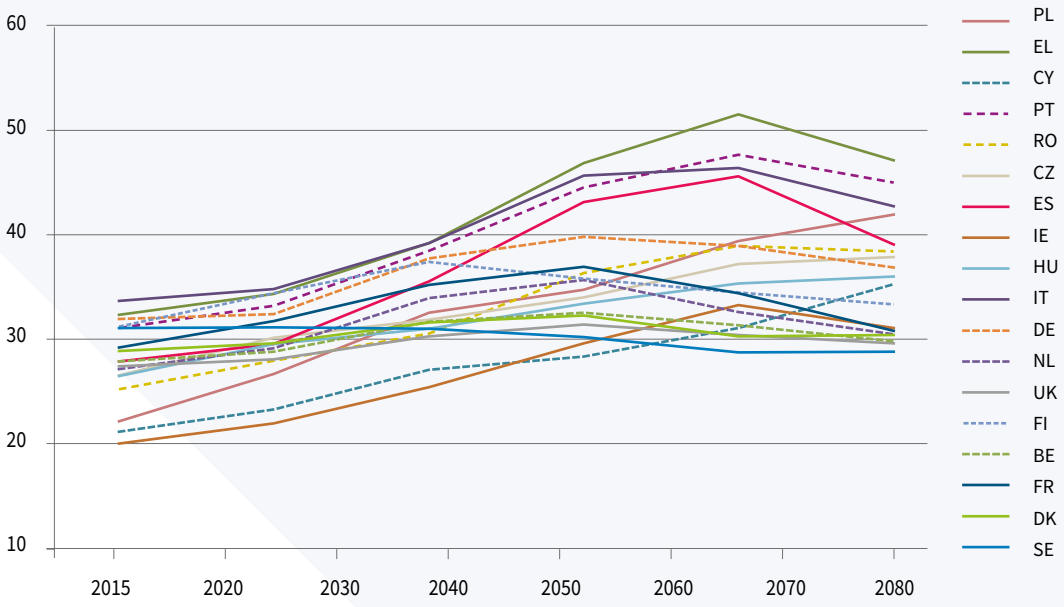
3.34 For the EU as a whole the old-age dependency ratio defined in this way is projected to increase rapidly from 28.8% in 2015 to 50.3% in 2050 and then more slowly to 52.3% in 2080. In other words the population structure will go from roughly three working age people per person over 65 to only two. This phenomenon, which is often described as the ageing of the population, is the combined result of four factors: increased expectation of life over age 65, low fertility leading to slow growth of the population from natural increase, the current age structure of the population (reflecting past peaks and troughs in births and migration) and future net migration, for most countries principally affecting working ages.

3.35 Both the increased expectation of life at older ages and the projected evolution of the size of the work-force point in the direction of needing to increase the eligibility

age for pensions and social security benefits, probably by at least five years over the period to 2060. If we rework the old-age dependency ratios to reflect the ratio of those aged 70 or more to those aged from 15 to 69 in 2060, with a gradual transition from the definition based on age 65 in 2015, the rises illustrated in Figure 6 are much more modest than shown in Figure 5, although still quite significant for some countries. Figures for the evolution of the dependency ratios on this basis are shown for all countries in Annex Table A.12.

3.36 *Some member states would need to increase the eligibility age faster to offset the rising old-age dependency ratio, but then might be able to level off by the 2040s. For others this would not be an adequate policy instrument to offset the decline in working age population. It should be emphasized also that true financial dependency will depend on how many people stay in work to older ages in the light of rising eligibility ages.*

FIGURE 6: RATIO OF PROJECTED POPULATION AGED X AND OVER TO PROJECTED POPULATION AGED 15 TO X FROM 2015 TO 2060, WHERE X INCREASES LINEARLY FROM 65 TO 70 BY 2060



Source: Own calculations based on AR18 cross-country tables

DEMOGRAPHIC PROJECTIONS – SUMMARY

3.37 In this section we have examined some key aspects of the Eurostat population projections which are used as the basis for the projections of future public expenditure in AR18. It is important to remember that these are projections based on a set of plausible assumptions, rather than forecasts. Population projections made by individual member states may differ significantly from these EU-wide projections. In order to be consistent between member states, some of the assumptions are rather formulaic and may not be entirely realistic, as should be the case under ISAP 2 (see paragraph 3.2), for some countries. In practice the future is likely to differ, possibly materially, from the assumptions made. Particularly significant in terms of the conclusions to be drawn would be continuing faster growth in life expectancy at older ages and changing patterns of net migration at working ages. One of the challenges of achieving sustainability of pension costs is to find ways of reducing the impact of uncertainty about future mortality improvement through design features.

The AAE would emphasize the importance of looking at the sensitivity of the projections to key assumptions in order to understand better the resilience of pension systems to a wide range of possible future outcomes.

4. FUTURE COSTS OF PUBLIC PENSIONS

4.1 The pension expenditure projected in AR18 is in respect of public provision for pensions. In most countries this is primarily the costs of contributory social security pension schemes (Pillar 1) and the costs of government employees' pension schemes[13] but it also covers costs of other non-contributory retirement benefits, such as minimum pension guarantees and welfare payments (usually means-tested) to those with no or low entitlements to the contributory social security benefits. Social security may be delivered through a single national scheme, or in some countries through a number of different schemes for different sections of the population, but still coordinated under national legislation and identifiable as public pension expenditure.

4.2 Projected pension costs are gross costs to the public purse, although some limited analysis is provided of offsetting taxation receipts on pension benefits. The methodology largely ignores the contributory nature of many social security schemes, whereby all or most of the future costs will be defrayed by contributions from individuals and from employers. Arguably this is just the vehicle for financing the expenditure and is akin to general taxation revenues which provide the financing for non-contributory social security.

4.3 Relatively brief mention is made[14] of private occupational and personal pensions. In a few countries these play a significant role in total pension expenditure, although this is not public expenditure, except in respect of tax reliefs and schemes for public sector workers. Occupational or workplace pension schemes are found in one form or another in 23 Member States, in nine of which participation is mandatory for at least some employees. Provision of data on occupational schemes was on a voluntary basis for the Ageing Working Group projections and so is incomplete. Expenditure on private pensions was only a significant share of 2016 total pension expenditure for Netherlands (44%), Denmark (30%), Sweden (24%) and Ireland (19%). To these should be added the UK, which has been omitted because it did not supply data to the Commission on private occupational pension schemes. Occupational schemes are expected to become more significant over the projection period, especially for those mandatory individual account arrangements (Pillar 1 bis) introduced in the 1990s and early 2000s to replace part of the Pillar 1 social security.

13 In Member States where a government employee pension scheme is provided as a Pillar 2 provision, in addition to the social security system (Pillar 1) which covers both public and private employees.

14 In section 1.5.2 of AR18.

4.4 The AR18 makes a particular feature of "special pensions" for the first time (Box II.1.2 on page 62 of the AR18). The report is not entirely clear on whether the costs for these are included in the total expenditure but we have assumed that they are. Special pensions include:

- social security for specific groups with entitlement to more advantageous conditions of participation than the main scheme
- special categories of pensioners such as war veterans
- pensions for armed forces and other uniformed services
- pensions for civil servants, members of parliament and the judiciary
- pensions for employees of other public services and publicly owned companies

In all of these, and a few other categories, expenditure on pensions is treated as public expenditure and the costs fall on the public purse. AR18 appears to equate public funding with Pillar 1 status, and in some countries the special pensions are Pillar 1 social security but with special conditions, e.g. for retirement age, accrual rate or benefit calculation. In other countries the pensions for civil and other public servants are more naturally seen as Pillar 2 occupational pension schemes and bear no relation to, and may be in addition to, Pillar 1 social security benefits. Nevertheless, since the costs of such schemes fall to the public purse, it is entirely appropriate that they should be included in the pension cost projections.[15]

4.5 Although having some similar characteristics to special pensions, disability and survivor pensions have not been treated as special pensions. Some limited information on the stand-alone costs of special pensions is provided in Graphs 2 and 3 on page 64 of AR18[16]. Although little information is provided, it seems that special pensions are undergoing their own programme of reform to reduce their generosity, with some countries aiming to get rid of special pensions entirely.

4.6 The social security and pension systems of the EU Member States are very diverse. Although there are many differences of detail, they may be categorised broadly into four groups, with a few countries having a combination:

(1) FLAT-RATE PENSIONS

[Denmark[17], Ireland (partly), Greece (partly), Malta (partly), Netherlands (partly), United Kingdom (partly)]

The amount of pension payable under these schemes does not depend on an individual's

15 In Volume 1 of AR18, where details are given of schemes covered in each Member State, it is stated that UK occupational pension schemes for public services are not considered part of the UK social security system and are not covered in the pension cost projections, whereas the equivalent arrangements in Ireland are covered. However, section 1.8 of Volume 2 mentions that UK public service pension schemes are not covered in the sensitivity scenarios, so by implication they are covered in the base projections. The 2018 Financial Stability Report from the UK's Office of Budget Responsibility provides a break-down of pension costs between social security and public service pensions, with 6.1% of GDP for the former and 2.0% for the latter in 2016-17. AR18 gives a figure of 7.7% of GDP, which, although lower than the UK official figures, may reflect exclusion of some benefits, and is certainly closer to the combined figure for social security and public service pensions than just the former.

16 Also in Tables II.AII.5 and II.AII.6 on page 179 of AR18.

17 We classify the Danish basic pension as flat-rate, although AR18 does not.

earnings but the full pension is a defined monetary amount. Entitlement may be based on an individual's contribution record, or may depend on length of residence in the country, and in some cases may be subject to a test of income and/or wealth from other sources.

(2) NOTIONAL DEFINED CONTRIBUTIONS

[Greece (partly), Italy, Latvia, Norway, Poland, Sweden]

Although conceptually similar to private funded defined contribution schemes, Notional (or Non-invested) Defined Contribution (NDC) does not involve the investment of funds, except as a buffer of working capital. Rights to benefit are built up as an accumulation in a personal account of contributions paid by the member and employer, with revaluation up to retirement age in line with an index. At retirement the accumulated individual account is converted to pension, with an annuity value appropriate to the age of retirement and taking into account the latest estimate of future longevity. NDC schemes operate on a pay-as-you-go basis with income from contributions (and any investment income) being used to pay pensions. Since both the calculation of contributions and the derivation of benefits are fixed, income and expenditure on a pay-as-you-go basis can only be kept aligned if there is some adjustment mechanism. In the Swedish NDC scheme, implemented in 1994, this is achieved by an "actuarial accounting" – a special form of balance sheet – and an Automatic Balancing Mechanism (see section 5)

(3) POINTS SYSTEM

[Croatia, Cyprus, France (partly), Germany, Lithuania, Romania, Slovakia]

Having some similarity to NDC, schemes based on a points system credit the individual member with points on the basis of pensionable salary for a period or contributions made. Points may be revalued, and in some cases supplementary points awarded, or some points may be deemed not to count. At retirement age points are converted into pension benefits by means of the value of a point at that time and for that age of retirement.

(4) DEFINED BENEFIT

[Austria, Belgium, Bulgaria, Czech Republic, Estonia, Finland, France (partly), Ireland (partly), Greece (partly), Hungary, Luxembourg, Malta (partly), Netherlands (partly), Portugal, Slovenia, Spain, United Kingdom (partly)]

With a variety of different formulae these schemes define the pension benefit payable from the normal retirement age as a function of salary and service. Salary may be anything from salary in the final year of work to an average over the whole career. Where averaged over a lengthy period, the salary in earlier years will often be subject to revaluation in line with an inflation index.

4.7 In all cases amounts of pensions in payment are usually increased year on year, either in line with general price levels or average earnings or some combination. The amount of flat-rate pension payable is similarly subject to regular review and indexation.

4.8 Defined benefit systems are generally characterised as Bismarckian and aim to replace income earned during a working career with a fairly high level of replacement income after retirement age. However, levels of generosity vary (and have changed over time), so there may still be a need for additional pension provision through complementary pension schemes in some countries. These are generally the responsibility of employers.

4.9 Flat-rate benefit systems are sometimes characterised as the Beveridge approach, after the man who designed the flat-rat benefit pension system for the UK which started in 1948. They are intended only to provide a safety net of income to cover basic subsistence needs, on the assumption that replacement of income would be achieved through occupational (and more recently personal) pension schemes.

4.10 The points system has been around as an alternative to DB for some time, particularly in France, and generally has a similar overall objective of a reasonable level of income replacement, whilst basing the benefit on the whole career.

4.11 NDC schemes began to be introduced in 1994 (in Sweden and Italy) to replace former traditional DB schemes. The aim was to tie the benefit more closely to the contributions made by (and on behalf of) the individual member, to incentivise later retirement and to make pensions systems "fairer" by reducing cross-subsidies and perverse incentive effects on the labour market.

4.12 Although the main demographic and economic assumptions for the cost projections are specified by the Commission[18], the actual process of projecting pension costs is left to member states, using their own models. This may introduce some heterogeneity, with different approaches being used. To improve comparability and quality the Ageing Working Group and the Commission carried out five peer review meetings in September to December 2017 to appraise the results country by country.

4.13 Notwithstanding the caveats, the overall projections of pension costs show a more sustainable future than earlier such reports. For the EU as a whole, pension costs are projected to rise from 11.2% of GDP in 2016 to 12.0% in 2040 and then falling to 11.0% in 2070. This relatively stable overall picture disguises some more significant increases and decreases in individual countries, as shown in Table 10, taken from Table II.1.8 of AR18. The largest increases over the period to 2040 are seen in Slovenia (3.2%), Italy (3.1%), Luxembourg (2.5%), Belgium (2.4%), Germany (1.9%), Spain (1.8%) and Ireland (1.7%). Some of these countries will continue to see rising costs in the following 30 years, with the exception of Italy and Spain, which would expect to see the results of reforms coming through to produce an overall reduction over the 2016 to 2070 period. Increases in projected costs over the whole period to 2070 are highest for Luxembourg (8.9%), Slovenia (3.9%), Malta (2.9%), Belgium (2.9%), Czech Republic (2.8%), Germany (2.4%) and Cyprus (2.3%). The largest reductions are to be seen in Greece (–6.6%), Croatia (–3.8%), France (–3.3%), Latvia (–2.6%), Portugal (–2.2%), Denmark (–1.9%), Estonia (–1.8%) and Italy (–1.7%).

18 AR18: Underlying Assumptions and Projection Methodologies, Institutional Paper 065, published in November 2017.

TABLE 10 : PUBLIC PENSIONS, GROSS AS % OF GDP, 2016-2070						
Country	2016	2040	2070	Ch 16-40	Ch 40-70	Ch 16-70
BE	12.1	14.5	15.0	2.4	0.5	2.9
BG	9.6	9.8	10.9	0.2	1.1	1.4
CZ	8.2	9.2	10.9	1.0	1.8	2.8
DK	10.0	8.2	8.1	-1.8	-0.1	-1.9
DE	10.1	12.0	12.5	1.9	0.5	2.4
EE	8.1	7.1	6.4	-1.0	-0.8	-1.8
IE	5.0	6.7	6.6	1.7	-0.1	1.6
EL	17.3	12.9	10.6	-4.4	-2.2	-6.6
ES	12.2	13.9	10.7	1.8	-3.3	-1.5
FR	15.0	15.1	11.8	0.0	-3.3	-3.3
HR	10.6	8.3	6.8	-2.2	-1.5	-3.8
IT	15.6	18.7	13.9	3.1	-4.8	-1.7
CY	10.2	11.5	12.4	1.3	0.9	2.3
LV	7.4	6.3	4.7	-1.1	-1.5	-2.6
LT	6.9	7.0	5.2	0.2	-1.8	-1.7
LU	9.0	11.5	17.9	2.5	6.4	8.9
HU	9.7	9.4	11.2	-0.3	1.8	1.5
MT	8.0	7.3	10.9	-0.7	3.5	2.9
NL	7.3	8.5	7.9	1.2	-0.7	0.6
AT	13.8	14.9	14.3	1.1	-0.5	0.5
PL	11.2	10.8	10.2	-0.3	-0.7	-1.0
PT	13.5	14.7	11.4	1.2	-3.4	-2.2
RO	8.0	7.7	8.7	-0.3	1.0	0.7
SI	10.9	14.2	14.9	3.2	0.7	3.9
SK	8.6	7.8	9.8	-0.8	2.0	1.2
FI	13.4	13.9	13.9	0.5	0.0	0.6
SE	8.2	6.8	7.0	-1.3	0.2	-1.2
UK	7.7	8.6	9.5	0.9	0.8	1.7
NO	10.7	11.9	12.8	1.2	0.9	2.1
EU*	11.2	12.0	11.0	0.8	-1.0	-0.2
EU27	11.9	12.7	11.4	0.9	-1.4	-0.5

Source AR18

4.14 AR18 provides a breakdown of the changes over the projection period into six components:

- **dependency ratio effect**, which measures changes in the ratio of those aged 65 and over to those aged 15 to 64
- coverage ratio effect, which measures the total number of pensions relative to the population aged 65 and over
- **benefit ratio effect**, which measures how the average spending per pensioner develops relative to the average wage
- **employment rate effect**, which measures the ratio of the population aged 20 to 64 to the number of working people aged 20 to 64

- **labour intensity effect**, which measures the working population aged 20 to 64 to the hours worked by the population in the same age group
- **career prolongation effect**, which measures the hours worked by the population aged 20 to 64 to the hours worked by the population aged 20 to 74

4.15 Table 11 shows the breakdown for each country and for the EU as a whole, taking the three last factors mentioned in the paragraph above as an aggregate labour market effect. The interaction effect is a balancing item.

