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The 2018 Ageing Report

Underlying Assumptions & Projection Methodologies

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European Commission
Directorate-General for Economic and Financial Affairs

The 2018 Ageing Report

Underlying Assumptions and Projection Methodologies

EUROPEAN ECONOMY

Institutional Paper 065

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This report has been prepared as part of the mandate the Economic and Financial Affairs (ECOFIN) Council gave to the Economic Policy Committee (EPC) in 2015 to update and further deepen its common exercise of age-related expenditure projections, on the basis of a new population projection by Eurostat.

The forthcoming report with the long-term projections, the sixth edition, of the budgetary impact of the ageing population in the 28 EU Member States over the period 2016–2070 will be calculated on the basis of the macroeconomic assumptions and the methodology described in this report, is envisaged to be presented to the ECOFIN Council in Spring 2018.

In response to the mandate, the EPC mandated a working group, the Ageing Working Group (AWG) under the chairmanship of Wolfgang Merz, to take forward the work needed to discharge this remit.

This report is presented by the EPC and the European Commission services (Directorate General for Economic and Financial Affairs - DG ECFIN) after full discussion on the basis of the AWG's comprehensive work. The Directorate-General for Economic and Financial Affairs provided the necessary analysis and calculations used in the report. The demographic projections were carried out by Eurostat.

The report was prepared under the supervision of Lucio Pench (Director in DG ECFIN), Jens Granlund (Chair of the EPC), Wolfgang Merz (Chairman of the AWG), Giuseppe Carone (Head of Unit in DG ECFIN). The main contributors were Pedro Arevalo, Santiago Calvo Ramos, Per Eckefeldt, Luigi Giamboni, Boriana Goranova, Benedetta Martinelli, Anda Patarau, Adriana Reut, Chris Uregian and the members of the AWG (see list of Members below). The EPC and the Economic and Financial Affairs DG would like to thank all those concerned.

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EXECUTIVE SUMMARY

1. 2018 AGEING REPORT: MANDATE AND BROAD PRINCIPLES

The sustainability of public finances in the EU can be better safeguarded if its analysis banks on reliable and comparable information on possible challenges to fiscal sustainability, including the expected strains caused by the demographic changes ahead.

For this reason, the ECOFIN Council gave a mandate to the Economic Policy Committee (EPC) to produce a new set of long-term budgetary projections by 2018, on the basis of new population projections to be provided by Eurostat.

The EPC and the Commission services (Directorate-General for Economic and Financial Affairs - DG ECFIN) agreed on a work programme with broad arrangements to organise the budgetary projections and reach an agreement on its assumptions and methodologies to discharge this mandate (see the overview of the projection exercise for details).

This report provides a description of the underlying macroeconomic assumptions and methodologies of the age-related expenditure projections for all Member States. On the basis of these assumptions and methodologies, age-related expenditures covering pensions, health care, long-term care, education and also unemployment benefits (for the sake of completeness) will be calculated and presented in the sixth Ageing Report to the ECOFIN Council in spring 2018.

The long-term projections show where (in which countries), when, and to what extent ageing pressures will accelerate as the baby-boom generation retires and as the EU population continues to extend its life span in the future. Hence, the projections are helpful in highlighting the immediate and future policy challenges for governments posed by demographic trends. The report provides a very rich set of information at the individual country level, compiled in a comparable manner. Comparable and reliable underlying projections are crucial since they cover a long time-span (until 2070).

The projections feed into a variety of policy debates and processes at EU level, including the overarching Europe 2020 strategy for smart, sustainable and inclusive growth. In particular, they are used in the context of the European Semester so as to identify policy challenges, including in setting the medium-term budgetary objectives (MTOs), in the annual assessment of the sustainability of public finances carried out as part of the Stability and Growth Pact, and additionally in the analysis on the impact of ageing populations on the labour market and potential economic growth.

Coverage and overview of the 2018 long-term projection exercise

The long-term projections take as starting point Eurostat's population projections for the period 2016 to 2070. In addition, the EPC, on the basis of proposals prepared by the Commission services (DG ECFIN) and the EPC (Ageing Working Group), agreed upon assumptions and methodologies common for all Member States to project a set of exogenous macroeconomic variables covering the labour force (participation, employment and unemployment rates), labour productivity, and the real interest rate (see Graph 1). This combined set of projections enabled the calculation of GDP for all Member States up to 2070, presented in this report.

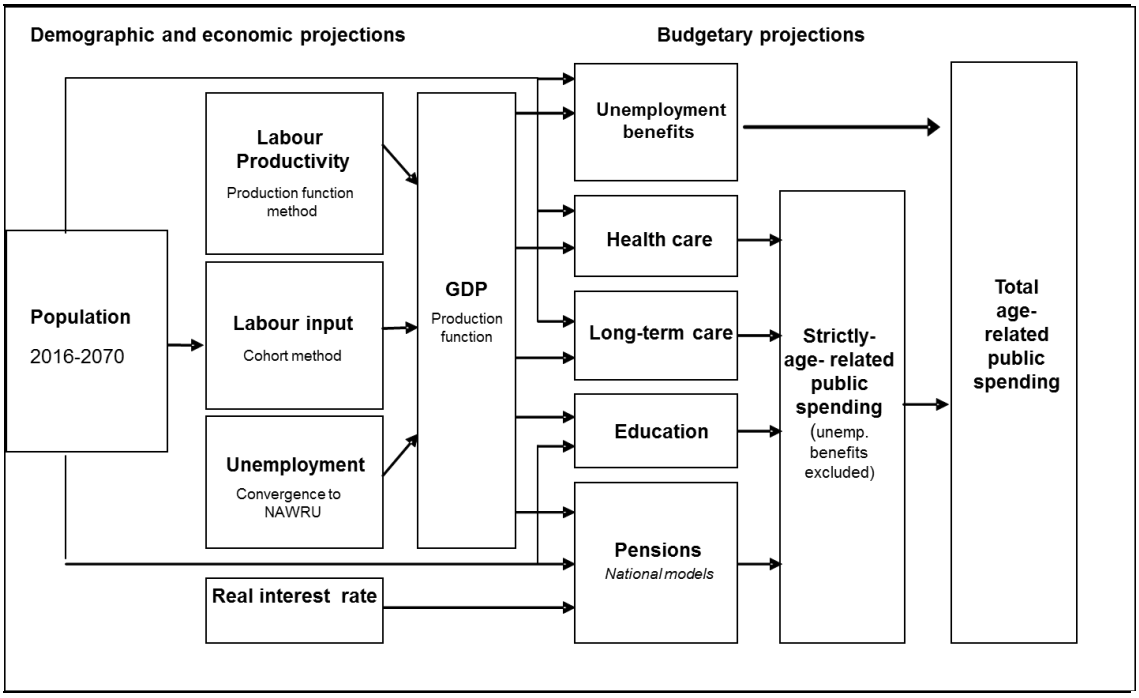
Separate budgetary projections will be carried out for five government expenditure items (pensions, health care, long-term care, education and unemployment benefit) on the basis of these assumptions. The projections for pensions will be run by the Member States using their own national model(s) in a peer reviewed process carried out by the EPC Ageing Working Group. In this way, the projections benefit from capturing the country-specific circumstances prevailing in the different Member States (different

pension legislation), while at the same time ensuring consistency by basing the projections on commonly agreed macro-economic underlying assumptions. The projections for health care, long-term care, education and unemployment will be run by the Commission services (DG ECFIN) in collaboration with the EPC Ageing Working Group, on the basis of a common projection model for each expenditure item. The results of this set of projections provide an overall projection of age-related public expenditures (see Graph 1).

The long-term projections are not forecasts. Projecting economic developments over the next half decade is a daunting analytical task facing policy makers. There is uncertainty surrounding the projections and the longer the projection period, the higher the degree of uncertainty. The projections are made under a 'no-policy-change' assumption. They do not aim to predict the future, they are made to illustrate what the future could be if current policies remain unchanged. The projection results are strongly influenced by the underlying assumptions. For this reason, a set of sensitivity tests are carried out to illustrate the extent to which the public expenditure projections are sensitive to key assumptions.

This report is structured in two parts. The first one describes the underlying assumptions: the population projection, the labour force projection, the potential GDP projections and the other macroeconomic assumptions as well as the sensitivity tests. The second part presents the methodologies for projecting future expenditure on pensions, health care, long-term care, education and unemployment benefits. A statistical annex gives an overview of the main assumptions and macroeconomic projections by country.

Graph 1: **Overview of the 2018 projection exercise**



Source: Commission services, EPC.

2. MAIN RESULTS: THE ECONOMIC IMPACT OF POPULATION AGEING

Significant changes in the distribution of the EU population projected

The age structure of the EU population is projected to change significantly in the coming decades. According to Eurostat, the overall size of the population is projected to be slightly larger by 2070 than in

2016. ([1]) The EU population is projected to increase by about 3.5% between 2016 (511 million) and 2040 (at 528 million) when it will peak, to then remain stable until 2050 and to thereafter decline to 520 million in 2070 (see Table 1). While the total EU population will increase by 1.8% over 2016-70, there are wide differences in population trends across Member States, with the population increasing in half of the EU countries and falling in the other half.

The demographic old-age dependency ratio set to continue to rise sharply over the coming decades

The demographic old-age dependency ratio (people aged 65 or above relative to those aged 15-64) is projected to increase significantly in the EU as a whole in the coming decades. Being about 25% in 2010, it has risen to 29.6% in 2016 and is projected to rise further, in particular up to 2050, and eventually reach 51.2% in 2070. This implies that the EU would move from four working-age people for every person aged over 65 years in 2010 to around two working-age persons over the projection horizon.

Changes in the size and age profile of the population depend upon assumptions regarding fertility rates, life expectancy and migration.

The total fertility rate (TFR) is projected to rise from 1.58 in 2016 to 1.78 by 2060 and further to 1.81 by 2070 for the EU as a whole. In the euro area, an increase of similar magnitude is projected, from 1.56 in 2016 to 1.79 in 2070 (see Table 2). This follows from an assumed process of convergence of fertility rates across Member States to that of the forerunners over the very long-term in Eurostat's 2015 population projections.

Life expectancy at birth for males is expected to increase by 7.8 years over the projection period, from 78.3 in 2016 to 86.1 in 2070 in the EU. For females, life expectancy at birth is projected to increase by 6.6 years, from 83.7 in 2016 to 90.3 in 2070, implying a convergence of life expectancy between males and females. The largest increases in life expectancies at birth, for both males and females, are projected to take place in the Member States with the lowest life expectancies in 2016.

For the EU as a whole, annual net migration inflows are projected to decrease from about 1.5 million people in 2016 to 914,600 by 2060 and 804,700 people by 2070 (an annual inflow of 0.2% of the EU population), as net migration flows are assumed to become gradually lower over the very long-term. There are however differences between Member States.

Projected increases in overall participation rates, in particular for older workers on account of implemented pension reforms, but labour supply set to decline

The labour force projections are made using a cohort simulation model, capturing the country-specific situation, and assume no further policy changes aside of legislated pension reforms. They reveal an increase of labour force participation rates, especially for older workers, reflecting the combined effect of the rising attachment of younger generations of women to the labour market, together with the expected effect of pension reforms.

The total participation rate (for the age group 20 to 64) in the EU is projected to increase by 3.2 percentage points (from 77.5% in 2016 to 80.7% in 2070). For the euro area a slightly lower increase of 3.1 pps. is projected (from 77.6% in 2016 to 80.6% in 2070) (see Table 3).

([1]) In this report, two EU aggregates are reported; EU* includes all 28 EU Member States and EU27 includes all EU Member States except the UK.

The largest increase in participation rates is projected for older workers (age group 55-64), rising by 12.2 pps. in the EU (16.2 pps. for women and 7.7 pps. for men). Consequently, the gender gap in terms of participation rates is projected to narrow substantially in the period up to 2070.

Still, given the projected evolution of prime-age population in many countries, total labour supply in the EU is projected to decrease over the projection horizon. The labour supply of men is calculated to decline at a constant pace (0.2% yearly) for a total reduction of 10.6% (around 13.5 million persons) by 2070. Female labour supply remains almost stable till 2030, but is expected to decline afterwards at a yearly pace of 0.2%. This will imply a reduction of almost 9 million persons after 2030, corresponding to a fall of 8.5% by 2070. In the euro area, the projected fall in total labour supply (men and women) between 2016 and 2070 is 9.7%, equivalent to about 15 million people, and corresponding to a decline of 0.2% per year between 2016 and 2070.

Further rises in employment rates projected, but the number of employed declining

Employment is determined by the population projections, participation rates and the unemployment rate assumptions. With regard to unemployment, it is projected to decline by 2.2 pps. (from 8.7% in 2016 to 6.5% in 2070) in the EU, under the general assumption that the unemployment rate would converge to the estimated NAWRU rates. ([2]) In the euro area, the unemployment rate is assumed to fall from 10.2% in 2010 to 6.8% in 2070.

The total employment rate (for individuals aged 20 to 64) in the EU is projected to increase from 71.1% in 2016 to 75.8% in 2070. In the euro area, a similar development is expected, with the employment rate reaching 75.3% in 2070. The employment rate of women is projected to rise by 6.9 pps. (from 65.3% in 2016 to 72.2% in 2070). The employment rate for older workers is expected to increase even more, by 12.6 pps. (from 55.3% in 2016 to 67.9% in 2070), reflecting the expected impact of pension reforms in many Member States aimed at increasing the retirement age.

The effective economic old age dependency ratio (inactive older persons (65+) in relation to the number of employed (aged 20 – 64) is projected to rise significantly; from 43.1% in 2016 to 68.5% in 2070 in the EU. In the euro area, a similar deterioration is projected from 46.2% in 2016 to 69.2% in 2070.

Both total employment and total hours worked are expected to fall in the EU and in the euro area over the projection period up to 2070.

Stable potential GDP growth projected over the long-term, though much lower than in previous decades

For the EU as a whole, the annual growth rate is set to average 1.4% up to 2020, slightly down to 1.3% during 2021-40 before gradually rising to 1.5% from 2050 until 2070. As a result, the average annual potential GDP growth rate for the period 2016-70 is projected to be 1.4% (see Table 4).

The projections for the euro area follow a similar, though slightly lower trajectory over the projection horizon, with annual growth of 1.2% through 2020, 1.1% in 2021-40 that rises to 1.5% during 2051-70, resulting in an average growth rate over the period 2016-70 of 1.3%.

As labour growth turns negative in the 2020s, only labour productivity drives GDP growth over the long-term

([2]) For countries where the estimated NAWRU rates are high, it is assumed that in those cases unemployment would be further reduced to the average in the EU.

The contribution of labour input – total hours worked – to potential growth in the EU and in the euro area is projected to be positive only up to the 2020s. Thereafter, resulting from the declining working-age population, labour input contributes negatively to potential growth.

Given the limited contribution of labour input, potential growth in the EU and EA – particularly after 2020 - will be driven almost entirely by labour productivity. Annual growth in labour productivity per hour worked in the EU is projected to increase from 0.9% up to 2020 to 1.6% by 2040 to and remain fairly stable thereafter throughout the rest of the projection period. As a result, the average annual growth rate is equal to 1.5% over the entire period. A similar trajectory is envisaged in the euro area, with labour productivity rising from 0.7% on average through 2020 to 1.6% by 2040 and remaining at that level through 2070, with overall average growth of 1.4% over the entire period.

There are risks to future potential GDP growth should developments of labour productivity growth (total factor productivity) be less dynamic than assumed in the baseline scenario

The projected increase in labour productivity rests on the assumption that TFP growth will converge to 1% by 2070 at the latest for all Member States (for countries with relatively high GDP per capita, convergence to a 1% growth rate is assumed to take place by 2045, while for countries with GDP per capita below the EU average a period of catching-up is assumed, with a higher growth rate of up to 1.5% until 2045). However, in light of the trend decline of TFP growth performance over the last decades, it is important assess the impact of lower TFP growth on age-related expenditure and fiscal sustainability ([3]). To this end, a scenario assuming lower TFP growth was run (TFP risk scenario), entailing convergence to a lower TFP growth rate of 0.8% (while still allowing for catching-up for countries with GDP per capita below the EU average). In the TFP risk scenario, annual average potential GDP growth during 2016-70 is projected to rise by 1.1% for the EU and euro area, as opposed to 1.4% and 1.3% respectively in the baseline.

Comparison with the 2015 long-term budgetary projection exercise

In terms of population projections, the total EU population is projected to be about 1.6 million larger than the EUROPOP2013 estimate by 2060, due to a large increase in the population above 65 years old that offsets the reduction in the working-age population. The population in the euro area is projected to be 5.3 million higher than in EUROPOP2013, with higher estimates for all population groups, but in particular for those above 65 years of age. As a result, the new Eurostat population projections lead to the old-age dependency ratio (persons aged 65 and more over those age 15-64) being 1.5 pps. higher for the EU as a whole in 2060, and 1.2 pp. higher for the euro area vis-à-vis the EUROPOP2013 projection.

Turning to economic growth, potential GDP growth has been revised downwards compared with the baseline projection in the 2015 Ageing Report. Annual average potential GDP growth over the period 2016-60 in the EU is projected to be 1.4%, namely 0.1 pp. below the projection in the 2015 Ageing Report and the same difference (-0.1 pp.) is anticipated for the euro area. In both cases, the downward revision is driven by slightly lower labour productivity growth projections, while there is minimal difference in the labour input contribution.

The downward revision is mostly concentrated in the first half of the projection horizon. For the EU, annual potential GDP growth over the period 2016-35 is now projected to average 1.3% as opposed to 1.4% in the 2015 projection, while during 2036-60 differences in GDP growth are smaller. For the euro area, annual potential GDP growth over the period 2016-35 is projected in the 2018 Ageing Report to average 1.1% as opposed to 1.3% in the 2015 Ageing Report, while during 2036-60, average GDP growth is projected to be rather similar.

([3]) The Eurogroup called for assessing risks to age-related expenditure and fiscal sustainability under adverse macro-economic prospects (see Eurogroup statement No 144/17, 20/3/2017.

Table 1: **Population projections, 2018 and 2015 Ageing Report**

	Projection exercise 2018						2018 AR - 2015 AR (2016-60)						
	Total population (million)			Old-age dependency ratio			Total population (thousand)			Old-age dependency ratio			
	2016	2070	% change 2016-2070	2016	2070	pps. change 2016-70	2016	2060	Diff in 2060 as % of total pop in 2060 EUROPOP2013	2016	2060	pps. change 2016-60	
BE	11.3	13.9	22.8%	28.4	45.2	16.7	-153.8	-1835.8	-11.9%	0.3	3.6	3.3	BE
BG	7.1	4.9	-31.9%	31.5	56.2	24.7	-2.8	-253.8	-4.6%	0.2	4.5	4.3	BG
CZ	10.6	10.0	-5.7%	28.1	49.7	21.6	-3.6	-784.6	-7.1%	0.1	5.7	5.6	CZ
DK	5.7	6.8	19.2%	29.5	50.2	20.8	46.5	216.7	3.3%	-0.2	3.2	3.4	DK
DE	82.5	79.2	-3.9%	32.2	55.9	23.7	1739.4	9898.9	14.0%	-1.4	-4.1	-2.7	DE
EE	1.3	1.2	-10.5%	29.7	52.7	23.0	10.6	128.1	11.7%	-0.2	1.2	1.4	EE
IE	4.7	6.0	28.9%	20.9	41.2	20.4	77.8	653.4	12.4%	0.0	8.6	8.6	IE
EL	10.8	7.7	-28.8%	33.4	63.1	29.7	-144.0	-298.4	-3.5%	0.7	6.4	5.7	EL
ES	46.4	49.9	7.4%	28.6	46.6	18.0	191.9	3430.8	7.4%	0.1	0.1	-0.1	ES
FR	66.8	77.0	15.3%	30.4	44.8	14.4	170.6	-80.9	-0.1%	0.1	0.5	0.4	FR
HR	4.2	3.4	-18.6%	29.3	56.2	26.9	-58.4	-171.5	-4.6%	0.3	1.4	1.1	HR
IT	60.8	54.9	-9.7%	34.5	60.3	25.8	-488.6	-9458.5	-14.3%	0.6	8.0	7.4	IT
CY	0.9	1.0	19.8%	22.2	61.0	38.7	-28.1	-110.2	-9.8%	0.8	9.2	8.5	CY
LV	2.0	1.3	-31.7%	30.5	53.8	23.3	5.0	26.1	1.9%	0.4	14.9	14.4	LV
LT	2.9	1.7	-40.1%	29.0	53.1	24.1	34.8	-0.9	0.0%	-0.2	18.3	18.5	LT
LU	0.6	1.0	78.0%	20.6	48.9	28.2	-0.5	-148.4	-13.0%	-0.2	9.1	9.2	LU
HU	9.8	8.9	-9.7%	27.5	52.0	24.5	-17.4	-44.6	-0.5%	0.1	0.7	0.6	HU
MT	0.4	0.5	19.3%	29.1	55.8	26.6	6.8	43.1	9.1%	-0.2	3.1	3.3	MT
NL	17.0	19.6	14.8%	28.1	48.4	20.3	82.5	2260.9	13.2%	-0.2	-3.4	-3.3	NL
AT	8.7	10.2	16.5%	27.6	54.4	26.9	107.3	533.8	5.5%	-0.5	0.8	1.2	AT
PL	38.0	30.9	-18.7%	23.7	62.2	38.5	-516.9	-446.3	-1.3%	0.4	3.9	3.5	PL
PT	10.3	8.0	-22.7%	32.1	67.2	35.1	34.5	327.1	4.0%	0.1	1.0	0.8	PT
RO	19.7	15.0	-23.8%	26.3	52.8	26.6	-174.2	-1745.7	-10.0%	0.2	4.9	4.7	RO
SI	2.1	2.0	-5.3%	28.1	50.2	22.1	-9.4	-41.7	-2.0%	0.1	2.5	2.4	SI
SK	5.4	4.9	-9.8%	21.0	56.8	35.8	12.7	547.7	12.0%	0.1	-6.7	-6.8	SK
FI	5.5	5.6	2.3%	32.8	52.0	19.1	-24.8	-590.9	-9.5%	0.1	4.6	4.6	FI
SE	9.9	13.9	39.9%	31.6	43.2	11.6	74.5	231.1	1.8%	-0.2	1.2	1.4	SE
UK	65.6	81.0	23.5%	27.9	46.0	18.0	343.6	-659.5	-0.8%	-0.1	0.8	0.9	UK
NO	5.2	7.0	33.9%	25.2	47.2	22.1	-46.0	-1334.1	-16.4%	0.2	5.1	4.9	NO
EA	340.3	345.6	1.5%	30.9	51.8	20.9	1624.9	5284.1	1.5%	-0.2	1.2	1.4	EA
EU*	510.9	520.3	1.8%	29.6	51.2	21.6	1316.2	1625.9	0.3%	-0.1	1.5	1.6	EU*
EU27	445.3	439.2	-1.4%	29.9	52.2	22.4	972.5	2285.4	0.5%	-0.1	1.7	1.7	EU27

(1) EA: euro area, EU*: All 28 EU Member States, EU27: All EU Member States except the UK.

Source: Commission services, EPC.

Table 2: **Population projection assumptions, 2018 and 2015 Ageing Report**

	Projection exercise 2018													2018 AR - 2015 AR (2016-60)											
	Fertility rate			Life expectancy at birth						Net migration				Fertility rate			Life expectancy at birth						Net migration				
				Males			Females			('000)		% of total pop.					Males			Females			('000)		% of total pop.		
	2016	2070	change 2016-70	2016	2070	change 2016-70	2016	2070	change 2016-70	2016	2070	2016	2070	2016	2060	change 2016-60	2016	2060	change 2016-60	2016	2060	change 2016-60	2016	2060	2016	2060	
BE	1.73	1.82	0.09	78.8	86.2	7.4	83.7	90.2	6.5	55.2	26.2	0.5	0.2	-0.08	-0.07	0.01	0.5	0.4	-0.1	0.3	0.3	0.0	-19.8	-12.6	-0.2	-0.1	BE
BG	1.51	1.80	0.29	71.8	83.3	11.5	78.5	87.8	9.3	-4.3	1.3	-0.1	0.0	-0.04	0.01	0.05	-0.1	-0.1	0.0	-0.1	-0.1	0.0	0.4	0.0	0.0	0.0	BG
CZ	1.62	1.82	0.20	76.2	84.9	8.7	82.1	89.3	7.2	18.6	8.5	0.2	0.1	0.05	0.00	-0.05	0.5	0.2	-0.3	0.4	0.2	-0.2	-6.5	-12.4	-0.1	-0.1	CZ
DK	1.79	1.82	0.02	78.8	86.1	7.3	82.9	90.0	7.1	36.7	9.3	0.6	0.1	0.03	-0.07	-0.10	0.2	0.1	-0.1	0.3	0.2	-0.1	19.0	1.3	0.3	0.0	DK
DE	1.49	1.68	0.19	78.7	86.1	7.4	83.6	90.1	6.5	750.0	143.5	0.9	0.2	0.07	0.01	-0.06	-0.3	-0.3	0.0	0.0	-0.1	-0.1	517.9	77.2	0.6	0.0	DE
EE	1.58	1.81	0.23	72.8	83.9	11.1	81.9	89.5	7.6	2.9	0.3	0.2	0.0	-0.03	-0.02	0.01	0.5	0.3	-0.2	0.1	0.0	-0.1	6.0	0.1	0.5	0.0	EE
IE	1.89	1.97	0.08	79.5	86.4	6.9	83.5	90.3	6.8	14.8	10.8	0.3	0.2	-0.12	-0.02	0.10	0.3	0.1	-0.2	0.0	0.0	0.0	46.4	-2.9	1.0	-0.1	IE
EL	1.39	1.64	0.25	78.8	86.5	7.7	83.9	90.3	6.4	-23.9	11.0	-0.2	0.1	0.03	0.00	-0.02	0.3	0.4	0.1	0.2	0.3	0.1	-0.3	5.8	0.0	0.1	EL
ES	1.31	1.88	0.57	80.5	86.9	6.4	86.0	91.2	5.2	12.9	136.8	0.0	0.3	-0.03	0.33	0.36	0.6	0.4	-0.2	0.5	0.3	-0.2	95.7	-121.2	0.2	-0.3	ES
FR	2.01	1.99	-0.02	79.5	86.6	7.1	85.6	91.1	5.5	53.6	55.3	0.1	0.1	0.00	0.01	0.01	0.4	0.3	-0.1	0.3	0.3	0.0	-34.5	-4.6	-0.1	0.0	FR
HR	1.41	1.65	0.25	75.0	84.4	9.4	81.1	88.9	7.8	-21.5	4.6	-0.5	0.1	-0.13	-0.06	0.07	0.4	0.2	-0.2	-0.1	0.0	0.1	-22.7	0.5	-0.5	0.0	HR
IT	1.33	1.66	0.33	80.7	86.9	6.2	85.3	90.9	5.6	134.5	163.8	0.2	0.3	-0.12	-0.01	0.11	0.5	0.4	-0.1	0.3	0.3	0.0	-183.2	-19.7	-0.3	0.0	IT
CY	1.31	1.62	0.30	80.6	87.0	6.4	84.3	90.2	5.9	1.0	3.7	0.1	0.4	-0.11	-0.06	0.05	1.1	0.8	-0.3	0.6	0.4	-0.2	1.6	-3.5	0.2	-0.3	CY
LV	1.74	1.87	0.13	69.4	82.7	13.3	79.5	88.6	9.1	-9.4	0.1	-0.5	0.0	0.20	0.08	-0.12	-0.6	-0.2	0.4	0.0	0.2	0.2	2.5	0.0	0.1	0.0	LV
LT	1.66	1.84	0.18	69.3	82.8	13.5	79.9	88.8	8.9	-28.2	0.0	-1.0	0.0	0.03	0.03	0.00	-0.3	-0.1	0.2	-0.3	0.0	0.3	6.4	0.2	0.2	0.0	LT
LU	1.40	1.69	0.29	79.2	86.4	7.2	84.6	90.9	6.3	10.8	4.0	1.9	0.4	-0.21	-0.12	0.08	-0.4	-0.1	0.3	0.6	0.4	-0.2	-0.2	-0.4	0.0	0.0	LU
HU	1.48	1.80	0.32	72.8	83.9	11.1	79.6	88.6	9.0	18.2	11.2	0.2	0.1	0.04	0.03	0.00	0.2	0.1	-0.1	0.2	0.2	0.0	-3.8	-0.2	0.0	0.0	HU
MT	1.41	1.75	0.33	80.0	86.8	6.8	84.3	90.6	6.3	3.5	1.0	0.8	0.2	-0.08	-0.06	0.02	0.9	0.7	-0.2	1.0	0.5	-0.5	1.9	0.1	0.4	0.0	MT
NL	1.66	1.81	0.16	79.8	86.5	6.7	83.3	90.1	6.8	85.5	24.5	0.5	0.1	-0.06	-0.01	0.06	0.1	0.3	0.2	-0.1	0.1	0.2	63.8	19.4	0.4	0.1	NL
AT	1.47	1.66	0.19	79.0	86.3	7.3	83.8	90.2	6.4	73.8	20.6	0.8	0.2	0.00	0.00	0.01	0.2	0.3	0.1	-0.1	0.1	0.2	26.0	0.0	0.3	-0.1	AT
PL	1.37	1.71	0.34	73.9	84.4	10.5	81.6	89.5	7.9	4.9	7.3	0.0	0.0	0.02	0.06	0.04	0.3	0.2	-0.1	0.1	0.2	0.1	4.0	0.1	0.0	0.0	PL
PT	1.34	1.59	0.25	78.2	85.9	7.7	84.3	90.4	6.1	-10.5	14.2	-0.1	0.2	0.05	0.01	-0.05	0.3	0.2	-0.1	0.4	0.2	-0.2	7.1	6.7	0.1	0.1	PT
RO	1.54	1.89	0.35	71.8	83.6	11.8	78.9	88.3	9.4	-63.8	2.6	-0.3	0.0	-0.15	0.05	0.20	-0.2	0.0	0.2	0.1	0.2	0.1	-62.0	-0.8	-0.3	0.0	RO
SI	1.58	1.81	0.24	78.2	85.8	7.6	83.8	90.1	6.3	0.2	2.5	0.0	0.1	-0.03	0.03	0.06	0.5	0.3	-0.2	0.3	0.2	-0.1	-3.8	-1.6	-0.2	-0.1	SI
SK	1.40	1.82	0.42	73.7	84.2	10.5	80.7	89.1	8.4	6.0	3.2	0.1	0.1	0.10	0.26	0.15	0.3	0.3	0.0	0.3	0.4	0.1	2.9	1.4	0.1	0.0	SK
FI	1.60	1.80	0.20	78.5	85.9	7.4	84.1	90.2	6.1	15.9	6.8	0.3	0.1	-0.20	-0.08	0.12	0.3	0.1	-0.2	0.1	0.0	-0.1	-4.6	-1.0	-0.1	0.0	FI
SE	1.86	2.03	0.16	80.6	86.7	6.1	84.3	90.3	6.0	103.5	24.4	1.0	0.2	-0.07	0.09	0.15	0.1	0.1	0.0	0.3	0.2	-0.1	51.4	-3.8	0.5	-0.1	SE
UK	1.80	1.87	0.07	79.6	86.5	6.9	83.3	90.1	6.8	244.0	107.3	0.4	0.1	-0.13	-0.07	0.05	0.0	0.1	0.1	0.0	0.0	0.0	79.5	-50.1	0.1	-0.1	UK
NO	1.70	1.83	0.13	80.2	86.6	6.4	84.3	90.4	6.1	27.4	16.1	0.5	0.2	-0.15	-0.07	0.08	0.2	0.1	-0.1	0.3	0.3	0.0	-22.2	-4.3	-0.4	0.0	NO
EA	1.56	1.79	0.24	79.3	86.4	7.1	84.6	90.6	6.1	1 148.6	628.2	0.3	0.2	-0.01	0.05	0.06	0.1	0.2	0.0	0.2	0.1	0.0	531.8	-56.8	0.2	0.0	EA
EU*	1.58	1.81	0.23	78.3	86.1	7.8	83.7	90.3	6.6	1 484.8	804.7	0.3	0.2	-0.03	0.03	0.06	0.2	0.2	0.0	0.2	0.2	0.0	591.1	-122.1	0.1	0.0	EU*
EU27	1.55	1.80	0.25	78.1	86.1	7.9	83.7	90.3	6.6	1 240.8	697.4	0.3	0.2	-0.04	0.03	0.06	0.2	0.2	0.0	0.2	0.2	0.0	511.6	-72.0	0.1	0.0	EU27

Source: Commission services, EPC.