TABLE 11: BREAKDOWN OF CHANGE IN GROSS PUBLIC EXPENDITURE: % OF GDP, 2016-2070

Country	2016 level	Dependency ratio contribution	Coverage ratio contribution	Benefit ratio contribution	Labour market effect contribution	Interaction effect	2070 level
BE	12.1	6.6	-1.9	-0.7	-0.9	-0.2	15.0
BG	9.6	6.0	-3.0	-1.1	-0.2	-0.4	10.9
CZ	8.2	5.4	-1.9	-0.5	0.0	-0.3	10.9
DK	10.0	4.6	-3.9	-1.6	-0.8	-0.2	8.1
DE	10.1	6.6	-1.3	-2.4	-0.3	-0.3	12.5
EE	8.1	4.6	-3.0	-3.0	0.2	-0.7	6.4
IE	5.0	4.2	-0.9	-1.4	-0.1	-0.2	6.6
EL	17.3	9.1	-1.9	-8.3	-4.9	-0.7	10.6
ES	12.2	7.6	-0.4	-4.9	-2.8	-0.9	10.7
FR	15.0	6.2	-2.9	-4.8	-1.4	-0.3	11.8
HR	10.6	6.3	-3.3	-4.9	-1.5	-0.4	6.8
IT	15.6	10.3	-4.5	-4.0	-2.8	-0.7	13.9
CY	10.2	11.6	-2.4	-4.1	-2.1	-0.8	12.4
LV	7.4	4.4	-1.4	-4.7	-0.5	-0.5	4.7
LT	6.9	5.0	-1.8	-4.0	-0.3	-0.6	5.2
LU	9.0	10.4	-0.8	-0.6	-0.1	-0.2	17.9
HU	9.7	6.4	-1.8	-1.6	-1.1	-0.3	11.2
MT	8.0	5.7	0.6	-2.3	-1.0	-0.2	10.9
NL	7.3	4.2	-2.7	0.0	-0.8	-0.2	7.9
AT	13.8	10.1	-3.3	-4.6	-1.1	-0.5	14.3
PL	11.2	11.7	-3.0	-8.1	-0.4	-1.2	10.2
PT	13.5	10.9	-3.3	-7.1	-1.9	-0.8	11.4
RO	8.0	5.6	-1.7	-2.6	-0.1	-0.5	8.7
SI	10.9	7.5	-2.1	-0.3	-0.7	-0.5	14.9
SK	8.6	8.8	-4.1	-1.5	-1.2	-0.8	9.8
FI	13.4	6.6	-2.5	-2.0	-1.3	-0.2	13.9
SE	8.2	2.4	0.6	-4.0	-0.1	-0.1	7.0
UK	7.7	3.1	-1.1	0.0	-0.3	-0.1	9.5
NO	10.7	7.6	-0.9	-3.9	-0.3	-0.3	12.8
EU*	11.2	6.5	-2.1	-3.3	-1.0	-0.3	11.0
EU27	11.9	6.7	-2.1	-3.7	-1.1	-0.4	11.4

Source AR18

4.16 The most important contributions are from the first three, with the dependency ratio effect showing increases in all countries, ranging up to 9.1% in Greece and more than 10% in Austria, Cyprus, Italy, Luxembourg, Poland and Portugal, offset by reductions in almost all countries in the coverage ratio and the benefit ratio. Arguably the coverage ratio and the dependency ratio should be considered together, as the use of a fixed notional retirement age of 65 to allocate between them is somewhat artificial when retirement ages are being increased in many countries (see paragraph 3.35).

4.17 The labour market effect makes a modest contribution to reducing pension costs, except for Greece (–4.9% of GDP), Italy and Spain (–2.8%) and Cyprus (–2.1%).

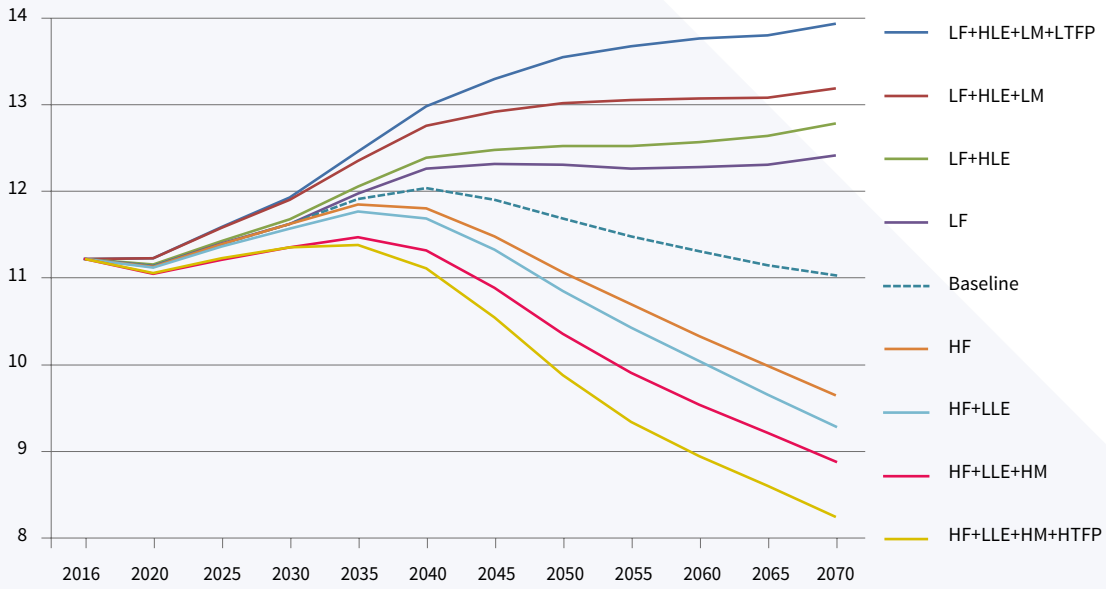
4.18 The most interesting component is the benefit ratio, which offers an, albeit crude, measure of how the improved financial sustainability position has been achieved by reducing the effective level of public pension benefits. The benefit ratio is projected to fall by 8.3% of GDP in Greece, 8.1% in Poland, 7.1% in Portugal and between 4% and 5% in Austria, Croatia, Cyprus, France, Italy, Latvia, Lithuania, Spain and Sweden. Only the Netherlands and United Kingdom have no benefit ratio change effect.

4.19 *It is important to understand that the pension cost projections are not forecasts. They are the result of applying agreed assumptions to the models. In view of the uncertainty it is desirable to consider a range of different sets of projection assumptions.*

AR18 does provide details of a number of alternative scenarios. The pension cost scenarios in this year's study look relatively benign overall, especially after 2040, with a few country exceptions which appear more challenging. However, a combination of more adverse demographic and economic assumptions could significantly worsen the outlook and make further reforms a necessity in a number of countries. In some cases the benign projections are heavily dependent on the success of reforms in balancing a rising effective retirement age and labour market activity and productivity. High levels of inflation and more adverse demographics (low birth rate, higher expectation of life, lower outwards migration) would also make the situation more challenging.

4.20 Figure 7 shows the overall effect of a number of variant assumption scenarios on the projected total pension costs for the EU. The first variant shown either side of the baseline is with high and low fertility assumptions (higher fertility reduces the costs). The next variant up or down adds low and high life expectancy to the high and low fertility (lower life expectancy reduces the costs). Then low and high migration are added (lower migration increases the costs). Finally low and high Total Factor Productivity growths are added (lower TFP growth increases the costs). As can be seen the variant fertility assumptions (20% lower or higher than the baseline) have the strongest impact. Alternative assumptions for Total Factor Productivity growth (0.4 pp lower or higher) is the next most significant variant assumption. However, the combined impact of several adverse changes to the assumptions gives a very different picture to the baseline projection.

FIGURE 7: VARIANT PROJECTIONS OF TOTAL PENSION COSTS FOR THE EU, % OF GDP, 2016-2070



Key:

LF	Low fertility	HF	High fertility
LLE	Low life expectancy	HLE	High life expectancy
LM	Low migration	HM	High migration
LTFP	Low Total Factor Productivity	HTFP	High Total Factor Productivity

Source: AR18 cross-country tables

4.21 *Uncertainty concerning the projected costs is even greater at the level of individual Member States, particularly over a period as long as 50 or more years. This does not mean that the exercise is not worthwhile. On the contrary, such long-term projections are essential for policy-making. However, in view of the uncertainty about the future outcome, projections should be regularly updated and policies should be designed as far as possible to be robust to changes in the expected future outturn.*

5. PENSION REFORM MEASURES AND LONG-TERM SUSTAINABILITY OF PUBLIC PENSIONS

5.1 As part of the conclusions of the Ageing Report 2015 - AR15 the Member States (MS) agreed that "further steps still need to be taken by Member States, though to varying degrees, to raise the effective retirement age, including by avoiding early exit from the labour market and by linking the retirement age or pension benefits to life expectancy".[19] This was notwithstanding the fact that AR15 forecast a slight decrease in pension expenditure for the EU as a whole from 2016 to 2060 as a result of already implemented reforms. In several countries crisis management in the aftermath of the global financial crash involved interventions by Central Banks and Governments aimed at stimulating investment and consumption-driven recovery and leading to different pension reform strategies. In a period when banks reduced lending for investment, consumption-driven growth was offered as an alternative. Improving adequacy of benefits to a wide section of society at risk of poverty was part of the solution in some MS. The pension reforms described in AR15 were motivated by the financial and subsequent economic crises and aimed to improve sustainability, in some cases compromising the adequacy objectives of the pension systems, and also limiting consumption of a significant part of the society. However, these austerity measures were not only objected to by the population but also challenged by some economists. PAR18 deals with the period of recovery from the financial and economic crisis, allowing a different direction of reform provisions.

5.2 *These elements influenced the pension reforms during the period 2015 to 2017, which are considered in PAR18, resulting in even more diverse solutions than before. The trend of taking into account increasing life expectancy continued. But in this period not only raising the required service period and retirement age were used, but incentives to work longer – such as bonus-malus schemes and flexible retirement programmes, which need employer support – became equally prevalent. More new measures were taken to reduce poverty and maintain adequacy in the form of minimum guarantees and more favourable indexation rules. Temporary contingency measures were withdrawn. Compared to the post-crisis period, there were some reversals of pensionable age rules, measures of (re)-introduction of schemes for special occupational categories and combining work and pensions may target multiple, and sometimes more general, social and economic objectives.*

5.3 Most MS implemented only parametric reforms: changing pensionable age, qualifying conditions (service period) and indexation rules. Pensionable age and qualifying conditions fall in the category of rebalancing the equilibrium between the active and retired period; indexation rules became more favourable to pensioners.

19 http://www.consilium.europa.eu/en/press/press-releases/2015/05/12/ecofin-ageing-populations/.

5.4 Table 12 below is slightly adapted from Table 8 of PAR18, combining three columns for reforms relating to pensionable age, including a separate column for minimum guarantee reforms (separated from other) and including a column for the number of measures taken.

5.5 The (normal) retirement age was raised in Belgium, Bulgaria, Greece, Finland, the Netherlands and the UK (six MS), and other age-related measures were implemented in three MS. More stringent service period requirements were put in place in Belgium, Bulgaria, Czech Republic, France, Lithuania, Malta, Spain and the UK (eight MS). These measures were used together in seven MS, although not always in the same direction. The Czech Republic and Poland relaxed the pensionable age, which might result lower pensions especially in the Polish NDC case. Austria, Belgium, Latvia and Malta also introduced protective measures for workers with long service period (early retirement, credits).

5.6 Five MS (Bulgaria, Czech Republic, Finland, Greece and Portugal) linked the increase of retirement age to increase in life expectancy. For example, Finland formulated a smooth transition, changing the parameter 1 to 2 months a year from 2030.[20] Other MS also postponed the introduction of this measure, although some have not defined the details.

Table 12: Pension reforms adopted in Member States, 1 July 2014 to 1 July 2017

Country	Contributions	Benefits in payment	Indexation rules	Taxation of benefits	Special categories	Early retirement	Eligibility conditions*	Qualifying period	Combining work and pension	Pensionable age	Supplementary pensions	Minimum guarantee	Other	No. of Measures*
Austria						X			X					2
Belgium		X				X	X	X	X	X	X			7
Bulgaria	X	X			X	X		X	X	X				7
Croatia	X		X		X									3
Cyprus														0
Czech Rep.			X					X		X	X			4
Denmark											X			1
Estonia											X		X	2
Finland	X	X	X		X	X	X	X	X	X		X	X	11
France	X	X	X		X		X	X	X		X	X	X	10
Germany	X					X			X		X	X		5
Greece	X	X	X			X	X	X	X	X		X	X	10
Hungary	X													1
Ireland		X									X		X	3
Italy	X	X	X	X	X	X		X			X			8
Latvia			X	X	X								X	4
Lithuania		X	X					X						3
Luxembourg														0
Malta				X		X		X			X		X	5
Netherlands										X	X			2
Poland								X		X				2
Portugal		X	X	X		X	X			X				6
Romania	X			X	X	X			X					5
Slovakia			X				X					X	X	4
Slovenia									X		X			2
Spain		X					X						X	3
UK		X						X		X	X			4

** other than pensionable age and qualifying period*

Source: PAR2018, Commission services

20 The life expectancy will increase by 5.1/4.8 (m/f) in the 2016-2070 period in Finland (MS Country fiche).

5.7 Another option to prolong working life is to facilitate deferred retirement. Austria, Croatia, Denmark, Finland and France introduced such incentive or bonus measures. For example, Austria will halve contributions for 3 years if a person chooses to work beyond pensionable age and Croatia since 2014 encourages later retirement with an additional accrual of 0.15% for each additional month worked, up to a maximum of five years.

5.8 Also along the line of maintaining the sustainability of pension systems, several MS have implemented measures reducing the early retirement options. The main instruments were raising the early (minimum) retirement age and/or cutting back early retirement schemes or introducing penalties for early retirement (malus schemes).
MS including Austria, Belgium, Bulgaria, Denmark, Finland, Greece, Luxembourg and Portugal. Austria and Luxembourg are phasing out their early retirement schemes.
Finland and Germany transforming them into flexible retirement (see above).
Some countries (Austria, Belgium, Bulgaria, Denmark) are changing disability and unemployment systems to stop them being used as early retirement schemes. These measures usually include changing the definition of ability to work and requiring control examinations. Finland changed the unemployment rules for flexible retirement. Germany, Italy and Romania opened up early retirement for specific groups of workers in hazardous jobs.

5.9 These tendencies underline a more differentiated approach to maintaining the sustainability of the pension system during the post-crisis phase than before. In the case of Austria, Finland, Germany and Slovenia these measures together form a flexible retirement system, where reduced working hours/part time work is supplemented by reduced/part-pension benefit, the first decreasing and the latter increasing until full retirement.

5.10 Basic and minimum pension rules were changed in Greece, Austria, Belgium, Bulgaria, Cyprus, Ireland, Malta, Poland, Romania, Slovakia and Slovenia. Targeted additional benefits aimed to improve low benefits by ad-hoc increases in the Czech Republic, Estonia, Italy and Sweden. Changing old age benefit taxation (raising the non-taxable minima) had a similar effect in Latvia, Malta and Romania.

5.11 Indexation amendments were made to improve the real value of pensions in Bulgaria, Cyprus, Czech Republic, Latvia, Lithuania, Portugal, Romania and Slovenia.

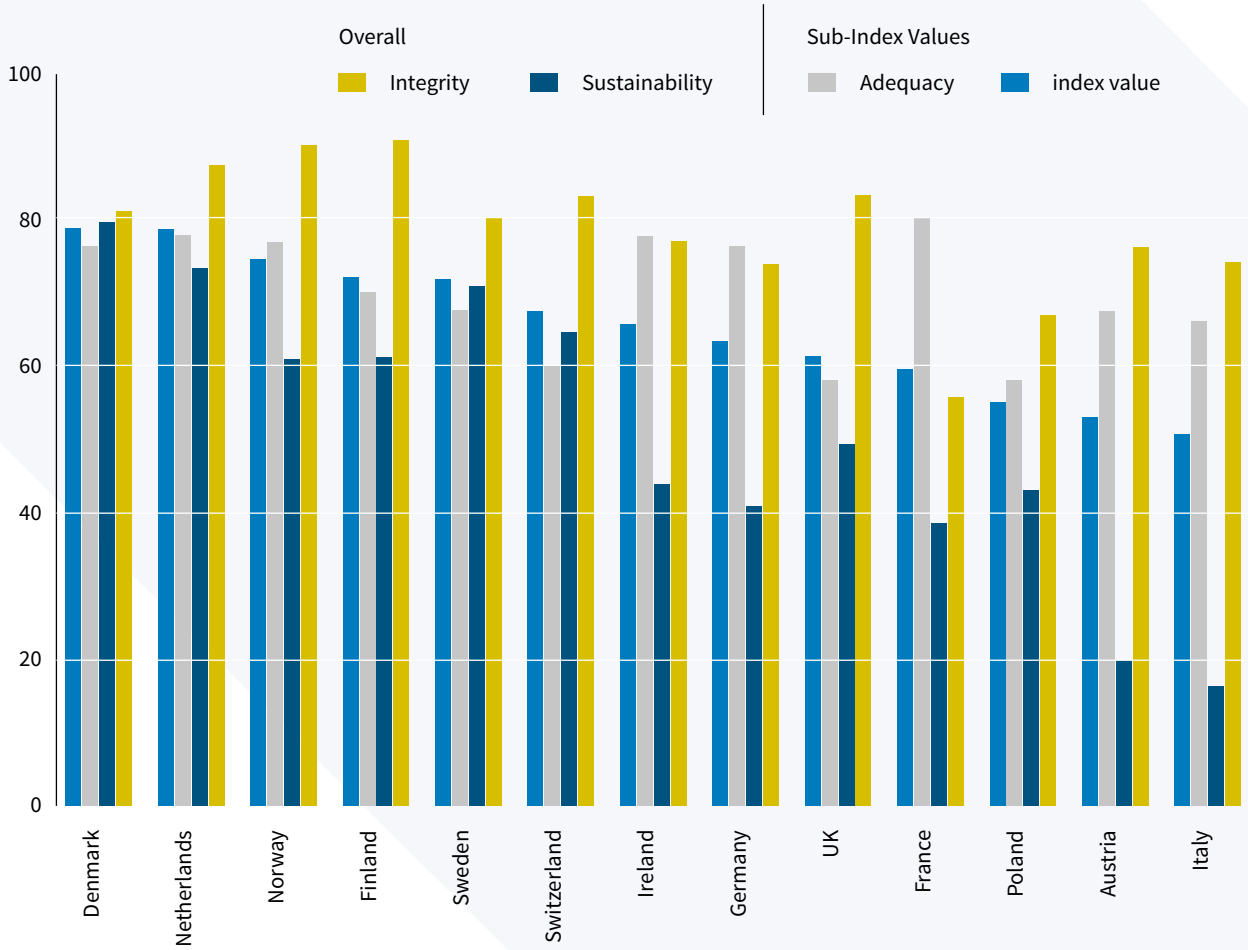
5.12 The plethora of continuing reforms suggests that most MS have not reached a point of being comfortable with financial sustainability and corresponding adequacy in the pensions system.
AR18 itself does not define what would constitute sustainability, although it may be implicit that it is not sustainable to have an ever increasing share of national income required to pay pensions.

5.13 Other organisations publish sustainability indices for different countries, based on a combination of different criteria. One of the best-known of these is the Melbourne Mercer Global Pension Index, with the 2017 version being published in June 2018 (see Figure 7). This includes 13 European countries, including Norway and Switzerland, and

ranks countries for sustainability based on a combination of ratings for adequacy (it represents the benefits that are currently being provided together with some important system design features), sustainability (it has a focus on the future and measures various indicators which will influence the likelihood that the current system will be able to continue to provide these benefits) and integrity (it considers several items that influence the overall governance and operations of the system which affects the level of confidence that the citizens of each country have in their system).

FIGURE 7: MELBOURNE MERCER GLOBAL PENSION INDEX 2017

Each index value represents a score between zero and 100



5.14 Another publication providing sustainability rankings is the Allianz Pension Sustainability Index, which covers 54 countries worldwide, including all 28 EU Member States, Norway and Switzerland. The overall ranking is derived from a combination of three "sub-indicators": demographics, public finances and pension system:

- demographics – measured by the old-age dependency ratio defined as the number of people aged 65 and over as a share of those aged 15 to 64, taking into account both the current ratio and that projected for 2050 under the UN World Population Prospects 2015 projections.

- public finances – measured as a combination of a) pension expenditure as a percentage of GDP, including the changes expected by 2050, and b) general government debt as a percentage of GDP.
- pension system – this is a combination of replacement rates (including future expected change) and an assessment of the importance of the funded pension system.

The table below shows the EU countries plus Norway and Switzerland (the rankings are from their full global analysis of 54 countries).

TABLE 13: ALLIANZ PENSION SUSTAINABILITY INDEX, 2016

	Total		Demographics		Public finances		Pension system	
Country	Score out of 10	Ranking	Score	Ranking	Score	Ranking	Score	Ranking
Denmark	7.93	2	7.4	18	7.3	22	8.53	2
Sweden	7.81	3	7.8	15	7.4	20	8.05	3
Netherlands	7.75	4	6.8	29	7.1	25	8.60	1
Norway	7.59	5	8.0	11	6.6	31	7.90	4
Latvia	7.41	7	7.4	20	8.1	12	7.10	16
Estonia	7.28	8	7.0	28	8.2	8	6.95	20
UK	7.20	11	7.4	19	6.4	36	7.50	9
Switzerland	7.11	13	6.8	30	6.5	34	7.60	8
Lithuania	6.94	16	8.0	12	7.4	21	6.20	35
Finland	6.93	17	7.0	25	5.6	44	7.60	7
Luxembourg	6.85	18	8.0	10	6.7	27	6.35	31
Czech Rep	6.70	20	6.4	38	6.6	33	6.90	21
Germany	6.49	25	6.0	41	5.7	42	7.15	14
Poland	6.48	26	5.8	42	6.4	37	6.90	22
Austria	6.45	28	6.6	33	5.2	47	7.00	19
Belgium	6.43	29	7.0	24	4.3	51	7.25	11
Bulgaria	6.43	30	6.6	35	6.6	32	6.30	33
Romania	6.43	31	6.4	39	6.7	28	6.35	32
Hungary	6.30	34	7.2	21	5.7	43	6.15	37
France	6.28	35	7.0	26	4.9	48	6.60	27
Slovakia	6.28	36	6.6	36	7.0	26	5.75	39
Ireland	6.24	37	6.6	34	5.4	46	6.50	30
Croatia	6.13	41	6.2	40	6.1	38	6.15	36
Portugal	6.09	42	5.0	49	3.9	52	7.75	6
Cyprus	5.89	44	7.0	27	5.8	41	5.40	40
Spain	5.83	45	4.6	51	5.5	45	6.60	28
Malta	5.76	47	6.4	37	6.0	39	5.35	42
Italy	5.68	49	4.8	50	3.7	53	7.10	15
Greece	5.49	51	5.0	48	3.3	54	6.85	23
Slovenia	5.46	52	5.2	46	4.7	49	6.00	38

5.15 It is noteworthy that the same countries come high in this list as in the Mercer analysis, although, apart from Denmark heading both lists, the next few countries are not in the same order in both lists and there are some surprises among the countries ranked quite highly by Allianz. The overall ranking is a weighted average of the sub-indicators and the ranking according to these components is quite variable. There is some correlation between the ranking for the pension system and the overall ranking, in particular the fact that the top four countries have reasonably robust second pillar pension systems.

5.16 *From an actuarial perspective we would regard the following as important for achieving a sustainable pension system:*

- *pension costs should be a relatively affordable percentage of GDP and not growing significantly over the long term*
- *resilience to ageing of the population, through some form of sustainability factor or automatic adjustment mechanism at retirement age to offset increasing length of life*
- *significant element of protection for those on low incomes through minimum guarantees in the public pension system*
- *robust funded second and third pillar pension arrangements*
- *regular actuarial reviews of long-term financial outcomes of the first pillar sound public finances more generally*

5.17 In recent years a lot of attention has been paid to automatic adjustment mechanisms. The idea originally formed part of the Swedish Notional Defined Contribution reform in 1994, where it provided a means of adjusting accrued benefit rights arising from accumulating the contributions in order to align with the flow of contribution income under a pay-as-you-go system. More recently there have been a number of different initiatives which can be seen as broadly offering automatic adjustment methods. Table 14 is taken from Table II.1.2 of AR18.

TABLE 14: AUTOMATIC BALANCING MECHANISMS, SUSTAINABILITY FACTORS AND LINKS TO LIFE EXPECTANCY IN PENSION SYSTEMS

Country	Automatic balancing mechanism	Sustainability factor (benefit link to life expectancy)	Retirement age linked to life expectancy
Italy		X	X
Latvia		X	
Poland		X	
Sweden	X	X	
France*		X	
Germany	X		
Finland		X	X
Portugal**		X	X
Greece***			X
Denmark****			X
Netherlands			X
Cyprus			X
Slovak Republic			X
Spain	X	X	
Lithuania	X		
Malta*****			X
Norway		X	
(UK)			(X)

In all the NDC system the benefit is linked to life Expectancy through the annuity factor.
**Pension benefits evolve in line with life expectancy, through the coefficient of 'proratisation'; it has been legislated until 2035 and not thereafter.*
*** Only two thirds of the increase in life expectancy is reflected in the retirement age.*
**** An automatic balancing mechanism is applied in auxiliary pension system.*
*****Subject to parliamentary decision.*
****** Subject to parliamentary decision. A stable proportion between the contribution periods and life expectancy at retirement is to be kept (the Government is obliged to lay on the Table of the House of Representatives, within intervals not exceeding the period of 5 years, a report giving recommendations with a view of keeping a stable proportion between the contribution periods and life expectancy at retirement).*

Source: Commission services, Economic Policy Committee.

5.18 NDC systems automatically incorporate adjustment of benefits for life expectancy as they accumulate contributions to retirement age and then convert the accumulated capital sum to a pension using a then current annuity factor. This can also act as an incentive for later retirement, as there would then be a longer period of accumulation and

a smaller annuity factor, both contributing to a larger amount of pension. As mentioned above, the Swedish NDC system also has another automatic balancing mechanism through the actuarial accounting balance sheet.

5.19 Germany has a rather different sort of automatic balancing mechanism which involves adjusting all pensions in payment each year to offset the change in the old-age dependency ratio.

5.20 Finland has introduced a life expectancy coefficient, which is based on the ratio of the capital value of pensions for those reaching 62 in 2009 to the capital value of pensions for those reaching 62 in each subsequent year of potential retirement. The capital values are based on a five year average of historical period mortality rates. This directly adjusts the pension benefits coming into payment for improving life expectancy, offsetting the cost of the longer period for which benefits can be expected to be paid. A somewhat similar adjustment is now to be made in Spain.

5.21 A number of countries have implemented increases in retirement age. This counts as an automatic balancing mechanism if the increase in retirement age is intended to be an automatic response to changes in life expectancy. Various formulae have been adopted; either to maintain the expectation of life at retirement age or to maintain a relationship between the expectation of time spent in retirement and the expectation of time spend in the working life. However, not all of these are totally automatic, as the final decision to increase the retirement age is often reserved for the Parliament.

The advantage of having an automatic process is that it reduces the scope for political interference which would undermine the maintenance of a sustainable system, although the counter-argument is that issues such as rising retirement age involve complex interactions and cannot be reduced to a formulaic approach.

5.22 It is not altogether clear how some countries are using expectation of life to propose adjustments to the age of eligibility for pension or retirement.
From an actuarial perspective we recommend that the focus should generally be on cohort expectations of life, as discussed in paragraph 3.19, since this reflects more accurately a best estimate of how long individuals in that cohort are expected to live, even though it does involve making assumptions about future changes in mortality rates.

6. ADEQUACY OF PENSIONS

6.1 *Management of pension systems designed for people in standard employment involves consideration of both adequacy and financial sustainability. The need to pay attention to adequacy of the benefits is crucially important given the current social outlook in terms of poverty prevention, income replacement and equality.*

6.2 The PAR18 analyses the adequacy of current and future pensions; i.e. how the income of men and women could be maintained for the duration of their retirement and how old-age poverty could be prevented.

6.3 What constitutes an adequate pension depends on what needs it is expected to cover, which is likely, in addition to the consumption of goods and services, to include essential care. A given pension level may be adequate in a country that provides tax-financed publicly-provided services and goods (such as subsidized access to care for the elderly), but inadequate in other countries where the elderly need to finance this themselves. The PAR18 introduced three inter-related aspects to measure adequacy: a) poverty protection b) income maintenance and c) pension duration.

6.4 Income Maintenance is measured using replacement rates particularly at retirement. In specific the report is using a simple average approach, the benefit ratio of the active and retired population and the aggregate replacement ratio (ARR) of the retirees. ARR is the ratio of the median individual gross pension income of people aged 65-74 to the median individual gross earnings of people aged 50 – 59.

For a deeper analysis the Report is introducing the so called Theoretical Replacement Rates (TRR) methodology, capturing individual career patterns by the time of the Report and forty years after. TRR is the ratio of the retiree's pension income in the first year after retirement to his/her earnings immediately before retirement.

6.5 Poverty protection is measured by At-Risk-Of-Poverty (AROP), using equalised household income, which in fact includes other measurable income beside pensions. Consideration of social exclusion has been introduced to facilitate better understanding of the multi-dimensional character and effects of poverty in both its economic and non-economic aspects.

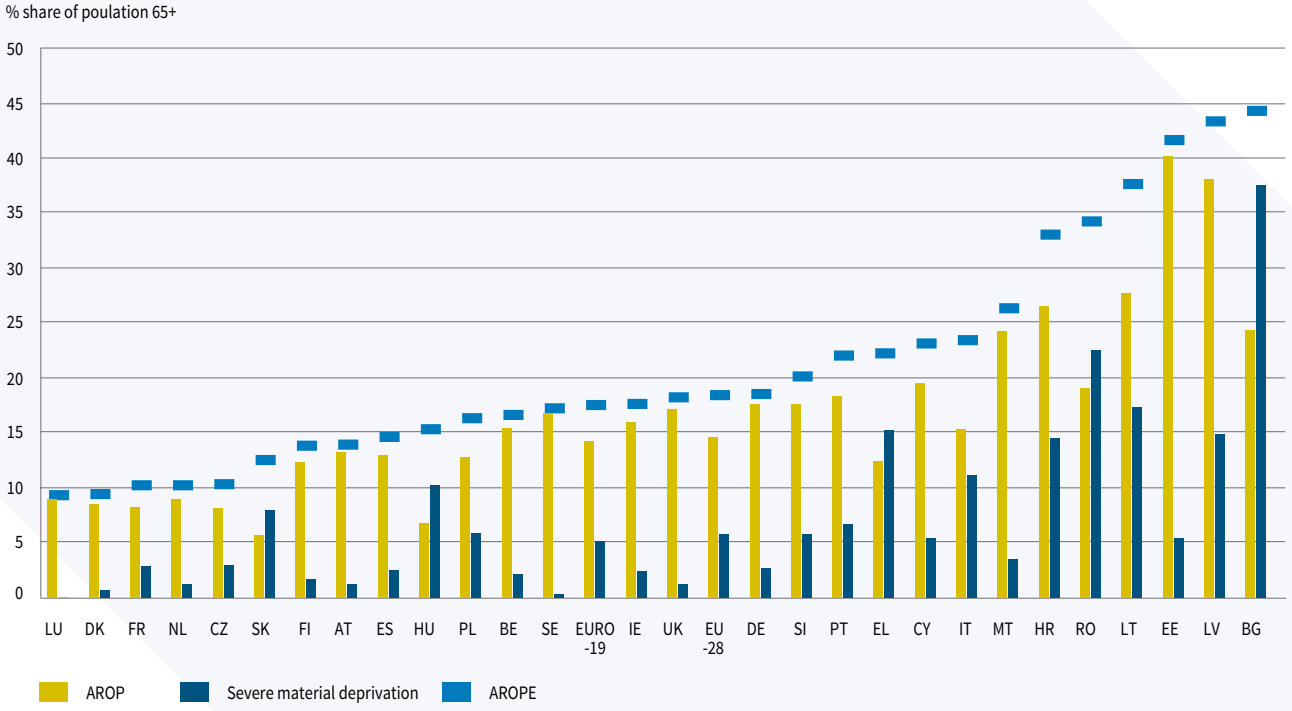
6.6 The Risks of Poverty and Social Exclusion (AROPE) among older people are very diverse across the Member States. In 2016, AROPE averaged 18.2 percent across the EU, but ranged from around 9 percent in Luxembourg and Denmark to almost 46 percent in Bulgaria. Almost every second older person in Bulgaria, and more than 30 percent in Latvia, Estonia, Lithuania, Romania and Croatia, is affected by poverty or social exclusion in old age (Figure 9 / the latest figures included in PAR18).

6.7 In the PAR18 the AROPE rate decreased in 16 Member States, with a fall of more than 10 percentage points in Bulgaria. At the same time, it has increased in 12 Member

States since 2013, with the highest increase in the Baltic States (Estonia, Latvia and Lithuania) and Malta – due, among other reasons, to limited redistribution and the lower effectiveness of social safety nets.

6.8 Poverty risks are related to income decline and to changes in the household size. The AROP rate is closely linked to the household type. Single older people have generally much higher poverty rates than older couples.

FIGURE 9: AT RISK OF POVERTY AND SEVERE MATERIAL DEPRIVATION IN OLD AGE (65+), 2016, %



	LU	DK	FR	NL	CZ	SK	FI	AT	ES	HU	PL	BE	SE	EURO-19	IE	UK	EU-28	DE	SI	PT	EL	CY	IT	MT	HR	RO	LT	EE	LV	BG
AROP	9	8,5	8,2	9	8,1	5,7	12,3	13,2	13	6,8	12,8	15,4	16,8	14,2	16	17,1	14,6	17,6	17,6	18,3	12,4	19,5	15,3	24,2	26,5	19,1	27,7	40,2	38,1	24,3
severe material deprivation	0	0,7	2,9	1,2	3	8	1,7	1,2	2,5	10,2	5,9	2,1	0,3	5,1	2,4	1,2	5,8	2,7	5,8	6,7	15,2	5,4	11,1	3,5	14,5	22,5	17,3	5,4	14,9	37,5
AROPE	9,1	9,2	10	10	10,1	12,3	13,6	13,7	14,4	15,1	16,1	16,4	17	17,3	17,4	18	18,2	18,3	19,9	21,8	22	22,9	23,2	26,1	32,8	34	37,4	41,4	43,1	45,9

Source: Eurostat. Notes: cut-off point: 60% of median equalized income after social transfers. Sorted by the AROPE rate. AROP refers to the income year 2015; severe material deprivation refers to the survey year 2016

6.9 Women are at higher risk of poverty or social exclusion. In 2016, the AROPE rate for women ranged from around 10 percent in the Netherlands and Denmark to over 50 percent in Bulgaria, and over 40 percent in the Baltic States. The highest gender differences in the AROPE rate are observed in Estonia, followed by Lithuania, Bulgaria and Latvia.

6.10 Women continue to be relatively over-represented among the recipients of minimum benefits, despite the fact that the share of minimum income recipients among women has decreased more rapidly in recent years.

Unpaid care work constitutes the main barrier to women's participation in labour markets and is a key determinant of the lower quality of their employment relative to men's. It is likely that no substantive progress will be made in achieving gender equality in the labour force until inequalities in unpaid care work are tackled; this will require the effective recognition, reduction and redistribution of unpaid care work between women and men, as well as between families and the State.

6.11 Since 2008, the share of non-standard workers (temporary and part-time workers) in total employment has increased substantially in most countries. Over the same period, the share of the self-employed has decreased slightly, though the ranks of the 'own-account' self-employed have swelled significantly in many countries. Moreover, even if data are scarce, 'dependent self-employed' numbers have also risen significantly. Crucially, in 2015 the poverty risk rate for non-standard workers and the self-employed is considerably higher than for standard workers. The poverty risk rate for the self-employed is an alarming three times higher than that of salaried workers in the EU-28. The 'relative poverty position index' which compares the self-employed to salaried workers, shows that for the EU-28 as a whole, the poverty risk rate of the self-employed is an alarming three times higher.

6.12 In the future, further reforms that increase career-length requirements may push more retirees with short careers onto minimum benefits, such as social pensions.