Table 3: **Labour force projections, 2018 and 2015 Ageing Report**

	Projection exercise 2018															2018 AR - 2015 AR (2016-60)														
	Employment rate						Participation rate						Unemployment rate			Employment rate						Participation rate						Unemployment rate			
	(20-64)			(55-64)			(20-64)			(55-64)			(15-64)			(20-64)			(55-64)			(20-64)			(55-64)			(15-64)			
	2016	2070	pps. change	2016	2070	pps. change	2016	2070	pps. change	2016	2070	pps. change	2016	2070	pps. change	2016	2060	pps. change	2016	2060	pps. change	2016	2060	pps. change	2016	2060	pps. change	2016	2060	pps. change	
BE	67.8	71.4	3.6	45.5	62.4	16.9	73.4	77.3	3.9	48.2	65.8	17.6	7.9	7.9	0.0	-1.0	0.9	1.9	-1.2	8.9	10.1	-1.3	1.5	2.7	-1.0	9.9	10.9	-0.3	0.5	0.8	BE
BG	67.8	67.8	0.0	54.6	59.3	4.7	73.3	72.5	-0.8	58.9	63.3	4.4	7.6	6.7	-0.9	2.4	-1.7	-4.1	4.6	2.7	-1.9	-1.2	-2.4	-1.2	2.1	2.4	0.3	-4.9	-0.8	4.1	BG
CZ	76.8	76.6	-0.2	58.8	64.9	6.2	80.0	79.8	-0.2	61.1	67.3	6.2	4.0	4.2	0.1	3.1	0.1	-3.0	7.2	-9.3	-16.5	1.2	-1.4	-2.7	6.6	-10.4	-17.0	-2.5	-1.9	0.7	CZ
DK	77.5	79.9	2.4	68.3	74.9	6.6	82.2	83.4	1.2	71.1	77.0	5.9	6.4	4.6	-1.7	0.5	0.2	-0.3	2.0	-0.5	-2.5	0.5	-0.1	-0.5	1.7	-1.0	-2.7	0.0	-0.3	-0.3	DK
DE	78.6	78.8	0.2	68.6	70.9	2.3	82.0	82.6	0.6	71.4	74.1	2.7	4.2	4.8	0.6	0.2	-1.4	-1.6	1.9	-1.4	-3.4	-0.4	-2.0	-1.6	1.1	-2.6	-3.6	-0.7	-0.6	0.0	DE
EE	76.9	75.7	-1.2	65.8	65.0	-0.8	82.4	81.9	-0.5	71.2	71.0	-0.2	6.8	7.9	1.1	1.7	-1.6	-3.3	2.8	-5.7	-8.5	1.2	-1.4	-2.6	4.7	-3.4	-8.1	-0.7	0.4	1.1	EE
IE	70.3	71.3	1.0	57.2	62.6	5.5	76.2	76.0	-0.1	61.0	65.8	4.8	8.1	6.5	-1.5	2.6	2.3	-0.3	2.5	1.4	-1.2	1.1	2.2	1.1	1.5	1.2	-0.2	-2.3	-0.3	1.9	IE
EL	56.0	74.4	18.4	36.5	70.6	34.1	73.3	80.7	7.4	45.2	75.3	30.2	23.8	7.9	-15.9	-1.4	-1.4	0.0	-6.5	-4.0	2.5	-1.8	-1.1	0.7	-5.0	-2.6	2.4	-0.1	0.4	0.5	EL
ES	63.9	77.6	13.7	49.1	76.6	27.5	79.2	84.1	4.9	59.2	81.8	22.6	19.7	7.9	-11.9	1.7	-1.3	-2.9	-0.7	-0.8	-0.2	-1.1	-1.0	0.1	-1.1	-0.1	1.0	-3.3	0.4	3.7	ES
FR	69.8	74.8	5.0	49.7	64.4	14.7	77.4	81.0	3.5	53.5	68.1	14.6	10.2	7.9	-2.4	0.0	0.5	0.5	2.8	4.6	1.8	0.2	0.9	0.7	3.1	5.2	2.0	0.2	0.4	0.2	FR
HR	61.6	69.9	8.4	38.4	52.0	13.5	70.2	75.6	5.3	42.3	54.7	12.5	13.2	7.9	-5.3	3.4	11.0	7.5	-0.9	2.7	3.5	1.4	5.3	3.8	-1.1	3.3	4.4	-3.5	0.4	3.9	HR
IT	61.6	67.3	5.7	50.3	70.5	20.1	69.6	72.9	3.2	53.4	73.1	19.7	11.9	7.9	-4.0	0.9	1.7	0.8	2.8	3.2	0.4	0.9	2.2	1.3	3.1	3.6	0.5	-0.2	0.4	0.6	IT
CY	68.3	78.6	10.4	52.3	72.7	20.4	78.6	83.6	5.0	59.0	76.8	17.8	13.5	6.1	-7.4	1.3	-1.9	-3.2	-2.3	-4.1	-1.8	-2.8	-2.0	0.8	-4.2	-3.8	0.4	-4.9	0.0	4.8	CY
LV	73.2	77.5	4.3	61.5	67.4	5.9	81.2	84.2	3.0	67.5	72.4	4.9	9.8	7.9	-1.9	1.0	1.3	0.3	3.4	-1.0	-4.4	0.6	1.9	1.3	3.6	-0.5	-4.1	-0.7	0.4	1.1	LV
LT	75.3	78.3	3.1	64.6	68.3	3.6	81.8	85.0	3.2	69.9	73.7	3.8	8.0	7.9	-0.1	4.1	4.5	0.4	9.6	4.0	-5.5	2.8	5.3	2.4	9.1	5.0	-4.1	-2.0	0.4	2.4	LT
LU	70.8	71.2	0.4	40.7	41.3	0.6	75.1	74.6	-0.5	42.4	42.5	0.1	6.2	5.0	-1.2	-0.7	-2.2	-1.4	-0.6	-4.0	-3.4	-0.3	-1.8	-1.5	-0.7	-4.5	-3.7	0.8	0.7	0.0	LU
HU	71.6	79.4	7.9	50.0	78.0	28.0	75.3	83.4	8.1	52.2	81.3	29.1	5.2	5.0	-0.2	4.6	5.6	1.0	1.6	4.3	2.7	2.0	3.8	1.8	0.5	3.7	3.2	-3.8	-2.5	1.3	HU
MT	70.1	80.8	10.7	44.3	68.0	23.7	72.9	85.0	12.2	45.6	70.1	24.5	4.2	5.6	1.4	3.0	4.7	1.7	7.1	5.9	-1.3	1.6	4.1	2.5	6.1	3.8	-2.3	-2.3	-1.1	1.2	MT
NL	77.1	81.0	3.9	63.5	74.5	11.0	81.6	84.5	2.9	68.4	78.8	10.4	6.1	4.5	-1.5	0.5	-1.2	-1.7	2.1	-1.2	-3.3	-0.4	-0.9	-0.5	2.7	0.2	-2.5	-1.0	0.6	1.6	NL
AT	74.8	78.6	3.8	49.2	59.2	10.0	79.4	82.4	3.0	51.8	61.3	9.5	6.1	4.9	-1.3	-1.4	-0.2	1.2	0.4	0.4	0.0	-0.2	0.7	0.9	1.4	1.1	-0.3	1.5	1.0	-0.5	AT
PL	69.6	70.7	1.1	46.4	50.8	4.4	74.1	74.9	0.8	48.5	53.0	4.4	6.3	5.8	-0.4	2.9	0.9	-2.0	3.0	-10.6	-13.7	0.8	-0.4	-1.2	2.0	-11.9	-13.9	-2.9	-1.6	1.2	PL
PT	70.7	75.8	5.1	52.0	64.3	12.3	79.6	82.1	2.5	58.4	69.4	11.0	11.5	7.9	-3.6	2.9	1.1	-1.8	1.2	0.3	-0.9	0.7	1.6	0.9	0.8	1.2	0.5	-3.1	0.4	3.5	PT
RO	66.3	66.6	0.3	42.6	49.2	6.6	70.3	70.6	0.3	44.0	50.7	6.7	6.1	6.2	0.1	1.7	3.5	1.7	-1.1	2.6	3.7	1.1	3.2	2.1	-1.3	2.6	3.9	-1.0	-0.7	0.3	RO
SI	70.2	74.8	4.6	38.5	58.2	19.7	76.3	79.4	3.1	41.1	60.9	19.7	8.1	5.9	-2.2	1.1	0.2	-0.9	-1.4	-3.6	-2.1	-0.3	-0.2	0.1	-1.7	-3.3	-1.6	-1.8	-0.5	1.3	SI
SK	70.1	75.6	5.6	49.6	71.2	21.7	77.3	81.9	4.6	54.4	76.3	21.9	9.7	7.9	-1.8	3.9	3.9	0.1	3.9	2.5	-1.4	1.7	4.6	2.9	4.0	4.1	0.1	-3.1	0.4	3.5	SK
FI	73.3	77.2	3.9	61.2	74.7	13.5	79.8	82.9	3.0	66.2	79.6	13.4	9.1	7.6	-1.5	-0.7	1.7	2.4	0.5	10.2	9.8	0.1	2.4	2.3	1.2	11.3	10.2	1.0	0.7	-0.3	FI
SE	81.2	82.3	1.0	75.7	74.5	-1.2	86.6	86.5	-0.1	79.9	77.7	-2.2	7.1	5.7	-1.4	0.0	-0.8	-0.8	1.3	-1.5	-2.8	0.2	-1.0	-1.2	2.1	-1.2	-3.3	0.2	-0.2	-0.4	SE
UK	77.5	80.0	2.4	63.5	70.8	7.3	81.0	84.5	3.5	66.0	74.2	8.3	5.0	6.2	1.2	1.1	0.4	-0.7	0.8	-0.1	-0.9	0.2	0.5	0.4	0.7	0.6	-0.1	-1.3	0.1	1.4	UK
NO	78.6	80.3	1.7	72.5	71.8	-0.7	82.1	82.8	0.7	73.9	72.8	-1.1	4.8	3.3	-1.5	-1.1	-0.2	0.9	2.6	1.8	-0.8	-0.3	-0.4	0.0	3.1	1.9	-1.2	1.1	-0.2	-1.3	NO
EA	69.9	75.3	5.4	55.3	69.3	14.0	77.6	80.6	3.1	59.8	73.0	13.2	10.2	6.8	-3.4	0.7	0.5	-0.1	1.5	1.7	0.2	-0.7	0.3	1.0	1.4	2.0	0.6	-0.9	0.1	1.0	EA
EU*	71.1	75.8	4.7	55.3	67.9	12.6	77.5	80.7	3.2	59.1	71.3	12.2	8.7	6.5	-2.2	1.1	0.8	-0.3	1.6	0.6	-1.0	0.2	0.7	0.5	1.4	0.8	-0.6	-1.3	-0.1	1.1	EU*
EU27	70.1	75.0	4.9	54.2	67.3	13.1	77.0	80.0	3.0	58.2	70.8	12.5	9.3	6.6	-2.7	1.1	0.8	-0.3	1.7	0.7	-1.0	0.2	0.7	0.5	1.5	0.8	-0.6	-1.2	-0.2	1.1	EU27

Source: Commission services, EPC.

Table 4: **Potential GDP projections, 2018 and 2015 Ageing Report**

	Projection exercise 2018										2018 AR - 2015 AR (2016-60)										
		Due to growth in										Due to growth in									
	GDP growth 2016-70	***Labour prod. (GDP/ hours worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	**GDP per capita growth 2016-70**	**GDP growth 2016-60**	***Labour prod. (GDP/ hours worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	**GDP per capita growth 2016-60**	
	1=2+5	2=3+4	3	4	5=6+7+8+9	6	7	8	9	10=1-6	1=2+5	2=3+4	3	4	5=6+7+8+9	6	7	8	9	10=1-6	
BE	1.5	1.3	0.8	0.4	0.3	0.4	0.0	-0.1	0.0	1.2	-0.3	-0.1	0.0	0.0	-0.2	-0.3	0.1	0.0	0.0	0.0	BE
BG	1.4	2.3	1.4	0.9	-0.9	-0.7	0.1	-0.3	0.0	2.1	0.0	0.3	0.2	0.0	-0.3	-0.1	-0.1	0.0	0.0	0.1	BG
CZ	1.5	1.8	1.2	0.6	-0.3	-0.1	0.0	-0.3	0.0	1.6	-0.2	0.1	0.1	0.0	-0.3	-0.2	-0.1	0.0	0.0	0.0	CZ
DK	1.6	1.4	0.9	0.5	0.2	0.3	0.1	-0.2	0.0	1.3	-0.2	-0.2	-0.1	-0.1	0.0	0.1	-0.1	0.0	0.0	-0.2	DK
DE	1.2	1.5	1.0	0.5	-0.3	-0.1	0.0	-0.2	-0.1	1.2	0.2	-0.1	0.0	-0.1	0.3	0.3	0.1	0.0	0.0	0.0	DE
EE	1.5	1.9	1.2	0.7	-0.4	-0.2	0.1	-0.2	0.0	1.7	0.1	-0.1	0.0	-0.1	0.2	0.2	0.0	0.0	0.0	-0.1	EE
IE	2.0	1.6	1.1	0.5	0.5	0.5	0.1	-0.1	0.0	1.6	0.3	0.1	0.2	0.0	0.2	0.2	0.0	0.0	0.0	0.1	IE
EL	0.8	1.1	0.8	0.4	-0.4	-0.6	0.5	-0.2	0.0	1.4	-0.3	-0.1	-0.1	0.0	-0.1	-0.1	-0.1	0.0	0.0	-0.2	EL
ES	1.5	1.3	0.9	0.5	0.1	0.1	0.2	-0.2	0.0	1.3	-0.2	-0.1	-0.1	0.0	-0.1	0.2	-0.2	-0.1	0.0	-0.3	ES
FR	1.6	1.3	0.8	0.5	0.3	0.3	0.1	-0.1	0.0	1.3	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	FR
HR	1.2	1.7	1.0	0.7	-0.4	-0.4	0.2	-0.2	0.0	1.6	-0.2	-0.2	-0.2	0.0	0.0	-0.1	0.1	0.0	0.0	-0.1	HR
IT	0.8	1.0	0.7	0.4	-0.2	-0.2	0.2	-0.2	0.0	1.0	-0.7	-0.3	-0.2	-0.1	-0.3	-0.3	0.0	-0.1	0.0	-0.3	IT
CY	1.4	1.2	0.7	0.5	0.2	0.3	0.2	-0.2	0.0	1.1	-0.7	-0.3	-0.2	-0.1	-0.4	-0.2	-0.3	0.1	0.0	-0.6	CY
LV	1.9	2.7	1.8	0.9	-0.8	-0.7	0.2	-0.3	0.0	2.6	0.5	0.5	0.6	-0.1	0.0	0.0	0.0	-0.1	0.0	0.5	LV
LT	1.1	2.0	1.2	0.8	-0.9	-0.9	0.3	-0.3	0.0	2.0	-0.1	-0.2	-0.1	-0.1	0.1	0.0	0.1	0.0	0.0	-0.1	LT
LU	2.3	1.4	0.9	0.5	0.8	1.1	-0.1	-0.2	0.0	1.2	-0.2	0.1	0.1	0.0	-0.3	-0.3	-0.1	0.0	0.1	0.1	LU
HU	1.6	1.9	1.3	0.7	-0.3	-0.2	0.2	-0.3	0.0	1.8	0.2	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.2	HU
MT	2.3	1.9	1.2	0.7	0.4	0.3	0.4	-0.3	0.0	2.0	0.8	0.5	0.3	0.2	0.3	0.2	0.2	0.0	0.0	0.6	MT
NL	1.5	1.3	0.8	0.5	0.2	0.3	0.1	-0.2	0.0	1.2	0.2	-0.1	-0.1	0.0	0.3	0.3	0.0	0.0	0.0	-0.1	NL
AT	1.5	1.4	0.9	0.5	0.1	0.3	0.1	-0.2	-0.1	1.2	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	-0.1	-0.1	AT
PL	1.4	2.2	1.3	0.8	-0.8	-0.4	0.0	-0.3	0.0	1.8	0.0	0.1	0.1	0.1	-0.1	0.0	-0.1	0.0	0.0	0.0	PL
PT	0.9	1.5	1.0	0.5	-0.6	-0.5	0.1	-0.2	0.0	1.4	-0.1	-0.1	-0.1	-0.1	0.0	0.1	0.0	0.0	0.0	-0.2	PT
RO	1.8	2.6	1.7	0.9	-0.8	-0.5	0.0	-0.3	0.0	2.3	0.3	0.5	0.4	0.1	-0.2	-0.2	0.2	0.0	0.0	0.5	RO
SI	1.5	1.8	1.2	0.6	-0.2	-0.1	0.1	-0.3	0.0	1.6	0.1	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	SI
SK	1.9	2.2	1.5	0.7	-0.4	-0.2	0.2	-0.3	0.0	2.1	0.5	0.2	0.1	0.1	0.3	0.2	0.1	0.0	0.0	0.3	SK
FI	1.3	1.3	0.8	0.5	0.0	0.0	0.1	-0.2	0.0	1.2	-0.2	-0.1	-0.1	0.0	-0.1	-0.2	0.1	0.0	0.0	0.0	FI
SE	1.9	1.5	1.0	0.5	0.5	0.6	0.0	-0.2	0.0	1.3	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	SE
UK	1.7	1.4	0.9	0.5	0.3	0.4	0.1	-0.2	0.0	1.3	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	UK
NO	1.8	1.5	0.9	0.5	0.3	0.5	0.0	-0.2	0.0	1.2	-0.5	-0.1	-0.1	0.0	-0.4	-0.4	0.0	0.0	0.0	-0.1	NO
EA	1.3	1.4	0.9	0.5	-0.1	0.0	0.1	-0.2	0.0	1.3	-0.1	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	EA
EU*	1.4	1.5	0.9	0.5	-0.1	0.0	0.1	-0.2	0.0	1.3	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	EU*
EU27	1.3	1.5	0.9	0.5	-0.2	0.0	0.1	-0.2	0.0	1.3	:	:	:	:	:	:	:	:	:	:	EU27

Source: Commission services, EPC.

Part I

Underlying assumptions and projection methodologies

1. POPULATION

1.1. BACKGROUND AND GENERAL APPROACH

The 2015-based population projections, released by Eurostat in February 2017, are the basis for the 2018 age-related expenditure projections for the 28 EU Member States. The projected fertility rates, life expectancy and net migration projections for the period 2015-2080, as well as the underlying methodologies used can be found on the Eurostat dedicated website ([4]).

National statistical institutes have collaborated with Eurostat during the preparation of these population projections ([5]).

The 2015-based population projections were made using a 'partial convergence' approach, meaning that the key demographic determinants are assumed to converge over the very long-term. Setting the year of convergence very far into the future (even beyond the projections' horizon) has the advantage of taking due account of recent trends and developments in the beginning of the period, while at the same time assuming a degree of convergence over the very long-term in terms of demographic drivers.

The demographic determinants are: (i) the fertility rate; (ii) the mortality rate and (iii) the level of net migration. As far as fertility and mortality are concerned, it is assumed that they tend to converge to that of the 'forerunners'.

Fertility rates are assumed to rise in almost all EU countries during 2016-70 but also to converge, with the difference in fertility rates between the countries with the highest and lowest rates shrinking in 2070 as compared to 2016.

Similarly, life expectancy is assumed to follow a convergent trajectory by increasing faster in countries with lower current levels of life expectancy and slower for those with higher current levels.

Migration flows on a net basis in each Member State are the result of a model taking various elements into account (past trends, latest empirical evidence and long-term partial convergence). Furthermore, immigration flows which depend on the specific age structure of the national population are added to the net migration projections.

1.2. ASSUMPTIONS FOR FERTILITY RATES

The total fertility rate (TFR) is assumed to rise in almost all Member States between 2016-70, increasing from 1.58 to 1.81 for the EU as whole and from 1.56 to 1.79 for the euro area.

1.2.1. Past trends

Total fertility rates (TFR([6])) (Table I.1.1 below) have increased between 2000 and 2015 in almost all Member States ([7]), with total fertility rates reaching above 1.8 in Ireland, France, Sweden and the UK. By contrast, fertility rates have decreased in Cyprus, Denmark, Luxembourg, Malta, Poland, Portugal, the Netherlands, and Finland.

Fertility rates declined sharply in the EU Member States after the post-war "baby boom" peak above 2.5 in the second half of the 1960s, to below the natural replacement level normally taken at 2.1. Fertility rates fell below replacement levels in the late 1960s in Sweden, Denmark, Finland, Luxembourg, Germany Hungary, Latvia and the Czech Republic.

([4]) The Eurostat's dedicated website on population projections can be found at http://ec.europa.eu/eurostat/web/population-demography-migration-projections/population-projections-data ; the datasets can be found on http://ec.europa.eu/eurostat/data/database?node_code=proj; Eurostat(2017): 'Summary methodology of the 2015-based population projections', available at http://ec.europa.eu/eurostat/cache/metadata/Annexes/proj_esms_an1.pdf.

([5]) This does not preclude national statistical institutes having different population projections based on their own assumptions and methodologies.

([6]) Fertility rates are reflected by the average number of children a woman would have, should she at each bearing age have the fertility rates of the year under review (this number is obtained by summing the fertility rates by age and is called the Total Fertility Rate, or TFR.

([7]) However, on average in the EU, a decline in TFRs since 2010 occurred (not shown).

Table I.1.1: **Past trends in total fertility rates (TFR), 1960-2015**

	1960	1980	2000	2015	*1960-2015*	*2000-15*
BE	2.54	1.68	1.67	1.70	*-0.8*	*0.0*
BG	2.31	2.05	1.26	1.53	*-0.8*	*0.3*
CZ	2.09	2.08	1.15	1.57	*-0.5*	*0.4*
DK	2.57	1.55	1.77	1.71	*-0.9*	*-0.1*
DE	2.37	1.56	1.38	1.50	*-0.9*	*0.1*
EE	1.98	2.02	1.36	1.58	*-0.4*	*0.2*
IE	3.78	3.21	1.89	1.92	*-1.9*	*0.0*
EL	2.23	2.23	1.25	1.33	*-0.9*	*0.1*
ES	2.86	2.20	1.22	1.33	*-1.5*	*0.1*
FR	2.73	1.95	1.89	1.96	*-0.8*	*0.1*
HR	:	:	:	1.40	*:*	*:*
IT	2.37	1.64	1.26	1.35	*-1.0*	*0.1*
CY	3.51	:	1.64	1.32	*-2.2*	*-0.3*
LV	:	1.88	1.25	1.70	*:*	*0.5*
LT	2.60	1.99	1.39	1.70	*-0.9*	*0.3*
LU	2.29	1.50	1.76	1.47	*-0.8*	*-0.3*
HU	2.02	1.91	1.32	1.45	*-0.6*	*0.1*
MT	3.62	1.99	1.68	1.45	*-2.2*	*-0.2*
NL	3.12	1.60	1.72	1.66	*-1.5*	*-0.1*
AT	2.69	1.65	1.36	1.49	*-1.2*	*0.1*
PL	2.98	2.28	1.37	1.32	*-1.7*	*0.0*
PT	3.16	2.25	1.55	1.31	*-1.9*	*-0.2*
RO	:	2.43	1.31	1.58	*:*	*0.3*
SI	2.18	2.11	1.26	1.57	*-0.6*	*0.3*
SK	3.04	2.32	1.30	1.40	*-1.6*	*0.1*
FI	2.72	1.63	1.73	1.65	*-1.1*	*-0.1*
SE	2.20	1.68	1.54	1.85	*-0.4*	*0.3*
UK	2.72	1.90	1.64	1.80	*-0.9*	*0.2*
NO	2.90	1.72	1.85	1.72	*-1.2*	*-0.1*
EA	2.77	1.97	1.50	1.55	*-1.2*	*0.0*
EU*	2.67	1.97	1.48	1.56	*-1.1*	*0.0*
EU27	2.67	1.98	1.47	1.55	*-1.1*	*0.1*

(1) EU and EA averages are simple averages.
Source: Commission services based on Eurostat data.

The fall took place somewhat later in Belgium, Netherlands, Austria, the UK, France (1972-73) and Italy (1975)([8]). Declines in fertility rates occurred much later in Greece, Spain, Portugal (1978-85), Malta (1980), Poland (1983) and Slovakia (in 1989) or Ireland (2000).

Several Member States had very low fertility rates (below 1.4) in 2000, namely Bulgaria, the Czech Republic, Germany, Estonia, Greece, Spain, Italy, Latvia, Lithuania, Hungary, Austria, Poland, Romania, Slovenia, and Slovakia.

([8]) The time series for Germany (DE) exclude the former GDR before 1991 and refer to the Federal Republic starting with 1991 reference year. Time series data for entire Germany are available under the code DE_TOT.

1.2.2. Most recent population projections

The 2015-based population projections assume a process of partial convergence in the fertility rates across Member States to that of the forerunners ([9]). The total fertility rate (TFR) is projected to rise from 1.58 in 2016 to 1.81 by 2070 for the EU as a whole (see table I.1.2). In the euro area, an increase of similar magnitude is projected, from 1.56 in 2016 to 1.79 in 2070.

Table I.1.2: **Projection of total fertility rates 2016-2070**

	Fertility rate				
	2016	2030	2060	2070	change 2016-2070
BE	1.73	1.75	1.80	1.82	0.09
BG	1.51	1.69	1.78	1.80	0.29
CZ	1.62	1.74	1.80	1.82	0.20
DK	1.79	1.73	1.79	1.82	0.02
DE	1.49	1.53	1.64	1.68	0.19
EE	1.58	1.75	1.80	1.81	0.23
IE	1.89	1.96	1.96	1.97	0.08
EL	1.39	1.40	1.58	1.64	0.25
ES	1.31	1.80	1.88	1.88	0.57
FR	2.01	2.00	1.99	1.99	-0.02
HR	1.41	1.51	1.61	1.65	0.25
IT	1.33	1.42	1.60	1.66	0.33
CY	1.31	1.40	1.56	1.62	0.30
LV	1.74	1.85	1.86	1.87	0.13
LT	1.66	1.76	1.82	1.84	0.18
LU	1.40	1.57	1.66	1.69	0.29
HU	1.48	1.68	1.77	1.80	0.32
MT	1.41	1.62	1.72	1.75	0.33
NL	1.66	1.74	1.79	1.81	0.16
AT	1.47	1.53	1.62	1.66	0.19
PL	1.37	1.56	1.68	1.71	0.34
PT	1.34	1.34	1.53	1.59	0.25
RO	1.54	1.81	1.88	1.89	0.35
SI	1.58	1.66	1.78	1.81	0.24
SK	1.40	1.60	1.79	1.82	0.42
FI	1.60	1.72	1.78	1.80	0.20
SE	1.86	1.91	2.01	2.03	0.16
UK	1.80	1.81	1.86	1.87	0.07
NO	1.70	1.76	1.81	1.83	0.13
EA	1.56	1.67	1.76	1.79	0.24
EU*	1.58	1.69	1.78	1.81	0.23
EU27	1.55	1.67	1.77	1.80	0.25

(1) EU and EA averages are weighted averages.
Source: Commission services based on Eurostat 2015-based population projections.

([9]) A description of the 2015-based population projection methodology can be found in Eurostat (2017) 'Summary methodology of the 2015-based population projections'.

The fertility rate is projected to increase over the projection period in all Member States, with the exception of France (the country with the highest TFR in 2016, namely 2.01). However, fertility rates in all countries are expected to remain below the natural replacement rate of 2.1 in the period to 2070.

1.3. ASSUMPTIONS FOR LIFE EXPECTANCY

The projections show increases in life expectancy at birth for both males and females over the projection horizon. For the EU as a whole, life expectancy at birth is expected to increase by 7.8 years for males and 6.6 years for females, with the largest increases in Member States with the lowest life expectancies in 2016.

1.3.1. Past trends

Life expectancy has been increasing in most developed countries worldwide over very long time periods. Since 1960, there have been significant increases in life expectancy at birth in all Member States (see Table I.1.3).

For both males and females, life expectancy at birth on average across the EU increased by around 10 years between 1960 and 2015: for males from 66.9 years to 76.8 years in 2015, and for females from 72.3 years to 82.6 years.

The difference between female and male life expectancies at birth for the EU as a whole rose from 5.4 years in 1960 to just under 7 years by 1980 and remained at that level until 2000 before starting to close. Since 2000, the increase in life expectancy has been 2.9 years for females and 3.9 years for males, resulting in a reduction in the difference between genders to 5.8 years by 2015.

The gains in life expectancies at birth have differed across countries between 1960 and 2015.

Females have gained 11 years or more in Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Malta, Austria, Poland, Portugal, Slovenia and Finland. Smaller increases of 8 years or less were observed in Bulgaria, Latvia, Hungary, the Netherlands and Slovakia.

Gains in life expectancies over the same period for males have been 11 years or more in Belgium, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Malta, Austria, Portugal, Slovenia, Finland and the UK, while increases of 8 years or less have occurred in Bulgaria, the Czech Republic, Denmark, Estonia, Croatia, Latvia, Lithuania, Hungary and Slovakia.

There is no consensus among demographers on very long-term trends, e.g. whether there is a natural biological limit to longevity, the impact of future medical breakthroughs, and the long-term effect of public health programmes and societal behaviour such as the reduction of smoking rates or increased prevalence of obesity. Past population projections from official sources have, however, generally underestimated the gains in life expectancy at birth as it was not assumed that the reduction of mortality would continue at the same pace in the long run. As a consequence, in certain cases the budgetary impact of ageing populations may have been different than originally projected.

Official demographic projections however still generally assume that gains in life expectancy at birth will slow down compared with historical trends. This is because mortality rates at younger ages are already very low and future gains in life expectancy would require improvements in mortality rates at older ages (which statistically have a smaller impact on life expectancy at birth).

On the other hand, the wide range of life expectancies across EU Member States, and also compared with other countries, points to considerable scope for future gains. In 2015, life expectancy at birth for females ranged from 78.2 in Bulgaria to 85.8 years in Spain, and for males ranging from 69.2 in Lithuania to 80.4 in Sweden.

1.3.2. Most recent population projections

The projected changes in life expectancy at birth and at age 65 for males and females underlying the 2015-based population projections can be found in Table I.1.4 below. The projections show increases in life expectancy at birth being sustained during the projection period, albeit with considerable diversity across Member States.

In the EU, life expectancy at birth for males is expected to increase by 7.8 years over the projection period, from 78.3 in 2016 to 86.1 in 2070. For females, life expectancy at birth is projected to increase by 6.6 years, from 83.7 in 2016 to 90.3 in 2070, implying a convergence of life expectancy between males and females. The largest increases in life expectancies at birth, for both males and females, are projected to take place in the Member States with the lowest life expectancies in 2016. Life expectancies for males in 2016 are the lowest in Bulgaria, Estonia, Latvia, Lithuania, Hungary and Romania, ranging between 69.3 and 72.8 years, and are projected to increase by more than 10 years up to 2070, indicating that some catching-up takes place over the projection period. For females, the largest gains in life expectancy at birth of 8 years or more are projected in Bulgaria, Latvia, Lithuania, Hungary, Romania and Slovakia, where life expectancy at

Table I.1.3: **Past trends in life expectancy at birth, 1960-2015**

	Males						Females					
	1960	1980	2000	2015	1960-2015	2000-2015	1960	1980	2000	2015	1960-2015	2000-2015
BE	66.8	69.9	74.6	78.7	11.9	4.1	72.8	76.7	81.0	83.4	10.6	2.4
BG	67.5	68.4	68.4	71.2	3.7	2.8	71.1	73.9	75.0	78.2	7.1	3.2
CZ	67.8	66.9	71.6	75.7	7.9	4.1	73.5	74.0	78.5	81.6	8.1	3.1
DK	70.4	71.2	74.5	78.8	8.4	4.3	74.4	77.3	79.2	82.7	8.3	3.5
DE	66.5	69.6	75.1	78.3	11.8	3.2	71.7	76.2	81.2	83.1	11.4	1.9
EE	64.7	64.2	65.6	73.2	8.5	7.6	73.1	74.3	76.4	82.2	9.1	5.8
IE	68.1	70.1	74.0	79.6	11.5	5.6	71.9	75.6	79.2	83.4	11.5	4.2
EL	67.3	73.0	75.9	78.5	11.2	2.6	72.4	77.5	81.3	83.7	11.3	2.4
ES	67.4	72.3	75.8	80.1	12.7	4.3	72.2	78.4	82.8	85.8	13.6	3.0
FR	66.9	70.2	75.3	79.2	12.3	3.9	73.6	78.4	83.0	85.5	11.9	2.5
HR	:	:	:	74.4	:	:	:	:	:	80.5	:	:
IT	67.2	70.6	76.9	80.3	13.1	3.4	72.3	77.4	82.8	84.9	12.6	2.1
CY	:	72.3	75.4	79.9	:	4.5	:	77.0	80.1	83.7	:	3.6
LV	65.2	63.6	65.0	69.7	4.5	4.7	72.4	74.2	76.1	79.5	7.1	3.4
LT	64.9	65.4	66.7	69.2	4.3	2.5	71.4	75.4	77.4	79.7	8.3	2.3
LU	66.5	70.0	74.6	80.0	13.5	5.4	72.2	75.6	81.3	84.7	12.5	3.4
HU	65.9	65.5	67.5	72.3	6.4	4.8	70.2	72.8	76.2	79.0	8.8	2.8
MT	66.5	68.0	76.3	79.7	13.2	3.4	70.5	72.8	80.5	84.0	13.5	3.5
NL	71.5	72.7	75.6	79.9	8.4	4.3	75.5	79.3	80.7	83.2	7.7	2.5
AT	66.2	69.0	75.2	78.8	12.6	3.6	72.7	76.1	81.2	83.7	11.0	2.5
PL	64.9	66.9	69.6	73.5	8.6	3.9	70.6	75.4	78.0	81.6	11.0	3.6
PT	61.1	67.9	73.3	78.1	17.0	4.8	66.7	74.9	80.4	84.3	17.6	3.9
RO	:	66.6	67.7	71.5	:	3.8	:	71.9	74.8	78.7	:	3.9
SI	66.1	67.4	72.2	77.8	11.7	5.6	72.0	75.2	79.9	83.9	11.9	4.0
SK	67.9	66.7	69.2	73.1	5.2	3.9	72.7	74.4	77.5	80.2	7.5	2.7
FI	65.5	69.2	74.2	78.7	13.2	4.5	72.5	78.0	81.2	84.4	11.9	3.2
SE	71.2	72.8	77.4	80.4	9.2	3.0	74.9	79.0	82.0	84.1	9.2	2.1
UK	67.9	70.2	75.5	79.2	11.3	3.7	73.7	76.2	80.3	82.8	9.1	2.5
NO	71.6	72.4	76.0	80.5	8.9	4.5	76.0	79.3	81.5	84.2	8.2	2.7
EA	66.5	69.1	73.2	77.5	11.1	4.3	72.1	76.2	80.2	83.3	11.2	3.1
EU*	66.9	68.9	72.7	76.8	9.9	4.1	72.3	75.8	79.6	82.6	10.3	3.0
EU27	66.8	68.9	72.6	76.7	9.9	4.1	72.2	75.8	79.5	82.6	10.4	3.1

(1) EU and EA averages are simple averages.
Source: Commission services using Eurostat data, 2015 Ageing Report.

birth in 2016 was below 80 years.

In the EU, life expectancy at 65 for males is expected to increase by 5.3 years over the projection period, from 18.1 in 2016 to 23.4 in 2070. For females, life expectancy at 65 for the EU as a whole is projected to increase by 5.1 years, from 21.5 in 2016 to 26.6 in 2070. Thus, a slight convergence of life expectancy between males and females is forecast.

The largest increases in life expectancy at 65 for both males and females are projected to take place in the Member States with the lowest life expectancies in 2016. Life expectancy is expected to increase for males by at least 7 years in Bulgaria, Latvia, Lithuania, Hungary and Romania – all countries where life expectancy at 65 was below 15 years in 2016 (i.e. at least 3.1 years below the EU average).

For females, the largest gains in life expectancy at 65 of 6 years or more are projected in Bulgaria, Croatia, Latvia, Lithuania, Hungary, Romania and Slovakia. In all of these countries, female life expectancy at 65 in 2016 was below 20 years (vis-à-vis 21.5 years on average in the EU).

1.4. ASSUMPTIONS FOR NET MIGRATION FLOWS

Assumptions for net migration typically are the most methodologically difficult, with high volatility over time and countries. On the basis of the assumptions used by Eurostat, annual net migration inflows to the EU as a whole are projected to decrease from about 1.5 million people in 2016 to 821,000 people by 2070 or 0.2% of the total population.

Table I.1.4: **Projection of life expectancy at birth and at 65**

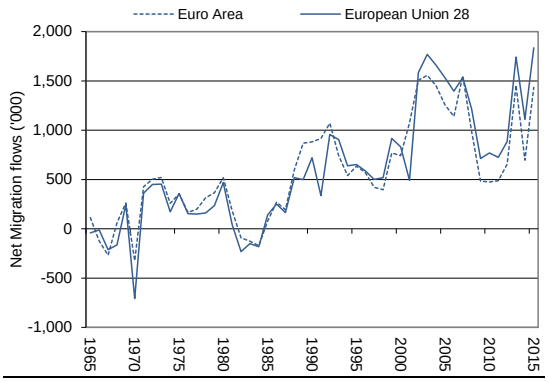
	Life expectancy at birth								Life expectancy at 65							
	Males				Females				Males				Females			
	2016	2060	2070	Change 2016-70	2016	2060	2070	Change 2016-70	2016	2060	2070	Change 2016-70	2016	2060	2070	Change 2016-70
BE	78.8	85.0	86.2	7.4	83.7	89.2	90.2	6.5	18.3	22.6	23.4	5.1	21.7	25.8	26.6	4.9
BG	71.8	81.5	83.3	11.5	78.5	86.3	87.8	9.3	14.5	20.3	21.5	7.0	17.9	23.5	24.7	6.8
CZ	76.2	83.5	84.9	8.7	82.1	88.1	89.3	7.2	16.3	21.3	22.4	6.1	19.9	24.7	25.7	5.8
DK	78.8	84.9	86.1	7.3	82.9	88.9	90.0	7.1	18.1	22.4	23.3	5.2	20.8	25.5	26.4	5.6
DE	78.7	84.9	86.1	7.4	83.6	89.0	90.1	6.5	18.1	22.4	23.3	5.2	21.3	25.6	26.4	5.1
EE	72.8	82.2	83.9	11.1	81.9	88.3	89.5	7.6	15.4	21.1	22.2	6.8	20.4	25.1	26.0	5.6
IE	79.5	85.3	86.4	6.9	83.5	89.2	90.3	6.8	18.5	22.7	23.5	5.0	21.1	25.7	26.6	5.5
EL	78.8	85.3	86.5	7.7	83.9	89.3	90.3	6.4	18.7	23.0	23.8	5.1	21.4	25.7	26.6	5.2
ES	80.5	85.9	86.9	6.4	86.0	90.3	91.2	5.2	19.3	23.2	23.9	4.6	23.2	26.6	27.3	4.1
FR	79.5	85.5	86.6	7.1	85.6	90.3	91.1	5.5	19.5	23.3	24.0	4.5	23.5	26.8	27.5	4.0
HR	75.0	82.9	84.4	9.4	81.1	87.6	88.9	7.8	15.6	21.0	22.0	6.4	19.1	24.3	25.3	6.2
IT	80.7	85.9	86.9	6.2	85.3	90.0	90.9	5.6	19.1	23.0	23.7	4.6	22.5	26.3	27.0	4.5
CY	80.6	86.0	87.0	6.4	84.3	89.3	90.2	5.9	19.0	23.0	23.8	4.8	21.3	25.4	26.3	5.0
LV	69.4	80.7	82.7	13.3	79.5	87.2	88.6	9.1	14.0	20.4	21.6	7.6	19.0	24.4	25.4	6.4
LT	69.3	80.8	82.8	13.5	79.9	87.4	88.8	8.9	14.3	20.6	21.8	7.5	19.3	24.6	25.6	6.3
LU	79.2	85.3	86.4	7.2	84.6	89.9	90.9	6.3	18.5	22.7	23.5	5.0	22.4	26.4	27.1	4.7
HU	72.8	82.1	83.9	11.1	79.6	87.2	88.6	9.0	14.9	20.8	22.0	7.1	18.7	24.3	25.4	6.7
MT	80.0	85.8	86.8	6.8	84.3	89.6	90.6	6.3	19.3	23.1	23.9	4.6	22.2	26.1	26.9	4.7
NL	79.8	85.5	86.5	6.7	83.3	89.0	90.1	6.8	18.4	22.6	23.4	5.0	21.2	25.6	26.4	5.2
AT	79.0	85.2	86.3	7.3	83.8	89.2	90.2	6.4	18.3	22.6	23.5	5.2	21.6	25.7	26.5	4.9
PL	73.9	82.8	84.4	10.5	81.6	88.3	89.5	7.9	16.0	21.5	22.6	6.6	20.2	25.1	26.1	5.9
PT	78.2	84.7	85.9	7.7	84.3	89.4	90.4	6.1	18.1	22.4	23.3	5.2	21.8	25.9	26.7	4.9
RO	71.8	81.8	83.6	11.8	78.9	86.9	88.3	9.4	14.8	20.8	22.0	7.2	18.2	24.0	25.1	6.9
SI	78.2	84.6	85.8	7.6	83.8	89.1	90.1	6.3	17.7	22.2	23.1	5.4	21.4	25.6	26.4	5.0
SK	73.7	82.6	84.2	10.5	80.7	87.8	89.1	8.4	15.3	21.0	22.1	6.8	19.1	24.6	25.6	6.5
FI	78.5	84.7	85.9	7.4	84.1	89.2	90.2	6.1	18.2	22.4	23.3	5.1	21.7	25.7	26.5	4.8
SE	80.6	85.7	86.7	6.1	84.3	89.4	90.3	6.0	19.0	22.8	23.6	4.6	21.7	25.8	26.6	4.9
UK	79.6	85.4	86.5	6.9	83.3	89.0	90.1	6.8	18.8	22.8	23.6	4.8	21.3	25.7	26.5	5.2
NO	80.2	85.5	86.6	6.4	84.3	89.4	90.4	6.1	18.8	22.7	23.5	4.7	21.7	25.8	26.6	4.9
EA	79.3	85.3	86.4	7.1	84.6	89.6	90.6	6.1	18.7	22.8	23.6	4.9	22.2	26.1	26.9	4.7
EU*	78.3	84.9	86.1	7.8	83.7	89.2	90.3	6.6	18.1	22.6	23.4	5.3	21.5	25.8	26.6	5.1
EU27	78.1	84.8	86.1	7.9	83.7	89.3	90.3	6.6	18.0	22.5	23.4	5.3	21.6	25.8	26.7	5.1

(1) EU and EA averages are weighted averages.
Source: Commission services based on Eurostat 2015-based population projections.

1.4.1. Past trends and driving forces

Migration flows to the EU and Euro area over the fifty years through 2015 are shown in Graph I.1.1. From 1965 through the mid-1980s net migration was mostly positive with annual net inflows averaging around 78,000 over the period though certain years saw large net outflows. Since 1985, annual net migration into the EU has been consistently positive and has risen significantly (albeit with periods of volatility): annual net entries averaged around 674,000 people per year between 1990-99 and around 1.27 million per year between 2000-09. Net migration inflows dropped to around 774,000 per year in the years 2009-12 following the global economic and financial crisis, but subsequently increased to pre-crisis levels with annual net flows averaging 1.58 million in years 2013-15, as the European economy gradually recovered and as a consequence of instability in North Africa and the Middle East.

Graph I.1.1: **Net migration flows (plus statistical adjustment), 1965-2015**



Source: Source: Commission services based on Eurostat data.

Net migration flows ([10]) between 1961 and 2015 per country are shown in Table I.1.5. Over this entire period, Germany, France, Italy and the UK recorded the largest number of net inflows in the EU. However, another notable development was that net migration flows turned positive starting in the 1980's for the UK, Czech Republic, Italy, Portugal, Spain, Cyprus, Greece, Hungary and Finland and in the 2000s for Croatia and Ireland. The crisis reversed this trend in Ireland, Spain, Cyprus, Greece, Croatia and Portugal that saw net outflows by 2015. Net migration inflows for the EU as a whole in 2015 (1.8 million) were around 45% higher than the average annual inflows in 2001-2015 (1.3 million). Due to extraordinary circumstances which created a severe one-off population shock, Germany alone with net migration inflows of 1.2 million in 2015 - a rise of almost 1 million vis-à-vis the average annual net flows the country saw between 2001-2015 - accounted for over 60% of the inward migration to the EU that year ([11]).

Table I.1.5: **Average annual net migration flows (plus statistical adjustment) 1961-2015**

	1961-1980	1981-2000	2001-2015	2015
BE	11,254	8,469	50,388	62,110
BG	-7,709	-25,036	-27,048	-4,247
CZ	-5,835	703	22,422	15,977
DK	2,800	8,909	16,538	41,886
DE	149,621	268,447	255,223	1,165,772
EE	7,761	-4,428	-2,895	2,410
IE	-1,757	-4,618	16,763	-264
EL	-7,003	42,101	113	-44,905
ES	-23,182	63,213	312,077	-7,490
FR	131,860	42,362	105,607	65,900
HR	-1,414	-11,496	3,233	-17,945
IT	-41,579	10,539	287,192	31,730
CY	-3,476	3,950	6,391	-2,000
LV	11,520	-5,485	-16,063	-10,640
LT	4,702	-6,567	-28,223	-22,403
LU	2,108	2,728	7,251	11,159
HU	-236	134	13,698	14,354
MT	-3,235	1,055	2,041	4,176
NL	22,162	28,782	19,157	55,018
AT	7,314	18,779	42,974	112,507
PL	-30,385	-23,323	-13,574	-12,792
PT	-46,167	2,991	5,441	-10,453
RO	-7,713	-43,352	-130,067	-46,530
SI	3,769	820	4,810	507
SK	-6,606	-4,211	389	3,127
FI	-8,682	5,152	12,097	12,575
SE	15,374	18,587	48,811	79,699
UK	-14,739	31,837	249,732	331,917
NO	2,073	7,987	30,476	29,353
EA	208,955	474,474	1,080,732	1,428,836
EU*	160,528	431,437	1,264,477	1,831,155
EU27	175,267	399,600	1,014,745	1,499,238

(1) For 2015: break in time series for Estonia, France; provisional data for France, Ireland; estimated data for Portugal, Romania, United Kingdom.
Source: Commission services based on Eurostat data.

([10]) Due to difficulties in having good statistics on migration flows for each Member State, net migration is measured as the difference between the total population stocks on 31 December and 1 January for a given calendar year, minus the difference between births and deaths (or natural increase). The population stocks transmitted to Eurostat from Member States include refugees usual residents for at least 12 months for all countries and asylum seekers usual residents for at least 12 months for BE, DE, EE, IE, EL, ES, FR, IT, CY, LU, NL, AT, PT, UK. This is different from the approach of subtracting recorded emigration flows from immigration flows that not only incorporates errors due to the difficulty of registering migration flows, but also includes all possible errors and adjustments in other demographic variables.

([11]) Though this one-off shock is forecast to phase out within a short time-frame, it nevertheless created a methodological challenge for the long-term migration projection.

Other countries with substantially higher net inflows in 2015 than on average between 2001-2015 include the UK, Austria, and Sweden. By contrast, countries that saw large declines in net flows in 2015 vis-à-vis average annual net flows in 2001-15 were Spain, Italy, France and Greece.

1.4.2. Most recent population projections

Table I.1.6 presents the projected net migration flows in the baseline of the 2015-based population projections. The methodology used to project net migration is summarised in Box I.1.1 and in greater detail in Eurostat (2017)([12]).

Table I.1.6: **Projection of net migration flows, 2016-70**

	Net migration ('000)				Net migration (% of population)				
	2016	2030	2060	2070	2016	2030	2060	2070	2016-70 (1)
BE	55	48	30	26	0.5	0.4	0.2	0.2	15.7
BG	-4	-9	1	1	-0.1	-0.1	0.0	0.0	-2.8
CZ	19	17	9	9	0.2	0.2	0.1	0.1	8.4
DK	37	27	11	9	0.6	0.4	0.2	0.1	15.5
DE	750	268	175	143	0.9	0.3	0.2	0.2	16.7
EE	3	1	0	0	0.2	0.1	0.0	0.0	5.1
IE	15	8	12	11	0.3	0.1	0.2	0.2	10.0
EL	-24	-4	10	11	-0.2	0.0	0.1	0.1	2.1
ES	13	119	154	137	0.0	0.3	0.3	0.3	14.5
FR	54	86	62	55	0.1	0.1	0.1	0.1	5.1
HR	-21	4	5	5	-0.5	0.1	0.1	0.1	5.4
IT	134	210	177	164	0.2	0.3	0.3	0.3	18.9
CY	1	3	4	4	0.1	0.3	0.4	0.4	19.3
LV	-9	-6	0	0	-0.5	-0.4	0.0	0.0	-10.2
LT	-28	-17	0	0	-1.0	-0.7	0.0	0.0	-25.7
LU	11	9	4	4	1.9	1.1	0.4	0.4	35.9
HU	18	16	14	11	0.2	0.2	0.2	0.1	9.9
MT	3	3	1	1	0.8	0.5	0.2	0.2	21.2
NL	86	59	29	25	0.5	0.3	0.1	0.1	12.4
AT	74	55	25	21	0.8	0.6	0.2	0.2	22.1
PL	5	-2	12	7	0.0	0.0	0.0	0.0	1.7
PT	-10	13	15	14	-0.1	0.1	0.2	0.2	8.8
RO	-64	-51	2	3	-0.3	-0.3	0.0	0.0	-7.2
SI	0	4	3	3	0.0	0.2	0.1	0.1	10.0
SK	6	5	4	3	0.1	0.1	0.1	0.1	5.9
FI	16	14	8	7	0.3	0.2	0.1	0.1	10.5
SE	104	57	27	24	1.0	0.5	0.2	0.2	17.5
UK	244	220	121	107	0.4	0.3	0.2	0.1	11.8
NO	27	26	18	16	0.5	0.4	0.3	0.2	17.6
EA	1149	878	713	628	0.3	0.3	0.2	0.2	12.8
EU*	1485	1157	915	805	0.3	0.2	0.2	0.2	11.3
EU27	1241	937	793	697	0.3	0.2	0.2	0.2	11.2

(1) Cumulative net migration as % of population in 2070.
Source: Eurostat 2015-based population projection.

For the EU as a whole, annual net inflows are projected to decrease from about 1.5 million people in 2016 (0.3% of the EU population) to 805,000 people by 2070 (0.2% of the EU population). Cumulatively, net migration inflows during the period 2016-70 are forecast to equal 11.3% of the total EU population and 12.8% of the total population of the euro area.

The countries with the highest cumulative net migration inflows as a share of population are projected to be Luxembourg, Austria, Malta, Cyprus, Italy and Sweden, for all of whom cumulative inflows as a share of population will be at least 50% higher than the EU average.

By contrast, cumulative net migration outflows are projected over this period for Bulgaria, Romania, Lithuania and Latvia.

Overall, based on these projections, certain major trends can be identified in the coming decades:

In aggregate, the implicit assumption underlying the migration projections is that there will continue to be substantial net inflows to the EU from the rest of the world. However, the absolute level of annual net inflows by the end of the projection horizon will fall significantly vis-à-vis the levels seen in 2015.

Secondly, Spain, Portugal, Cyprus and Ireland, for whom net migration was positive on average in 2001-2015 but had turned negative in 2015 due to the economic crisis, are expected to see a reversion to net inflows as early as 2016. For Greece and Croatia, the return to net inflows will take longer.

Thirdly, other countries with net migration outflows on average between 2001-2015 (Bulgaria, Poland, Latvia, Lithuania, and Romania), are projected to have these outflows be eliminated or even reversed by 2060 at the latest.

([12]) Eurostat (2017), 'Methodology for the migration assumptions in the 2015-based population projections'.

Box I.1.1: **Methodology for the migration assumptions in the 2015-based population projections**

The model used to produce migration assumptions for the 2015-based population projections is built upon four components ([1]):

a) nowcast;

b) trend model;

c) convergence model;

d) working-age population 'feedback mechanism'.

The weight of the first three components in the overall migration assumptions varies depending on the year of reference. This model tries to take into account past migration trends, very latest evidences, driving demographic factors as well as a vision about future developments in migration flows. On purpose, it does not require non-demographic data input.

Being the jump-off time of reference of the population projections the 1 January 2015 ('2015-based' projections), the migration events that should have been considered were those until the year 2014. However, because of the timing of the exercise, provisional data for the year 2015 and for part of the year 2016 were available at the time of the projections computations. In order to incorporate the latest empirical evidence, the net migration observed in 2015 has been directly taken as 'assumption' for the year 2015.

For the year 2016, the Member States have been invited to provide a statistically sound forecast of net migration, using all the latest (usually monthly or quarterly) available data. The nowcast for the net migration in 2016 has been provided by all countries except Belgium, Estonia, France, Hungary, Romania and Slovakia. For these latter countries, assumptions for the year 2016 where then produced using the other components of the migration model (see below).

([1]) Excerpt from Eurostat (2017), 'Methodology for the migration assumptions in the 2015-based population projections', which contains a comprehensive description of the methodology.

In order to take into account past migration in the formulation of assumptions on future flows, net migration trends were identified and extrapolated by applying Auto-Regressive Integrated Moving Average (ARIMA) models selected by an automated model specification procedure. The extrapolated trends can point to any direction, i.e. indicating increase, decrease or stability of the future flows, depending on the past migration trends. They are mainly an attempt to incorporate any past regularity in migration flows into the assumption for the future; in several cases, however, the best possible model was a 'random walk'.

Considering that the prolongation of the latest migration trends very far in the future may require implausible assumptions, an additional component of the migration model dealt with a longer term view on migration.

The values of net migration based on the convergence assumption for the long term are derived by a piecewise linear interpolation between the last observed value (2015) and the common reference value in the far future. In order to reduce the influence of the last observation, the linear interpolation has been applied first between the net migration value in the year 2015 and an intermediate point value estimated for the year 2020, obtained as the average of the net migration observed in the last 20 years (1996-2015). Afterwards, a second linear interpolation was done between the intermediate value in 2020 and the reference value of convergence (here equal to zero in 2150). By doing so, the potential impact of an extreme starting value in 2015 is smoothed by forcing it towards a more 'stable' value derived from a much longer time period.

Once projected values of the total net migration are available from both the trends and the convergence models, they are pooled giving progressively more weight to the convergence model. This was done by means of a simple weighted average, where the weight attributed to the trend component goes from one in 2015

(Continued on the next page)

Box (continued)

to zero in 2050, year by which the transition from the trends to the convergence is completed.

In countries where the size of the population of working ages (conventionally 15-64 years old) is projected to shrink, a 'feedback' correction factor for immigration is applied. This additional immigration is limited to 10% of the projected shrinkage of the working-age population between two consecutive years. This quantity is estimated as overall volume, added in one round to the corresponding annual assumptions for each year of the projections period and distributed by age and sex in accordance with the country- and year-specific immigration patterns.

Putting all the parts together, the assumptions on total net migration are derived from observed data for 2015, from national nowcasting for the year 2016 when available, from a mix of trends extrapolation and long-term convergence from the following year to 2050, almost exclusively from the trends component at the beginning and progressively more from the 'convergence' values until entering the long-term period (2050 onwards) in which the convergence assumption defines the migration values. All over the projections horizon, net migration flows may be increased due to the additional feedback mechanism depending on the working-age population change.

The methodology applied for the 2015-based population projections is the same applied in the previous round of projections (Eurostat Population Projections 2013-based – EUROPOP2013), except for the following changes:

1. The intermediate point for net migration used in the double linear interpolation of the convergence model is computed over the latest available 20 years instead than over the latest available 10 years as in the EUROPOP2013 model.

2. The transition from trend to convergence starts at the beginning of the projections period (i.e., in 2015), while in EUROPOP2013 the transition was starting in 2020.

3. In EUROPOP2013, the transition for countries with negative net migration at the intermediate point above described was shortened to be completed by 2035; in the 2015-based projections, the final year of the transition remains the same (2050) for all countries.

Emigration levels used to break down the net migration by flow are estimated as average over the latest 5 years (2010 – 2014) rather than over the latest 3 years (2010 – 2012) as in EUROPOP2013.

1.5. OVERALL RESULTS OF THE 2015-BASED POPULATION PROJECTIONS

The EU population is projected to increase from 511 million in 2016 to 528.5 million in 2040, before declining to 520 million in 2070. During this period, the population will age dramatically due to the dynamics in fertility, life expectancy and migration.

1.5.1. Baseline population size

Table I.1.7 presents an overview of the baseline population projections for the period 2016-70 ([13]). These projections are the basis for the 2018 EC-EPC age-related expenditure projection exercise.

The overall size of the population is projected to be slightly larger by 2070 than in 2016, with a hump-shaped trajectory. The EU population is projected to increase from 510.9 million in 2016 to 528.5 million in 2040, remain stable until 2050 and decline thereafter to 520.3 million in 2070.

Moreover, while the total EU population is set to increase by 1.8% over the 2016-70 projection horizon, there are wide differences in trends across Member States.

Decreases of the total population are projected for half of the EU28 Member States, with the declines ranging from -3.9% (Germany) to -40.1% (Lithuania). The strongest population growth is projected in Luxembourg (+78.0%), Sweden (+39.9%), and Ireland (28.9%), while the lowest positive growth is projected for Finland (2.3%).

In 2016, the Member States with the largest population were Germany (82.5 million), France (66.8 million), the United Kingdom (65.6 million), Italy (60.8 million) and Spain (46.4 million). In 2070, the UK is projected to become the most populous country (81 million), followed by Germany (79.2 million), France (77 million), Italy (54.9 million) and Spain (49.9 million).

Table I.1.7: **Total population projections 2016-2070**

	Total population (annual average - millions)						% change
	2016	2030	2040	2050	2060	2070	2016-70
BE	11.3	12.3	12.9	13.3	13.6	13.9	22.8
BG	7.1	6.4	5.9	5.5	5.2	4.9	-31.9
CZ	10.6	10.7	10.5	10.5	10.3	10.0	-5.7
DK	5.7	6.3	6.6	6.7	6.8	6.8	19.2
DE	82.5	84.6	84.1	82.6	80.7	79.2	-3.9
EE	1.3	1.3	1.3	1.3	1.2	1.2	-10.5
IE	4.7	5.2	5.4	5.7	5.9	6.0	28.9
EL	10.8	9.9	9.4	8.9	8.3	7.7	-28.8
ES	46.4	47.2	48.3	49.3	49.6	49.9	7.4
FR	66.8	70.7	73.0	74.4	75.6	77.0	15.3
HR	4.2	3.9	3.8	3.7	3.5	3.4	-18.6
IT	60.8	60.3	60.0	58.9	56.8	54.9	-9.7
CY	0.9	0.9	1.0	1.0	1.0	1.0	19.8
LV	2.0	1.7	1.6	1.5	1.4	1.3	-31.7
LT	2.9	2.4	2.1	2.0	1.8	1.7	-40.1
LU	0.6	0.8	0.9	0.9	1.0	1.0	78.0
HU	9.8	9.7	9.5	9.3	9.1	8.9	-9.7
MT	0.4	0.5	0.5	0.5	0.5	0.5	19.3
NL	17.0	18.4	19.1	19.2	19.3	19.6	14.8
AT	8.7	9.7	10.1	10.2	10.2	10.2	16.5
PL	38.0	37.2	35.8	34.3	32.8	30.9	-18.7
PT	10.3	9.9	9.5	9.1	8.5	8.0	-22.7
RO	19.7	18.0	17.0	16.3	15.7	15.0	-23.8
SI	2.1	2.1	2.1	2.0	2.0	2.0	-5.3
SK	5.4	5.5	5.4	5.3	5.1	4.9	-9.8
FI	5.5	5.7	5.7	5.7	5.7	5.6	2.3
SE	9.9	11.3	12.0	12.7	13.3	13.9	39.9
UK	65.6	71.8	75.2	77.7	79.4	81.0	23.5
NO	5.2	5.9	6.3	6.6	6.8	7.0	33.9
EA	340.3	349.0	352.2	351.8	348.3	345.6	1.5
EU*	510.9	524.1	528.5	528.4	524.4	520.3	1.8
EU27	445.3	452.4	453.3	450.8	445.0	439.2	-1.4

Source: Commission services based on Eurostat 2015-based population projections.

Conversely, in the age cohorts above 69 years old, the projected population in 2070 will be higher than the population in 2015.

Moreover, while in 2015 the largest cohort for both males and females is 45-49 years old, in 2070 the largest cohort will be 70-74 years old for women and 50-54 years old for men. Overall, the median age will rise from 42.4 years old in 2015 to 46.7 years old in 2070.

Similar developments are anticipated for the euro area. For males, in all age cohorts between 0-64, the projected population in 2070 is lower than the population in 2015 while the opposite is true for the cohorts 65 years old and above. For females, the age cohorts up to 69 years old are projected to have a smaller population in 2070 than in 2015, while the population in the cohorts 70 years old and above is projected to grow during this period.

The drivers of these trends are manifold: first, the increasing share of the population in the higher age

([13]) The population projections published by Eurostat refer to the population as of January 1st each year. The projections in this table (and used throughout in this report) for year t are calculated as the average of the Eurostat projections on January 1st for year t and year t+1, as done in previous projection exercises.