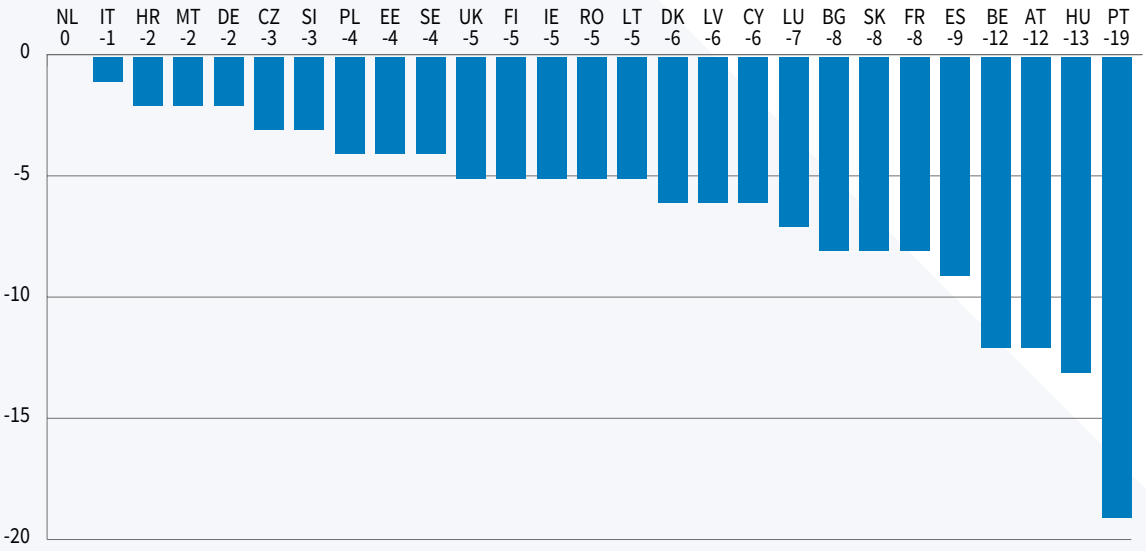
In principle everyone who, for any reason, couldn't manage for a long and adequately paid career job throughout his/her working life, then as pensioners he/she will be at a higher risk of entering poverty.

6.13 The high degree of differentiation between employment statuses remains a difficult challenge for national social security systems. It fuels a permanent tension between employment and self-employment.

Adequate social benefits (pension, unemployment benefits) should be available to all employed and self-employed. Attention should be paid on the non-average different profiles of the individuals.

6.14 Because of the financial crisis, in order to consolidate public finances, many Member States reduced real pension benefits through changes in the indexation mechanisms for benefit payments. To assess the impact of changes in indexation rules of future pension adequacy in the 2015 pension Adequacy Report - PAR15, prospective replacement rates were calculated at the point in time ten years after retirement. The coming up results showed that the relative value of pensions is set to decrease over time in all Member States. Three years later, on the basis of AR18 assumptions regarding wage evolution and inflation used for the calculation of prospective Theoretical Replacement Rates (TRRs), it remains the same picture (Figure below). Older retirees suffer from (relative) pension erosion after retiring. Current indexation mechanisms are, to some extent, responsible for lower pension adequacy among older pensioners.

FIGURE 10: NET TRR, BASE-CASE PERSON, 10 YEARS AFTER (2066), P.P. DIFFERENCE FROM BASE CASE



Source: OECD and Member States' projections. Notes: countries are ordered by TRR 10 years after retirement. EL no data

6.15 The theoretical replacement rates though in some circumstances - where the actual contributory service, pensionable age, etc, are taken into account - vary significantly from the actual ones. For example in the occupational pensions in the Netherlands, the last 10 years barely no indexation is given to members while for the next 10 years indexation will probably be scarce. So the "zero difference" for the Netherlands is merely impossible.

6.16 *Raising pension awareness is important; however it is very difficult to rise. So other ways must be sought as for example providing people with fitting default pension products or helping them with a good choice architecture in order to help people not to end up in poverty. As life expectancy improves, pension income for a career of a similar number of years will become relatively lower.*

6.17 Uncertainties surround many aspects of the future, including the outcomes of pension reforms, development of career and other demographic patterns, economic growth, and employment prospects, and hence the projections under discussion.

6.18 Future adequacy is highly dependent on the ability of people to work sufficiently long to match the planned increase in pensionable age. Early retirement is penalized although the penalty appears generally less than actuarially neutrals. Actuarially fair incentives should be considered in order to ensure that working longer and delaying pension take up will be rewarded. This penalty though pushes the employees to postpone their retirement date. On that basis we could say that pension systems discourage early retirement.

6.19 Having started working early or late does not matter much in terms of the pension eventually earned, so long as people work up to Standard Pensionable Age (SPA). To analyse the pension impact of early/late starts two cases were considered for people

who started working in 2014 and 2018, and retire at the SPA in 2056. In Spain, it makes no difference if someone starts their career 2 years earlier than the base case. At the opposite end, in Bulgaria the difference is 4 percentage points.

6.20 Linking the pensionable age to increase in life expectancy has become widely used as a result of the ageing of society, applied by extending the active period (Greece, Portugal), maintaining constant the ratio of 1/3 to 2/3 between the retired and the active period (France) or a combination of these (Finland).

6.21 According to both Reports, AR18 and PAR18, while examining reforms in the period between 2016 and 2018, a main impact from sustainability perspective was the labour participation rates of workers close to and after retirement.

Working longer entails longer exposure to labour market risks. Incentives thus should be given to employers as well. Otherwise this risk for the older employees would be higher than that in the earlier stages of their career.

6.22 After a period of reforms driven by sustainability during the financial crisis several Member States are moving towards adequacy improvements. Several countries have used the leverage of indexation to improve the real values of pensions, while others, aiming to protect low -income pensioners, have introduced basic pensions, raised / improved minimum and/or basic pensions and/or targeted additional benefits.

6.23 *In the future, further reforms that increase career-length requirements may push more retirees with short careers onto minimum benefits, such as social pensions.*

6.24 The capacity of pension systems to secure adequate living standards increasingly depends on the educational level as well as on the extent of access to health care, social services and long-term care. Education level and health status are a key determinant of employment in late adulthood.

CONCLUSIONS ON ADEQUACY

6.25 Soon after the crisis, the number of reform initiatives declined and more attention has been paid towards adequacy, the benefit side of pensions.

6.26 Emphasis is given to adjusting the pension duration with regard to life expectancy since it affects significantly the income replacement and the poverty prevention capacity of pension systems. Working life duration must be seen in relation to retirement duration for intergenerational fairness in the context of rising life expectancies.

6.27 The long periods of exclusion of women from the labour market in order to perform unpaid caring roles is clearly reflected in low pensions and poverty in later life; this injustice requires urgent attention.

6.28 *The AAE points out that the issues highlighted in paragraph 5.2.1 of PAR18 about ensuring adequate coverage and access to pensions for all, need increased attention.*

6.29 *The AAE endorses the final remark of the Conclusions of PAR18 that joint efforts at the EU level need to be pursued to face together the constantly evolving pension policies, demographic situation and labour market.*

6.30 *The AAE strongly endorses Principle 15 of European Pillar of Social Rights which states that "Everyone in old age has the right to resources that ensure living in dignity."*

7. MEASURING SOCIAL SECURITY LIABILITIES FOR NATIONAL ACCOUNTS

7.1 In addition to the publication of the AR18, this year has seen the publication for the first time of disclosures in national accounts of the pension entitlements of households or pension liabilities of contributory social security pension schemes. National Accounts are drawn up under the European System of National and Regional Accounts (ESA 2010), which is based on the UN recommended System of National Accounts (SNA 2008). The EU called for pension liabilities to be shown in a Supplementary Table 29 on an accrued-to-date benefit basis and not in the core national accounts. Member States transmitted the Supplementary Table 29 pension data to Eurostat by 31 December 2017. These results have already been published at a national level by the great majority of Member States and it is expected that Eurostat will publish a summary of the results for the whole EU before the end of 2018 once all member states have published their own results.

7.2 The liabilities disclosed in Supplementary Table 29 represent the present value of future pension payments in respect of the liabilities accrued up to the reporting date. In Supplementary Table 29 no credit is taken for the value of future contributions, which represents the largest asset of social security pension schemes, or indeed of benefits expected to accrue in future. The approach is that of a 'closed fund', similar to accounting requirements for occupational pension schemes in company accounts. However, just as the accrued liability for pensions in a corporate pension scheme has to be accompanied by an actuarial valuation of the assets and liabilities and an assessment of the required future contribution rate, *the Supplementary Table 29 disclosure is of limited value on its own in the context of assessing the financial status of the pension scheme, since it does not provide any information about its financial sustainability.*

Indeed it is questionable what the information does represent and whether it has any value, even in accounting terms, when similar values of accrued liabilities are not calculated for other areas of public spending, nor do these disclosures provide information about the capability of governments to meet their pension liabilities. It does, however, provide a statistical tool for economic analysis of households' pension wealth.

7.3 *The statistical cross-country comparability of the results is also questionable.* For example, non-contributory pension schemes are not included in the Supplementary Table 29 disclosures and there are numerous differences between different Member States in how they have addressed particular issues such as guaranteed minimum pensions, non-employment credits for benefit, treatment of the accrual rate where not uniform and whether allowance is made for future salary increases on accrued liabilities or not (PBO approach as compared to an ABO approach).

There are thought to be significant inconsistencies between methodological approaches used by different Member States. Also, because of the limitations of what is being measured, there will be significant differences between Member States arising from the nature of their public pension systems.

7.4 *For the purposes of assessing the financial sustainability of public pension systems, we strongly recommend using the 'open group' approach based on which the cash-flow projections exercise of AR18 is undertaken. This 'open group' approach, which takes into account all the liabilities, including those still accruing and those in respect of future joiners, as well as all assets, including the future contributions from current and future participants of the pension scheme, is much more appropriate for examining the financial viability of a social security system operated largely on a pay-as-you-go basis and is equally applicable to all the different types of social security system in the EU. The accrued-to-date approach adopted by Eurostat for the Supplementary Table 29 disclosures is based on the concept of the position on winding up at the date of the accounts. Whilst this is meaningful in relation to workplace pensions provided by employers, it does not have any obvious validity in relation to national social security schemes.*

7.5 The size of the accrued-to-date social security pension liabilities disclosed in Supplementary Table 29 is very large for the great majority of Member States. In fact, as is illustrated in a recent paper in the International Social Security Review[21], the size of those liabilities as at 31 December, 2015, as disclosed by Member States for the first time in December 2017, varied between 130% of GDP in Ireland and 380% of GDP in Belgium[22].

As mentioned above: *a Member State with a higher pension liability as a percentage of GDP does not necessarily have a less financially sustainable social security pension scheme.*

7.6 *If these numbers are disclosed without sufficient and proper explanation, they could be misused or misinterpreted by the media and other users, creating an unjustified negative perception of social security systems.*

In order to minimise the risk of potential misuse of Supplementary Table 29 pension liability figures, it is important in our view to create a solid framework for effective communication and interpretation of the figures. The key objective of such a framework should be to provide all stakeholders with accurate, relevant and comprehensive information on the financial status of a social security pension scheme that enables informed decisions to be made.

7.7 The Social Security Subcommittee is working on a project, led by the Task Force on Projections and Methodology, to examine in detail the impact on the Supplementary Table 29 disclosure of different forms of social security pension schemes in the EU. We will also be liaising closely with Eurostat on providing technical input on how the methodological and communication aspects of Supplementary Table 29 disclosures could be enhanced.

21 Stavrakis (2018) Reporting the pension obligations of social security schemes: An EU perspective. International Social Security Review 71, 3/2018, 105-123.

22 In respect of 23 Member States which had published their Table 29 results at a national level at the time when the ISSR paper was written.

8. HEALTH CARE COSTS

8.1 After pension costs, health care represents the next largest proportion of age-related public expenditure, at 6.8% of GDP for the EU as a whole in 2016, compared to 11.2% of GDP for pensions. However, whereas pension costs are now projected to fall in many countries by 2070, and reduce slightly for the EU as a whole, health care costs are projected to increase in all Member States (MS). This is perhaps not surprising, given the continued ageing of the population and, in particular, the growth of the very old population (80 and over) noted in paragraphs 3.30 to 3.32. However, projecting health care costs is not straightforward, since the costs depend not just on numbers in the population but on utilisation of health services, the changing nature of health service provision and the costs of delivering those services.

8.2 Table 15 shows the projected growth of health care spending for each MS up to 2070 on the so-called "AWG reference scenario", as well as on the "AWG risk scenario" and the "TFP risk scenario"; where AWG stands for Ageing Working Group and TFR is Total Factor Productivity (see paragraph 8.7 for an explanation of these terms). Some MS are showing significantly higher growth of health care spending over the projection period than the 0.9% of GDP for the EU as a whole, and the AWG risk scenario in many cases would double the increases.

8.3 Utilisation of health services will depend on the health status of the elderly population. Will living longer mean more years of healthy life or longer periods requiring health care? Demand for health care also changes as expectations grow of what might be available. Incentive structures in health care systems (and in some systems supply of health care professionals) also play an important role in driving demand. Improvements in technology and in available drugs and therapies may also increase demand.

Costs of delivery can be expected to rise with inflation but, given the high specialist labour content of costs, earnings rather than prices inflation may be dominant and insufficient supply of skilled labour may result in earnings in the health sector growing faster than elsewhere in the economy.

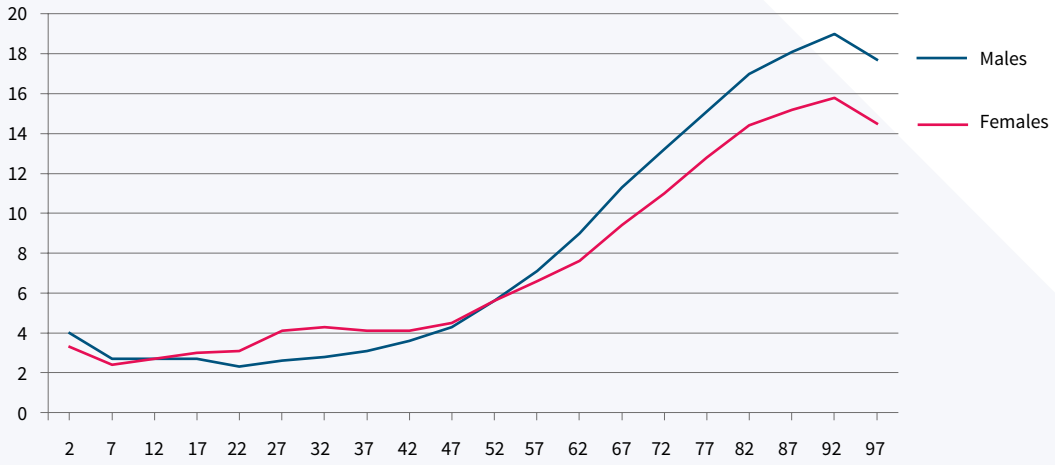
Technological and therapeutic developments, whilst having some potential for improved productivity, tend overall to result in inflation of prices in health care significantly greater than general retail price inflation.

TABLE 15: HEALTH CARE SPENDING AS % OF GDP						
	AWG reference scenario				AWG risk scenario	TFP risk scenario
Country	Ch 16-70	2016	2040	2070	2070	2070
MT	2.7	5.6	7.3	8.3	9.9	8.2
PT	2.4	5.9	7.5	8.3	9.2	8.2
UK	1.4	7.9	8.8	9.4	10.3	9.3
AT	1.3	7.0	7.7	8.3	9.1	8.2
NO	1.2	7.7	8.4	8.9	9.8	8.8
SK	1.2	5.6	6.6	6.8	8.1	6.7
EL	1.2	5.0	5.9	6.2	6.9	6.1
LU	1.2	3.9	4.4	5.1	5.6	5.0
CZ	1.1	5.4	6.2	6.5	7.3	6.4
SI	1.0	5.6	6.7	6.7	7.6	6.6
DK	1.0	6.9	7.4	7.9	8.7	7.8
IE	1.0	4.1	4.9	5.1	5.8	5.2
RO	0.9	4.3	5.1	5.2	6.4	5.1
HU	0.8	4.9	5.6	5.7	6.7	5.7
PL	0.8	4.3	4.8	5.2	6.0	5.1
NL	0.8	6.2	6.9	7.0	7.6	7.0
FI	0.8	6.1	6.6	6.9	7.5	6.8
SE	0.7	6.9	7.4	7.7	8.5	7.6
DE	0.7	7.4	8.0	8.1	8.9	8.1
HR	0.7	5.2	5.7	5.9	6.7	5.9
IT	0.7	6.3	6.9	7.0	7.5	7.0
LV	0.6	3.7	4.4	4.3	5.5	4.3
ES	0.5	5.9	6.7	6.4	7.1	6.4
FR	0.5	7.9	8.4	8.3	9.1	8.3
LT	0.4	4.1	4.6	4.5	5.3	4.4
BE	0.4	5.9	6.2	6.3	6.9	6.3
CY	0.4	2.8	3.0	3.2	3.4	3.2
BG	0.3	5.0	5.5	5.2	6.3	5.2
EE	0.3	5.3	5.4	5.6	6.4	5.5
EU*	0.9	6.8	7.4	7.7	8.4	7.6
EA	0.7	6.8	7.4	7.4	8.1	7.4
EU27	0.7	6.6	7.2	7.3	8.0	7.3

Source AR18

8.4 Spending on health per capita rises steeply from about age 50 and upwards, reaching a peak at about age 95 which is 5 to 6 times as high as between ages 5 and 50. Figure 11 shows this for the EU as a whole. Graphs II.2.1 in AR18 show age-related expenditure for individual countries, which show more variation and volatility but the same general picture for most.

FIGURE 11: AGE-RELATED EXPENDITURE PROFILES OF HEALTH CARE PROVISION (PER CAPITA SPENDING AS % OF GDP PER CAPITA, EU28)



Source AR18

8.5 A simplistic approach to projecting health care spending might be to apply current age-related expenditure profiles to the projected population in future years. However, this would imply that healthy life expenditure remains frozen at current levels and that future gains in life expectancy are subject to increasing demand for health services. This is a possibility but there is an extensive literature discussing how future health care costs may develop, with little consensus on which approach is the most appropriate.

8.6 Apart from the difficulty of knowing how to model the incidence of health care spending by age and gender, there is an extensive discussion on how those costs are likely to increase in future, how the increases will relate to future increases in general prices and economy wide average earnings, and whether technological developments will result in greater productivity or just higher prices.