Table I.1.8: **Decomposition of the population by age-groups, 2016 and 2070**

	2016				2070			
	(0-14)	(15-64)	(65+)	(80+)	(0-14)	(15-64)	(65+)	(80+)
BE	17%	65%	18%	6%	16%	58%	26%	11%
BG	14%	65%	21%	5%	14%	55%	31%	15%
CZ	15%	66%	19%	4%	15%	57%	28%	13%
DK	17%	64%	19%	4%	15%	56%	28%	11%
DE	13%	66%	21%	6%	14%	55%	31%	13%
EE	16%	65%	19%	5%	15%	56%	29%	14%
IE	22%	64%	13%	3%	17%	59%	24%	11%
EL	14%	64%	21%	7%	12%	54%	34%	17%
ES	15%	66%	19%	6%	16%	57%	27%	13%
FR	18%	63%	19%	6%	17%	57%	26%	11%
HR	15%	66%	19%	5%	13%	56%	31%	13%
IT	14%	64%	22%	7%	13%	55%	33%	15%
CY	16%	69%	15%	3%	11%	55%	34%	14%
LV	15%	65%	20%	5%	15%	55%	30%	15%
LT	15%	66%	19%	5%	15%	56%	30%	14%
LU	16%	69%	14%	4%	15%	57%	28%	11%
HU	14%	67%	18%	4%	15%	56%	29%	12%
MT	14%	66%	19%	4%	15%	55%	31%	13%
NL	16%	65%	18%	4%	16%	57%	28%	11%
AT	14%	67%	19%	5%	14%	56%	30%	12%
PL	15%	69%	16%	4%	13%	54%	33%	16%
PT	14%	65%	21%	6%	12%	53%	35%	16%
RO	15%	67%	18%	4%	15%	55%	29%	13%
SI	15%	66%	19%	5%	15%	57%	28%	14%
SK	15%	70%	15%	3%	14%	55%	31%	14%
FI	16%	63%	21%	5%	15%	56%	29%	12%
SE	17%	63%	20%	5%	17%	58%	25%	10%
UK	18%	64%	18%	5%	16%	58%	26%	11%
NO	18%	66%	17%	4%	16%	57%	27%	11%
EA	15%	65%	20%	6%	15%	56%	29%	13%
EU*	16%	65%	19%	5%	15%	56%	29%	13%
EU27	15%	65%	19%	6%	15%	56%	29%	13%

Source: Commission services based on Eurostat 2015-based population projections.

cohorts is due to the combination of the numerous cohorts born in the 1950's and 1960's and the continuing projected gains in life expectancy. Secondly, the size of the groups between the ages of 20-59 (the bulk of the working age population) shrinks significantly between 2015 and 2070 due to fertility rates below natural replacement level and shrinking cohorts of women in childbearing ages. Finally, net migration flows are not projected to offset the aforementioned trends.

These developments are depicted in more detail by age groups in Table I.1.8 below that highlights as well the overall impact on the share of working age population.

The proportion of young people (aged 0-14) is projected to remain fairly constant by 2070 in the EU28, falling from 16% to 15%. Those aged 65 and over will become a much larger share, rising from 19% to 29% of the population, while the share of those aged 80 and over will increase from 5% to 13%, becoming almost as large as the young population in 2070. By contrast, those aged 15-64 – namely the working-age population - will become a substantially smaller share of the total population, declining from 65% to 56%.

As a result of these trends among age-groups, the dependency ratios in the EU are projected to increase significantly (Table I.1.9 below).

The demographic old-age dependency ratio (people aged 65 or above relative to those aged 15-64) is projected to increase from 29.6% to 51.2% in the EU as a whole over the projection period This implies that the EU would move from having just over three working-age people for every person aged over 65 years to around two working-age persons.

Table I.1.9: **Demographic total dependency ratio (0-14 plus 65+/(15-64)), 2016-2070**

	Old-age dependency ratio (65+/15-64)			p.p. change	Very old-age dependency ratio (80+/15-64)			p.p. change	Total dependency ratio			p.p. change
	2016	2060	2070	2016-2070	2016	2060	2070	2016-2070	2016	2060	2070	2016-2070
BE	28.4	43.5	45.2	16.7	8.5	16.9	18.4	9.8	54.7	71.0	72.5	17.8
BG	31.5	63.0	56.2	24.7	7.2	24.6	26.8	19.6	52.9	89.3	81.6	28.7
CZ	28.1	55.7	49.7	21.6	6.1	22.9	23.3	17.2	51.6	83.6	75.6	23.9
DK	29.5	45.0	50.2	20.8	6.7	17.1	18.9	12.1	55.5	71.2	77.7	22.2
DE	32.2	55.1	55.9	23.7	8.9	21.4	24.1	15.1	52.3	79.9	81.0	28.7
EE	29.7	55.7	52.7	23.0	8.1	20.9	24.9	16.9	54.6	83.2	79.0	24.4
IE	20.9	44.2	41.2	20.4	4.9	18.7	19.0	14.1	55.4	75.4	70.2	14.9
EL	33.4	67.2	63.1	29.7	10.3	32.7	31.0	20.7	55.8	89.6	86.0	30.2
ES	28.6	53.2	46.6	18.0	9.2	26.9	22.4	13.1	51.5	81.8	75.3	23.8
FR	30.4	43.3	44.8	14.4	9.4	19.0	18.9	9.5	59.8	73.0	74.6	14.8
HR	29.3	53.7	56.2	26.9	7.5	20.3	23.3	15.9	51.5	77.0	80.0	28.5
IT	34.5	61.0	60.3	25.8	10.5	28.4	26.8	16.3	55.6	83.3	83.5	27.8
CY	22.2	55.7	61.0	38.7	4.9	18.2	25.4	20.5	45.6	75.9	81.7	36.1
LV	30.5	65.2	53.8	23.3	7.9	25.0	27.3	19.5	54.2	97.1	81.8	27.7
LT	29.0	63.9	53.1	24.1	8.1	25.7	24.9	16.8	51.2	94.4	79.3	28.1
LU	20.6	44.6	48.9	28.2	5.8	16.2	19.5	13.7	44.3	69.9	74.9	30.6
HU	27.5	53.2	52.0	24.5	6.4	21.6	22.0	15.5	49.1	79.8	78.6	29.5
MT	29.1	53.9	55.8	26.6	6.4	20.1	24.3	17.9	50.6	80.5	82.3	31.7
NL	28.1	44.3	48.4	20.3	6.8	17.5	18.7	11.8	53.2	70.7	76.1	22.9
AT	27.6	51.3	54.4	26.9	7.4	19.3	22.3	14.9	48.8	75.6	79.2	30.4
PL	23.7	64.9	62.2	38.5	6.1	24.4	30.3	24.2	45.6	90.3	86.7	41.1
PT	32.1	64.9	67.2	35.1	9.3	30.2	29.8	20.5	53.6	85.8	89.7	36.2
RO	26.3	56.7	52.8	26.6	6.4	23.3	24.4	18.0	49.1	84.7	80.8	31.7
SI	28.1	55.0	50.2	22.1	7.6	23.4	23.8	16.3	50.5	82.0	76.5	26.0
SK	21.0	59.4	56.8	35.8	4.5	22.3	26.2	21.7	42.9	85.6	82.7	39.7
FI	32.8	49.7	52.0	19.1	8.3	18.8	21.7	13.5	58.7	75.9	78.3	19.5
SE	31.6	42.7	43.2	11.6	8.1	15.7	17.5	9.4	59.5	73.0	73.0	13.5
UK	27.9	43.5	46.0	18.0	7.5	16.5	18.5	11.0	55.4	71.2	73.7	18.3
NO	25.2	44.1	47.2	22.1	6.4	16.5	18.7	12.3	52.3	71.1	74.6	22.3
EA	30.9	52.3	51.8	20.9	9.1	22.7	22.6	13.6	54.3	78.5	78.4	24.1
EU*	29.6	51.6	51.2	21.6	8.3	21.6	22.3	14.0	53.5	78.2	78.0	24.6
EU27	29.9	53.1	52.2	22.4	8.4	22.5	23.0	14.6	53.2	79.5	78.9	25.7

Source: Commission services based on Eurostat 2015-based population projections.

Similarly, the very old-age dependency ratio (people aged 80 or above relative to those aged 15-64) is projected to almost triple from 8.3% to 22.3% in the EU as a whole over the projection period – an increase of 14 p.p. During the same period, the total age-dependency ratio (people aged 14 and below and aged 65 and above relative to the population aged 15-64) is projected to rise by almost 25 p.p., rising from 53.5% to 78%.

The difference is noticeable among individual EU Member States. A relatively small increase in the total age-dependency ratio (less than 20 p.p.) is projected in Belgium, Ireland, France, Finland, Sweden and the UK, while in Poland and Slovakia an increase of around 40 percentage points or more is expected by 2070.

In 2070, the countries with the highest total age-dependency ratio will be Portugal (89.7%), Poland (86.7%), Greece (86%), Italy (83.5%) and Slovakia (82,7%). The other countries for which the total dependency ratio will be 80% or above in 2070 include Malta, Bulgaria, Cyprus, Latvia, Germany, Romania and Croatia.

By contrast, the countries with the lowest projected total dependency ratios in 2070 that are more than one standard deviation from the EU average are Ireland (70.2%), Belgium (72.5%) and Sweden (73%), despite all three countries being above the EU average in 2016. This reflects higher-than-average projected fertility rates (Ireland, Sweden, Belgium) and/or cumulative net migration inflows between 2016-70 (Belgium, Sweden) as shown in Tables I.1.2 and I.1.6 above.

1.6. POPULATION AGEING IN THE EU IN A GLOBAL CONTEXT

By 2070, the EU's share of the total world population is forecast to shrink to 4.5%, and its dependency ratios will be second highest globally among large countries.

Table I.1.10: **Geographic distribution of world population, 1960-2070 (% of total world population)**

	1960	1980	2000	2015	2040	2070	p.p. change 1960-2015	p.p. change 2015-2070
Africa	9.4%	10.8%	13.3%	16.2%	22.8%	32.1%	6.8	15.9
Asia	56.1%	59.3%	60.7%	59.9%	56.0%	49.1%	3.8	-10.8
China	21.7%	22.3%	20.9%	18.9%	15.4%	11.4%	-2.8	-7.5
Japan	3.1%	2.6%	2.1%	1.7%	1.3%	0.9%	-1.4	-0.8
India	14.8%	15.6%	17.1%	17.7%	17.4%	15.7%	2.9	-2.0
Europe	20.0%	15.6%	11.8%	10.0%	7.9%	6.4%	-9.9	-3.6
Russian Federation	4.0%	3.1%	2.4%	1.9%	1.5%	1.2%	-2.0	-0.8
*EU**	13.5%	10.4%	7.9%	6.9%	5.5%	4.5%	-6.6	-2.3
EA	8.7%	6.8%	5.2%	4.6%	3.7%	3.0%	-4.2	-1.6
Latin America and the Caribbean	7.3%	8.2%	8.6%	8.6%	8.2%	7.4%	1.3	-1.2
Northern America	6.8%	5.7%	5.1%	4.8%	4.5%	4.4%	-1.9	-0.4
United States of America	6.2%	5.2%	4.6%	4.3%	4.1%	4.0%	-1.8	-0.4
Oceania	0.5%	0.5%	0.5%	0.5%	0.6%	0.6%	0.0	0.1

Source: UN Population Prospects (2017 UN Revision).

The UN population statistics and projections provide a source for demographic trends in a global perspective ([14]).

The share of the current EU Member States in the world population fell from 13.5% in 1960 to 6.9% in 2015 (see Table I.1.10). The shares of Japan, China and the US in the global population also declined in 2015 vis-à-vis 1960, in contrast with the rising shares in Africa, India and Latin America.

Africa's world population share is projected to increase at the fastest rate of all continents to 32.1% by 2070. The share of Asia is forecast to decline after 2015 though it will still be by far the largest continent with 49.1% of the world population in 2070. The decline is particularly evident for China, whose world population share is projected to fall from 18.9% to 11.4% between 2015 and 2070.

By 2070, the share of the EU in the global population is forecast to reach 4.5%, shrinking by 2.3 p.p. relative to that in 2015. This will be close to the share of Northern America (4.4%) that will also decline relative to 2015 but by less (0.4 p.p.).

Looking at the age structure in the UN projections, it can be seen in Table I.1.11 that in comparison to other large countries, the EU had the second highest old-age dependency ratio in 2015 (29.2%) after Japan (42.7%). This ratio is forecast to rise in the EU by 25 p.p. by 2070, reaching 54.2% - still the second highest ratio amongst large countries.

Most continents are forecast to experience a significant ageing of their populations between 2015-70, with old-age dependency ratios climbing by 21.3 p.p. in Northern America, 25.4 p.p. in Asia and 33.6 p.p. in Latin America. The old-age dependency ratio is forecast at 36.5% for Asia by 2070 while in Northern America and Latin America it is projected to reach 43.6% and 45% respectively. Africa is forecast to remain the only continent with a relatively low old-age dependency ratio at the end of the projection period (at 13.5%).

Future demographic change is particularly pronounced in China and Japan, where the old age dependency ratio is projected to reach 53.3% and 69.6% respectively in 2070.

The UN projections show that Europe is currently the oldest continent in the world when looking at the 'very-old-age dependency ratio' - the ratio of over 80 years old to the working age population - and will remain so by 2070. This ratio was equal to 7% in 2015 but is forecast to rise to 21.5% by 2070, while in other continents it is expected to remain below 17%, with Africa again at the lowest level (2.7%).The large increase in the forecast for Europe is driven by the EU, whose very-old dependency ratio is projected to rise by 15.9 p.p. from 8.2% in 2015 to 24% in 2070, and remain the second highest among large countries.

The only large countries forecast to see a larger rise in the very old-age dependency ratio between 2015 and 2070 than that in the EU are Japan and China, with their ratios rising by 23.3p.p. and 19.8 p.p. respectively and reaching 35.8% and 22.1% respectively.

([14]) The United Nations Population Division produces global population projections revised every two years. The latest projections are the 2017 Revision.

Table I.1.11: **Global demographic dependency ratios, 1960-2070 (%)**

	Old-age dependency ratio (65+/(15-64))						"Very" old-age dependency ratio (80+/(15-64))					
	1960	2000	2015	2070	p.p. change 1960-2015	p.p. change 2015-70	1960	2000	2015	2070	p.p. change 1960-2015	p.p. change 2015-70
World	8.6	10.9	12.6	30.5	4.0	17.8	1.0	1.9	2.6	9.9	1.6	7.3
Africa	5.7	6.2	6.2	13.5	0.6	7.3	0.5	0.7	0.8	2.7	0.4	1.8
Asia	6.4	9.1	11.2	36.5	4.7	25.4	0.6	1.3	2.0	12.0	1.5	10.0
China	6.5	10.1	13.3	53.3	6.8	39.9	0.3	1.5	2.3	22.1	1.9	19.8
Japan	8.8	24.9	42.7	69.6	33.9	27.0	1.1	5.4	12.4	35.8	11.4	23.3
India	5.4	7.2	8.6	31.0	3.2	22.4	0.6	0.9	1.3	7.6	0.8	6.3
Europe	13.6	21.8	26.4	49.4	12.8	23.0	2.0	4.3	7.0	21.5	5.0	14.4
Russian Federation	9.6	18.0	19.4	34.5	9.8	15.1	1.3	2.9	4.5	14.1	3.2	9.6
*EU**	15.2	23.4	29.2	54.2	14.1	25.0	2.3	5.0	8.2	24.0	5.9	15.9
EA	15.7	24.2	30.6	56.0	14.9	25.3	2.4	5.3	8.9	25.1	6.5	16.2
Latin America and the Caribbean	6.8	8.9	11.4	45.0	4.6	33.6	0.8	1.6	2.4	16.4	1.7	13.9
Northern America	15.0	18.6	22.3	43.6	7.3	21.3	2.3	4.9	5.7	16.8	3.3	11.2
United States of America	15.2	18.7	22.1	43.1	7.0	20.9	2.3	4.9	5.6	16.4	3.3	10.8
Oceania	12.5	15.4	18.5	34.1	6.0	15.6	1.9	3.4	4.6	12.7	2.7	8.1

Source: UN Population Prospects (2017 UN Revision).

1.7. COMPARISON WITH THE EUROPOP2013 PROJECTION USED IN THE 2015 AGEING REPORT

By 2060, the total EU population is projected to be about 1.6 million larger than the EUROPOP2013 estimate, due to a large increase in the population above 65 years old that offsets the reduction in the working-age population. The population in the euro area is projected to be 5.3 million higher than in EUROPOP2013, with higher estimates for all population groups, but in particular for that above 65 years of age.

A comparison of the main results of the 2015-based population projection with the EUROPOP2013 projection used in the 2015 Ageing Report is provided in this section.

In 2016 the total population in the EU as a whole is projected to be 1,316,000 people larger compared with the EUROPOP2013 projection for the same year, and 1,625,000 people larger for the euro area (see Table I.1.12).

This development is largely driven by Germany that is now projected to have a 1.7 million larger population in 2016 than in EUROPOP2013, in large part due to the large migration inflows recorded in 2015.

By 2060, the total EU population is projected to be about 1.6 million larger (+0.3%) than projected by EUROPOP2013 while the euro area population is projected to be 5.3 million larger.

At the EU level, the young population (0-14) projection is very close to that in EUROPOP2013 (-0.1%) and the increase in the total population projection is driven by the large rise in the population above 65 that in 2060 is now projected to be 3.5 million or 2.4% larger than before.

The latter development offsets the decline in the projection of the working age population (15-64 years old) of 1.8 million or -0.6% vis-à-vis the EUROPOP2013 projection.

In the euro area, all population sub-group projections for 2060 are higher than the EUROPOP2013 projections.

However, the largest increases in absolute and relative terms are concentrated among those above 65 (3 million or 3% higher) and the young (1.2 million or 2.4% higher), while the increase in the working-age population projection is notably lower (1.1 million or 0.6% higher).

As shown in Table I.1.13, these varied trends between population sub-groups have an impact on the old-age dependency ratio (persons aged 65 and over in relation to persons aged 15-64 over the projection period (2013-60).

Table I.1.12: **Difference between 2015-based population projections and EUROPOP2013 ('000)**

	Total population			Population 0-14			Population 15-64			Population 65+		
	2016	2060	Diff in 2060 as % of total population in 2060 EUROPOP2013	2016	2060	Diff in 2060 as % of total population in 2060 EUROPOP2013	2016	2060	Diff in 2060 as % of total population in 2060 EUROPOP2013	2016	2060	Diff in 2060 as % of total population in 2060 EUROPOP2013
BE	-154	-1,836	-11.9%	-51	-427	-16.4%	-97	-1,213	-13.2%	-5	-196	-5.4%
BG	-3	-254	-4.6%	3	-44	-5.8%	-11	-211	-7.1%	5	1	0.1%
CZ	-4	-785	-7.1%	-1	-141	-8.3%	-5	-641	-10.3%	2	-3	-0.1%
DK	47	217	3.3%	2	-42	-3.9%	40	94	2.4%	4	165	10.2%
DE	1,739	9,899	14.0%	591	1,838	19.8%	1,428	6,212	16.1%	-280	1,849	8.1%
EE	11	128	11.7%	0	17	10.2%	9	67	11.1%	1	44	13.6%
IE	78	653	12.4%	26	79	8.2%	42	209	6.6%	10	365	32.5%
EL	-144	-298	-3.5%	-22	-122	-11.1%	-128	-283	-6.1%	6	106	3.7%
ES	192	3,431	7.4%	21	1,590	25.6%	101	1,190	4.6%	70	651	4.7%
FR	171	-81	-0.1%	80	-88	-0.7%	52	-137	-0.3%	38	145	0.8%
HR	-58	-172	-4.6%	-15	-52	-10.1%	-40	-97	-4.6%	-4	-23	-2.1%
IT	-489	-9,459	-14.3%	-316	-2,038	-22.8%	-300	-6,473	-17.3%	127	-947	-4.8%
CY	-28	-110	-9.8%	-7	-57	-33.1%	-21	-72	-11.2%	0	19	6.5%
LV	5	26	1.9%	5	3	1.5%	-4	-56	-7.2%	4	79	20.2%
LT	35	-1	0.0%	5	-38	-11.7%	27	-93	-9.0%	3	130	27.5%
LU	0	-148	-13.0%	-4	-45	-23.1%	3	-116	-16.5%	0	12	4.8%
HU	-17	-45	-0.5%	4	30	2.2%	-21	-70	-1.4%	0	-4	-0.1%
MT	7	43	9.1%	0	3	4.2%	6	21	7.8%	1	19	14.2%
NL	82	2,261	13.2%	-7	381	14.6%	84	1,536	15.7%	6	344	7.3%
AT	107	534	5.5%	8	53	3.9%	100	290	5.2%	0	191	6.8%
PL	-517	-446	-1.3%	-103	68	1.6%	-428	-736	-4.1%	14	222	2.0%
PT	34	327	4.0%	15	34	3.6%	7	151	3.4%	12	142	5.0%
RO	-174	-1,746	-10.0%	-72	-277	-10.4%	-103	-1,241	-12.8%	0	-229	-4.5%
SI	-9	-42	-2.0%	-3	-4	-1.2%	-6	-43	-3.8%	-1	5	0.8%
SK	13	548	12.0%	12	199	37.9%	-2	321	13.2%	3	29	1.8%
FI	-25	-591	-9.5%	-15	-167	-16.5%	-9	-395	-10.9%	-1	-30	-1.8%
SE	75	231	1.8%	11	56	2.5%	59	58	0.8%	4	117	3.7%
UK	344	-660	-0.8%	-106	-919	-6.7%	399	-72	-0.2%	51	331	1.7%
NO	-46	-1,334	-16.4%	-22	-312	-22.5%	-24	-881	-18.1%	0	-141	-7.4%
EA	1,625	5,284	1.5%	339	1,212	2.4%	1,291	1,116	0.6%	-5	2,956	3.0%
EU*	1,316	1,626	0.3%	61	-108	-0.1%	1,183	-1,799	-0.6%	72	3,533	2.4%
EU27	973	2,285	0.5%	167	811	1.3%	784	-1,728	-0.7%	22	3,202	2.5%

Source: Commission services based on Eurostat population projection 2015 and EUROPOP2013.

Specifically, with the 2015 population projections, the old-age dependency ratio is projected to be 1.5 pp. higher for the EU as a whole in 2060, and 1.2 pp. higher for the euro area vis-à-vis the EUROPOP2013 projection.

The old-age dependency ratio in 2060 is now projected to be significantly higher in certain Member States such as Latvia (14.9 pps. higher), Lithuania (18.3 pps. higher), Cyprus (9.2 p.p.), Luxembourg (9.1 pps.), Ireland (8.6 pps.) and Italy (8 pps.).

By contrast, only in three Member States the old age dependency ratio in 2060 is projected to be lower in the 2015 projection vis-à-vis the EUROPOP2013 projection – namely Slovakia (-6.7 pps.), Germany (-4.1 pps.) and the Netherlands (-3.4 pps.).

The differences in the demographic assumptions that are driving the above-mentioned differences in the population projections and dependency ratios between the 2015-based population projections and EUROPOP2013 are explored below.

Table I.1.14 summarises the differences in the fertility rates and net migration assumptions underpinning the 2015-based population projections and EUROPOP2013.

Compared with the EUROPOP2013 projection, total fertility rates are initially lower in 2016 for the EU as a whole and the euro area in the 2015 projection (-0.03 and -0.01 respectively). However, this is reversed by 2060 with the EU and euro area having higher fertility rates vis-à-vis the previous projection (0.03 and 0.05 respectively).

Table I.1.13: **Old-age dependency ratio compared: 2015 population projections - EUROPOP2013 (percentage points)**

	2016	2030	2060	2016-2060
BE	0.3	1.4	3.6	3.3
BG	0.2	1.2	4.5	4.3
CZ	0.1	0.9	5.7	5.6
DK	-0.2	-1.0	3.2	3.4
DE	-1.4	-4.1	-4.1	-2.7
EE	-0.2	-2.1	1.2	1.4
IE	0.0	-1.6	8.6	8.6
EL	0.7	3.3	6.4	5.7
ES	0.1	0.6	0.1	-0.1
FR	0.1	0.7	0.5	0.4
HR	0.3	0.8	1.4	1.1
IT	0.6	3.7	8.0	7.4
CY	0.8	-1.2	9.2	8.5
LV	0.4	1.3	14.9	14.4
LT	-0.2	-1.6	18.3	18.5
LU	-0.2	1.1	9.1	9.2
HU	0.1	0.8	0.7	0.6
MT	-0.2	-0.1	3.1	3.3
NL	-0.2	-1.7	-3.4	-3.3
AT	-0.5	-1.8	0.8	1.2
PL	0.4	1.6	3.9	3.5
PT	0.1	0.5	1.0	0.8
RO	0.2	2.1	4.9	4.7
SI	0.1	0.2	2.5	2.4
SK	0.1	0.0	-6.7	-6.8
FI	0.1	1.0	4.6	4.6
SE	-0.2	-0.8	1.2	1.4
UK	-0.1	-0.8	0.8	0.9
NO	0.2	1.8	5.1	4.9
EA	-0.2	0.0	1.2	1.4
EU*	-0.1	0.1	1.5	1.6
EU27	-0.1	0.3	1.7	1.7

(1) Old-age dependency ratio defined as persons aged 65 and over in relations to persons aged 15-64.
Source: Commission services based on Eurostat 2015-based population projections and EUROPOP2013.

Overall, 16 EU Member States are now projected to have higher fertility rates in 2060 than in the EUROPOP2013 projection, with especially large increases in fertility rates in 2060 for Spain (0.33) and Slovakia (0.26).

Of the twelve EU Member States whose fertility rates in 2060 are now projected to be lower, the largest declines are for Luxembourg (-0.12), Finland (-0.08), Belgium (-0.07), the UK (-0.07) and Denmark (-0.07).

Net migration inflows in 2016 according to the 2015-based population projections are notably higher than the EUROPOP2013 projection by around 591'000 for the EU and 532'000 for the euro area. However, cumulatively between 2016 and 2060, net migration is forecast to be 3.2 million lower for the EU and 1.1 million lower for the euro area in the 2015-based population projections ([15]).

Table I.1.14: **Differences in demographic assumptions underpinning 2015-based population projections and EUROPOP2013**

	Fertility rate			Net migration ('000)		
	2016	2060	2016-60	2016	2060	2016-60
BE	-0.08	-0.07	0.01	-20	-13	-1,079
BG	-0.04	0.01	0.05	0	0	-132
CZ	0.05	0.00	-0.05	-6	-12	-643
DK	0.03	-0.07	-0.10	19	1	254
DE	0.07	0.01	-0.06	518	77	3,962
EE	-0.03	-0.02	0.01	6	0	99
IE	-0.12	-0.02	0.10	46	-3	603
EL	0.03	0.00	-0.02	0	6	251
ES	-0.03	0.33	0.36	96	-121	-1,203
FR	0.00	0.01	0.01	-35	-5	-356
HR	-0.13	-0.06	0.07	-23	0	-51
IT	-0.12	-0.01	0.11	-183	-20	-5,080
CY	-0.11	-0.06	0.05	2	-4	-59
LV	0.20	0.08	-0.12	3	0	68
LT	0.03	0.03	0.00	6	0	79
LU	-0.21	-0.12	0.08	0	0	-66
HU	0.04	0.03	0.00	-4	0	-128
MT	-0.08	-0.06	0.02	2	0	35
NL	-0.06	-0.01	0.06	64	19	1,396
AT	0.00	0.00	0.01	26	0	180
PL	0.02	0.06	0.04	4	0	-162
PT	0.05	0.01	-0.05	7	7	243
RO	-0.15	0.05	0.20	-62	-1	-1,078
SI	-0.03	0.03	0.06	-4	-2	-47
SK	0.10	0.26	0.15	3	1	101
FI	-0.20	-0.08	0.12	-5	-1	-233
SE	-0.07	0.09	0.15	51	-4	65
UK	-0.13	-0.07	0.05	80	-50	-219
NO	-0.15	-0.07	0.08	-22	-4	-770
EA	-0.01	0.05	0.06	532	-57	-1,106
EU*	-0.03	0.03	0.06	591	-122	-3,200
EU27	-0.04	0.03	0.06	512	-72	-2,981

Source: Commission services based on Eurostat 2015-based population projections and EUROPOP2013.

The final potential demographic assumption driving the differences between the 2015-based population projections and EUROPOP2013 is life expectancy at birth (Table I.1.15).

In the EU as a whole, life expectancy at birth in 2016 is assumed to be higher in the 2015-based demographic projection than in the EUROPOP2013 for both males (+0.2 years) and

([15]) Notwithstanding the declining cumulative projection at EU and euro area level, in certain countries (i.e Denmark, Germany, Estonia, Ireland, Greece, Latvia, Lithuania, Malta, Netherlands, Austria, Portugal, Slovakia and Sweden), cumulative net migration over the 2016-60 horizon is now projected to be higher than in the EUROPOP2013 projection.

females (+0.2 years). The largest increases in 2016 (of 0.5 years or more) for males occur in Belgium, Czech Republic, Estonia, Spain, Italy, Malta and Slovenia, and for females in Spain, Cyprus, Luxembourg and Malta. By contrast, life expectancy at birth in 2016 is lower in the latest projections vis-à-vis EUROPOP2013 for males in Bulgaria, Germany, Latvia, Lithuania, Luxembourg and Romania and for females in Bulgaria, Croatia, Lithuania, the Netherlands, and Austria.

Table I.1.15: **Life expectancy at birth compared: 2015-based population projection and EUROPOP2013 (years)**

	Males			Females		
	2016	2060	change 2016-60	2016	2060	change 2016-60
BE	0.5	0.4	-0.1	0.3	0.3	0.0
BG	-0.1	-0.1	0.0	-0.1	-0.1	0.0
CZ	0.5	0.2	-0.3	0.4	0.2	-0.2
DK	0.2	0.1	-0.1	0.3	0.2	-0.1
DE	-0.3	-0.3	0.0	0.0	-0.1	-0.1
EE	0.5	0.3	-0.2	0.1	0.0	-0.1
IE	0.3	0.1	-0.2	0.0	0.0	0.0
EL	0.3	0.4	0.1	0.2	0.3	0.1
ES	0.6	0.4	-0.2	0.5	0.3	-0.2
FR	0.4	0.3	-0.1	0.3	0.3	0.0
HR	0.4	0.2	-0.2	-0.1	0.0	0.1
IT	0.5	0.4	-0.1	0.3	0.3	0.0
CY	1.1	0.8	-0.3	0.6	0.4	-0.2
LV	-0.6	-0.2	0.4	0.0	0.2	0.2
LT	-0.3	-0.1	0.2	-0.3	0.0	0.3
LU	-0.4	-0.1	0.3	0.6	0.4	-0.2
HU	0.2	0.1	-0.1	0.2	0.2	0.0
MT	0.9	0.7	-0.2	1.0	0.5	-0.5
NL	0.1	0.3	0.2	-0.1	0.1	0.2
AT	0.2	0.3	0.1	-0.1	0.1	0.2
PL	0.3	0.2	-0.1	0.1	0.2	0.1
PT	0.3	0.2	-0.1	0.4	0.2	-0.2
RO	-0.2	0.0	0.2	0.1	0.2	0.1
SI	0.5	0.3	-0.2	0.3	0.2	-0.1
SK	0.3	0.3	0.0	0.3	0.4	0.1
FI	0.3	0.1	-0.2	0.1	0.0	-0.1
SE	0.1	0.1	0.0	0.3	0.2	-0.1
UK	0.0	0.1	0.1	0.0	0.0	0.0
NO	0.2	0.1	-0.1	0.3	0.3	0.0
EA	0.1	0.2	0.0	0.2	0.1	0.0
EU*	0.2	0.2	0.0	0.2	0.2	0.0
EU27	0.2	0.2	0.0	0.2	0.2	0.0

Source: Commission services based on Eurostat 2015-based population projection and EUROPOP2013.

Life expectancy at birth in 2060 for the EU as a whole is also projected to be higher in the 2015 projection vis-à-vis EUROPOP2013, and by the same number of years for males and for females (0.2 years) as in 2016.

For males, the largest rises in life expectancy at birth in 2060 vis-à-vis the EUROPOP2013 projection are estimated in Cyprus and Malta, while Bulgaria, Germany, Latvia, Lithuania and Luxembourg now have lower assumptions of life expectancy at birth in 2060 vis-à-vis the 2013 projections.

For females, the biggest rises in life expectancy at birth in 2060 vis-à-vis the EUROPOP2013 are projected in Malta, Cyprus, Luxembourg and Slovakia, while Bulgaria and Germany are now anticipated to have slightly lower life expectancy at birth in 2060 than was assumed in 2013.

2. LABOUR FORCE PROJECTIONS

The total participation rate in the EU is projected to rise by 3.2 pps. (from 77.5% in 2016 to 80.7% in 2070). For the euro area a slightly lower increase of 3.1 pps. is projected (from 77.6% in 2016 to 80.6% in 2070).

The total employment rate in the EU is projected to increase from 71.1% in 2016 to 75.8% in 2070. Such evolution is largely determined by improvements in the employment of the older people (+12.6 pps.) and that of women (+6.9 pps.).

Total labour supply in the EU is projected to decrease over the projection horizon by 9.6%. The labour supply of men will see a larger reduction (-10.6%) compared to women (-9.2%). The euro area countries will experience a similar reduction (-9.7%) by 2070.

2.1. INTRODUCTION

The macroeconomic implications of the demographic trends described in the previous chapter will depend in large part on the future growth of the labour force and on how long people stay in the labour force. Working longer can provide more resources to pay for the higher social security and health care costs associated with population ageing. It will also allow a smaller proportion of total resources to be used for support of the older population and more to be allocated to the young, to education in particular, and unemployed.

How long people work will depend, among other factors, on incentive effects of public and private pension programs ([16]). Hence the future effects of pension reforms legislated by Member States are duly taken into account.

The section starts with a comparison of recent trends in labour forces and an overview of the estimated effects of legislated pension reform. Projections of the participation rates and employment are the main content of the section ([17]). An analysis of the economic dependency ratio and a comparison with the 2015 Ageing Report conclude. Boxes and Annexes focus on assumptions and methodological aspects of the projections.

2.2. PAST TRENDS AND MAIN DRIVERS OF LABOUR MARKET DEVELOPMENTS

Labour force composition has undergone profound changes in the last decades. While participation rates for prime age men remained stable, younger cohorts tend to enter the labour market later while women and older people have steadily increased their attachment to the labour market. There are basically four sets of stylised facts underlying these changes, namely:

- social factors, such as longer schooling or change in the role of women in households;
- demographic factors, including the decline of fertility rates and delays in childbearing;
- institutional factors, in particular changes in early retirement or changes in the statutory/effective age of retirement, and/or;
- economic factors, such as, substitution and income effects of labour taxation particularly relevant for second earners, take-up rates of part-time employment, and the share (relative prices) of services in the economy.

Despite a large cross-country labour force variability (see Table I.2.1), some common features call for our attention and need to be catered for in any projection exercise. They can be summarised as follows:

- the participation rates of prime-age male workers (aged 25 to 54), at around 90%, is the highest of all groups. The participation rates of men aged 55 to 64 years, which had recorded a steady decline in the past twenty five years, are

([16]) Other aspects that may affect the labour supply are the health and disability trends and the implementation of active labour market policies that may improve the demand for older workers and the flexibility of work at older ages.

([17]) In order to project participation rates by gender and single age, the cohort simulation model (CSM) developed by the European Commission (DG ECFIN) is used. Labour force projections are based on a 'no-policy-change' assumption (see Box I.2.1).

Table I.2.1: **Historical participation rates: Total**

	20-64			20-24			25-54			55-64			
	1985	2000	2015	1985	2000	2015	1985	2000	2015	1985	2000	2015	
BE	65.1	70.8	73.3	67.6	60.7	51.0	75.7	82.8	85.1	27.3	25.9	46.6	BE
BG		67.1	73.8		48.5	42.1		81.6	83.2		25.1	58.0	BG
CZ		77.4	78.7		69.3	52.1		88.5	88.6		38.1	58.0	CZ
DK	82.2	81.4	81.3	85.0	79.1	71.8	89.1	87.9	87.1	53.2	56.9	67.6	DK
DE	69.3	74.6	81.8	74.5	71.1	68.4	77.0	85.4	87.6	39.5	42.9	69.4	DE
EE		77.6	81.5		64.7	64.4		88.0	87.9		47.3	68.7	EE
IE	65.4	73.0	75.8	82.0	73.6	62.2	66.1	78.4	81.2	45.8	46.3	60.1	IE
EL	64.7	69.6	73.1	60.3	63.1	47.4	70.6	78.3	85.4	46.1	40.9	41.6	EL
ES		69.8	79.1		60.9	56.7		78.0	87.4		40.8	57.6	ES
FR	72.7	74.9	77.3	76.8	59.3	62.3	82.2	86.4	87.5	35.6	31.7	52.6	FR
HR			71.8			50.8			84.5			44.3	HR
IT	62.5	63.6	68.6	66.7	55.8	44.1	70.4	74.2	76.8	33.8	28.6	51.1	IT
CY		75.6	79.8		72.6	64.5		81.6	87.9		51.2	57.4	CY
LV		73.7	80.5		64.8	65.1		85.5	87.6		39.0	65.5	LV
LT		78.6	80.8		64.6	58.8		89.3	89.3		45.6	66.2	LT
LU	62.9	69.0	75.7	77.2	56.3	52.0	69.5	79.8	87.7	25.7	27.6	40.3	LU
HU		65.0	73.8		57.6	51.4		77.3	85.8		22.6	48.1	HU
MT		60.5	71.3		79.5	72.0		64.2	81.0		29.5	42.4	MT
NL	63.5	76.0	81.5	71.1	80.6	76.1	69.6	83.6	87.1	30.3	38.6	67.1	NL
AT		74.1	78.7		71.7	73.7		85.3	88.0		31.4	48.6	AT
PL		72.9	73.2		63.7	55.3		82.7	85.1		32.1	46.9	PL
PT		76.4	79.1		63.6	56.9		84.6	88.8		53.0	57.0	PT
RO		75.9	70.8		60.9	49.2		84.4	82.5		52.5	42.7	RO
SI		73.4	76.0		59.4	53.4		87.7	90.8		23.7	39.7	SI
SK		76.5	76.2		70.1	51.9		88.3	87.3		24.6	51.8	SK
FI		79.6	79.9		77.7	70.2		88.1	86.6		45.5	65.2	FI
SE		80.7	86.2		61.3	72.0		86.8	90.9		68.4	78.7	SE
UK	75.9	77.7	80.6	81.6	76.9	76.4	81.6	84.0	85.8	51.4	52.8	64.4	UK
NO		82.9	82.4		74.6	72.1		87.7	86.5		66.2	73.4	NO
EA		72.0	77.2		64.1	60.0		82.2	85.3		37.3	58.0	EA
EU*		73.1	77.1		65.0	61.3		82.7	85.4		39.7	57.3	EU*

(1) EU figures for 2000 do not include Croatia.
Source: Eurostat, LFS.

showing clear signs of a reversal in most countries since the turn of the century, mostly due to pension reforms raising the statutory retirement age or the state pension age;

- female participation rates have steadily increased over the past twenty five years, largely reflecting societal trends;

- the participation rates of young people (aged 20 to 24 years) have declined, mostly due to a longer stay in education;

- Given these trends, the main drivers of change in the total participation rate will be changes in the labour force attachment of prime age women, older workers (especially men) and, to a lesser extent, young people;

- In the aggregate, when considering the entire working age population, the LFS participation rates have increased by 4 pps. between 2000 and 2015 at EU level. When referring to the euro area countries a slightly higher increase of 5.2 pps. has been registered over the same period.

Table I.2.2: **Historical participation rates: Men**

	20-64			20-24			25-54			55-64			
	1985	2000	2015	1985	2000	2015	1985	2000	2015	1985	2000	2015	
BE	81.5	80.1	78.3	69.3	65.5	55.5	94.0	92.1	89.9	45.1	36.3	52.2	BE
BG		73.4	78.0		58.3	49.6		84.4	86.4		39.9	62.7	BG
CZ		86.2	86.6		77.3	60.2		95.0	95.4		54.5	68.3	CZ
DK	88.0	85.7	85.0	86.5	84.4	73.1	93.5	91.5	90.8	65.8	64.5	72.7	DK
DE	86.0	82.9	86.7	77.3	74.6	70.3	94.6	93.7	92.5	58.8	52.5	75.3	DE
EE		83.3	85.8		75.8	72.3		91.6	92.6		54.4	67.7	EE
IE	90.2	86.2	84.1	88.5	79.2	65.7	94.3	92.0	89.6	73.6	64.6	71.5	IE
EL	87.4	85.1	81.7	74.7	69.3	49.5	94.8	94.5	93.1	67.3	57.7	54.9	EL
ES		84.4	84.8		65.2	58.9		93.2	92.6		60.3	66.2	ES
FR	85.0	81.9	81.8	82.5	63.2	66.7	96.0	94.3	92.4	44.3	35.5	55.1	FR
HR			76.9			59.0			86.9			55.0	HR
IT	84.8	78.6	79.5	76.1	61.9	51.0	95.2	90.4	87.7	54.4	42.2	63.3	IT
CY		89.2	85.2		78.2	63.2		95.3	92.6		69.5	70.0	CY
LV		80.5	84.0		74.7	70.2		88.5	90.6		53.8	68.0	LV
LT		82.8	83.0		70.0	63.5		90.4	90.4		59.0	69.8	LT
LU	84.2	82.2	81.3	79.1	61.5	53.6	94.9	94.2	93.9	40.2	38.6	45.5	LU
HU		73.6	81.0		66.0	56.2		84.3	92.0		34.3	57.8	HU
MT		85.8	85.8		81.7	75.4		93.5	95.4		52.9	62.1	MT
NL	83.2	85.8	87.2	72.5	82.5	75.7	92.7	93.8	92.1	49.2	50.8	77.6	NL
AT		83.2	83.4		75.3	76.7		93.6	91.6		44.5	57.4	AT
PL		79.4	80.5		68.3	63.9		88.4	90.6		41.1	57.5	PL
PT		84.8	82.9		70.0	58.0		92.4	91.7		64.5	65.0	PT
RO		82.6	80.7		67.2	57.9		91.0	91.6		58.4	53.8	RO
SI		78.0	79.7		63.4	59.4		90.7	92.9		33.5	46.4	SI
SK		84.7	83.4		78.0	63.0		94.0	93.6		41.0	58.4	SK
FI		82.6	81.6		82.2	70.7		91.1	89.6		46.4	63.2	FI
SE		83.1	88.7		64.8	73.4		88.6	93.3		72.1	81.8	SE
UK	90.1	86.1	86.6	91.4	83.8	80.0	95.5	91.9	91.9	69.2	63.3	71.4	UK
NO		87.4	85.0		78.8	73.6		91.7	89.0		72.7	76.9	NO
EA		82.3	83.3		68.7	63.5		92.9	91.4		48.5	65.2	EA
EU*		82.4	83.4		70.3	65.6		92.0	91.4		50.6	65.0	EU*

(1) EU figures for 2000 do not include Croatia.
Source: Eurostat, LFS.

Table I.2.3: **Historical participation rates: Women**

	20-64			20-24			25-54			55-64			
	1985	2000	2015	1985	2000	2015	1985	2000	2015	1985	2000	2015	
BE	48.7	61.3	68.2	65.9	55.8	46.3	57.1	73.2	80.2	11.0	15.8	41.2	BE
BG		61.0	69.6		38.5	34.1		78.9	79.8		12.5	53.8	BG
CZ		68.8	70.7		61.5	43.6		81.9	81.4		23.3	48.3	CZ
DK	76.3	77.1	77.5	83.4	74.2	70.4	84.5	84.3	83.4	42.4	48.2	62.6	DK
DE	53.2	66.2	76.8	71.8	67.8	66.5	59.2	77.0	82.5	24.3	33.4	63.8	DE
EE		72.3	77.3		52.8	56.3		84.5	83.0		41.9	69.4	EE
IE	40.1	59.9	67.6	75.4	67.9	58.5	37.0	64.9	73.2	18.9	27.7	49.0	IE
EL	43.7	54.6	64.7	49.1	57.1	45.1	47.8	62.2	77.7	26.4	25.9	29.5	EL
ES		55.2	73.4		56.6	54.5		62.7	82.0		22.5	49.4	ES
FR	60.9	68.1	73.0	71.7	55.7	57.9	68.4	78.6	82.7	27.7	28.2	50.3	FR
HR			66.7			42.3			82.1			34.4	HR
IT	41.3	48.9	57.8	57.6	49.9	36.9	46.5	57.9	65.9	15.1	15.9	39.6	IT
CY		62.8	74.9		68.0	65.7		68.6	83.8		33.6	45.3	CY
LV		67.6	77.3		54.7	59.7		82.7	84.6		28.0	63.5	LV
LT		74.7	78.7		59.1	53.8		88.3	88.2		35.4	63.3	LT
LU	41.8	55.5	70.0	75.5	51.0	50.4	43.2	64.9	81.3	13.6	16.8	35.0	LU
HU		56.7	66.7		49.0	46.2		70.5	79.6		13.2	39.9	HU
MT		35.1	56.2		77.1	68.3		34.5	65.8		8.6	22.6	MT
NL	43.4	66.0	75.9	69.7	78.7	76.6	45.4	73.0	82.1	13.2	26.4	56.7	NL
AT		65.1	74.0		68.1	70.7		76.8	84.4		18.9	40.2	AT
PL		66.7	66.0		59.2	46.2		77.1	79.6		24.4	37.3	PL
PT		68.3	75.5		57.1	55.8		77.1	86.0		42.9	49.9	PT
RO		69.4	60.7		54.9	39.9		77.9	72.9		47.5	32.8	RO
SI		68.8	72.0		55.1	47.4		84.7	88.6		14.8	32.9	SI
SK		68.5	69.0		62.3	40.4		82.5	80.8		11.1	45.8	SK
FI		76.6	78.2		73.3	69.7		85.1	83.6		44.6	67.2	FI
SE		78.3	83.7		57.7	70.6		84.9	88.4		64.6	75.5	SE
UK	61.8	69.6	74.7	71.6	70.1	72.7	67.7	76.2	79.9	35.0	42.6	57.7	UK
NO		78.3	79.6		70.4	70.4		83.5	83.9		59.7	69.8	NO
EA		61.6	71.1		59.5	56.4		71.4	79.3		26.6	51.1	EA
EU*		63.9	70.8		59.8	56.9		73.4	79.4		29.6	50.0	EU*

(1) EU aggregate for 2000 do not include Croatia.
Source: Eurostat, LFS.

Box I.2.1: **Main features of the Cohort Simulation Model (CSM) and main assumptions of the 2018 projections**

In order to project participation rates by gender and single age, the cohort simulation model (CSM) ([1]) developed by the European Commission (DG ECFIN) is used. This methodology is based on the calculation of the average probability of labour force entry and exit observed over the last 10 years ([2]). The average entry and exit rates are then used to project future participation rates as older generations are progressively replaced by younger ones. For those Member States having legislated pension reforms, average exit rates are changed (in the age group 51 - 74) to take into account their projected impact, according to the best reasoned judgment of the EPC and Commission Services. Otherwise, both average entry and exit rates are kept constant throughout the projection period, reflecting a 'no policy change' assumption ([3]).

The rationale for using the CSM is to reflect the substantial changes in labour market behaviour in recent decades across different cohorts and gender groups.

The CSM is used to project participation rates, as in the 2006, 2009, 2012 and 2015 long-term exercises. This methodology is particularly suited to take into account the significant rise in the labour force participation of women over recent decades, as younger women, with a much stronger attachment to the labour force, gradually replace older women with relatively low participation rates. Simultaneously, the cohort methodology also caters for a (relatively small) decline in the participation rate of men over recent generations in a large majority of countries, a trend opposite to what is observed for women.

The 2018 projection is made using the Eurostat demographic projections 2015 prepared independently by EUROSTAT in collaboration with National Statistical Institutes. Population projections are the major driving force of labour force projections([4]).

The following assumptions were made:

- the base year for labour market projections is 2016; 2017 is the first year of projections; the projection horizon is extended to 2070;
- Average entry/exit rate are calculated, as a ten years average (2007–16), using participation rates by single age and sex from the harmonised EU Labour Force Surveys of Member States (as compiled by Eurostat);
- labour market participation rates are calculated, by single age and sex, using average entry/exit rates in the labour force over the period 2007-16;
- A corrective mechanism for young cohorts (15-29) is applied, in order to avoid that any increase in education enrolment rates (and the corresponding decline in participation rates) feeds into future declines of participation rates for prime age workers. This assumption implies that participation rates at each single year of age between age 15 and 19 remain

([1]) The methodology was initially developed at the OECD, see J.-M. Burniaux, R. Duval, and F. Jaumotte (2003).
([2]) A more detailed description of the methodology can be found in Carone (2005).
([3]) For a given set of exogenous macroeconomic assumptions and using partial equilibrium methodologies, a 'no policy change' assumption tries to measure future outcomes corresponding to unchanged policies. It should not be interpreted as a forecast, because no assumptions are made regarding (entry/exit) probability distributions, but more as an 'unbiased' estimate.
([4]) In order to be consistent with Labour Force Survey data, rather than using Eurostat population projections 2015 for 1st January, the projections are adjusted to reflect the average value for the year. This could explain some discrepancies with reported figures in Chapter 1.

(Continued on the next page)

Box (continued)

constant at the last observed level (2016). Participation rates between ages 20 and 29 are allowed to increase if this is the outcome of the cohort simulation model; otherwise, the rates are kept constant at the level observed in 2016;

- Pension reforms were modelled through their estimated impact on the labour market exit rates of older workers (aged 51-74)([5]). This is largely a judgemental approach, using the probabilistic nature of the CSM. Specifically, exit rates of older workers (51-74) calculated separately for both genders, are adjusted relatively to average historical values (2007-16) in order to account for the future expected effects of enacted pension reforms. The estimation of the "adjustment" takes into account country-specific information about the relationship between retirement behaviour and the parameters of the pension system together with cross-country evidence of the impact of changes in the implicit tax rate on continuing work and retirement decisions. This framework for analysis is able to incorporate a broad typology of measures, inter alia, increases in the statutory retirement age or in the state pension age, the convergence of women's lower statutory retirement age to that of men, the linking of the statutory retirement age to changes in life expectancy, the tightening of conditions for early retirement, and changes in (price) incentives affecting the retirement decision. Moreover, policy changes can be incorporated as one-off measures or be phased in progressively within a specified period.

Steps to project the labour force/supply

Firstly, participation rates by single age and gender are projected up to 2070 using the CSM. Aggregate values for participation rates are a weighted average of participation rates by single age and gender using population shares as weights. For example, the average participation rate for age groups $\underline{a}$ (lower age) to $\overline{a}$ (upper age) in period t is calculated as:

$$PR(\underline{a},\overline{a},t) = \sum_{a=\underline{a}}^{\overline{a}} \sum_{g=m,f} PR_{a,g}^{t} * p_{a,g}^{t}$$

where

$$p_{a,g}^{t} = \frac{pop_{a,g}^{t}}{\sum_{a=\underline{a}}^{\overline{a}} \sum_{g=m,f} pop_{a,g}^{t}}$$

where a is the age index; g is the gender index; $PR_{a,g}^{t}$ is the participation rate for single age a and gender g in period t; pop is the population; and p is the structure of the population.

Secondly, the labour force ($LF_{a,g}^{t}$)/labour supply (for each single age and gender combination) is calculated multiplying the age/gender labour force participation rate by the corresponding population projection:

$$LF_{a,g}^{t} = PR_{a,g}^{t} * pop_{a,g}^{t}$$

The total labour supply for age groups $\underline{a}$ (lower age) to $\overline{a}$ (upper age) in period t is calculated as:

([5]) Estimations were carried out by the Commission services (DG ECFIN), in close cooperation with EPC-AWG delegates. A more detailed description of the methodology can be found in Carone (2005).

(Continued on the next page)

Box (continued)

$$LF(\underline{a},\bar{a},t) = \sum_{a=\underline{a}}^{\bar{a}} \sum_{g=m,f} LF_{a,g}^{t} = \sum_{a=\underline{a}}^{\bar{a}} \sum_{g=m,f} PR_{a,g}^{t} * pop_{a,g}^{t}$$

Age aggregates commonly used are the groupings (15-64; 20-64; 25-54; 55-64; 20-71; 20-74).

Impact of pension reforms

A comprehensive assessment of how to shift the distribution of retirement ages ultimately depends on the judgement of all the relevant factors underlying retirement decisions that is carried out by Commission Services (DG ECFIN) in close cooperation with EPC-AWG delegates.

Historical retirement/exit rates (the average over the period 2007-16) are replaced in the CSM with the new estimated exit rates, according to the phasing-in of the reforms. Consequently, pension reforms change estimated participation rates for older workers (51 – 74).

Data sources and an additional assumption on labour input

Labour force participation rates are derived from the harmonised EU Labour Force Surveys of Member States (as compiled by Eurostat). Detailed data by single age and gender are used, covering individuals aged 15 to 74 years old for the period 2007-16. The starting point of the projections is 2016, the year for which the most recent figures are available.

In addition the production function methodology is used to project GDP growth (see Chapter 3), using total hours worked as the labour input variable. The split between full- and part-time work (for the age groupings 15-24, 25-54, 55-64, and 65-74), as well as the corresponding weekly hours of work, is fixed at the average values for the last available year (2016), during the entire projection period.

Although part-time vs. full-time rates and the corresponding average weekly hours of work are frozen per age group over the projection period, total hours worked change due to "compositional effects" that mostly reflect the projected increase in labour force participation of women, for which the incidence of part-time is higher than for men.

2.3. LEGISLATED PENSION REFORMS IN EU MEMBER STATES

In the aftermath of the crisis many countries have legislated sustainability enhancing pension reforms.

Member States have legislated gradual and substantial pension reforms over the last two decades ([18]).

The intensity of pension reforms has been particularly strong since 2000 (see Graph I.2.1). These reforms generally comprised a wide-range of measures (see Graph I.2.2). Most European countries modified substantially their pension system rules and parameters (mostly eligibility for pension, but also other measures).

Moreover, the recession that hit the European Union in 2008-09 prompted in many countries an acceleration of sustainability-enhancing pension reforms, through the adoption of additional measures. A description of past legislated pension reforms that have an impact on future participation rates, covering a total of 28 EU Member States, is provided in Box I.2.2.

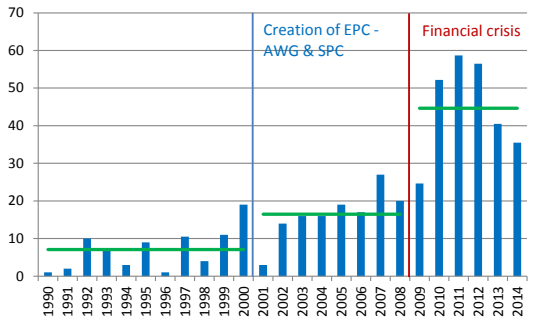
([18]) An extensive review of the pension reforms legislated in the last decades is in Carone, G., Eckefeldt, P., Giamboni, L., Laine, V. and S. Pamies-Sumner (2016) . "Pension Reforms in the EU since the Early 2000's: Achievements and Challenges Ahead", Discussion paper 42, December 2016.

Table I.2.4: **Adoption of automatic adjustment mechanisms**

Country	Automatic balancing mechanism	Sustainability factor (benefit link to life expectancy)	Retirement age linked to life expectancy	Legislated
Italy		X	X	1995 & 2010
Latvia		X		1996
Sweden	X	X		1998 & 2001
Poland		X		1999
France*		X		2003
Germany	X			2004
Finland		X	X	2005 & 2015
Portugal**		X	X	2007 & 2013
Greece***			X	2010
Denmark****			X	2011
Spain	X	X		2011 & 2013
Netherlands			X	2012
Cyprus			X	2012
Slovak Republic			X	2012
Lithuania	X			2016

(1) 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.
Source: Carone et al. (2016), Commission services, EPC.

Graph I.2.1: **Number of (main) pension measures in the EU since the 1990's**

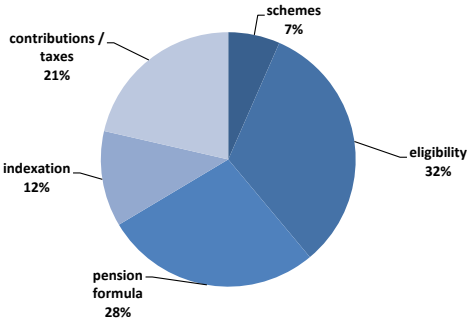


Source: Carone et al. (2016).

Among the measures that have a direct impact on the retirement decisions and on the labour supply, and hence taken into account when projecting participation rates, the most common adopted one, over the last decade(s), consisted of raising retirement ages.

Indeed, nearly all European countries have increased the level of early and statutory retirement ages in the coming years with some that opted for the introduction of automatic link between retirement ages and life expectancy (see Table I.2.4) ([19]). Easing of the conditions to cumulate pension and wage has been also a benchmark approach and some countries have even abolished the notion of statutory retirement age ([20]).

Graph I.2.2: **Decomposition of (main) pension measures in the EU since the mid-2000's**



Source: Carone et al. (2016).

([19]) Other mechanisms that aimed at automatically adjusting the key pension parameters to changes in life expectancy such as the adoption of an automatic balancing mechanism or a sustainability factor, are crucial to safeguard sustainability of the pension systems but they do not have a direct impact on labour supply.

([20]) For more information on the pension reforms legislated in the last decades refer to Carone, G., Eckefeldt, P., Giamboni, L., Laine, V. and S. Pamies- Sumner (2016) . "Pension Reforms in the EU since the Early 2000's: Achievements and Challenges Ahead", Discussion paper 42, December 2016.

Box I.2.2: **Pension reforms legislated in Member States and reflected in the labour force projections**

The box lists only the measures legislated in the MSs that have a direct impact on the labour market participation rates and that are somewhat reflected in the participation rates projected with the CSM model. For a more exhaustive overview of the pension systems refer to Annex 2 and 3 in Part II.

Belgium

Until 2012, early retirement was allowed as from the age of 60 with 35 career years in the wage earners' and self-employed schemes (60 in the civil servants' scheme with a minimum of 5 years of service). As from 2013, a first parametric pension reform raised the minimum early retirement age and the mini-mum number of career years required for eligibility, respectively to 62 in 2016 and to 40 years in 2015. The 2015 pension reform raises the minimum early retirement age and the minimum number of career years required for eligibility respectively to 63 years in 2018 and 42 years of career in 2019, after a short transition period. Nevertheless, exceptions are still possible: as from 2019, for people aged 61 with a 43-year career, and aged 60 with a 44 year career. This reform also raises the statutory retirement age in the three main public old-age pension schemes (wage earners, self-employed and civil servants), from 65 for both men and women to 66 in 2025 and to 67 in 2030. Forty-five career years are still required for a full pension.

Unemployment with company allowances has been modified under the wage earners' scheme: the minimum age is raised from 60 to 62 in 2015 (from 55 in 2015 to 60 in 2020 for companies undergoing restructuring). Moreover, since 1/1/2015, the new beneficiaries of this scheme must be available to the labour market and are included in the labour supply. The pension bonus addressed to people working after the age of 60 (while complying with the requirement for early retirement) has been abolished since 1/1/2015.

Austria

The statutory retirement age is 65 years for men and all civil servants (also females) and 60 years for women, respectively. The female retirement age will be gradually raised to 65 years in the period from 2024 to 2033 (by ½ years steps).

On January 1st 2014, new pension reform measures came into effect. Overall, these measures tightened access to early retirement and modified invalidity pensions schemes.

Concretely, the early retirement scheme "Korridorpension", although can still be accessed by men with 62 years, it now requires an increased number of insurance years (40 years by 2017). The penalty for early retirement is 5.1% per year (for persons born after January 1, 1955).

The early old-age pension scheme for long-term contributors "Hacklerregelung" was tightened by increasing the retirement age by two years to 57 for women, with a gradual increase to 62 by 2028, and 62 for men. The possibility to purchase schooling and study years for being used as equivalents for additional contributory years has been practically abolished now. Furthermore, deductions for early retirement is 4.2% p.a. (for men born after January 1, 1954/for women at the age of 62 born after January 1, 1966). In the heavy worker regulation "Schwerarbeitspension", the early retirement age is 60 for men and 60 for women by 2024, with insurance year at least 45 years (at least 10 years of hard labour within 20 years before retirement) and penalties for early retirement is 1.8% per year (for persons born after January 1, 1955). The bonus for later retirement continues to amount to 4.2% p.a. (cumulated to a maximum of 12.6%). For the early old-age pension for long-term contributors in combination with heavy worker regulation (Hackler-Schwerarbeit), the minimum retirement age is 55 years for women born between January 1, 1959 and December 31, 1963 and 60 years for men born between January 1, 1954 and December 31, 1958. Required insurance years is for women 40 years and for men 45 years; 1.8% deduction per year before the regular retirement age.

In December 2010, the government approved measures to foster rehabilitation and keep people in the workforce, thereby decreasing expenditure on invalidity pensions. Specifically, it is now necessary to apply for rehabilitation before applying for an invalidity pension. During

(Continued on the next page)

Box (continued)

rehabilitation, payments are higher than unemployment benefits, and unemployment benefits are paid for longer periods, if an individual does not find a job after rehabilitation. Temporary invalidity pensions have been abolished for people below the age of 50 and will be gradually phased out.

On January 1, 2014 comprehensive new regulations for invalidity and occupational disability pensions came into effect with the main target to re-integrate people with health problems into the labour market. The temporary invalidity pension was replaced by medical and job-related rehabilitation and was completely abolished for people born after December 31, 1963. These people will receive special unemployment benefits (Rehabilitationsgeld) instead. Therefore, the temporary invalidity pension will fade out in the coming years.

Bulgaria

With the entering into forces of the pension reform measures legislated in August 2015, the statutory retirement age of men and women is gradually increased and equalized to 65 years by 2037 and thereafter automatically extended in line with the increase in life expectancy.

The required period of service for qualifying retirement for workers in the normal work conditions is gradually increased by 2 months annually till it reaches 40 years for men and 37 years for women by 2027 (from 38 years for men and 35 years for women in 2015).

The retirement age in case of shortage of insured length of service is gradually increased to 67 years, while the minimum required length of service remains unchanged at 15 years of actual period of service (not including periods of military service, maternity leave and unemployment).

A possibility for granting a reduced early retirement pension is introduced for persons who are within 12 months of the statutory retirement age, with the lifetime reduction of the pension by 0.4% for each month of anticipation.

The retirement age for workers in strenuous and hazardous work conditions (the first and second categories) is gradually increased to 55 years (for workers in first category) and to 60 years (for workers in second category).

As of January 2016 for workers in the defence and security sector a minimum retirement age 52 years and 10 months is introduced in addition to the required minimum length of service 27 years. The minimum retirement age will be increased by 2 months annually to 55 years.

Croatia

As of 1 January 2011, the retirement age for old age and early pension between men and women is gradually equalizing, by raising the retirement age for women for 3 months each year. Full equalization will be completed by 2030 (65 for old age pension and 60 for early retirement). After equalization, in the period 2031-2038 retirement age for early and old age pension will be raising for 3 months each year, to 62 for early pension and 67 for old age pension.

Early retirement is sanctioned with monthly deduction which varies in accordance with the accrued pension service; from 0.10% to 0.34% per month of early retirement (i.e. permanent decrement from 1.2% to a maximum of 4.08% per year, early retirement period is up to five years). People aged 60 with 41 years of pension service can retire without deduction of pension.

The extension of the working life is financially stimulated for those with minimum 35 years of pension service with 0.15% increase of the amount of pension per month of later retirement, up to a maximum of five years, i.e. a maximum of 9% increase is possible.