8.7 AR18 develops health care cost projections on 12 different approaches.

(1) The **"demographic scenario"**, in which age-related public health care spending per capita remains constant in real terms.

(2) The **"high life expectancy scenario"**, which is similar to the "demographic scenario" but allows for greater longevity (life expectancy at birth two years higher).

(3) The **"healthy ageing scenario"** assumes that all future gains in life expectancy are spent in good health, in other words that the age-related health expenditure profile shifts to higher ages as life expectancy improves.

(4) The **"death-related costs scenario"** assumes that a large share of health expenditure comes in the years just before death.

(5) The **"income elasticity scenario"** considers higher growth of public spending on health, with an income elasticity of demand falling from 1.1 in the base year to 1.0 in 2070, with age-related spending otherwise remaining constant in real terms as in the "demographic scenario".

(6) The **"EU28 cost convergency scenario"** assumes that the country-specific age-gender per capita public expenditure profiles as a share of GDP per capita which are below the average EU profiles in 2016 increase up to the EU average by 2070.

(7) The **"labour intensity scenario"** attempts to project health care expenditure under the assumption that unit costs are driven by changes in labour productivity rather than growth in the national income.

(8) The **"sector-specific composite indexation scenario"** seeks to capture differing trends in expenditure on hospital care, pharmaceuticals and therapeutic appliances, preventive health care, governance, administration and capital investment.

(9) The **"non-demographic determinants scenario"** attempts to estimate the impact of non-demographic drivers of health care expenditure such as technology, income and institutional settings. It is similar to the "income elasticity scenario" but with an initial elasticity of demand of 1.4.

(10) The **"AWG reference scenario"** takes age-related expenditure profiles mid-way between the "demographic scenario" and the "healthy ageing scenario", together with elasticity of demand as in the "income elasticity scenario".

(11) The **"AWG risk scenario"** takes age-related expenditure profiles mid-way between the "demographic scenario" and the "healthy ageing scenario", together with the higher elasticity of demand in the "non-demographic determinants scenario".

(12) The **"Total Factor Productivity risk scenario"** is similar to the "AWG reference scenario" but with lower Total Factor Productivity growth.

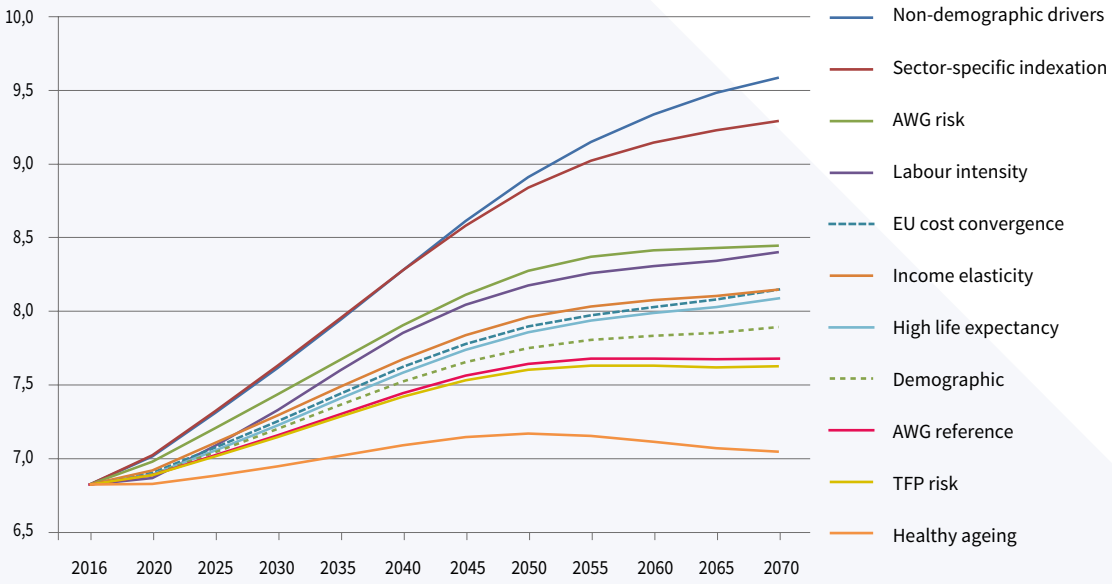
TABLE 16 : INCREASE IN PUBLIC EXPENDITURE ON HEALTH CARE COSTS OVER 2016 TO 2070, AS % OF GDP

	AWG reference scenario	AWG risk scenario	Demographic scenario	High life expectancy scenario	Healthy ageing scenario	Death-related costs scenario	Income elasticity scenario	EU28 cost convergence scenario	Labour intensity scenario	Sector-specific composite indexation scenario	Non-demograph determinan scenario
BE	0.4	0.9	0.8	1.0	-0.2	0.6	1.0	1.0	1.3	2.4	2.1
BG	0.3	1.3	0.4	0.4	-0.4	0.4	0.7	2.1	1.2	1.5	2.4
CZ	1.1	1.9	1.4	1.6	0.4	1.0	1.7	1.8	2.5	2.7	3.2
DK	1.0	1.8	1.2	1.4	0.4	0.9	1.5	1.2	1.7	3.9	3.0
DE	0.7	1.5	0.9	1.1	0.1	0.7	1.2	1.0	2.1	1.8	2.6
EE	0.3	1.1	0.4	0.4	-0.3	:	0.6	1.2	1.0	1.4	2.1
IE	1.0	1.7	1.1	1.2	0.6	:	1.3	2.2	1.2	1.5	2.4
EL	1.2	2.0	1.3	1.5	0.7	:	1.5	2.4	0.5	2.6	3.0
ES	0.5	1.2	0.6	0.7	0.1	0.5	0.8	1.1	0.6	2.2	2.0
FR	0.5	1.2	0.7	0.8	-0.2	0.5	1.0	0.8	0.8	2.2	2.5
HR	0.7	1.5	1.0	1.1	0.1	:	1.2	1.9	1.2	1.7	2.7
IT	0.7	1.1	0.9	1.1	0.2	0.8	1.0	1.0	1.0	1.5	2.0
CY	0.4	0.6	0.4	0.4	0.2	:	0.4	4.4	0.5	1.0	0.9
LV	0.6	1.8	0.5	0.6	0.0	:	0.9	3.3	0.8	0.6	2.8
LT	0.4	1.2	0.5	0.6	-0.1	:	0.8	2.8	0.6	0.7	2.2
LU	1.2	1.7	1.4	1.5	0.7	:	1.5	2.8	2.1	2.1	2.4
HU	0.8	1.8	1.1	1.2	0.1	0.8	1.4	2.1	1.5	1.3	3.0
MT	2.7	4.3	2.8	3.2	1.7	:	3.3	3.5	3.0	4.3	5.9
NL	0.8	1.4	1.0	1.2	0.3	0.7	1.2	1.1	1.3	2.8	2.4
AT	1.3	2.1	1.6	1.8	0.6	1.4	1.8	1.6	2.8	2.7	3.3
PL	0.8	1.7	1.0	1.1	0.3	0.7	1.3	2.5	2.3	1.4	2.7
PT	2.4	3.3	2.7	3.1	1.5	:	3.0	3.4	3.4	4.7	4.8
RO	0.9	2.1	0.9	1.1	0.3	:	1.3	2.6	1.8	1.6	3.3
SI	1.0	2.0	1.1	1.3	0.4	1.0	1.4	1.4	1.7	2.1	3.1
SK	1.2	2.6	1.5	1.7	0.0	1.3	2.0	2.0	2.4	2.5	4.3
FI	0.8	1.4	1.1	1.3	0.2	0.9	1.3	1.3	1.3	2.6	2.5
SE	0.7	1.5	0.9	1.1	0.2	0.6	1.2	1.0	1.6	1.9	2.6
UK	1.4	2.4	1.7	2.0	0.7	1.4	2.0	1.7	2.3	4.2	3.8
NO	1.2	2.1	1.5	1.7	0.5	:	1.8	1.6	2.7	4.1	3.5
EU*	0.9	1.6	1.1	1.3	0.2	:	1.3	1.3	1.6	2.5	2.8

Source AR18

8.8 Table 16 shows the increase in health spending costs country by country for the projection period 2016 to 2070 on eleven of the scenarios (the TFP risk scenario is almost the same as the AWG reference scenario). In most cases the highest cost increases result from the sector-specific composite indexation scenario and the non-demographic determinants scenario. Figure 12 shows the development of health care costs for the EU as a whole for the different scenarios.

FIGURE 12: RANGE OF RESULTS FROM DIFFERENT SCENARIOS ON HEALTH CARE FROM 2016-2070, EU28



Source Ar18

8.9 Public expenditure on health care is in most cases only part of the picture. Privately funded health costs as a % of GDP varies quite markedly from country to country and this information would need to be included to get a more complete picture.

8.10 The way in which health care will develop in future is subject to multiple uncertainties. There are many positive stories coming from medical research about cures for some cancers, for Alzheimer's and many other conditions. If only one of these were to come to fruition within a few years there could be another step change in increasing longevity with an inevitable step change in health costs at older ages (and implications for the pension cost projections in section 4 as well). Although it might be considered speculative to include specific assumptions, such a step change in the cost projections, at least one of the variant projections could take a view on the potential impact of game-changing research.

8.11 On the other hand there are potential adverse developments in health. The obesity epidemic is gathering pace across Europe and could have the effect of dampening the increase in life expectancy, although it may be expected to lead to higher health costs to treat the various illnesses (e.g. diabetes) which are exacerbated by obesity.

8.12 *What can be predicted with a fair degree of certainty is that expectations of what can be provided by way of health care will continue to grow and the containment of future cost growth will depend critically on managing those expectations.*

9. LONG-TERM CARE COSTS

9.1 Long-term care (LTC) is usually defined as a set of services required by persons with a reduced degree of functional capacity (whether physical or cognitive) and who, as a consequence of this, are dependent for an extended period of time on help with basic and/or instrumental Activities of Daily Living (ADL). Basic ADL are often provided in tandem with basic medical services such as nursing care, prevention, rehabilitation or services of palliative care. Instrumental Activities of Daily Living (IADL)) or assistance care services are mostly linked to home help. (Colombo et al., 2011 Providing and Paying for Long Term Care - OECD).

TABLE 17: NUMBER OF DEPENDENT PEOPLE (IN THOUSANDS) AND AVERAGE ANNUAL GROWTH RATE (AAGR) – AWG REFERENCE SCENARIO 2016-2070

	Total			receiving institutional care			receiving home care			receiving cash benefits		
Country	Ch 16-70	2016	AAGR %	Ch 16-70	2016	AAGR %	Ch 16-70	2016	AAGR %	Ch 16-70	2016	AAGR %
BE	702	997	1.0	163	144	1.4	311	560	0.8	227	293	1.1
BG	1	136	0.0	-0	13	-0.1	-4	22	-0.4	6	102	0.1
CZ	566	572	1.3	117	126	1.2	124	100	1.5	325	346	1.2
DK	174	160	1.4	65	54	1.5	109	106	1.3	0	0	N/A
DE	1412	2749	0.8	525	775	1.0	170	379	0.7	716	1595	0.7
EE	30	172	0.3	7	13	0.8	7	26	0.5	16	133	0.2
IE	190	104	1.9	74	35	2.1	116	69	1.8	0	0	N/A
EL	170	368	0.7	80	125	0.9	91	243	0.6	0	0	N/A
ES	2413	1549	1.8	431	328	1.6	1250	737	1.8	732	484	1.7
FR	1381	3018	0.7	667	1100	0.9	702	1207	0.8	12	711	0.0
HR	15	156	0.2	6	21	0.5	6	22	0.4	3	112	0.0
IT	1561	3245	0.7	226	685	0.5	440	674	0.9	895	1887	0.7
CY	52	39	1.6	13	8	1.8	13	8	1.8	27	23	1.4
LV	-1	44	-0.0	-1	13	-0.2	-1	15	-0.1	1	16	0.1
LT	-4	203	-0.0	-19	89	-0.4	15	59	0.4	-0	55	0.0
LU	42	15	2.5	18	5	3.0	20	9	2.2	3	2	2.0
HU	70	315	0.4	45	255	0.3	25	60	0.6	0	0	N/A
MT	21	17	1.5	9	4	2.2	12	8	1.6	1	5	0.2
NL	675	823	1.1	279	303	1.2	395	521	1.0	0	0	N/A
AT	773	731	1.4	104	91	1.4	166	175	1.2	503	465	1.4
PL	1344	1873	1.0	86	86	1.3	123	122	1.3	1135	1665	1.0
PT	165	333	0.8	19	33	0.8	12	156	1.0	134	284	0.7
RO	147	429	0.6	69	223	0.5	78	206	0.6	0	0	N/A
SI	91	111	1.1	30	35	1.1	30	34	1.2	31	42	1.0
SK	112	285	0.6	53	50	1.4	-15	68	-0.5	75	167	0.7
FI	361	549	0.9	44	42	1.3	162	183	1.2	155	324	0.7
SE	551	539	1.3	119	103	1.4	197	198	1.3	236	237	1.3
UK	3385	3492	1.3	746	644	1.4	1195	1243	1.3	1445	1605	1.2
NO	449	367	1.5	86	45	2.0	220	200	1.4	143	121	1.4
EU*	16400	23023	1.0	3975	5402	1.0	5749	7068	1.1	6676	10554	0.9
EA	10146	15352	0.9	2722	3876	1.0	3897	4989	1.1	3527	6487	0.8
EU27	13015	19532	1.0	3229	4757	1.0	4554	5825	1.1	5231	8949	0.9
EU* s	586	822	1.0	142	193	1.0	205	252	1.1	238	377	0.9

Source: AR18 summarised

9.2 The dynamics of the number of dependent persons, as given in Table 17, influences the growth rate of long-term care spending (as % of GDP) as given in Table 18. The age-related expenditure profiles used in the AR18 suggest that long-term care costs for the recipient related to a severe disability is relatively independent of age in the New Member States which tend to have less extensive long-term care systems, and where costs tend to be higher for younger recipients, while they vary markedly for the EU15 countries. The time series for Member States are given for institutional care, home care and cash benefits, as summarised in Table 17.

9.3 Total long-term care public spending, for the EU as whole, is projected in the AR18 to rise from 1.2% of GDP in 2016 to 2.7% by 2070. In most Member States long-term care spending will increase throughout the period 2016 to 2070. Table 18 summarises the total costs of long-term care as a percentage of GDP, in descending order of change over the period 2016 to 2070.

TABLE 18: LONG-TERM CARE SPENDING AS % OF GDP – AWG REFERENCE SCENARIO

					AWG risk scenario	TFP risk scenario
Country	Ch 16-70	2016	2040	2070	2070	2070
NO	3.4	3.7	5.3	7.1	8.9	7.1
LU	2.8	1.3	2.0	4.1	6.5	4.0
NL	2.5	3.5	5.3	6.0	8.3	6.0
DK	2.2	2.5	3.8	4.7	7.3	4.7
FI	2.1	2.2	3.6	4.2	5.1	4.2
IE	1.9	1.3	2.1	3.3	4.8	3.3
AT	1.9	1.9	2.6	3.8	5.3	3.8
SE	1.7	3.2	4.1	4.9	5.7	4.9
BE	1.7	2.3	3.2	4.0	5.8	4.0
CZ	1.6	1.3	2.1	2.9	3.7	2.9
MT	1.4	0.9	1.6	2.3	4.2	2.3
ES	1.3	0.9	1.5	2.2	4.4	2.2
UK	1.3	1.5	2.1	2.8	3.3	2.7
IT	1.2	1.7	2.3	3.0	3.9	2.9
LT	1.0	1.0	1.7	2.0	4.6	2.0
SI	0.9	0.9	1.4	1.8	4.4	1.9
PT	0.9	0.5	0.9	1.4	3.2	1.4
PL	0.8	0.5	0.9	1.3	2.1	1.3
FR	0.6	1.7	2.3	2.4	4.5	2.4
DE	0.6	1.3	1.8	1.9	3.4	2.6
SK	0.6	0.9	1.2	1.5	2.9	1.5
EE	0.5	0.9	1.1	1.4	3.8	1.4
HU	0.4	0.7	0.9	1.1	4.8	1.1
HR	0.3	0.9	1.1	1.2	2.0	1.2
RO	0.3	0.3	0.5	0.6	4.6	0.6
CY	0.3	0.3	0.4	0.6	3.2	0.6
BG	0.1	0.4	0.5	0.5	1.4	0.5
LV	0.1	0.4	0.5	0.6	3.0	0.6
EL	0.1	0.1	0.1	0.2	4.9	0.2
EU*	1.2	1.6	2.2	2.7	4.3	2.9
EA	1.1	1.6	2.2	2.7	4.5	2.9
EU27	1.1	1.6	2.3	2.7	4.5	2.9

Source AR18

9.4 Spending on long-term care is projected to almost double in many countries. Within the broad EU totals there is a great deal of variation in long-term care expenditure by Member State. At the extremes long-term care spending in Norway is projected to rise from 3.7% of GDP in 2016 to 7.1% in 2070, whilst in Greece it is projected to rise from 0.1% of GDP in 2016 to 0.2% in 2070. Significant growth in long-term care spending (more than 2% of GDP) is projected for Norway, Luxembourg, Netherland, Denmark and Finland.