Czech Republic

To be entitled to an old age pension a person has to reach an insurance period of at least 35 years and a retirement age specified by a law; or at least 20 years of insurance and the age 5 years higher than is the statutory retirement age. Non-contributory periods are also included in the insurance period.

In October 2011, a pension reform was approved. The statutory retirement age was increased above 65 years. For generations born in 1936 and younger the statutory retirement age is continuously postponed without any limits. The speed of increase has been set with respect to increase of life expectancy and also in order to unify retirement ages for men and women, regardless number of

(Continued on the next page)

Box (continued)

children raised. The unification will be completed in 2041 for people born in 1975.

In June 2017 a reform has been legislated that cap the increase in statutory retirement age at 65. Under the new rules no further increase in statutory retirement age above 65 is envisage.

Early retirement is possible up to 3 years prior the statutory retirement age under the condition that the statutory retirement age is lower than 63 years. This period of 3 years will gradually increase to 5 years under the condition that the statutory retirement age must be at least 63 years and actual age of the person higher than 60 years. Early pensions are permanently reduced while retiring in ages higher than the statutory one is awarded by additional bonuses.

Germany

In 2007, a major reform legislated the gradual increase of the statutory retirement age from age 65 to age 67 by the year 2029 with steps of 1or 2 months depending on the year of birth.

Pathways to early retirement have been reduced, fully affecting birth cohorts from 1952 onwards. Early retirement is possible at the age of 63 for persons with an insurance record of at least 35 years (with a permanent reduction of 0.3 % for each retired month pensioners fall short of the statutory retirement age – no penalty with 45 years of contributions due to 'Rente mit 63'). Because the latter is gradually increasing to the age of 67 by 2030, the maximum permanent deduction will increase to 14.4 % (early retirement remains at 63).

On July 2014, a pension reform has been legislated that aimed at improving pension benefits and early retirement conditions for certain groups:

- the possibility of retirement without pension reductions two years ahead of the statutory retirement age (65) if contributions have been paid for 45 years, including periods of unemployment (Rente mit 63). Beginning in 2016, the age will rise by 2 months a year until it returns to age 65. The new pension rules did not change the scheduled increase in the retirement age;

- Continuation of labour agreement after reaching statutory retirement age: According to the last pension reform, employers and employees can continue the employment relationship for a certain period after the statutory pensionable age has been reached. The agreement to postpone retirement must be reached before the pensionable age.

Denmark

In 2006 Denmark introduced a major reform package known as the "Welfare Agreement". The key elements of the reform was a discretionary increase in the voluntary early retirement pension (VERP) age from 60 to 62 years in 2019-2022 and the public old-age pension age from 65 to 67 years in 2024-2027. Furthermore, retirement ages are indexed to life-expectancy for a 60 year old as of 2025 for VERP and 2030 for the public old-age pension. Finally, the minimum contribution period to VERP was increased from 25 to 30 years.

In 2011 the "Retirement Reform" brought forward the discretionary increase in the retirement ages agreed in the "Welfare Reform". The retirement age for VERP will increase from 60 to 62 years from 2014-2017, while the public old-age pension age will increase from 65 to 67 years in 2019-2022. Furthermore, the VERP period is reduced from 5 to 3 years from 2018-2023. Private pension wealth also lowers the VERP amount to a higher degree than before the reform, making the VERP scheme less favourable to people with large private pension wealth.

Estonia

The statutory retirement age for men and women is legislated to be equalized by 2016 and to be increased to 65 years by 2026. The qualification period for old age pension is 15 years of pensionable service in Estonia.

Early retirement is possible 3 years before the official retirement age but the benefit received (pension) will be reduced by 0,4% per each month of early retirement. One can also postpone the retirement, after reaching the official retirement age, and is entitled to receive the 0,9% higher pension benefit per each month of postponement. If a person keeps on working during the retirement, he/she will receive the full pension in addition to wage.

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Box (continued)

Greece

In November 2012, the parliament approved a pension law, scheduled for implementation on January 1, 2013, to increase the statutory retirement age from 65 to 67 to receive a full pension. The full contributory career is 40 years. In addition, from 2020 onwards, the statutory retirement age for men and women is scheduled to be automatically adjusted (every 3 years) to reflect changes in life expectancy.

In August 2015 an additional reform reduced pathways towards early retirement leaving the statutory retirement age to be automatically adjusted to changes in life expectancy.

Ireland

Effective on 1st January 2014, the State Pension Transition will be abolished from 2014, while the age of qualification will rise to 67 in 2021 and then to 68 in 2028. Separately the criteria to qualify for a contributory pension has been amended to increase the minimum number of paid contributions required for State Pension (Contributory) qualification in April 2012.

The Public Service Pensions (Single Scheme) and Remuneration Bill 2011 provides also for a new single pension scheme for all new entrants to the public service. E.g. it implies a new statutory pensionable age of 66 (linked to State Pension age, so rising progressively to 67 and 68).

Spain

The 2013 pension reform legislated the statutory retirement age will gradually increase from 65 in 2013 to 67 in 2027 and the contributory career for a full pension will be gradually increased from 35 to 37 years, with calculations being made on a monthly basis, instead of rounding to the next full year.

Early retirement for involuntary retirees (collective dismissals) requires a minimum retirement age of 63 years (increasing progressively from 61 in 2013 to 63 in 2027) and a minimum contributory period of 33 years (same as before).

Early retirement for voluntary retirees requires a minimum age of 65 (increasing progressively from 63 in 2013 to 65 in 2027), a minimum contributory period of 35 years (previously 35) and the computed benefit must be greater than the minimum pension

In the case that a worker with a 40-year career decides voluntarily to retire at the earliest possible age (63 years), the penalty to the pension at retirement is 15%, 7.5% for each of the two years remaining to reach the statutory retirement age. For involuntary retirement, the earliest retirement age is 61 years and the annual penalty 7%, so that the corresponding penalty is 28%.

Access to early partial retirement is restricted: For longer careers (longer than 36.5 years) the minimum age is increased progressively between 2013 and 2027 from 61 to 63 years. For medium careers (between 33 and 36.5 years) the minimum age is raised progressively from 61 to 65 years. For careers shorter than 33 years, partial retirement is not possible (before the reform only 30 years were required).

Bonuses exist for late retirement: +2%, +2¾%, and +4% for an extra year, respectively, for careers below 25 years, between 25 and 37, and over 37.

The contributory retirement pension will be compatible with any work, both wage- and self-employed, carried out by the pensioner, provided the pensioner has reached the statutory retirement age.

Finland

On January 1 2017, Finland implemented a multipart reform to its earnings-related pension program that increases the retirement age for most workers, and amends the early and partial retirement options. The key provisions of the reform include:

- Raising the minimum retirement age gradually (by three months a year) from 63 to 65 for persons born after 1954, and automatically linking future increases (of up to two months a year) to changes in life expectancy.
- Benefits claimed at or after the target retirement age are not subject to reductions for life expectancy.

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Box (continued)

– Lowering the earliest age for benefit accrual from 18 to 17 for employed persons; it remains age 18 for self-employed persons.

France

In 2010 France implemented a pension reform (law n°2010-1330) that includes the following provisions:

– The standard pension age will be gradually increased, for all pension schemes, from 60 to 62 years of age. Simultaneously, the full rate pensionable age will rise from 65 to 67. These two rises imply a 4 months increase in age limits every year from generation 1951 to generation 1955. (For example, people born in 1956 will be able to claim pension at 62 in 2018 and a full rate pension at 67 in 2023);

– The early retirement age for long contributory careers will also be increased by 2 years.

– Closing down of pathways to early retirement in the public sector: i) for parents with 3 children after a 15 years career; ii) provisions in the "Cessation Progressive d'Activité" programme;

– To be entitled to the minimum pension, insured persons will have first to reach the full rate pensionable age.

– Some categories/groups will still be granted a full rate pension at 65 years of age;

– People suffering from a professional disease or an accident that result in a permanent incapacity of at least 10% can continue to retire at 60 with a full rate pension.

In December 2013, the National Assembly approved a public pension reform that gradually increases the required number of contribution years for a full retirement benefit. The number of required contribution years for a full benefit will rise gradually from 41.5 to 43 years in the 2020–2035 periods.

In October 2015, an agreement has been reached on complementary pension schemes Agirc and Arrco The agreement introduces a system of incentives to postpone retirement. The coefficients work in the following way:

– For individuals who retire less than one calendar year after the age at which they are entitled to a full basic pension, the AGIRC and ARRCO complementary pension benefits are reduced by a solidarity coefficient of 10% for three years or until they reach 67.

– Individuals who retire between one and two years after that age receive their full pension, with no solidarity coefficient or increase coefficient.

– For each additional year that the individual delays retirement, the pension is increased for one year by an increase coefficient of 10% (up to a maximum 30%).

– Pensioners exempted from the "general social security contribution" (CSG) and certain precarious categories of pensioners are exempted from the solidarity coefficient (but are subject to the increase coefficient). Pensioners paying the CSG at the reduced rate are subject to the solidarity coefficient but with a 5% reduction instead of 10%.

Hungary

Since the 2009 reform, the statutory retirement age is legislated to increase from 62 to 65 between 2014 and 2022.

As from 2011, a special allowance was introduced, to give women the opportunity to retire after 40 eligibility years (including years in employment or pregnancy confinement benefit, child care fee, child home care allowance, and child).

A recent pension reform, with effects since January 2012, was approved with the following main components:

– The gradual elimination of nearly all early retirement possibilities (except for women with 40 eligibility years or more), leading to a convergence of the effective retirement age towards the statutory one.

– Implement stringent eligibility conditions for disability pensions will also contribute to decrease the number of pensioners and increase employment.

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Box (continued)

Italy

In 2016 the SRA is 66 years and 7 months for men and female employees in the public sector with 20 years of contributions. It is temporary lower for female employees in the private sector and the female self-employed, though rapidly increasing, catching up the statutory retirement age of other workers as of 1st January, 2018.

Early retirement is allowed on the basis of a minimum contribution requirement, regardless of the age. In 2016, the required contribution period is:

- 42 years and 10 months, for men;
- 41 years and 10 months, for women.

Those enrolled in the pension system after 1995 (i.e. those under the NDC) may retire up to a maximum of three years earlier than the statutory retirement age, as long as they have 20 years of contributions and a pension not inferior to 2.8 times the old age allowance.

Starting from 2013, an indexation mechanism is applied, linking the eligibility requirements to changes in life expectancy at 65. Such a mechanism applies to:

- the minimum age requirement for old age pensions (Statutory retirement age) and old age allowances (*assegno sociale*);
- the minimum contribution requirements for early pensions, regardless of age;
- the minimum age requirement for early pensions, under the NDC regime.

In any case, according to a specific legislative provision, the statutory retirement age must be at least 67 in 2021.

With the 2017 budget law, some measures to facilitate earlier access to pension have been introduced in favour of:

- workers so-called "precocious" (with at least 1 year of actual work before the age of 19) lowering the contribution requirement regardless of age. Compared to the general rule, such reduction accounts for 1 year and 10 months for males and 10 months for females. Such a facilitation is only granted to given categories of workers under particular disadvantageous conditions);
- workers involved in arduous works ("lavori usuranti");

Besides, temporary measures (up to 2018) have been also foreseen to facilitate earlier exit from the labour market (however not before the age of 63), through the following interventions:

- so-called "APE sociale" consisting of social public assistance benefits (which are not pensions though included in public expenditure, d62) granted before retirement to workers in disadvantageous conditions stated by law;
- so-called "Ape di mercato" consisting of a loan granted by the bank sector and guaranteed by pension entitlements. The loan (not included in public expenditure) is to be repaid by beneficiaries in 20 years after retirement;
- so called "RITA" which is linked to the "Ape di mercato" for the acceding prerequisites, though benefits (not included in public expenditure) are financed through part of the capital accumulated by workers in their private, funded pension schemes.

Cyprus

On 20 March 2009, the Social Insurance Law No. 22(I)/2009 was approved regarding the pension reform package for securing the long-term viability of the Social Insurance Scheme. The two measures of the reform expected to impact in future labour force participation rates are:

- Stricter eligibility conditions to old-age pensions, which are to be introduced gradually over the period until January 2012, namely increase of the minimum contributory period to 10 years (previously 3 years);
- Maximum limit of 6 years on credits granted to an insured person in the lower end of the income distribution for any period of time spent in full time education or approved training after

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Box (continued)

16 years of age (previously no maximum limited existed). This measure came into effect on January 2010.

A recent pension reform was approved (21 December 2012, 193(I)/2012) which includes the following components:

- the increase in in the minimum contributory period from 10 to 15 years by 2017, reducing the eligibility of the public pension scheme;
- the gradual increase in the statutory retirement age to 65 by 2016, and the subsequent linking of the retirement age in line with life expectancy;
- the introduction of penalties for early retirement.

Latvia

A recent pension reform was approved (14/06/2012) which gradually increases the retirement age, by 3 months a year, until reaching 65 years and the minimum contributory to 20 years in 2025. The Legislation provides an opportunity to retire 2 years before the normal retirement age, if person's insurance record is 30 years or more (60 today and 63 by 2025) . The amount of early retirement pension is 50% of pension amount. The full pension is restored after reaching normal retirement age.

Lithuania

In June 2011, a new law was passed that gradually increases the statutory retirement age from 62.5 to 65 for men and from 60 to 65 for women by 2026. Under the new law, the retirement age will increase every year by 2 months for men and by 4 months for women, starting in January 2012. In order to receive a full pension, workers must also have a career contribution of 30 years.

Malta

In December 2006, the government completed the legislative process associated with the enactment of the pension reform bill. Following the implementation of the reform, pension age was to be gradually raised to 65 years, however, a number of provisos apply, whereby for persons born on or before the 31 December 1951, pension age is 61 years while for females pension age is 60 years; in the case of a person born during the calendar years 1952-1955, pension age is 62 years; for persons born during the period 1956-1958, pension age is 63 years; for persons born in the period 1959-1961, pension age is 64 years.

The reform also states that a person of 61 years of age, not having attained pensionable age, may claim a pension if he/she is no longer employed provided that the claimant has accumulated since her/his 18th birthday a total of: (i) 40 years of paid or credited contributions (for those born after 1962); or (ii) 35 years of paid or credited contributions (for those born between 1952

With the Budget law for 2016, some further refinements have been introduced: the contributory period has been increased to 41 years, credits for human capital development and lifelong learning has been introduced in the system, child rearing credits have been strengthened and a system of Incentives to defer retirement has been adopted.

The Netherlands

A recent pension reform (7/02/2012) stated an increase in the statutory retirement age to 67 in 2023 and the adoption of a link of the retirement age to gains in life expectancy as of 2023. The rise of the statutory retirement age to 67 is accelerated in June 2015 and now reaches this age in 2021. The linkage to life expectancy remains unaffected.

The duration of social security arrangements for people below the retirement age (disability pensions, survivors' pensions, unemployment schemes and social assistance) is also prolonged in line with the rise in the statutory retirement age for retirement.

Poland

The general system: all insured persons born after 1948 are covered by the new defined contribution PAYG with notional accounts and three-pillars.

A recent pension reform has repealed the one legislated in June 2012. The standard retirement age remains at 65 years of age for men and 60 for women instead of increasing to 67 for both sexes (2020 for men and 2040 in the case of women).

(Continued on the next page)

Box (continued)

The current retirement ages of 66 (men) and 61 (women) are lowered to 65 and 60 by October 2017.

There are no early pension for those born after 1948 and retiring after 2008, with the exception of miners. Since 2007, disability pension insurance contributions were reduced.

In 2009, "bridging" pensions and compensation benefits replaced early retirement pensions for eligible workers. This only affects those that started working in special conditions before 1999.

Portugal

Portugal introduced in 2007 a "Sustainability factor" linking initial benefits to average life expectancy at retirement (i.e. at the legal retirement age of 65). Individuals can opt to postpone retirement beyond the legal retirement age to compensate (at least partially) for the financial penalty associated with the sustainability factor. Simultaneously, a "national strategy for the promotion of active ageing" was introduced aiming to encourage older workers to remain longer in the labour force through: better access to vocational training, improvement of older workers employment conditions, a higher penalty for early retirement, and benefits granted in case of longer contribution careers.

In December 2013, Portugal approved several laws restricting qualifying conditions for pensions, e.g. in 2014 and 2015 the statutory retirement age of old-age pensions is shifted to 66 years. As from 2015, the legal age for entitlement to old-age pensions will vary according to the evolution of life expectancy at 65 years of age.

Until April 2012, in SS general regime, the old age pension could be claimed before the legal retirement age if the insured person had both a minimum age of 55 and 30 years of contributory career. Between that date and 2015 the early retirement due to long contributory careers has been suspended. In 2015, a temporary early retirement scheme for long contributory careers was implemented allowing an individual aged 60 or older and at least 40 years of contributory career apply for an old-age early pension. The pension benefit is reduced by 0.5% for each month of anticipation to statutory retirement age (penalty) and multiplied by the sustainability factor. If the contributory career is higher than 40 years, for each year above the 40 years the statutory retirement age is reduced by 4 months.

Romania

In 2007, a three pillar pension system was introduced. As regards the first pillar, the retirement age for men will increase from 64 to 65, while the statutory retirement age for women will increase to 63 by 2030. There will also be an increase in the mandatory contributory period.to 15 years. Penalties for early retirement have been increased, while eligibility for disability pensions has been tightened.

For active military police corps and special public servants within national defense, public order and national security, the standard retirement age will increase gradually up to 60 in 2030.

Early retirement pension can be granted up to 5 years before the insured person reaches the standard retirement age, provided they completed the full contributory period required by the law and exceeded it with a minimum of 8 years. Partial early retirement pension is granted to the insured persons who completed the full contribution period required by the law and exceeded it with less than 8 years. In case of partial early retirement pension, the quantum is calculated by diminishing the old-age pension benefit by 0.75% for each month of anticipation before complying with the old-age pension requirements.

Slovenia

A recent pension reform was approved (12/2012) which among other measures, comprises the followings:

– a gradual increase in the statutory retirement age to 65 both for men (in 2016) and women (in 2020);

– higher penalties for early retirement, as well as bonuses for prolonging working lives;

– the lengthening the definition of a full career.

(Continued on the next page)

Box (continued)

Slovakia

There has been a major reform of pension system in 2004 where a three-pillar system has been introduced. As from 2004, the retirement age is gradually converging to 62 for both men and women. Moreover, based on the 2012 pension reform, as from 2017 the retirement age will be automatically annually increased by the y-o-y difference of 5-year moving average of the unisex life expectancy.

Pensioners are allowed to retire two years before reaching the statutory retirement age. In that case, the old-age pension is reduced by 0.5% per every month prior to retirement age. On the other hand, the pension is increased by 0.5% per every additional working month above the retirement age.

The United Kingdom

Women's state pension age (SPA) is increasing to reach 65 (men's SPA) by 2018. Thereafter, both will be further increased to 66 from 2018-2020 and to 67 from 2026-2028.

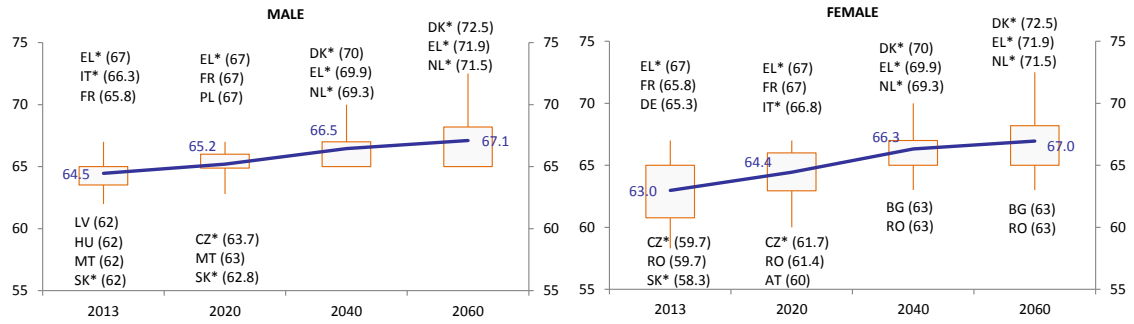
2.4. THE IMPACT OF PENSION REFORMS ON THE PARTICIPATION RATE OF OLDER WORKERS

By changing eligibility criteria and incentives towards retirement, recent reforms will affect the behaviour of the older worker in the coming decades. Effective exit age for men and women is projected to increase by around 2.3 and 2.9 years respectively at EU level.

As already underlined in the previous section, in the last decade, MSs have legislated measures that are changing qualifying condition for retirement. Indeed, when looking at Table I.2.1, the participation rates for the age group 55-64, the one been more affected by reform measures aiming at postponing retirement age and promoting active policies for the older, has increased by 17.5 pps. since 2000. The increase in even larger, around 20.5 pps., when focusing on women participation rates.

The legislated measures, in many MSs, envisage additional increases in retirement ages that will impact on the people retirement's decisions in the future (see Graph I.2.3). The evolution of legislated retirement ages, together with changes in qualifying conditions (i.e. minimum contributory period) or incentives to retire (i.e. penalties for early retirement and bonuses for postponing retirement) and their impact on future participation rates and hence on average exit age has been estimated and reflected in the projected participation rates (see Box I.2.1).

Graph I.2.3: **Statutory retirement age evolution (men and women)**



(1) *Countries where statutory retirement age is legislated to increase in line with increase in life expectancy. Reported retirement ages calculated according to life expectancy increases as from Eurostat demographic projections.
Only countries with the highest and lowest retirement ages are shown here. For a comprehensive description, see Table II.A2.2 in Annex 2, Part II.
PL: the retirement age is 65 for men and 60 for women.
Source: Carone et al. (2016).

Graph I.2.4 show the estimated impact of pension reforms on participation rates in the age group 55-64 by 2070. In most of the 26 EU Member States that have recently legislated pension reforms, they are projected to have a sizeable impact on the labour market participation of older workers, which depends on their magnitude and phasing-in.

Overall in the EU, the participation rate of older people (55-64) is estimated to be higher by about 11.3 pps. for men and 14.3 pps. for women by 2070 due to the projected impact of pension reforms. Also when considering the age-group 65-74, higher participation rates are projected by 2070 for the majority of countries where policy changes entail changed to the retirement age also beyond age 64 (see Graph I.2.6).

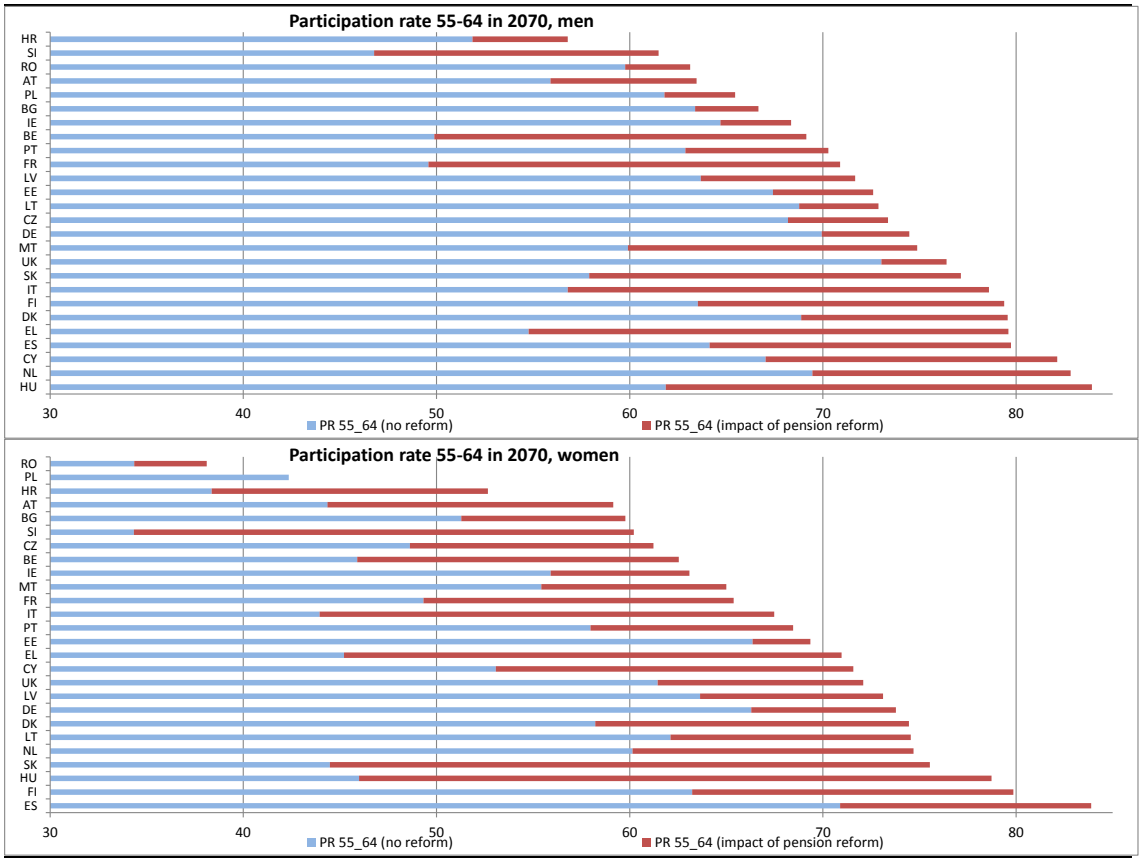
It should be recalled that total participation rates (15-64) are mainly driven by changes in the participation rate of prime-age workers (25-54), as this group accounts for about 60% of the total labour force. Therefore, even these significant projected increases in participation rates for older workers will only have a rather limited impact on the total participation rate. For example, the 12.2 pps.(13.2 for euro area countries) increase in the participation rate of workers aged 55 to 64 years in the EU will lead to an increase in the total participation rate (15-64) of only about 3.2 pps.by 2070 (3.1 for euro area countries - see Table I.2.5).

The increases in the average exit ages from the labour market for 2070, as presented in Graph I.2.5, are calculated based on participation rates discussed above. The Graph provides a summary measure of the long-term impact of enacted pension reforms in 26 Member States ([21]).

Projections show an average increase of 2.3 years in the effective retirement age for men ([22]). As a result of the implementation of the automatic link between retirement age and increases in life expectancy, an increase in the average exit age higher than 4 years is expected in Greece, Italy, Cyprus, Slovakia and Finland. The expected increase in the retirement age of women is slightly higher (2.9 years on average), reflecting in a number of countries the progressive convergence of retirement ages across gender. Increases higher than 4 years have been projected for some countries with a link between retirement age and life expectancy (Denmark, Greece, Italy, Cyprus, Netherland, Slovakia and Finland).

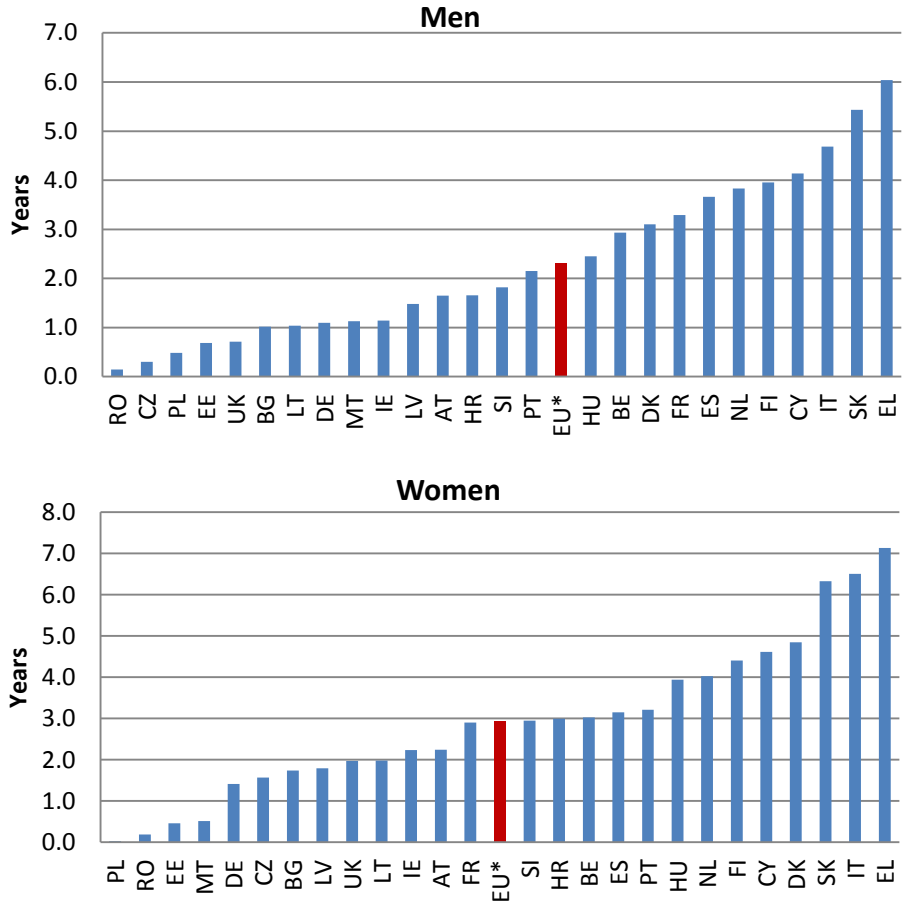
([21]) Excluding Luxembourg, Sweden and Norway.
([22]) Non-weighted average of the 26 Member States considered.

Graph I.2.4: **Impact of pension reforms on the participation rate of the age group 55-64**



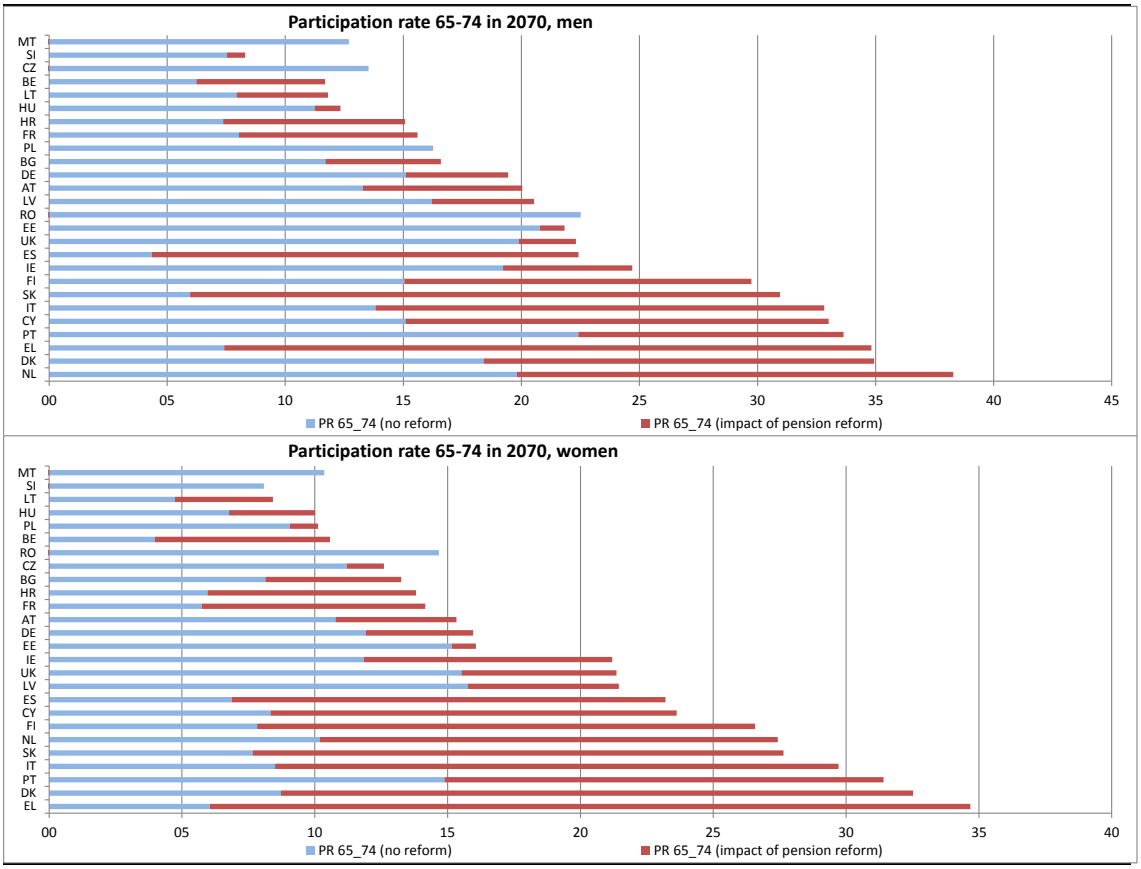
(1) LU, SE and NO excluded as there is no legislated pension measures that will affect retirement behaviour in the interval 2016 - 70.
Source: Commission services, EPC.