TABLE 19: AVERAGE ANNUAL GROWTH RATE (AAGR) OF LONG-TERM CARE SPENDING AS % OF GDP, 2016-2070, IN DIFFERENT SCENARIOS

Country	AWG ref.	AWG risk	AWG TFP risk	Demo-graphic	Base case	High life expect.	Healthy ageing	Shift to formal care	Coverage converg.	cost con-verg.	cost+cov. converg.
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
BE	1.02	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
BG	0.59	1.71	1.02	1.01	1.12	1.34	0.91	1.29	1.12	1.84	1.84
CZ	1.43	2.31	0.57	0.41	0.60	0.66	0.35	1.51	1.87	1.09	2.46
DK	1.16	1.89	1.41	1.27	1.50	1.73	1.19	1.85	1.57	2.00	2.06
DE	0.73	1.99	1.16	1.16	1.27	1.45	1.07	1.54	2.09	1.27	2.09
EE	0.78	1.81	1.35	1.27	1.41	1.63	1.18	1.91	1.79	1.54	1.94
IE	1.67	2.70	0.77	0.75	0.86	0.98	0.52	1.14	0.86	2.86	2.86
EL	1.05	2.37	1.68	1.66	1.71	1.94	1.48	1.99	2.50	1.71	2.50
ES	1.60	7.49	1.03	1.36	1.10	1.29	0.88	1.48	1.87	6.80	7.61
FR	0.59	2.90	1.59	1.63	1.62	1.95	1.45	1.83	2.11	2.53	3.01
HR	0.60	1.79	0.62	0.70	0.71	0.88	0.54	1.06	1.56	1.01	1.88
IT	1.00	1.53	0.59	0.70	0.73	0.82	0.30	1.30	1.16	1.22	1.72
CY	1.14	1.54	0.99	1.04	1.05	1.24	0.86	1.33	1.17	1.51	1.64
LV	0.54	4.45	1.13	1.17	1.23	1.32	0.95	1.57	1.28	4.49	4.57
LT	1.30	3.64	0.52	0.50	0.58	0.71	0.20	1.34	2.03	2.13	3.80
LU	2.17	2.87	1.27	1.29	1.33	1.57	1.07	1.53	1.33	3.04	3.04
HU	0.90	3.04	2.15	1.94	2.20	2.46	2.01	2.46	2.86	2.42	3.16
MT	1.74	3.64	0.88	0.84	0.98	1.14	0.63	1.42	2.19	2.65	3.79
NL	0.98	2.88	1.73	1.73	1.77	1.98	1.52	1.92	2.11	2.65	3.02
AT	1.30	1.59	0.98	1.06	1.14	1.33	0.85	1.33	1.24	1.64	1.75
PL	1.83	1.91	1.30	1.20	1.42	1.64	1.19	1.76	1.42	2.02	2.03
PT	1.78	2.74	1.81	1.56	1.84	2.02	1.58	2.69	1.86	2.84	2.86
RO	1.29	3.33	1.77	1.65	1.79	2.04	1.62	3.23	2.70	2.69	3.42
SI	1.22	5.20	1.27	1.02	1.32	1.51	0.97	1.83	2.79	3.87	5.36
SK	0.92	2.90	1.28	1.19	1.31	1.53	1.11	1.61	1.47	2.83	3.01
FI	1.23	2.19	0.90	0.83	1.01	1.09	0.57	1.70	1.33	2.07	2.37
SE	0.79	1.56	1.23	1.28	1.33	1.53	1.12	1.51	1.33	1.68	1.68
UK	1.13	1.06	0.79	0.77	0.93	1.12	0.68	1.20	1.06	1.07	1.19
NO	1.21	1.47	1.11	1.06	1.16	1.37	0.97	1.57	1.19	1.54	1.57
EU*	1.02	1.63	1.21	1.12	1.33	1.56	1.11	1.50	1.33	1.75	1.75
EA	0.97	1.86	1.11	1.10	1.19	1.40	0.98	1.54	1.54	1.62	1.97
EU27	1.00	1.93	1.11	1.12	1.19	1.41	0.98	1.53	1.60	1.65	2.05
EU* s	1.17	1.93	1.11	1.12	1.20	1.41	0.98	1.54	1.60	1.64	2.05

Source: The AR18, summarised

9.5 Definitions as given in AR18:

I	AWG reference	The **"AWG reference scenario"** combines the assumptions of the "demographic" and the **"healthy ageing"** scenarios. This scenario is used in the multilateral budgetary surveillance at EU level. Specifically, it is assumed that half of the projected gains in life expectancy are spent without disability (i.e. demanding care), thus taking an intermediate position between the **"demographic"** and **"healthy ageing"** scenario assumptions.
II	AWG risk	The **"AWG risk scenario"** keeps the assumption that half of the future gains in life expectancy are spent with no care-demanding disability, as in the **"AWG reference scenario"**. In addition, it combines with the **"cost and coverage convergence scenario"** by assuming convergence upwards of unit costs to the EU-average as well as coverage convergence upwards to the EU-average. In comparison to the **"AWG reference scenario"**, this scenario thus captures the impact of additional cost drivers to demography and health status, i.e. the possible effect of a convergence in coverage and in real living standards on LTC spending.
III	AWG TFP risk	The **"Total factor productivity risk scenario".** As in the previous AR15, a productivity risk scenario has been included, assuming lower Total Factor Productivity (TFP) growth [23]. In the **"AWG reference scenario"** country-specific TFP growth rates converge to 1% by 2045, whereas in this TFP scenario, growth rates would converge to 0.8%.
IV	Demographic	The **"demographic scenario"** assumes that the base year shares of the dependent population who receive either informal care, formal care at home or institutional care are kept constant by age cohort over the projection period. Those constant shares are then applied to the projected changes in the dependent population. Thus, the dependent population evolves precisely in line with the total elderly population and all gains in life expectancy are spent in bad health/with disability. Over the projection period unit costs of care are assumed to evolve in line with GDP per capita.
V	Base case	The **"base case scenario"** amends unit cost growth assumptions of the **"demographic scenario".** Unit costs of in-kind care grow in line with GDP per worker, rather than GDP per capita. This reflects the highly labour-intensive nature of LTC and the fact that productivity gains are expected to be particularly slow in this sector, as the services are difficult to automate or re-engineer. Given the current deficit of formal care provision, the LTC market is expected to be supply-driven rather than demand-driven. Therefore wages are assumed to be the main driver for unit costs for in-kind benefits. By contrast, unit costs for cash benefits are more related to a form of income support, so they are assumed to evolve in line with GDP per capita growth.

23 More details of the assumptions are given in AR18: Underlying Assumptions and Projection Methodologies, Institutional Paper 065, published in November 2017 and found at: https://ec.europa.eu/info/publications/economy-finance/2018-ageing-report-underlying-assumptions-and-projection-methodologies_en.

VI	High life expectancy	The **"high life expectancy scenario"** models the budgetary impact of alternative demographic assumptions, where life expectancy is higher for all ages than in the **"AWG reference scenario"**. In this scenario, as in the health care and pension models, it is assumed that life expectancy at birth is two years higher. The rationale for examining the effect of longer lives is twofold. First, there is a marked increase in public expenditure with older age (i.e. 80 and over). In fact, the age profile for LTC expenditure tends to be steeper at the highest age groups than that for health expenditure, and the share of institutionalised individuals increases sharply among persons aged over 80. Second, the higher age groups are also the part of the demographic projections which is likely to be the most uncertain.
VII	Healthy ageing	The **"healthy ageing scenario"** (referred to in AR15 as the **"constant disability scenario"**) reflects an alternative assumption about trends in age-specific ADL-dependency rates to model a relative decrease in morbidity. It is inspired by the so-called "relative compression of morbidity", and it is analogous to the "healthy ageing" performed in the framework of health care expenditure projections. It assumes that the age-specific disability profile shifts in line with life- expectancy, and so the disability rate of a specific age group in the future is equal to that of a younger cohort today, with the shift corresponding to the shift in life-expectancy. This results in a gradual decrease over time in disability prevalence for each age cohort.
VIII	Shift to formal care	The **"shift to formal care scenario"** policy-change scenario is run to assess the impact of a demand-driven increase in the (public) provision of formal care, replacing care provided in an informal setting. In particular, this scenario examines the budgetary impact of a progressive shift into the formal sector of care of 1 percentage point per year of dependent persons who have so far received only informal care. This extra shift takes place during the first ten years of the projection period only.
IX	Coverage convergence	The **"coverage convergence scenario"** scenario assumes that growing expectations of the populations and the exchange of best practices will lead to an expansion of publicly-financed formal care provision into those groups of population that relied on informal care until now. Note that "formal coverage" covers any of the three types of formal LTC: institutional care, formal home care and cash benefits. The remaining number of "dependent" people is assumed to receive informal care. This scenario should also be considered as a policy-change scenario, as it assumes a considerable shift in the current LTC provision policy, while aiming to take into account the high diversity of country-specific current care mix.
X	Cost convergence	The **"cost convergence scenario"** is a policy change scenario that models upward convergence to the EU average of the relative cost profiles (as a proportion of GDP per capita) for those countries that in the base year are below the EU average.
XI	cost+coverage convergence	The **"cost and coverage convergence scenario"** combines the coverage convergence scenario and the cost convergence scenario, as described in the sections above. The new "cost and coverage convergence scenario" proposes a balanced and plausible hypothesis of how the same pressures may lead to convergences in both cost and coverage of services.

9.6 Another part of the Commission (DG for Employment, Social Affairs and Inclusion), in collaboration with the European Social Policy Network (ESPN), published in August 2018 Challenges in long-term care in Europe: A study of national policies 2018[24]. This Synthesis Report describes the national long-term care provisions in 35 European countries, with a focus on long-term care arrangements for the elderly (65 or over). It analyses the four main challenges which are common to all European countries: the access and adequacy of long-term care provision, the quality of formal home care as well as residential services, the employment of informal carers, and the financial sustainability of national long-term care systems. The report concludes that the 35 countries covered by the ESPN face and will continue to face significant long-term care system challenges and makes a series of recommendations to help overcome them. The report states that in many eastern European countries there are long waiting lists. In the Czech Republic in 2016, there were 37,247 beds in homes for the elderly and almost 67,000 unsettled applications. In Lithuania, in 2014, 47% of the elderly in need of long-term care were on a waiting list for residential care, with an average waiting time of six months.

9.7 In Slovenia currently, there are 7,400 older adults on the waiting list for acceptance to institutional care. The capacity of institutional care without specialised institutions in Slovenia is 20,500 beds. There are also differences for Slovenia between the ESPN report and AR18. In the ESPN report there is only 22,415 residents in institutional care, 21,612 users of home-based care 487 users of day care and 16,570 recipients of cash benefits.

9.8 Long-term care provision has been subject to reforms in most of the 35 countries under scrutiny over the past 10 years (2008-2018). There have been three main trends with regard to different aspects of long-term care care: a) a readjustment of the long-term care policy mix, moving away from residential care towards home care and community-care, b) measures addressing financial sustainability and c) better access and affordability of provision, including improvements to the status of informal carers.

9.10 As for the financial sustainability issue, there have been various trends across Europe, such as decreasing funding for residential care and increasing the out-of-pocket payments required from beneficiaries. Germany and Luxemburg are raising the contributory rates for long-term care insurance. Portugal is tightening eligibility conditions for benefits. Budgetary restrictions were implemented during the crisis and the post-crisis period in several countries, including Denmark, Spain, Portugal, Ireland and UK. For instance, in Spain a budgetary adjustment made to the long-term programme in 2012 is thought to have resulted in a 37,405 drop in beneficiaries by 2015. Spain ceased to require social security payments from non-professional home carers in 2012.

24 Challenges in long-term care in Europe: A study of national policies 2018, Slavina Spasova, Rita Baeten, Stéphanie Coster, Dalila Ghailani, Ramón Peña-Casas and Bart Vanhercke August 2018, European Commission, Directorate-General for Employment, Social Affairs and Inclusion. Joint Report prepared by the Social Protection Committee (SPC) and the European Commission (DG EMPL). Can be downloaded from: http://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8084&furtherPubs=yes

9.11 Another major trend in several countries has been a search for ways to improve the access and affordability of long-term care provision. These measures range from providing increasing funding for some components of long-term care to tackling the status of informal carers.

9.12 Estonia has been tackling the shortage of home care services by allocating additional funds from the EU structural funds during the period 2014-2020. The government has decided that 49 million EUR will be used to relieve the burden of family members who currently take care of disabled people. Additionally, 28.3 million EUR from the European Social Fund and 5.3 million EUR of co-financing from the government was allocated to local governments in 2016, for the development of social services. Slovenia has allocated 70 million EUR from Structural funds for development of innovative schemes and information system for community-based long-term care. Austria, Germany, Finland, Poland, Romania and Sweden introduced measures to counter inter-institutional and territorial long-term care fragmentation. Austria, Germany, Italy, and Malta have introduced reforms improving eligibility conditions and benefit levels.

9.13 Several countries have undertaken reforms to optimise and clarify the responsibilities of the public authorities and territorial structures responsible for long-term care, changing the entities responsible for benefits and transferring competences. As of 2017, Romania has been implementing measures recentralising some long-term care costs, from local authorities to the state budget.

9.14 Germany has extended eligibility for benefits by amending the definition of "in need of care" and the associated assessment method. This is expected to improve the adequacy of benefits, particularly for persons suffering from dementia. Recent reforms have allowed more flexibility in combining different types of benefits and establishing incentives for informal care, mainly in order to enhance opportunities for relatives to provide informal care at home.

9.15 Austria currently does not allow recourse to the assets of persons living in residential long-term care facilities, or the assets of their relatives. Malta has introduced a "Carer at Home" scheme. Applicants need to be over sixty years of age and the carer (who cannot be a family member) needs to have a recognised qualification.

9.16 Austria, France, Czech Republic, Poland and Portugal have introduced reforms recognising and improving the status of informal carers. Since 2007, Austria has been implementing a "24-hour care" programme, in order to legalise private informal long-term care arrangements, offering the carers (mostly migrants from Slovakia and Romania) the option of self-employment or dependent employment and providing public co-funding. Since 2010 France has introduced several reforms aimed at supporting care leave for informal carers, and also respite options, training and education. The formal definition of "informal carer" constitutes a genuine recognition of the work done by this type of carer.

9.17 In Poland, in 2015, the government introduced benefits to support the labour market re-integration of individuals previously engaged in care responsibilities, using subsidised employment measures.

9.18 Portugal has over the past five years introduced various support measures for informal carers, including training and respite care. Portugal is currently examining the possibility of creating a legal status of informal carer, which, if approved, would result in profound changes to informal care.

9.19 Belgium, Poland, Portugal, and Germany introduced reforms improving the status of formal carers and addressing the quality of jobs and professionalization of the sector.

9.20 Germany, France and Romania have introduced reforms improving the quality of long-term care provisions. In 2012, Romania adopted a law regulating the quality of social services and in 2015 established minimum standards for service providers of residential and non-residential care for elderly and disabled people. This provision led to the withdrawal of accreditation of many providers.

9.21 Germany, Denmark, Greece, Finland and Norway have introduced programs of special care for elderly people with dementia. In 2017, Denmark, launched a national plan called "A secure and dignified life with dementia", which includes a package of specific measures for elderly people with this disease. In 2016, Greece adopted the "National Action Plan for Alzheimer's-Dementia disease 2015- 2020" which includes, the creation of special care units (day-care centres, etc.) for persons suffering from Alzheimer's and Dementia as well as the provision of support to carers of these persons.

9.22 Denmark and Netherland have been developing the use of innovative technologies, mostly with the aim of enabling elderly people to live an autonomous life at home.

9.23 In Cyprus and Finland more comprehensive reforms are on-going. In 2020 the whole Finnish social and health care service system – including long-term care – will be overhauled if the social and health care reform ("SOTE") comes into force. The reform would result in an important territorial reorganisation of long-term care, introducing new personal budgets and more room for private for-profit service providers to operate.

9.24 *The big unknown when looking at long-term care is how much care will be provided informally by family and friends. In many countries the dynamics of family have been changing and will continue to change in the future with the inevitable result that a much larger proportion of care will need to be "paid for" care rather than "informal" care.*

10. ACTUARIES IN SOCIAL SECURITY AND PENSIONS

10.1 It is not the purpose of this paper to provide a comprehensive analysis of social security and pension systems across Europe. The AAE has previously published reviews of different aspects of complementary pension schemes in the EU (for example Collinson et al, 2001; Brown et al, 2004; Hammer et al, 2004). The AAE has published analysis in July 2012[25] and after the publication of the Ageing Report 2015 - AR15[26]. Actuaries are typically involved in the financial management of all types of occupational defined benefit plans and also in many types of defined contribution plan, especially where there are embedded guarantees, and decumulation products. Many countries have a statutory role for actuaries in complementary pension plans.

10.2 A number of countries also have a statutory requirement for regular actuarial reporting on the finances of social security and this can be an important factor in ensuring sustainability of social security pension promises, as it helps to place the political pressures for more generous social security into a firm financial monitoring environment. From early days of the International Social Security Association (ISSA) a century ago there has been a strong strand of thinking internationally that actuarial reporting should form a key element of good social security governance and this is underlined by social security guidelines which have been issued by the ISSA. The International Actuarial Association has published a model standard of actuarial practice (ISAP2) on Financial Analysis of Social Security Programs, developed in cooperation with the International Labour Office (ILO) and the ISSA. The ISSA-ILO Guidelines on Actuarial Work for Social Security were adopted by the ISSA in 2016. We recommend that these should be followed in the EU, both for actuarial work in individual countries and for EU level exercises such as The Ageing Report.

10.3 Actuarial modelling approaches and methodologies should be used to project future cash flows and assess the short, medium and long term impact of pension policies and reforms on adequacy and sustainability of pension system provision in an integrated way. This does not appear to be being done consistently across the EU at present and the AAE have interacted with DGEcfin and the Ageing Working Group to suggest improvements in the methodology and disclosures in order to meet international standards for social security actuaries.

10.4 The Institutions for Occupational Retirement Provisions IORP Directive requires IORPs to have an actuarial function, as is the case for insurance companies under the Solvency 2 Directive 2009/138/EC. The AAE strongly supports such a requirement, which is consistent with the extensive use made of actuaries by IORPs in existing regulatory structures. Not all countries have an automatic requirement for an actuary in Defined Contributions (DC) plans, where there are no guarantees or biometric risks, although even

25 Sustainability of pension systems in Europe – the demographic challenge. Groupe Consultatif Actuariel Européen Position Paper. July 2012

26 The ageing of the EU – implications for pensions. AAE, March 2016

for some of these it may be desirable to have actuarially calculated technical provisions, especially in relation to future expenses where there are limits on what deductions can be made from the plan. Asset/liability management and general risk management are actuarial issues, as is the monitoring of adequacy of resulting benefits and any drawdown or annuitisation provisions. In Spain there is a requirement for all DC occupational plans to have regular actuarial reporting.

10.5 Actuaries are professionals with expertise in the quantification and management of long-term risks which are susceptible to mathematical modelling. This includes all types of social security, as well as complementary workplace pensions or mandatory pensions, whether funded or not. The member associations of the AAE have robust educational and professionalism requirements for those who are qualified actuaries and the AAE issues model standards of actuarial practice for the associations to adopt for some specifically EU applications. Actuaries are well-placed to play an active role in analysing the impact of future changes on pension and social security provision and to advise EU and national institutions.

ACRONYMS

AAE	Actuarial Association of Europe
ABO	Accumulated Benefit Obligation *It concerns the past service of a pension plan members and constitutes the present value of their rights established as at the date of the valuation without allowing for future salary increases.*
AR18	Ageing Report 2018
AWG	Ageing Working Group
DC	Defined Contribution
DGEcfin	Directorate-General for Economic and Financial Affairs
EU	European Union
EPC	Economic Policy Committee
EUROPOP	Eurostat population projections
ESSPOP	Eurostat Social Security population projections
GDP	Gross Domestic Product
IORP	Institutions for occupational Retirement Provisions
ILO	International Labour Office
ISSA	International Social Security Association
ISAP	International Standard of Actuarial Practice
MS	Member States
PAR18	Pension Adequacy Report 2018
PBO	Pension Benefit Obligation *It concerns the past service of a pension plan members and constitutes the present value of their rights established as at the date of the valuation allowing for future salary increases*
TFP	Total Factor of Productivity

ANNEX TABLE A.1

Fertility rates, 1960-2080

	BIRTHS PER WOMAN													
	1960	1970	1980	1990	2000	2010	2015	2020	2030	2040	2050	2060	2070	2080
BE	2.54	2.25	1.68	1.62	1.67	1.86	1.70	1.73	1.75	1.76	1.78	1.80	1.82	1.84
BG	2.31	2.17	2.05	1.82	1.26	1.57	1.52	1.62	1.69	1.73	1.76	1.78	1.80	1.82
CZ	2.09	1.92	2.08	1.90	1.15	1.51	1.57	1.68	1.74	1.76	1.78	1.80	1.82	1.84
DK	2.57	1.95	1.55	1.67	1.77	1.87	1.71	1.71	1.73	1.75	1.77	1.79	1.82	1.84
DE	2.37	2.03	1.56	1.45	1.38	1.39	1.49	1.50	1.53	1.57	1.60	1.64	1.68	1.72
EE	1.98	2.17	2.02	2.05	1.36	1.72	1.59	1.67	1.75	1.77	1.78	1.80	1.81	1.83
IE	3.78	3.85	3.21	2.11	1.89	2.05	1.92	1.96	1.96	1.96	1.96	1.96	1.97	1.97
EL	2.23	2.40	2.23	1.40	1.27	1.51	1.33	1.33	1.40	1.46	1.52	1.58	1.64	1.70
ES	2.86	2.90	2.20	1.36	1.23	1.37	1.33	1.57	1.80	1.87	1.88	1.88	1.88	1.89
FR	2.73	2.47	1.95	1.78	1.89	2.03	1.96	2.01	2.00	1.99	1.99	1.99	1.99	1.99
HR						1.55	1.40	1.47	1.51	1.54	1.58	1.61	1.65	1.70
IT	2.37	2.38	1.64	1.33	1.26	1.46	1.34	1.36	1.42	1.48	1.54	1.60	1.66	1.71
CY	3.51	2.54	2.47	2.41	1.64	1.44	1.30	1.35	1.40	1.45	1.51	1.56	1.62	1.67
LV		2.00	1.88	2.01	1.25	1.36	1.70	1.83	1.85	1.85	1.85	1.86	1.87	1.88
LT	2.60	2.40	1.99	2.03	1.39	1.50	1.70	1.71	1.76	1.79	1.81	1.82	1.84	1.85
LU	2.29	1.97	1.50	1.60	1.76	1.63	1.47	1.54	1.57	1.60	1.63	1.66	1.69	1.73
HU	2.02	1.98	1.91	1.87	1.32	1.25	1.45	1.61	1.68	1.72	1.75	1.77	1.80	1.82
MT	3.62	2.02	1.99	2.04	1.70	1.36	1.45	1.54	1.62	1.67	1.70	1.72	1.75	1.77
NL	3.12	2.50	1.60	1.62	1.72	1.79	1.65	1.73	1.74	1.76	1.77	1.79	1.81	1.84
AT	2.69	2.29	1.65	1.46	1.36	1.44	1.49	1.49	1.53	1.56	1.59	1.62	1.66	1.70
PL	2.98	2.20	2.28	1.99	1.37	1.38	1.32	1.45	1.56	1.61	1.65	1.68	1.71	1.74
PT	3.16	3.01	2.25	1.56	1.55	1.39	1.31	1.28	1.34	1.40	1.47	1.53	1.59	1.65
RO			2.43	1.83	1.31	1.54	1.47	1.72	1.81	1.85	1.87	1.88	1.89	1.90
SI	2.18	2.10	2.11	1.46	1.26	1.57	1.57	1.62	1.66	1.70	1.74	1.78	1.81	1.85
SK	3.04	2.41	2.32	2.09	1.30	1.43	1.40	1.47	1.60	1.68	1.74	1.79	1.82	1.85
FI	2.72	1.83	1.63	1.78	1.73	1.87	1.65	1.71	1.72	1.74	1.76	1.78	1.80	1.83
SE	2.20	1.92	1.68	2.13	1.54	1.98	1.85	1.87	1.91	1.95	1.98	2.01	2.03	2.04
UK	2.72	2.43	1.90	1.83	1.64	1.92	1.80	1.80	1.81	1.83	1.84	1.86	1.87	1.89
NO	2.90	2.50	1.72	1.93	1.85	1.95	1.73	1.74	1.76	1.77	1.79	1.81	1.83	1.85

Source AR18 cross-country tables

ANNEX TABLE A.2

Projection of net migration flows, 1961-2060

	NET MIGRATION FLOWS (000s)				PROJECTION OF NET MIGRATION FLOWS (000s)							
	Average 1961-1980	Average 1981-2000	Average 2001-2015	2015	2020	2030	2040	2050	2060	Cumulative net migration 2020-2060	2016 popn (millions)	Cumulative net mign as % of 2016 popn
LT	4.7	-6.6	-28.2	-22.4	-23.8	-17.0	-6.3	1.3	0.2	-328.9	2.9	-11.3%
LV	11.5	-5.5	-16.1	-10.6	-8.0	-6.1	-1.5	1.2	0.0	-98.5	2.0	-4.9%
RO	-7.7	-43.4	-130.1	-46.5	-65.1	-51.1	-8.9	7.7	1.6	-814.5	19.7	-4.1%
BG	-7.7	-25.0	-27.0	-4.2	-11.9	-9.1	0.5	3.9	0.7	-98.0	7.1	-1.4%
PL	-30.4	-23.3	-13.6	-12.8	0.0	-2.4	16.2	29.7	11.6	483.5	38.0	1.3%
EL	-7.0	42.1	0.1	-44.9	-16.8	-4.1	7.9	13.3	10.5	148.9	10.8	1.4%
EE	7.8	-4.4	-2.9	2.4	2.3	1.4	1.2	0.7	0.1	46.5	1.3	3.6%
HR	-1.4	-11.5	3.2	-17.9	-1.7	4.2	5.0	6.0	5.2	174.4	4.2	4.2%
SK	-6.6	-4.2	0.4	3.1	5.9	5.0	6.8	6.5	3.8	226.7	5.4	4.2%
FR	131.9	42.4	105.6	65.9	77.0	85.9	77.3	69.2	62.2	3035.9	66.8	4.5%
PT	-46.2	3.0	5.4	-10.5	2.4	12.8	18.2	15.8	14.6	559.4	10.3	5.4%
CZ	-5.8	0.7	22.4	16.0	21.5	17.5	20.5	14.0	8.8	650.8	10.6	6.1%
HU	-0.2	0.1	13.7	14.4	19.9	16.2	20.8	15.3	13.8	681.8	9.8	7.0%
SI	3.8	0.8	4.8	0.9	4.2	4.1	4.3	3.8	2.8	154.2	2.1	7.3%
FI	-8.7	5.2	12.1	12.6	15.8	13.7	10.7	8.5	7.8	444.2	5.5	8.1%
IE	-1.8	-4.6	16.8	-0.3	9.9	7.5	11.4	13.7	12.2	430.2	4.7	9.2%
NL	22.2	28.8	19.2	55.0	66.9	59.5	43.7	29.6	28.6	1808.2	17.0	10.6%
UK	-14.7	31.8	249.7	331.9	251.5	220.1	181.0	134.2	121.1	7235.5	65.6	11.0%
DE	149.6	268.4	255.2	1165.8	327.3	268.1	206.0	199.0	175.0	9243.9	82.5	11.2%
ES	-23.2	63.2	312.1	-7.5	51.2	119.4	163.4	170.9	153.8	5570.8	46.4	12.0%
IT	-41.6	10.5	287.2	31.7	161.2	209.7	217.7	197.4	176.7	7919.1	60.8	13.0%
DK	2.8	8.9	16.5	41.9	33.4	26.8	18.9	10.7	11.4	789.2	5.7	13.8%
BE	11.3	8.5	50.4	62.1	53.2	48.3	41.5	32.8	29.5	1643.6	11.3	14.5%
CY	-3.5	4.0	6.4	-2.0	1.7	2.9	3.9	4.9	4.4	148.3	0.9	16.5%
NO	2.1	8.0	30.5	29.4	27.3	26.0	23.7	20.2	18.1	928.4	5.2	17.9%
SE	15.4	18.6	48.8	79.7	67.9	57.2	44.7	30.5	27.4	1803.3	9.9	18.2%
AT	7.3	18.8	43.0	112.5	67.8	55.4	40.3	26.3	24.8	1683.4	8.7	19.3%
MT	-3.2	1.1	2.0	4.2	3.2	2.6	2.0	1.4	1.3	83.1	0.4	20.8%
LU	2.1	2.7	7.3	11.2	10.2	8.7	7.0	5.0	4.5	280.8	0.6	46.8%
EU	160.5	431.4	1264.5	1831.2	1127.1	1157.2	1154.3	1053.3	914.6	43905.8	510.9	8.6%

Source AR18 cross-country tables

ANNEX TABLE A.3

Period life expectancy at age 65, 2016-2070

EXPECTATION OF LIFE AT 65 (MALES)					
					Change
	2016	2030	2050	2070	2016-2070
BE	18.3	19.8	21.7	23.4	5.1
BG	14.5	16.3	19.0	21.5	7.0
CZ	16.3	17.9	20.3	22.4	6.1
DK	18.1	19.5	21.5	23.3	5.2
DE	18.1	19.6	21.5	23.3	5.2
EE	15.4	17.3	19.9	22.2	6.8
IE	18.5	19.9	21.8	23.5	5.0
EL	18.7	20.2	22.1	23.8	5.1
ES	19.3	20.6	22.3	23.9	4.6
FR	19.5	20.8	22.5	24.0	4.5
HR	15.6	17.4	19.8	22.0	6.4
IT	19.1	20.4	22.1	23.7	4.6
CY	19.0	20.5	22.2	23.8	4.8
LV	14.0	16.2	19.0	21.6	7.6
LT	14.3	16.6	19.3	21.8	7.5
LU	18.5	20.0	21.8	23.5	5.0
HU	14.9	16.8	19.5	22.0	7.1
MT	19.3	20.6	22.3	23.9	4.6
NL	18.4	20.0	21.8	23.4	5.0
AT	18.3	19.9	21.7	23.5	5.2
PL	16.0	17.9	20.3	22.6	6.6
PT	18.1	19.6	21.5	23.3	5.2
RO	14.8	16.8	19.5	22.0	7.2
SI	17.7	19.2	21.3	23.1	5.4
SK	15.3	17.2	19.8	22.1	6.8
FI	18.2	19.6	21.5	23.3	5.1
SE	19.0	20.3	22.0	23.6	4.6
UK	18.8	20.1	22.0	23.6	4.8
NO	18.8	20.1	21.9	23.5	4.7

EXPECTATION OF LIFE AT 65 (FEMALES)					
					Change
	2016	2030	2050	2070	2016-2070
BE	21.7	23.1	24.9	26.6	4.9
BG	17.9	19.7	22.3	24.7	6.8
CZ	19.9	21.4	23.6	25.7	5.8
DK	20.8	22.4	24.5	26.4	5.6
DE	21.3	22.8	24.7	26.4	5.1
EE	20.4	22.0	24.1	26.0	5.6
IE	21.1	22.7	24.8	26.6	5.5
EL	21.4	22.9	24.8	26.6	5.2
ES	23.2	24.3	25.9	27.3	4.1
FR	23.5	24.6	26.1	27.5	4.0
HR	19.1	20.8	23.2	25.3	6.2
IT	22.5	23.8	25.5	27.0	4.5
CY	21.3	22.8	24.6	26.3	5.0
LV	19.0	20.9	23.3	25.4	6.4
LT	19.3	21.2	23.5	25.6	6.3
LU	22.4	23.8	25.6	27.1	4.7
HU	18.7	20.6	23.1	25.4	6.7
MT	22.2	23.5	25.3	26.9	4.7
NL	21.2	22.8	24.7	26.4	5.2
AT	21.6	23.1	24.9	26.5	4.9
PL	20.2	21.9	24.1	26.1	5.9
PT	21.8	23.2	25.0	26.7	4.9
RO	18.2	20.2	22.8	25.1	6.9
SI	21.4	22.8	24.7	26.4	5.0
SK	19.1	21.0	23.4	25.6	6.5
FI	21.7	23.0	24.8	26.5	4.8
SE	21.7	23.1	24.9	26.6	4.9
UK	21.3	22.8	24.8	26.5	5.2
NO	21.7	23.1	25.0	26.6	4.9

Source AR18 cross-country tables

ANNEX TABLE A.5

Projection of population aged 0-14, 2015-2080, millions

	2015	2020	2030	2040	2050	2060	2070	2080	% CHANGE 2015-2080
BE	1.9	2.0	2.0	2.1	2.2	2.2	2.2	2.3	18.4
BG	1.0	1.0	0.9	0.8	0.8	0.7	0.7	0.7	-33.5
CZ	1.6	1.7	1.6	1.5	1.6	1.6	1.5	1.5	-6.0
DK	1.0	1.0	1.0	1.1	1.0	1.0	1.1	1.0	7.6
DE	10.7	11.2	11.8	11.2	10.8	11.2	11.0	10.7	0.2
EE	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-18.1
IE	1.0	1.1	1.0	0.9	1.0	1.1	1.0	1.1	7.0
EL	1.6	1.5	1.2	1.1	1.1	1.0	0.9	1.0	-38.6
ES	7.1	6.9	6.5	7.0	7.7	7.8	8.1	8.6	22.0
FR	12.4	12.3	12.4	12.8	13.0	12.9	13.2	13.3	7.7
HR	0.6	0.6	0.5	0.5	0.5	0.5	0.4	0.4	-29.3
IT	8.4	8.0	7.0	7.1	7.1	6.9	6.9	7.1	-15.4
CY	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-16.8
LV	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	-30.6
LT	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	-40.5
LU	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	67.9
HU	1.4	1.4	1.4	1.4	1.3	1.3	1.3	1.3	-9.4
MT	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	23.0
NL	2.8	2.8	2.9	3.1	3.0	3.0	3.1	3.0	7.6
AT	1.2	1.3	1.4	1.4	1.4	1.4	1.4	1.4	12.5
PL	5.7	5.8	5.2	4.6	4.5	4.4	4.1	4.0	-30.2
PT	1.5	1.3	1.1	1.1	1.1	1.0	0.9	0.9	-36.6
RO	3.1	2.9	2.7	2.5	2.4	2.4	2.3	2.3	-25.5
SI	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-0.3
SK	0.8	0.8	0.8	0.7	0.7	0.7	0.7	0.7	-17.0
FI	0.9	0.9	0.9	0.9	0.9	0.8	0.8	0.8	-8.6
SE	1.7	1.8	2.0	2.1	2.2	2.3	2.4	2.5	47.6
UK	11.5	11.9	12.2	12.5	12.7	12.9	13.0	13.1	14.1
NO	0.9	1.0	1.0	1.0	1.1	1.1	1.1	1.1	19.4
EU	79.3	79.9	78.1	77.7	78.2	78.2	78.1	78.9	-0.6
EU ex UK	67.8	68.0	65.9	65.1	65.5	65.3	65.1	65.8	-3.1

Source Eurostat 2015 based population projections

ANNEX TABLE A.6

Projection of population aged 15-64, 2015-2080, millions

	2015	2020	2030	2040	2050	2060	2070	2080	% CHANGE 2015-2080
BE	7.3	7.4	7.5	7.7	7.9	7.9	8.1	8.1	11.0
BG	4.8	4.4	3.9	3.5	3.0	2.8	2.7	2.5	-47.2
CZ	7.1	6.8	6.7	6.4	5.9	5.6	5.7	5.5	-22.3
DK	3.6	3.8	3.9	3.9	4.0	4.0	3.8	3.8	4.8
DE	53.4	54.3	50.9	48.8	47.5	44.9	43.8	43.2	-19.2
EE	0.9	0.8	0.8	0.8	0.7	0.7	0.7	0.6	-26.9
IE	3.0	3.1	3.2	3.3	3.2	3.4	3.5	3.5	17.8
EL	7.0	6.7	6.1	5.3	4.6	4.4	4.1	3.8	-45.7
ES	30.8	30.4	29.0	26.7	25.6	27.2	28.4	29.0	-5.8
FR	41.8	41.8	41.6	41.4	42.3	43.7	44.1	44.5	6.4
HR	2.8	2.6	2.4	2.3	2.1	2.0	1.9	1.8	-36.3
IT	39.2	38.8	36.9	33.6	31.9	31.0	30.0	28.7	-26.9
CY	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.5	-6.5
LV	1.3	1.2	1.0	0.9	0.8	0.7	0.7	0.7	-45.5
LT	1.9	1.8	1.4	1.2	1.1	0.9	1.0	0.9	-52.0
LU	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.6	55.2
HU	6.7	6.4	6.1	5.7	5.3	5.1	5.0	4.9	-26.7
MT	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-0.7
NL	11.1	11.2	11.2	11.1	11.4	11.3	11.1	11.1	0.3
AT	5.8	6.0	6.1	6.1	6.1	5.8	5.7	5.6	-3.0
PL	26.4	25.1	23.3	22.0	19.3	17.3	16.6	15.5	-41.2
PT	6.8	6.6	6.1	5.4	4.9	4.6	4.2	3.9	-42.2
RO	13.4	12.7	11.4	10.1	9.0	8.5	8.3	8.1	-39.7
SI	1.4	1.3	1.3	1.2	1.1	1.1	1.1	1.1	-22.2
SK	3.8	3.7	3.5	3.3	3.0	2.8	2.7	2.6	-32.8
FI	3.5	3.4	3.4	3.4	3.3	3.2	3.2	3.1	-11.7
SE	6.2	6.4	6.9	7.2	7.6	7.7	8.0	8.2	33.3
UK	41.9	42.8	44.3	45.2	46.3	46.4	46.6	46.5	10.9
NO	3.4	3.5	3.7	3.8	4.0	4.0	4.0	4.0	19.1
EU	333.0	331.0	320.6	308.0	299.7	294.3	292.5	288.5	-13.4
EU ex UK	291.1	288.2	276.3	262.9	253.4	247.9	245.8	242.0	-16.9