Graph I.2.5: **Impact of pension reforms on the average exit age from the labour force, age-group 55-64**



(1) Based on the age group 50 - 70. LU, SE and NO excluded as there is no legislated pension measures that will affect retirement behaviour in the interval 2016 - 70.
Source: Commission services, EPC.

Graph I.2.6: **Impact of pension reforms on the participation rate of the age group 65-74**



(1) LU, SE and NO excluded as there is no legislated pension measures that will affect retirement behaviour in the interval 2016 - 70.
Source: Commission services, EPC.

2.5. RESULTS OF THE PROJECTION OF LABOUR MARKET PARTICIPATION RATES

Social and institutional factors like younger women's higher attachment to the labour market and pension reforms determine participation rates to increase in the future and reduce some of the gaps observed currently in the labour market: women vs men and prime age vs old age workers.

2.5.1. Projection of participation rates

The total participation rate in the EU is projected to increase by 3.2 pps. For the euro area a slightly lower increase of 3.1 pps. is projected.

The projections reveal a rightward shift in the age profile of participation rates, particularly visible at 50+ ages, reflecting the combined effect of the rising attachment of younger generations of women to the labour market, together with the expected effect of pension reforms (see Graphs I.2.6 and I.2.7).

Table I.2.5 presents participation rate projections. The total participation rate (for the age group 20 to 64) in the EU is projected to increase by 3.2 percentage points (from 77.5% in 2016 to 80.7% in 2070). For the euro area a slightly lower increase of 3.1 pp is projected (from 77.6% in 2016 to 80 .6% in 2070). For the age group 15-74, the projected increases in participation rates are smaller (compared with the age group 20-64), reflecting composition effects as young and (very) old people have lower participation rates than prime age workers.

The population of working age is projected to decline substantially in the coming decades, as large cohorts of people retire and are replaced by smaller ones of younger workers. Other things being equal and given the age profile of participation rates, the increasing share of older workers in the labour force puts downward pressure on the total participation rate. Nevertheless, the combined effects of the women's catching up in terms of participation rates and the projected effects of pension reforms more than offset this demographic trend.

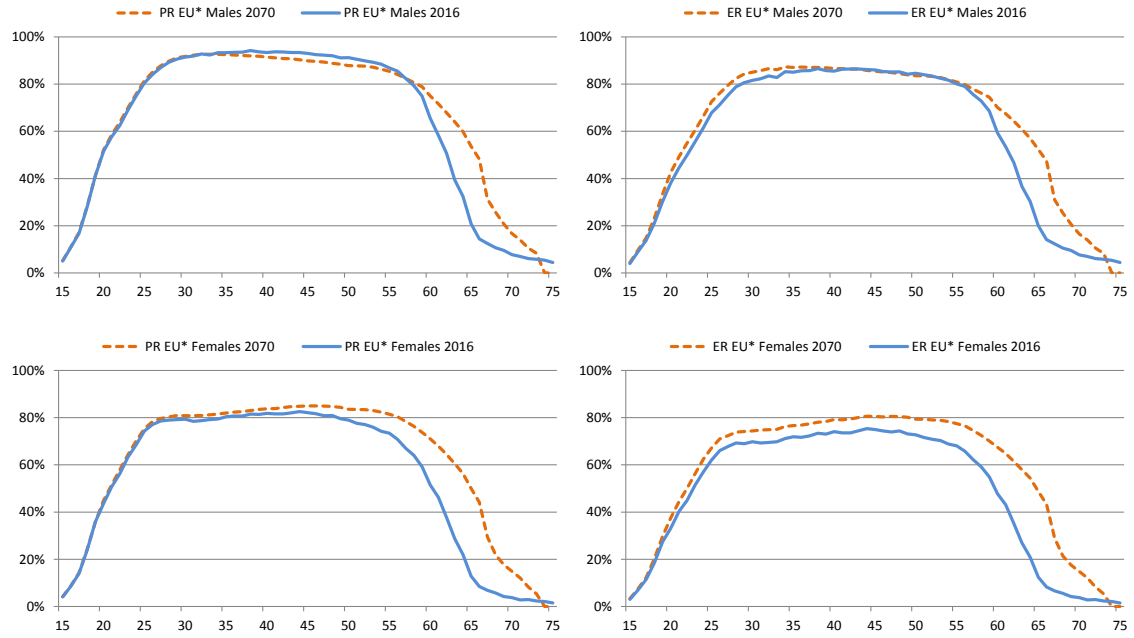
Tables I.2.5 to I.2.7 provide an overview of major developments in participation rates between 2016 and 2070 broken down by age groups and gender. By large, the biggest increase in participation rates is projected for older workers (around 16.2 pps. for women and 7.7 pps. for men) in the EU. Consequently, the gender gap in terms of participation rates is projected to narrow substantially in the period up to 2070.

The participation rate of total prime age workers (25-54) in the EU is projected to slightly increase between 2016 (85.5%) and 2070 (86.7%).

This is the result of opposite trends by gender. In fact, prime age women's participation rate is projected to rise by 3.1 pps., reaching 82.6% in 2070, while prime age men's participation rate is projected to decline by 0.7 pps., attaining 90.7% in 2070.

There are wide differences across countries. In almost all countries total participation rates (aged 20-64) are projected to increase; while in a few the opposite holds. The highest increases are projected for MT, HU and EL (7 ½ pps. or more), with projected high increases of older workers (55-64), but also of prime age workers (25-54). By contrast, decreases are projected for BG, EE and LU, (-0.5 pps. or less), with negative or very low increases for prime-age and/or older workers.

Graph I.2.7: **Age profiles of participation and employment rates by gender in 2016 and 2070 - euro area**



Source: Commission services, EPC.

Table I.2.5: **Participation rates by age groups - Total, 2016 - 2070**

	Total		Young		Prime age		Older		Change 2070-2016				
	20-64		20-24		25-54		55-64		Total	Young	Prime age	Older	
	2016	2070	2016	2070	2016	2070	2016	2070	20-64	20-24	25-54	55-64	
BE	73.4	77.3	49.1	51.0	85.1	85.3	48.2	65.8	3.9	2.0	0.2	17.6	BE
BG	73.3	72.5	40.7	43.0	82.0	80.8	58.9	63.3	-0.8	2.3	-1.2	4.4	BG
CZ	80.0	79.8	53.3	53.1	88.9	88.7	61.1	67.3	-0.2	-0.1	-0.1	6.2	CZ
DK	82.2	83.4	72.6	74.3	87.3	86.9	71.1	77.0	1.2	1.7	-0.5	5.9	DK
DE	82.0	82.6	68.2	69.2	87.4	87.4	71.4	74.1	0.6	1.0	0.0	2.7	DE
EE	82.4	81.9	67.0	70.8	87.9	87.7	71.2	71.0	-0.5	3.8	-0.2	-0.2	EE
IE	76.2	76.0	65.8	66.9	81.2	81.3	61.0	65.8	-0.1	1.1	0.1	4.8	IE
EL	73.3	80.7	44.7	46.9	85.4	88.2	45.2	75.3	7.4	2.2	2.8	30.2	EL
ES	79.2	84.1	55.1	55.3	87.4	89.7	59.2	81.8	4.9	0.2	2.2	22.6	ES
FR	77.4	81.0	62.4	63.3	87.5	88.0	53.5	68.1	3.5	0.9	0.5	14.6	FR
HR	70.2	75.6	57.8	63.4	82.0	85.2	42.3	54.7	5.3	5.6	3.1	12.5	HR
IT	69.6	72.9	45.8	45.8	77.5	76.6	53.4	73.1	3.2	0.0	-0.9	19.7	IT
CY	78.6	83.6	60.6	64.0	86.8	88.5	59.0	76.8	5.0	3.4	1.7	17.8	CY
LV	81.2	84.2	64.5	64.9	87.9	91.9	67.5	72.4	3.0	0.4	4.0	4.9	LV
LT	81.8	85.0	60.3	61.4	89.3	92.5	69.9	73.7	3.2	1.1	3.2	3.8	LT
LU	75.1	74.6	48.6	50.2	87.1	88.6	42.4	42.5	-0.5	1.5	1.5	0.1	LU
HU	75.3	83.4	54.3	54.5	86.1	88.7	52.2	81.3	8.1	0.2	2.6	29.1	HU
MT	72.9	85.0	72.7	75.0	82.0	91.4	45.6	70.1	12.2	2.3	9.3	24.5	MT
NL	81.6	84.5	75.1	77.9	87.0	87.3	68.4	78.8	2.9	2.8	0.3	10.4	NL
AT	79.4	82.4	73.9	74.8	88.4	90.6	51.8	61.3	3.0	0.9	2.2	9.5	AT
PL	74.1	74.9	58.2	58.3	85.0	85.8	48.5	53.0	0.8	0.1	0.8	4.4	PL
PT	79.6	82.1	57.9	59.0	89.2	90.6	58.4	69.4	2.5	1.1	1.4	11.0	PT
RO	70.3	70.6	44.7	46.3	81.9	81.3	44.0	50.7	0.3	1.7	-0.6	6.7	RO
SI	76.3	79.4	55.5	56.6	90.5	89.9	41.1	60.9	3.1	1.2	-0.6	19.7	SI
SK	77.3	81.9	53.3	54.9	87.6	88.2	54.4	76.3	4.6	1.6	0.6	21.9	SK
FI	79.8	82.9	69.7	71.1	86.3	85.8	66.2	79.6	3.0	1.5	-0.5	13.4	FI
SE	86.6	86.5	72.4	73.5	90.9	91.5	79.9	77.7	-0.1	1.0	0.6	-2.2	SE
UK	81.0	84.5	76.4	76.4	86.1	89.2	66.0	74.2	3.5	0.0	3.1	8.3	UK
NO	82.1	82.8	69.6	70.5	86.4	88.0	73.9	72.8	0.7	0.8	1.6	-1.1	NO
EA	77.6	80.6	60.1	61.1	85.5	86.3	59.8	73.0	3.1	1.0	0.8	13.2	EA
EU*	77.5	80.7	61.7	63.2	85.5	86.7	59.1	71.3	3.2	1.4	1.2	12.2	EU*
EU27	77.0	80.0	59.2	60.6	85.4	86.3	58.2	70.8	3.0	1.4	0.9	12.5	EU27

Source: Commission services, EPC.

Table I.2.6: **Participation rates by age groups - Men, 2016 - 2070**

	Total		Young		Prime age		Older		Change 2070-2016				
	20-64		20-24		25-54		55-64		Total	Young	Prime age	Older	
	2016	2070	2016	2070	2016	2070	2016	2070	20-64	20-24	25-54	55-64	
BE	78.6	81.0	52.5	54.7	90.3	89.1	53.7	69.1	2.4	2.2	-1.2	15.4	BE
BG	77.7	77.5	47.7	51.3	85.6	85.7	63.6	66.7	-0.2	3.6	0.1	3.1	BG
CZ	87.7	86.4	63.0	62.4	95.4	95.1	71.3	73.4	-1.3	-0.7	-0.3	2.1	CZ
DK	85.4	86.1	71.4	72.8	90.8	90.3	75.4	79.6	0.8	1.4	-0.5	4.1	DK
DE	86.6	84.5	69.8	70.6	92.0	89.9	77.1	74.5	-2.1	0.8	-2.1	-2.6	DE
EE	87.3	86.9	73.9	77.4	93.7	93.6	70.9	72.6	-0.4	3.5	0.0	1.7	EE
IE	84.1	80.5	68.6	69.9	89.3	86.5	71.1	68.4	-3.7	1.3	-2.8	-2.8	IE
EL	81.7	85.3	46.9	49.7	93.3	93.1	57.6	79.6	3.6	2.8	-0.2	22.0	EL
ES	84.6	84.9	57.7	57.9	92.5	91.2	67.0	79.7	0.3	0.2	-1.3	12.8	ES
FR	81.8	84.3	66.4	67.1	92.4	91.4	56.0	70.9	2.6	0.7	-1.0	14.9	FR
HR	75.2	78.3	63.7	69.0	85.3	87.6	50.7	56.8	3.1	5.2	2.4	6.1	HR
IT	80.4	80.5	51.8	52.0	88.2	85.3	65.9	78.6	0.1	0.1	-3.0	12.7	IT
CY	84.1	86.4	59.0	63.4	92.3	90.7	70.9	82.1	2.2	4.5	-1.5	11.2	CY
LV	83.8	85.0	68.4	70.5	90.2	92.4	69.4	71.7	1.1	2.2	2.2	2.2	LV
LT	84.0	85.7	66.4	67.8	90.2	92.9	73.7	72.9	1.6	1.4	2.7	-0.8	LT
LU	80.6	77.6	47.4	49.9	93.0	92.2	49.8	45.2	-3.0	2.5	-0.8	-4.7	LU
HU	82.8	88.1	60.1	60.5	92.3	93.8	62.5	83.9	5.3	0.4	1.5	21.4	HU
MT	86.8	89.7	75.7	78.5	96.0	96.3	64.3	74.9	2.9	2.8	0.3	10.6	MT
NL	87.0	87.1	75.1	77.4	91.7	89.9	78.3	82.8	0.1	2.3	-1.8	4.6	NL
AT	84.0	83.7	75.5	75.3	91.8	91.6	61.2	63.5	-0.3	-0.2	-0.1	2.3	AT
PL	81.6	82.6	67.0	67.9	90.8	91.3	58.9	65.5	1.1	0.9	0.4	6.6	PL
PT	83.6	82.4	60.5	60.9	91.9	90.3	67.0	70.3	-1.2	0.4	-1.7	3.3	PT
RO	80.2	82.0	53.4	55.3	91.0	92.9	54.9	63.1	1.8	2.0	1.9	8.2	RO
SI	79.3	81.4	61.7	62.9	91.9	91.7	46.7	61.5	2.1	1.2	-0.3	14.8	SI
SK	84.2	86.8	65.3	68.1	93.5	93.3	60.9	77.1	2.6	2.8	-0.2	16.2	SK
FI	82.1	84.6	70.0	71.1	89.7	88.5	65.2	79.4	2.5	1.1	-1.3	14.2	FI
SE	89.1	88.3	74.4	74.7	93.3	93.0	82.7	80.9	-0.8	0.3	-0.3	-1.8	SE
UK	86.9	87.7	79.0	79.0	92.2	92.8	72.8	76.4	0.9	0.0	0.7	3.6	UK
NO	84.6	84.3	70.5	72.0	88.8	89.5	77.7	74.4	-0.3	1.5	0.7	-3.2	NO
EA	83.5	83.8	63.3	64.2	91.4	89.8	66.9	75.0	0.3	0.8	-1.5	8.0	EA
EU*	83.7	84.5	65.7	66.8	91.4	90.7	66.7	74.4	0.8	1.1	-0.7	7.7	EU*
EU27	83.3	83.9	63.4	64.4	91.3	90.3	65.9	74.0	0.6	1.1	-1.0	8.2	EU27

Source: Commission services, EPC.

Table I.2.7: **Participation rates by age groups - Women, 2016 - 2070**

	Total		Young		Prime age		Older		Change 2070-2016				
	20-64		20-24		25-54		55-64		Total	Young	Prime age	Older	
	2016	2070	2016	2070	2016	2070	2016	2070	20-64	20-24	25-54	55-64	
BE	68.2	73.5	45.5	47.2	79.8	81.4	42.8	62.5	5.3	1.6	1.5	19.7	BE
BG	68.8	67.3	33.3	34.2	78.1	75.5	54.7	59.8	-1.6	0.9	-2.6	5.1	BG
CZ	72.0	73.0	43.1	43.5	82.0	82.1	51.4	61.2	1.0	0.4	0.1	9.8	CZ
DK	79.1	80.5	73.9	75.9	83.8	83.3	66.9	74.5	1.5	2.1	-0.5	7.6	DK
DE	77.3	80.7	66.6	67.8	82.7	84.9	65.9	73.8	3.4	1.2	2.3	7.9	DE
EE	77.5	76.8	59.8	64.1	82.0	81.6	71.4	69.3	-0.7	4.2	-0.3	-2.0	EE
IE	68.5	71.4	62.7	63.6	73.4	75.8	51.0	63.1	3.0	1.0	2.3	12.1	IE
EL	65.1	75.6	42.5	43.8	77.8	82.7	34.0	71.0	10.5	1.3	4.9	37.0	EL
ES	73.7	83.2	52.4	52.5	82.3	88.1	51.7	83.9	9.5	0.1	5.7	32.2	ES
FR	73.2	77.5	58.2	59.3	82.7	84.4	51.3	65.4	4.2	1.1	1.6	14.1	FR
HR	65.3	72.7	51.6	57.4	78.7	82.6	34.4	52.7	7.4	5.9	3.8	18.3	HR
IT	59.0	64.8	39.4	39.4	66.8	67.4	41.7	67.5	5.8	-0.1	0.6	25.7	IT
CY	73.5	80.8	62.4	64.7	81.8	86.1	47.3	71.6	7.3	2.3	4.2	24.3	CY
LV	78.6	83.3	60.4	59.1	85.6	91.3	66.0	73.1	4.7	-1.3	5.7	7.1	LV
LT	79.7	84.3	53.9	55.1	88.4	92.1	66.9	74.5	4.6	1.1	3.7	7.6	LT
LU	69.5	71.6	49.9	50.5	81.0	85.1	34.7	39.9	2.2	0.6	4.1	5.3	LU
HU	68.0	78.6	48.1	48.2	79.8	83.3	43.5	78.7	10.6	0.1	3.5	35.2	HU
MT	58.3	80.2	69.4	71.4	67.3	86.3	26.9	65.0	21.9	2.0	19.0	38.1	MT
NL	76.2	81.7	75.1	78.5	82.2	84.5	58.6	74.7	5.6	3.4	2.4	16.1	NL
AT	74.8	81.0	72.2	74.3	84.9	89.5	42.7	59.1	6.2	2.1	4.6	16.4	AT
PL	66.6	66.9	49.1	48.5	78.9	80.0	39.2	40.3	0.3	-0.6	1.0	1.1	PL
PT	75.8	81.9	55.2	57.1	86.6	90.9	50.8	68.5	6.1	1.9	4.3	17.7	PT
RO	60.3	59.2	35.4	37.3	72.3	69.8	34.2	38.1	-1.1	1.9	-2.5	3.9	RO
SI	73.1	77.4	49.0	50.1	89.0	88.1	35.5	60.2	4.3	1.2	-0.9	24.7	SI
SK	70.4	76.8	40.7	41.1	81.5	82.9	48.5	75.5	6.5	0.4	1.4	27.0	SK
FI	77.6	81.1	69.3	71.1	82.7	83.1	67.2	79.9	3.5	1.8	0.3	12.7	FI
SE	84.1	84.6	70.3	72.1	88.4	89.9	77.1	74.6	0.5	1.8	1.5	-2.6	SE
UK	75.3	81.2	73.6	73.6	80.1	85.5	59.4	72.1	5.9	-0.1	5.3	12.7	UK
NO	79.4	81.1	68.7	68.9	83.8	86.4	70.1	71.1	1.7	0.2	2.6	1.1	NO
EA	71.6	77.3	56.8	57.9	79.6	82.5	53.0	71.0	5.7	1.1	2.9	17.9	EA
EU*	71.4	76.9	57.6	59.3	79.6	82.6	52.0	68.2	5.5	1.7	3.1	16.2	EU*
EU27	70.8	76.0	54.8	56.5	79.5	82.1	51.0	67.4	5.2	1.7	2.6	16.4	EU27

Source: Commission services, EPC.

2.5.2. Projection of labour supply

Total labour supply in the EU is projected to decrease over the projection horizon by 9.6%. The labour supply of men will see a larger reduction (-10.6%) compared to women (-9.2%). The euro area countries will experience a similar overall reduction (-9.7%) by 2070.

Labour supply projections are calculated by single age and gender (by multiplying participation rates by population values). Total labour supply in the EU is projected to decrease over the projection horizon. The labour supply of men is calculated to decline at a constant pace (0.2% yearly) for a total reduction of 10.6% (around 13.5 million persons) by 2070. Women labour supply remains almost stable till 2030 but is expected to decline afterwards at a yearly pace of 0.2% (see Graph I.2.8). This will imply a reduction of almost 9 million persons after 2030 that correspond to 8.5% of the labour force in 2016. When both men and women and considered, in the euro area, the projected fall in labour supply between 2016 and 2070 is 9.7%, equivalent to about 15 million people.

Graph I.2.8 highlights the wide diversity across Member States of labour supply projections, ranging from an increase of 16.3% in Sweden to a decrease of 33.1% in Bulgaria (2030-70).

The initial almost neutral trend across most countries in the first fifteen years of the projections (2016-2030) is projected to deteriorate after 2030, when a large majority of countries are expected to record a decline (20 EU Member States in total).

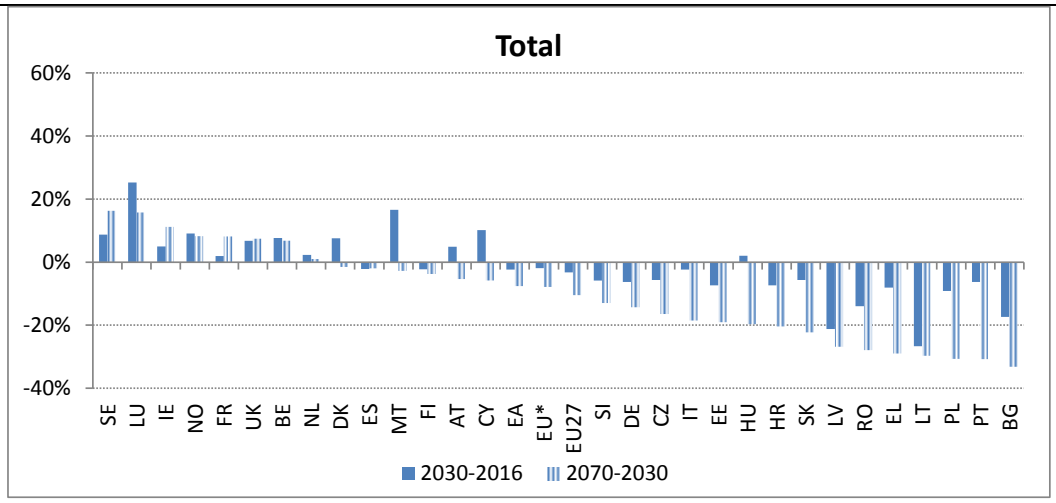
In the eight largest (in terms of labour force) EU Member States, representing about ¾ of the total EU labour force in 2016, their prospective evolution in the period 2016-2070 is strikingly dissimilar (see Table I.2.8). Expected differences in the annual growth rate of total labour force are very significant, because they are "compounded" over a long period. Poland and Romania are projected to register average annual declines of almost 1pp., Italy and Germany are expected to register a decline of about 0.4. Conversely, the UK and France are expected to register expansions in the total labour force. Consequently, country rankings (in terms of labour force shares) are expected to change significantly in the period 2016-2070.

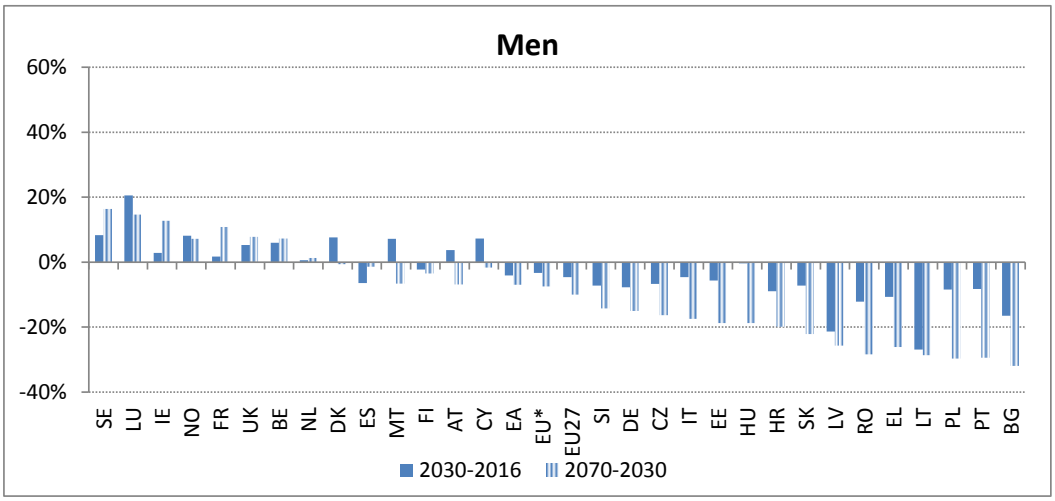
Table I.2.8: **Labour supply projections in the EU Member States**

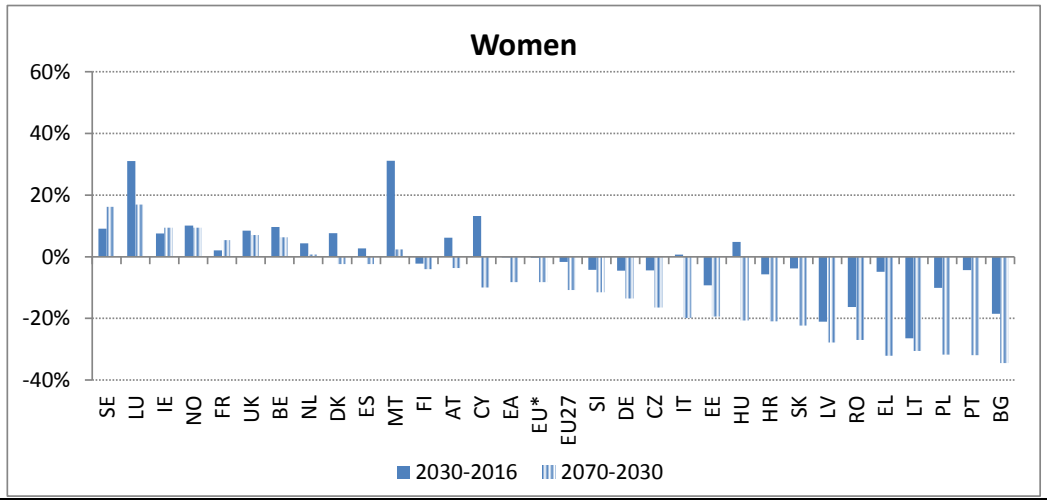
	Total LF (20-64) (thousands persons)		Avg. annual growth rate of the LF (in %)	Impact on potential output growth in percentage (1)
	2016	2070	2016-2070	
DE	41 039	32 982	-0.4	-0.1
UK	31 160	35 749	0.3	0.3
FR	29 179	32 179	0.2	0.2
IT	25 178	20 050	-0.4	-0.2
ES	22 526	21 621	-0.1	0.1
PL	17 891	11 288	-0.8	-0.4
RO	8 523	5 294	-0.9	-0.4
NL	8 238	8 518	0.1	0.2
CZ	5 207	4 107	-0.4	-0.2
SE	4 933	6 235	0.4	0.4
BE	4 912	5 651	0.3	0.3
PT	4 906	3 188	-0.8	-0.4
EL	4 666	3 050	-0.8	-0.4
HU	4 587	3 760	-0.4	-0.1
AT	4 300	4 271	0.0	0.1
BG	3 189	1 763	-1.1	-0.6
DK	2 744	2 909	0.1	0.2
SK	2 719	1 997	-0.6	-0.2
NO	2 556	3 019	0.3	0.3
FI	2 526	2 378	-0.1	0.0
IE	2 076	2 424	0.3	0.3
HR	1 773	1 308	-0.6	-0.2
LT	1 423	735	-1.2	-0.7
SI	975	799	-0.4	-0.1
LV	963	556	-1.0	-0.5
EE	652	489	-0.5	-0.2
CY	420	436	0.1	0.2
LU	279	404	0.7	0.6
MT	194	220	0.2	0.3
EA	157 172	141 947	-0.2	0.0
EU*	237 178	214 361	-0.2	0.0
EU27	206 018	178 611	-0.3	0.0

(1) Impact of LF growth differentials relative to the EU average.
Source: Commission services, EPC.

Graph I.2.8: **Percentage change in total labour supply of the population aged 20 to 64 (2070 - 2016)**







(1) Countries ranked in descending order of total change over the period 2070 - 2016.
Source: Commission services, EPC.

2.5.3. Breaking down changes in participation rates and labour force

Table I.2.9 applies a shift-share analysis to changes in the total participation rate over the period 2016 to 2070, focusing on both the age and gender dimensions. The overall participation rate is algebraically broken down in three components: i) a participation rate effect; ii) a population/demographic effect, and iii) an interaction/residual effect ([23]).

The participation rate effect, reflecting changes in participation rates of specific age/gender groups, tends to be positive across a large majority of Member States. It basically reflects the trend rise in the participation rates of women and older workers. Graph I.2.9 (the first two panels) also suggest that the projected rise in the participation rates of women and older workers is a major driving force of changes in the aggregated participation rate.

The demographic effect (i.e. the effect of the structure of the working age population) is negative in many Member States, being mainly driven by projected developments in the prime-age population (aged 25 to 54) and women. Women are associated with both positive participation and negative demographic effects. The former reflects the upward displacement of the participation rate age profile of younger cohorts embedded in the CSM, the latter reflects the ageing of the population which has a stronger impact on women than on men, largely due to their (still) relatively lower average exit ages from the labour force. For some countries, the interaction effect is also important (e.g. CY, IT).

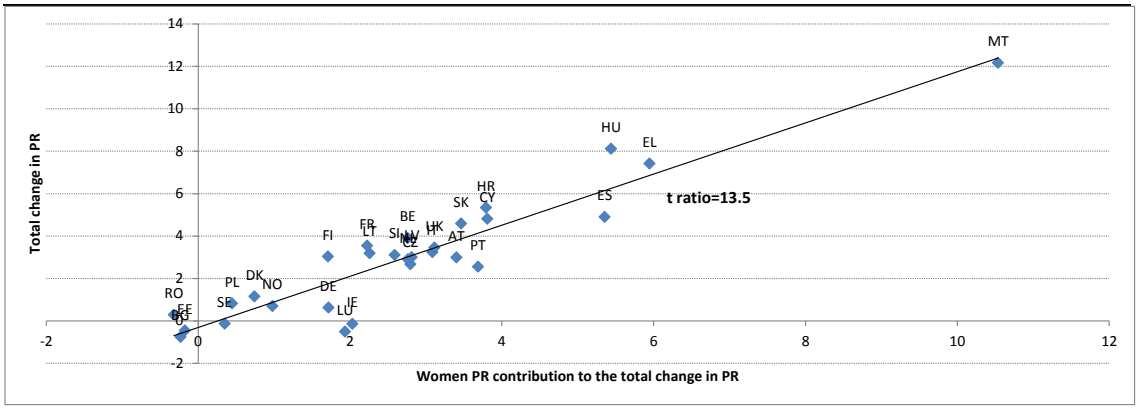
([23]) This breakdown is based on the rule for approximating the difference of a product:
$y_1x_1 - y_0x_0 = x_0\Delta y + y_0\Delta x + \Delta y\Delta y$. For more details see Carone (2005), pp. 54.