Source Eurostat 2015 based population projections

ANNEX TABLE A.7

Projection of population aged 65 and over, 2015-2080, millions

	2015	2020	2030	2040	2050	2060	2070	2080	% CHANGE 2015-2080
BE	2.0	2.2	2.7	3.1	3.3	3.4	3.6	3.9	90.2
BG	1.4	1.5	1.6	1.7	1.8	1.7	1.5	1.4	-1.5
CZ	1.9	2.1	2.4	2.7	3.0	3.1	2.8	2.8	48.6
DK	1.1	1.2	1.4	1.6	1.6	1.8	1.9	2.0	90.2
DE	17.1	18.3	21.8	24.1	24.3	24.7	24.5	23.9	40.1
EE	0.2	0.3	0.3	0.3	0.3	0.4	0.3	0.3	38.1
IE	0.6	0.7	0.9	1.2	1.5	1.5	1.5	1.6	164.6
EL	2.3	2.4	2.7	3.1	3.3	2.9	2.6	2.5	9.5
ES	8.6	9.3	11.6	14.4	15.9	14.6	13.3	13.4	55.5
FR	12.2	13.8	16.5	18.7	19.0	19.0	19.7	20.9	70.6
HR	0.8	0.9	1.0	1.0	1.1	1.1	1.1	1.0	32.0
IT	13.2	14.0	16.4	19.3	19.9	19.0	18.0	18.0	36.2
CY	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	176.3
LV	0.4	0.4	0.4	0.5	0.5	0.5	0.4	0.4	-4.7
LT	0.5	0.6	0.6	0.7	0.6	0.6	0.5	0.5	-14.1
LU	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	280.2
HU	1.8	2.0	2.1	2.4	2.6	2.7	2.6	2.5	42.4
MT	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	95.4
NL	3.0	3.4	4.3	4.9	4.8	5.0	5.4	5.6	85.6
AT	1.6	1.7	2.2	2.6	2.8	3.0	3.1	3.1	94.9
PL	5.9	7.0	8.6	9.3	10.5	11.2	10.3	9.6	63.3
PT	2.1	2.3	2.7	3.0	3.2	3.0	2.8	2.7	28.5
RO	3.4	3.7	3.9	4.5	4.9	4.8	4.4	4.2	23.0
SI	0.4	0.4	0.5	0.6	0.6	0.6	0.6	0.6	50.1
SK	0.8	0.9	1.1	1.3	1.5	1.6	1.5	1.5	91.3
FI	1.1	1.2	1.4	1.5	1.5	1.6	1.6	1.7	54.2
SE	1.9	2.1	2.4	2.7	2.9	3.3	3.4	3.7	94.3
UK	11.5	12.5	15.1	17.4	18.5	20.2	21.4	22.8	98.8
NO	0.8	0.9	1.2	1.4	1.6	1.7	1.9	2.0	141.2
EU	96.1	105.2	125.2	142.7	150.6	152.1	149.9	151.0	57.1
EU ex UK	84.6	92.7	110.1	125.3	132.1	132.0	128.5	128.1	51.5

Source Eurostat 2015 based population projections

ANNEX TABLE A.8

Projection of population aged 80 and over, 2015-2080, millions

	2015	2020	2030	2040	2050	2060	2070	2080	% CHANGE 2015-2080
BE	0.6	0.7	0.8	1.0	1.3	1.3	1.5	1.6	164.7
BG	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.6	83.0
CZ	0.4	0.4	0.7	0.9	0.9	1.3	1.3	1.2	178.3
DK	0.2	0.3	0.4	0.5	0.6	0.7	0.7	0.9	272.2
DE	4.5	5.8	6.3	7.9	10.4	9.6	10.5	11.1	144.7
EE	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	127.5
IE	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.6	329.2
EL	0.7	0.8	0.9	1.0	1.3	1.4	1.3	1.1	60.4
ES	2.7	2.9	3.6	4.6	6.2	7.3	6.4	5.5	100.9
FR	3.9	4.1	5.3	6.9	8.0	8.3	8.3	8.8	128.8
HR	0.2	0.2	0.2	0.3	0.4	0.4	0.4	0.5	129.3
IT	4.0	4.5	5.4	6.3	8.1	8.8	8.0	7.9	98.7
CY	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	485.8
LV	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	68.9
LT	0.1	0.2	0.2	0.2	0.3	0.2	0.2	0.2	52.5
LU	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	491.9
HU	0.4	0.5	0.6	0.8	0.8	1.1	1.1	1.1	166.7
MT	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	336.7
NL	0.7	0.8	1.3	1.6	2.0	2.0	2.1	2.4	231.2
AT	0.4	0.5	0.6	0.8	1.1	1.1	1.3	1.4	231.2
PL	1.5	1.7	2.2	3.4	3.5	4.1	5.0	4.5	198.0
PT	0.6	0.7	0.8	1.0	1.2	1.4	1.3	1.2	103.8
RO	0.8	0.9	1.0	1.4	1.6	2.0	2.0	1.8	119.4
SI	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.2	138.8
SK	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.7	292.8
FI	0.3	0.3	0.5	0.6	0.6	0.6	0.7	0.7	163.8
SE	0.5	0.5	0.8	0.9	1.1	1.2	1.4	1.6	215.5
UK	3.1	3.4	4.7	5.7	7.2	7.6	8.6	9.8	215.0
NO	0.2	0.2	0.4	0.5	0.6	0.7	0.7	0.9	287.1
EU	26.9	30.4	37.7	48.1	58.7	63.5	65.0	65.9	144.5
EU ex UK	23.8	27.0	33.1	42.4	51.5	55.9	56.5	56.1	135.3

Source Eurostat 2015 based population projections

ANNEX TABLE A.9

Projection of population aged 90 and over, 2015-2080, millions

	2015	2020	2030	2040	2050	2060	2070	2080	% CHANGE 2015-2080
BE	0.10	0.12	0.16	0.21	0.30	0.37	0.40	0.48	406.2
BG	0.03	0.04	0.05	0.08	0.11	0.13	0.18	0.20	568.8
CZ	0.05	0.07	0.09	0.17	0.20	0.25	0.38	0.39	660.2
DK	0.04	0.05	0.07	0.12	0.14	0.18	0.20	0.24	451.5
DE	0.69	0.86	1.40	1.49	2.20	3.01	2.70	3.43	396.9
EE	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.05	571.3
IE	0.02	0.03	0.04	0.07	0.10	0.15	0.20	0.22	823.0
EL	0.09	0.13	0.19	0.23	0.30	0.39	0.45	0.39	331.2
ES	0.45	0.59	0.74	1.04	1.44	2.00	2.41	1.96	334.1
FR	0.72	0.91	1.13	1.66	2.15	2.52	2.63	2.79	288.5
HR	0.02	0.03	0.04	0.05	0.08	0.09	0.11	0.13	586.7
IT	0.67	0.83	1.15	1.46	1.83	2.56	2.69	2.51	276.4
CY	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.05	1281.9
LV	0.01	0.02	0.02	0.03	0.04	0.05	0.05	0.06	474.9
LT	0.02	0.02	0.03	0.04	0.06	0.07	0.06	0.07	330.6
LU	0.00	0.00	0.01	0.01	0.02	0.02	0.03	0.04	1189.4
HU	0.05	0.07	0.09	0.14	0.19	0.22	0.33	0.33	505.3
MT	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.02	918.6
NL	0.12	0.14	0.20	0.34	0.45	0.58	0.56	0.66	469.0
AT	0.07	0.09	0.11	0.16	0.23	0.33	0.32	0.41	465.6
PL	0.19	0.27	0.39	0.59	0.97	0.95	1.34	1.62	757.6
PT	0.08	0.10	0.16	0.21	0.28	0.35	0.42	0.38	357.4
RO	0.09	0.12	0.18	0.23	0.35	0.45	0.57	0.61	615.8
SI	0.01	0.02	0.03	0.04	0.05	0.07	0.08	0.08	551.3
SK	0.02	0.03	0.04	0.07	0.11	0.13	0.19	0.22	971.7
FI	0.04	0.05	0.07	0.12	0.15	0.17	0.18	0.22	410.3
SE	0.09	0.10	0.13	0.22	0.24	0.32	0.36	0.46	386.2
UK	0.55	0.63	0.84	1.30	1.61	2.21	2.31	2.88	419.9
NO	0.04	0.05	0.05	0.10	0.13	0.17	0.20	0.25	468.1
EU	4.25	5.30	7.35	10.10	13.66	17.63	19.29	20.90	392.1
EU ex UK	4.13	5.17	7.16	9.76	13.21	17.05	18.72	20.24	389.9

Source Eurostat 2015 based population projections

ANNEX TABLE A.10

Projection of population aged 100 and over, 2015-2080

	2015	2020	2030	2040	2050	2060	2070	2080	% CHANGE 2015-2080
BE	2001	1957	5071	7394	11883	18673	25409	31321	1465
BG	358	339	907	1550	3277	4855	7353	11483	3108
CZ	798	668	2112	3320	8023	10562	15177	27250	3315
DK	1022	1318	2016	3327	6532	8641	12772	15488	1415
DE	17474	15025	35119	68188	80284	137541	204829	207043	1085
EE	136	141	431	750	1068	1640	2086	2859	2002
IE	964	1621	2420	3823	7055	11106	16795	24253	2416
EL	6130	6137	11369	17540	22836	31907	43745	51730	744
ES	15479	21492	45421	57842	92355	137084	199635	250123	1516
FR	24458	20856	54218	71579	123939	166200	210321	234742	860
HR	314	225	699	1353	2183	3845	5158	7280	2218
IT	19095	17586	43077	66360	94021	130468	200072	221839	1062
CY	76	60	111	241	516	836	1243	2023	2562
LV	194	176	527	945	1288	2144	2783	3515	1712
LT	368	249	748	1260	1749	3153	4078	4335	1078
LU	67	84	290	437	689	1210	1997	2702	3933
HU	1448	1497	3558	5462	9604	14536	19288	30722	2022
MT	57	92	227	451	935	1225	1308	1851	3147
NL	2170	2460	4772	8017	16455	24520	36190	38617	1680
AT	1404	1192	2932	4953	7638	12725	20462	22579	1508
PL	5118	5467	16710	25790	45653	78674	81735	129374	2428
PT	4066	3769	6837	11317	16620	24187	32941	42142	936
RO	1558	1827	5094	8962	13889	22587	35122	46532	2887
SI	236	224	713	1198	1944	3271	4358	5905	2402
SK	641	805	2153	3337	6332	10993	13617	21773	3297
FI	741	912	1879	2949	6087	7840	10028	12846	1634
SE	1953	2273	3509	5304	10414	13229	19951	25482	1205
UK	14504	17051	30456	45859	81399	112002	167845	191798	1222
NO	887	1159	1731	2424	5105	7519	11595	14516	1537
EU	122830	125503	283376	429508	674668	995654	1396298	1667607	1258
EU ex UK	108326	108452	252920	383649	593269	883652	1228453	1475809	1262

Source Eurostat 2015 based population projections

ANNEX TABLE A.11

Projection of old-age dependency ratios based on ratio of those over 65 to those aged 15-64, 2015-2080

POPULATION AGED 65+/POPULATION 15-64									
	2015	2020	2030	2040	2050	2060	2070	2080	CHANGE 2015-2080
CY	21.2	24.3	30.6	34.8	42.1	55.2	60.9	62.5	41.3
PL	22.2	27.8	37.0	42.2	54.6	64.8	62.4	61.5	39.3
PT	31.1	34.6	43.6	55.6	65.3	64.9	67.0	69.0	37.9
SK	19.7	24.4	32.6	39.1	50.9	59.4	57.0	56.4	36.7
EL	32.4	35.7	44.4	58.4	71.0	67.5	63.1	65.3	32.9
HR	28.3	32.3	39.9	44.8	50.1	53.5	56.1	58.6	30.3
LU	20.5	21.5	26.6	32.7	38.2	44.3	48.7	50.2	29.7
IT	33.7	36.1	44.3	57.3	62.5	61.2	60.2	62.7	29.0
AT	27.5	28.4	35.7	42.2	45.3	51.0	54.4	55.3	27.8
MT	27.6	32.5	40.3	41.2	45.7	53.6	55.9	54.2	26.6
BG	30.2	34.0	40.1	47.5	57.7	63.3	56.4	56.4	26.2
RO	25.2	29.1	34.7	45.2	53.9	56.9	52.9	51.4	26.2
EE	28.7	31.8	37.6	42.3	48.8	55.8	52.7	54.3	25.6
NO	24.5	26.8	31.8	37.1	39.5	43.9	47.1	49.6	25.1
IE	20.0	22.8	28.7	36.6	45.5	44.5	41.3	45.0	25.0
HU	26.5	30.7	35.1	41.1	48.9	53.1	52.1	51.5	25.0
SI	26.6	31.8	40.8	48.2	55.7	55.3	50.4	51.3	24.7
CZ	26.6	31.4	36.0	41.9	51.9	56.0	49.9	50.8	24.2
DK	28.8	30.9	35.5	39.6	39.8	44.6	50.0	52.5	23.7
FI	31.3	35.9	42.2	43.4	45.5	49.5	51.8	54.6	23.3
DE	32.0	33.7	42.9	49.4	51.2	55.0	55.9	55.2	23.2
NL	27.2	30.4	38.4	44.0	42.5	44.2	48.3	50.3	23.1
LV	29.5	32.7	43.2	51.0	59.3	65.7	54.1	51.7	22.2
LT	28.1	31.5	45.8	56.9	60.1	64.2	53.6	50.3	22.2
UK	27.5	29.1	34.1	38.5	40.0	43.4	45.8	49.1	21.6
BE	27.9	30.0	35.8	39.9	41.4	43.5	45.0	47.9	20.0
ES	27.9	30.7	40.2	54.0	62.1	53.7	46.8	46.1	18.2
FR	29.2	32.9	39.7	45.1	45.1	43.4	44.6	46.8	17.6
SE	31.1	32.5	34.6	36.9	37.9	42.6	43.1	45.2	14.1
EU	28.8	31.7	39.1	46.4	50.3	51.6	51.2	52.3	23.5

Source AR18 cross-country tables

ANNEX TABLE A.12

Projection of old-age dependency ratios based on ratio of those over 65 to those aged 15-64 in 2015, transitioning to the ratio of those over 70 to those aged 15-69 in 2060

	2015	2020	2030	2040	2050	2060	CHANGE 2015-2060
BE	27.9	28.8	31.7	32.6	31.4	29.8	1.9
BG	30.3	32.6	35.3	38.1	41.1	41.6	11.3
CZ	26.6	30.1	31.9	34.0	37.2	37.9	11.3
DK	28.9	29.6	31.6	32.2	30.3	30.4	1.5
DE	31.9	32.4	37.8	39.8	39.0	36.8	4.9
EE	28.8	30.7	33.2	34.5	35.9	36.8	8.0
IE	20.0	22.0	25.4	29.6	33.3	31.0	11.0
EL	32.4	34.3	39.2	46.8	51.5	47.1	14.8
ES	27.9	29.6	35.5	43.1	45.6	39.1	11.2
FR	29.2	31.7	35.2	36.9	34.4	30.8	1.6
HR	28.3	31.1	35.0	36.2	36.9	35.6	7.4
IT	33.6	34.8	39.2	45.7	46.4	42.8	9.1
CY	21.2	23.3	27.1	28.4	31.1	35.3	14.1
LV	29.6	31.6	38.0	41.0	43.2	42.7	13.2
LT	28.0	30.3	40.1	45.4	44.9	42.6	14.5
LU	20.5	20.7	23.6	26.5	28.5	29.8	9.3
HU	26.5	29.5	31.0	33.4	35.3	36.0	9.5
MT	27.5	31.2	35.8	34.2	34.1	35.5	8.0
NL	27.2	29.1	33.9	35.7	32.6	30.5	3.3
AT	27.5	27.3	31.6	34.1	34.3	34.2	6.6
PL	22.2	26.7	32.5	34.7	39.4	41.9	19.7
PT	31.1	33.2	38.5	44.5	47.6	45.0	13.9
RO	25.2	27.9	30.5	36.3	38.9	38.4	13.2
SI	26.6	30.5	35.8	39.0	41.1	37.8	11.2
SK	19.8	23.5	28.6	31.7	36.5	38.9	19.1
FI	31.2	34.4	37.4	35.8	34.5	33.4	2.1
SE	31.1	31.1	31.0	30.2	28.8	28.8	-2.2
UK	27.4	28.1	30.3	31.4	30.4	29.6	2.2
NO	24.5	25.7	28.2	30.2	29.7	29.8	5.3
EU	28.9	30.6	34.5	37.5	37.6	35.6	6.7

Source AR18 cross-country tables

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ACTUARIAL ASSOCIATION OF EUROPE

MAISON DES ACTUAIRES
1 PLACE DU SAMEDI
B-1000 BRUSSELS
BELGIUM
+31 2 201 60 21
INFO@ACTUARY.EU
WWW.ACTUARY.EU