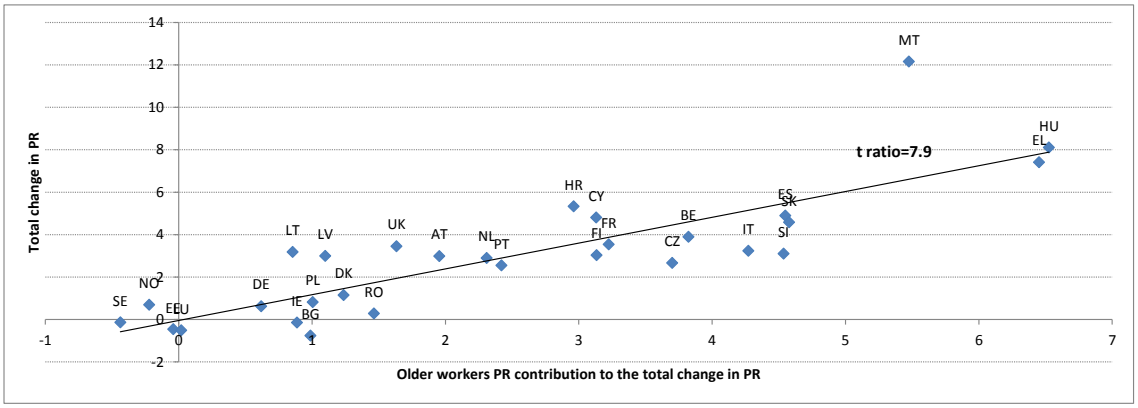
Table I.2.9: **Contribution to the overall change in participation rates, 2070 - 2016 (in %)**

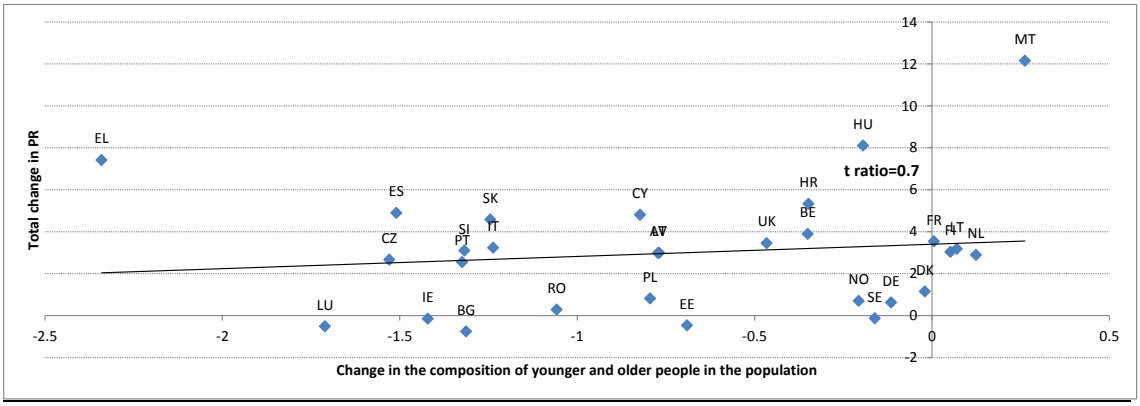
	Participation rates in 2070	Total change in participation rates (in %)	Contribution of group specific changes in participation rates												Demographic effect						Interaction effect	
			Men & Women				Men				Women											
			Total (20-64)	Young (20-24)	Prime age (25-54)	Older (55-64)	Total (20-64)	Young (20-24)	Prime age (25-54)	Older (55-64)	Total (20-64)	Young (20-24)	Prime age (25-54)	Older (55-64)	Total (20-64)	Young (20-24)	Prime age (25-54)	Older (55-64)	Men	Women		
BE	77.3	3.9	4.1	0.2	0.1	3.8	1.4	0.1	-0.4	1.7	2.8	0.1	0.5	2.2	-0.3	0.2	-0.8	0.2	0.4	-0.3	0.1	BE
BG	72.5	-0.8	0.4	0.2	-0.8	1.0	0.5	0.2	0.0	0.3	-0.2	0.0	-0.9	0.6	-1.3	0.8	-3.4	1.2	0.8	-0.7	0.2	BG
CZ	79.8	-0.2	1.2	0.0	-0.1	1.3	0.1	0.0	-0.1	0.2	1.1	0.0	0.0	1.0	-1.5	1.1	-4.4	1.8	0.1	-0.1	0.2	CZ
DK	83.4	1.2	1.1	0.2	-0.3	1.2	0.3	0.1	-0.2	0.4	0.7	0.1	-0.2	0.8	0.0	-0.9	0.0	0.9	0.6	-0.5	0.1	DK
DE	82.6	0.6	0.7	0.1	0.0	0.6	-1.0	0.0	-0.7	-0.3	1.7	0.1	0.8	0.9	-0.1	0.5	-0.5	-0.2	0.3	-0.3	0.0	DE
EE	81.9	-0.5	0.2	0.3	-0.1	0.0	0.3	0.2	0.0	0.2	-0.2	0.2	-0.1	-0.2	-0.7	1.1	-3.3	1.5	0.9	-0.8	0.1	EE
IE	76.0	-0.1	1.0	0.1	0.0	0.9	-1.2	0.1	-1.0	-0.3	2.0	0.0	0.9	1.1	-1.4	2.0	-6.3	2.9	1.5	-1.2	0.3	IE
EL	80.7	7.4	8.6	0.2	1.9	6.5	2.3	0.1	-0.1	2.2	5.9	0.1	1.7	4.2	-2.3	0.7	-5.0	1.9	2.6	-2.1	1.2	EL
ES	84.1	4.9	6.2	0.0	1.6	4.5	0.8	0.0	-0.5	1.3	5.4	0.0	2.0	3.3	-1.5	1.9	-4.2	0.9	0.7	-0.6	0.2	ES
FR	81.0	3.5	3.6	0.1	0.3	3.2	1.3	0.0	-0.3	1.6	2.2	0.1	0.6	1.6	0.0	0.6	-0.2	-0.4	1.5	-1.3	-0.1	FR
HR	75.6	5.3	5.6	0.5	2.1	3.0	1.7	0.3	0.8	0.7	3.8	0.3	1.3	2.2	-0.3	0.0	-0.7	0.4	0.8	-0.7	0.1	HR
IT	72.9	3.2	3.7	0.0	-0.6	4.3	0.3	0.0	-1.0	1.3	3.1	0.0	0.2	2.9	-1.2	0.4	-3.7	2.1	1.4	-1.0	0.8	IT
CY	83.6	5.0	4.8	0.4	1.2	3.3	0.8	0.3	-0.5	1.0	3.9	0.1	1.6	2.3	-0.8	-2.3	-2.4	3.8	2.1	-1.9	1.0	CY
LV	84.2	3.0	3.8	0.0	2.7	1.1	1.1	0.1	0.7	0.2	2.8	-0.1	2.0	0.9	-0.8	1.7	-3.0	0.5	1.4	-1.3	-0.1	LV
LT	85.0	3.2	3.1	0.1	2.1	0.9	0.9	0.1	0.9	-0.1	2.3	0.1	1.2	1.0	0.1	-0.1	0.2	0.0	1.2	-1.1	0.0	LT
LU	74.6	-0.5	1.2	0.1	1.1	0.0	-0.6	0.1	-0.3	-0.4	1.9	0.0	1.4	0.5	-1.7	0.1	-3.4	1.5	-0.7	0.6	-0.1	LU
HU	83.4	8.1	8.3	0.0	1.7	6.5	2.7	0.0	0.5	2.2	5.4	0.0	1.2	4.3	-0.2	0.3	-0.5	0.1	1.1	-0.9	0.0	HU
MT	85.0	12.2	12.0	0.3	6.2	5.5	1.4	0.2	0.1	1.2	10.5	0.1	6.2	4.3	0.3	-0.2	0.8	-0.3	-0.2	0.1	-0.1	MT
NL	84.5	2.9	2.8	0.3	0.2	2.3	0.0	0.1	-0.6	0.5	2.8	0.2	0.8	1.8	0.1	-0.1	0.6	-0.4	0.8	-0.7	-0.1	NL
AT	82.4	3.0	3.6	0.1	1.5	2.0	0.2	0.0	-0.1	0.2	3.4	0.1	1.6	1.7	-0.8	-0.3	-1.7	1.2	0.5	-0.5	0.2	AT
PL	74.9	0.8	1.5	0.0	0.5	1.0	0.9	0.0	0.2	0.7	0.4	0.0	0.3	0.1	-0.8	0.2	-1.9	0.9	0.8	-0.6	0.1	PL
PT	82.1	2.5	3.5	0.1	1.0	2.4	-0.2	0.0	-0.6	0.3	3.7	0.1	1.5	2.1	-1.3	0.2	-3.8	2.3	1.8	-1.6	0.4	PT
RO	70.6	0.3	1.2	0.1	-0.4	1.5	1.6	0.1	0.7	0.8	-0.3	0.1	-0.8	0.4	-1.1	0.8	-2.3	0.5	-0.3	0.2	0.1	RO
SI	79.4	3.1	4.2	0.1	-0.4	4.5	1.7	0.1	-0.1	1.7	2.6	0.0	-0.3	2.8	-1.3	1.5	-3.1	0.3	-0.6	0.6	0.2	SI
SK	81.9	4.6	5.2	0.2	0.4	4.6	1.7	0.1	-0.1	1.6	3.5	0.0	0.5	3.0	-1.2	0.3	-3.3	1.7	0.5	-0.4	0.7	SK
FI	82.9	3.0	3.0	0.2	-0.3	3.1	1.3	0.1	-0.4	1.6	1.7	0.1	0.1	1.5	0.1	-0.3	0.3	0.0	0.4	-0.4	0.0	FI
SE	86.5	-0.1	0.1	0.1	0.4	-0.4	-0.3	0.0	-0.1	-0.2	0.3	0.1	0.5	-0.3	-0.2	0.0	-1.3	1.1	0.2	-0.2	0.0	SE
UK	84.5	3.5	3.8	0.0	2.1	1.6	0.6	0.0	0.2	0.4	3.1	0.0	1.8	1.3	-0.5	-0.3	-1.8	1.7	0.9	-0.8	0.1	UK
NO	82.8	0.7	1.0	0.1	1.1	-0.2	0.0	0.1	0.2	-0.3	1.0	0.0	0.9	0.1	-0.2	-0.5	-1.6	1.9	-0.3	0.3	-0.1	NO
EA	80.6	3.1	3.5	0.1	0.5	2.9	0.4	0.0	-0.5	0.9	3.1	0.1	1.0	2.0	-0.6	0.7	-1.9	0.6	1.0	-0.8	0.1	EA
EU*	80.7	3.2	3.6	0.1	0.9	2.6	0.6	0.1	-0.3	0.8	2.9	0.1	1.1	1.8	-0.5	0.6	-1.9	0.7	0.9	-0.7	0.1	EU*
EU27	80.0	3.0	3.5	0.1	0.6	2.7	0.6	0.1	-0.4	0.9	2.8	0.1	0.9	1.8	-0.6	0.7	-1.9	0.6	0.9	-0.7	0.1	EU27

Source: Commission services, EPC.

Graph I.2.9: **Correlation between the total change in participation rates (2070 - 2016) and possible determinants**







Source: Commission services, EPC.

2.6. EMPLOYMENT PROJECTIONS

The total employment rate in the EU is projected to increase from 71.1% in 2016 to 75.8% in 2070. Such evolution is largely determined by above the average improvements in the employment of the older people (+12.6 pps.) and of women (+6.9 pps.).

The methodology used projects employment as a residual variable. Employment is determined given Eurostat's population projections, future participation rates derived using the CSM, and finally the unemployment rate assumptions (see Box I.2.3).

Box I.2.3: Assumptions on structural unemployment

The structural unemployment rate estimates (NAWRU), based on the methodology developed by the Output Gap Working Group (OGWG) attached to the Economic Policy Committee (EPC), are used as a proxy for structural unemployment rate in the baseline scenario.

As a general rule, actual unemployment rates are assumed to converge to NAWRU rates in 5 years (currently 2021), corresponding to the closure of the output gap. On their turn, NAWRU rates are assumed to gradually ([1]) converge to the minimum of country-specific *Anchors* ([2]) or the median of national *Anchors*, whichever is the lowest.

Anchors values are country-specific values for the NAWRU that are calculated on the basis of the coefficients of a panel estimation model in which the short term NAWRU for EU old member states is regressed on a set of structural variables (unemployment benefit replacement rates, Active labour market policies, an index of the employment protection legislation and the tax wedge) together with a set of cyclical variables (TFP, construction index and real interest rate). To derive country specific anchors, it is assumed then that the non-structural variables are set at their average values ([3]).

Capping country-specific NAWRU values to the weighted median is done in order to avoid extrapolating into the far future very high unemployment rate values. It should be noted that this cap on unemployment rates is a crucial assumption for some countries which currently register high levels. Higher long-term unemployment than assumed here would, through weaker employment growth, lead to lower potential output growth. Capping unemployment rates, as done in some cases, leads to higher employment, employment growth and GDP growth, and essentially assumes the implementation of future policy measures in the labour market. Therefore, this is not aligned with a 'no-policy-change' approach.

In order to avoid changes in total/average unemployment rates as a result of the interaction between cohort-specific structural unemployment rates and the structure of the labour force, the age-specific unemployment rates (by gender) for each projection year are calculated as follows:

$$u_{a,g}^{t} = \frac{u_{total}^{t}}{\sum_{a,g}\left\{u_{a,g}^{2013} * l_{a,g}^{t}\right\}} * u_{a,g}^{2016}$$

where

$$l_{a,g}^{t} = \frac{LF_{a,g}^{t}}{LF_{total}^{t}}$$

where $u_{a,g}^{t}$ is the unemployment rate in age group a, gender g, and period t; u_{total}^{t} is the total unemployment rate in period t; and $l_{a,g}^{t}$ is the fraction in the total labour force.

This means that the unemployment rate structure (by age and gender) observed in the base year (2016) is kept unchanged throughout the projection period, thereby age/gender values are adjusted proportionally in order to satisfy a given total unemployment rate target.

([1]) In addition, if the estimated NAWRU ten years ahead (2026) is lower than the country specific anchor, the former is assumed to replace the anchor. The gradual convergence, for countries whose NAWRU's is higher than the EU median, is assumed to be completed by 2050.
([2]) Under the guidance of the EPC-OGWG and with the twin objectives of improving the medium-term framework for fiscal surveillance up to T+10 (currently 2026), DG ECFIN carried out some econometric work (Orlandi, 2012) leading to the estimation of *Anchor* values for the NAWRU.
([3]) Over the estimation sample.

(Continued on the next page)

Box (continued)

The table below presents the unemployment rate assumptions. In the EU, the unemployment rate is assumed to decline by 2.2 pps. (from 8.7% in 2016 to 6.5% in 2070). In the euro area, the unemployment rate is expected to fall from 10.2% in 2016 to 6.8% in 2070.

Table 1: Unemployment rate assumptions (age 15 - 64, in percentage)

	2016	2026	2050	2070	
BE	7.9	8.2	7.9	7.9	BE
BG	7.6	6.7	6.7	6.7	BG
CZ	4.0	4.2	4.2	4.2	CZ
DK	6.4	4.6	4.6	4.6	DK
DE	4.2	4.8	4.8	4.8	DE
EE	6.8	8.5	7.9	7.9	EE
IE	8.1	6.5	6.5	6.5	IE
EL	23.8	12.1	7.9	7.9	EL
ES	19.7	15.4	7.9	7.9	ES
FR	10.2	8.7	7.9	7.9	FR
HR	13.2	12.5	7.9	7.9	HR
IT	11.9	9.1	7.9	7.9	IT
CY	13.5	6.3	6.1	6.1	CY
LV	9.8	10.1	7.9	7.9	LV
LT	8.0	8.1	7.9	7.9	LT
LU	6.2	5.0	5.0	5.0	LU
HU	5.2	5.0	5.0	5.0	HU
MT	4.2	5.6	5.6	5.6	MT
NL	6.1	4.5	4.5	4.5	NL
AT	6.1	4.9	4.9	4.9	AT
PL	6.3	5.8	5.8	5.8	PL
PT	11.5	9.1	7.9	7.9	PT
RO	6.1	6.2	6.2	6.2	RO
SI	8.1	5.9	5.9	5.9	SI
SK	9.7	9.4	7.9	7.9	SK
FI	9.1	7.6	7.6	7.6	FI
SE	7.1	5.8	5.7	5.7	SE
UK	5.0	6.2	6.2	6.2	UK
NO	4.8	3.3	3.3	3.3	NO
EA	10.2	8.4	6.7	6.8	EA
EU*	8.7	7.6	6.5	6.5	EU*
EU27	9.3	7.8	6.5	6.6	EU27

Source: Commission services, EPC.

Table I.2.10: **Employment rate projections by age group: Total**

	Total		Young		Prime age		Older		Change 2070-2016				
	20-64		20-24		25-54		55-64		Total	Young	Prime age	Older	
	2016	2070	2016	2070	2016	2070	2016	2070	20-64	20-24	25-54	55-64	
BE	67.8	71.4	39.8	41.2	79.1	79.1	45.5	62.4	3.6	1.4	0.1	16.9	BE
BG	67.8	67.8	34.4	37.2	76.1	75.9	54.6	59.3	0.0	2.9	-0.3	4.7	BG
CZ	76.8	76.6	48.5	48.2	85.7	85.5	58.8	64.9	-0.2	-0.2	-0.2	6.2	CZ
DK	77.5	79.9	65.4	68.8	82.5	83.3	68.3	74.9	2.4	3.5	0.8	6.6	DK
DE	78.6	78.8	63.7	64.1	84.0	83.6	68.6	70.9	0.2	0.3	-0.4	2.3	DE
EE	76.9	75.7	59.1	61.4	82.7	81.9	65.8	65.0	-1.2	2.2	-0.8	-0.8	EE
IE	70.3	71.3	55.7	58.9	75.3	76.5	57.2	62.6	1.0	3.2	1.2	5.5	IE
EL	56.0	74.4	24.2	39.8	65.9	81.4	36.5	70.6	18.4	15.6	15.5	34.1	EL
ES	63.9	77.6	32.3	46.5	71.5	83.2	49.1	76.6	13.7	14.2	11.7	27.5	ES
FR	69.8	74.8	48.2	52.4	79.7	81.9	49.7	64.4	5.0	4.2	2.2	14.7	FR
HR	61.6	69.9	43.1	53.4	72.5	79.1	38.4	52.0	8.4	10.3	6.6	13.5	HR
IT	61.6	67.3	29.9	35.1	68.9	70.6	50.3	70.5	5.7	5.2	1.8	20.1	IT
CY	68.3	78.6	43.6	55.1	76.6	83.6	52.3	72.7	10.4	11.5	7.0	20.4	CY
LV	73.2	77.5	53.6	56.3	79.7	85.0	61.5	67.4	4.3	2.7	5.3	5.9	LV
LT	75.3	78.3	51.9	53.1	82.7	85.7	64.6	68.3	3.1	1.2	3.1	3.6	LT
LU	70.8	71.2	41.1	44.1	82.5	84.8	40.7	41.3	0.4	2.9	2.3	0.6	LU
HU	71.6	79.4	48.1	48.5	82.2	84.7	50.0	78.0	7.9	0.3	2.5	28.0	HU
MT	70.1	80.8	66.8	66.5	79.3	87.1	44.3	68.0	10.7	-0.3	7.8	23.7	MT
NL	77.1	81.0	68.9	73.1	82.9	84.3	63.5	74.5	3.9	4.2	1.4	11.0	NL
AT	74.8	78.6	66.5	68.7	83.6	86.6	49.2	59.2	3.8	2.2	3.0	10.0	AT
PL	69.6	70.7	48.9	49.4	80.4	81.5	46.4	50.8	1.1	0.5	1.1	4.4	PL
PT	70.7	75.8	42.9	48.7	80.2	84.3	52.0	64.3	5.1	5.8	4.1	12.3	PT
RO	66.3	66.6	36.7	38.1	77.5	77.1	42.6	49.2	0.3	1.4	-0.5	6.6	RO
SI	70.2	74.8	46.9	50.5	83.5	84.8	38.5	58.2	4.6	3.5	1.3	19.7	SI
SK	70.1	75.6	42.8	45.9	80.0	81.9	49.6	71.2	5.6	3.1	1.9	21.7	SK
FI	73.3	77.2	58.5	61.5	79.9	80.5	61.2	74.7	3.9	3.0	0.6	13.5	FI
SE	81.2	82.3	62.4	65.5	85.9	87.6	75.7	74.5	1.0	3.0	1.6	-1.2	SE
UK	77.5	80.0	68.8	66.8	83.0	85.1	63.5	70.8	2.4	-2.0	2.2	7.3	UK
NO	78.6	80.3	63.8	66.3	82.7	85.3	72.5	71.8	1.7	2.5	2.6	-0.7	NO
EA	69.9	75.3	47.9	52.6	77.4	80.9	55.3	69.3	5.4	4.7	3.5	14.0	EA
EU*	71.1	75.8	51.0	54.7	78.8	81.8	55.3	67.9	4.7	3.6	3.1	12.6	EU*
EU27	70.1	75.0	48.0	52.3	78.2	81.2	54.2	67.3	4.9	4.3	3.0	13.1	EU27

Source: Commission services, EPC.

The total employment rate (for individuals aged 20 to 64) in the EU is projected to increase from 71.1% in 2016 to 75.8% in 2070. In the euro area, a similar development is expected, with the employment rate attaining 75.3% in 2070 (see Table I.2.10).

The aftermath of the 2008-09 economic recession has complicated the task of producing comparable employment rate projections (both across countries and projection rounds). Firstly, the methodology used in general, and in particular the capping of unemployment rates, tends to generate stronger declines (rises) in unemployment (employment) rates in those Member States that have undergone the more severe increases in unemployment rates during the crisis. Secondly, in some Member States, employment rate projections are also negatively affected by the downward revision in participation rates, namely for prime-age male workers.

In the EU, the employment rate of women is projected to rise from 65.3% in 2016 to 72.2% in 2070. The employment rate for older workers for both genders is expected to increase by even more, from 55.3% in 2016 to 67.9% in 2070, reflecting the expected impact of recent pension reforms in many Member States aiming at increasing the retirement age.

Mainly as a result of the ageing process, the age structure of the working population is projected to undergo a number of significant changes. The share of older workers (aged 55 to 64) on the employment (aged 20 to 64) at EU level is projected to rise from 16.8% in 2016 to 21.0% in 2030 and then to reverse to 20.4% in the long run (see Table I.2.13). In the euro area, the medium-term increase is even more pronounced, from 17.2 % to 22.4% by 2030, but even for this group of countries the long term prospect envisages a reduction in the employment share of the older

Table I.2.11: **Employment rate projections by age group: Men**

	Total		Young		Prime age		Older		Change 2070-2016				
	20-64		20-24		25-54		55-64		Total	Young	Prime age	Older	
	2016	2070	2016	2070	2016	2070	2016	2070	20-64	20-24	25-54	55-64	
BE	72.4	74.6	41.7	43.2	83.7	82.5	50.9	65.8	2.2	1.4	-1.3	14.9	BE
BG	71.4	72.1	40.3	44.5	79.1	80.2	58.5	62.1	0.7	4.2	1.0	3.7	BG
CZ	84.7	83.4	57.5	56.8	92.7	92.4	68.5	70.6	-1.4	-0.7	-0.3	2.1	CZ
DK	80.9	82.9	63.6	66.9	86.5	87.1	72.4	77.3	2.0	3.3	0.6	4.9	DK
DE	82.8	80.3	64.4	64.5	88.1	85.6	73.9	71.0	-2.5	0.1	-2.5	-2.9	DE
EE	81.0	79.6	63.5	64.8	87.9	87.2	64.3	65.3	-1.4	1.3	-0.7	1.0	EE
IE	76.6	74.6	56.2	60.1	81.8	80.7	65.7	64.3	-2.0	3.9	-1.1	-1.4	IE
EL	65.5	79.5	26.9	42.6	76.1	87.2	46.4	74.5	13.9	15.8	11.1	28.1	EL
ES	69.6	78.8	34.2	48.9	77.4	85.2	55.7	74.7	9.2	14.7	7.9	19.0	ES
FR	73.6	77.8	51.0	55.3	84.2	85.1	51.4	66.5	4.2	4.3	0.9	15.0	FR
HR	66.4	72.6	47.3	57.8	76.4	82.0	45.3	53.2	6.3	10.5	5.6	7.9	HR
IT	71.7	74.6	34.6	40.3	79.3	79.2	61.7	75.3	2.9	5.7	-0.1	13.6	IT
CY	73.3	81.2	44.1	55.4	81.7	85.9	61.6	77.0	7.9	11.4	4.1	15.4	CY
LV	74.6	77.3	54.1	58.9	81.3	85.0	61.3	65.3	2.7	4.9	3.7	4.0	LV
LT	76.3	78.0	56.4	57.9	82.6	85.2	67.0	66.4	1.6	1.5	2.6	-0.6	LT
LU	76.2	74.2	39.8	43.6	88.5	88.5	47.5	43.6	-2.0	3.9	0.0	-3.9	LU
HU	78.6	83.9	53.4	53.9	88.2	89.7	59.8	80.6	5.3	0.5	1.5	20.9	HU
MT	83.5	85.1	69.6	69.7	92.7	91.7	62.3	72.1	1.6	0.1	-1.0	9.9	MT
NL	82.6	83.8	68.6	72.4	88.1	87.3	72.8	78.4	1.2	3.8	-0.8	5.5	NL
AT	78.7	79.5	66.9	68.3	86.6	87.4	57.6	60.7	0.8	1.4	0.8	3.1	AT
PL	76.7	78.1	56.4	57.7	86.2	87.0	55.9	62.4	1.4	1.3	0.8	6.5	PL
PT	74.2	75.9	45.0	50.4	83.0	84.2	58.5	64.3	1.7	5.3	1.2	5.8	PT
RO	75.1	76.9	44.1	45.9	85.5	87.4	52.8	60.9	1.8	1.8	1.9	8.1	RO
SI	73.3	76.8	51.8	55.8	85.6	87.1	43.2	58.2	3.5	4.0	1.5	15.0	SI
SK	77.1	80.7	54.1	58.4	86.4	87.4	55.8	72.1	3.6	4.3	1.0	16.3	SK
FI	75.0	78.5	56.8	59.8	83.0	83.0	59.9	74.2	3.6	3.0	-0.1	14.3	FI
SE	83.1	83.7	62.8	65.5	88.1	88.9	77.6	77.0	0.6	2.7	0.8	-0.6	SE
UK	83.0	82.9	70.0	67.7	89.0	88.9	69.7	72.4	-0.1	-2.3	-0.1	2.7	UK
NO	80.4	81.4	63.4	66.8	84.5	86.4	75.7	73.1	1.0	3.4	1.9	-2.6	NO
EA	75.5	78.3	50.2	54.9	83.2	84.4	61.6	70.9	2.8	4.7	1.2	9.3	EA
EU*	76.9	79.3	53.9	57.3	84.6	85.7	62.0	70.5	2.4	3.4	1.1	8.5	EU*
EU27	76.0	78.6	51.1	55.2	84.0	85.1	61.0	70.1	2.6	4.1	1.1	9.1	EU27

Source: Commission services, EPC.

workers (20.9% in 2070). Greece will almost double the share of the older on working age employment by 2070, while Italy will be the only country with a share higher than 25% at the end of the considered interval (26.8% in 2070 and 28.7 in 2030) ([24]).

The share of the older workers is generally higher for women (20.8% at EU level and 21.6 for euro area in 2070), probably reflecting the need for staying longer in employment to fulfil qualifying conditions for retirement because of later entrance in the labour market and interrupted working careers.

([24]) See Part III - Statistical Annex for employment rates for the age group 15-74.

Table I.2.12: **Employment projections by age group: Women**

	Total		Young		Prime age		Older		Change 2070-2016				
	20-64		20-24		25-54		55-64		Total	Young	Prime age	Older	
	2016	2070	2016	2070	2016	2070	2016	2070	20-64	20-24	25-54	55-64	
BE	63.2	68.1	37.9	39.1	74.3	75.7	40.2	59.0	4.9	1.2	1.3	18.8	BE
BG	64.1	63.2	28.1	29.5	73.0	71.3	51.1	56.4	-0.8	1.4	-1.7	5.4	BG
CZ	68.7	69.6	39.0	39.3	78.4	78.4	49.5	59.1	0.9	0.3	0.1	9.7	CZ
DK	74.1	76.9	67.2	70.9	78.5	79.3	64.2	72.4	2.7	3.7	0.8	8.3	DK
DE	74.4	77.3	63.0	63.6	79.7	81.5	63.6	70.8	2.9	0.6	1.8	7.3	DE
EE	72.9	71.7	54.5	57.9	77.4	76.5	66.9	64.7	-1.3	3.3	-0.9	-2.3	EE
IE	64.2	67.9	55.1	57.6	69.0	72.2	48.8	60.9	3.7	2.5	3.2	12.1	IE
EL	46.8	68.8	21.3	36.5	55.9	74.8	27.5	66.7	22.0	15.2	18.9	39.2	EL
ES	58.1	76.4	30.4	44.0	65.6	81.1	42.8	78.5	18.2	13.6	15.5	35.7	ES
FR	66.2	71.8	45.4	49.4	75.3	78.5	48.0	62.3	5.6	4.0	3.2	14.3	FR
HR	56.8	67.1	38.7	48.7	68.5	76.0	32.0	50.8	10.4	10.0	7.5	18.7	HR
IT	51.6	59.6	24.9	29.6	58.5	61.5	39.7	65.5	8.0	4.7	3.0	25.7	IT
CY	63.6	76.0	43.1	54.7	72.0	81.2	43.2	68.6	12.4	11.6	9.2	25.3	CY
LV	71.9	77.8	53.0	53.6	78.1	85.0	61.6	69.5	5.9	0.6	6.9	7.9	LV
LT	74.3	78.7	47.2	48.3	82.8	86.3	62.8	70.2	4.4	1.1	3.5	7.4	LT
LU	65.1	68.2	42.5	44.5	76.3	81.1	33.5	39.0	3.0	2.0	4.8	5.5	LU
HU	64.6	74.8	42.5	42.7	76.1	79.6	41.6	75.3	10.2	0.2	3.4	33.7	HU
MT	56.1	76.2	63.7	63.2	65.1	82.2	26.4	63.7	20.2	-0.5	17.2	37.3	MT
NL	71.6	78.1	69.2	73.9	77.8	81.2	54.2	70.5	6.5	4.7	3.4	16.3	NL
AT	70.9	77.7	66.1	69.1	80.6	85.8	41.1	57.8	6.8	3.0	5.2	16.6	AT
PL	62.5	63.1	41.0	40.9	74.4	75.8	37.9	39.0	0.6	-0.1	1.3	1.2	PL
PT	67.4	75.7	40.7	46.9	77.5	84.4	46.2	64.4	8.3	6.2	6.8	18.2	PT
RO	57.4	56.2	28.8	30.4	69.2	66.7	33.5	37.3	-1.2	1.6	-2.4	3.9	RO
SI	66.8	72.7	41.8	44.9	81.2	82.5	33.8	58.2	5.9	3.1	1.3	24.4	SI
SK	63.0	70.4	31.0	32.9	73.5	76.3	43.9	70.4	7.4	1.9	2.8	26.5	SK
FI	71.5	75.8	60.2	63.2	76.7	78.0	62.5	75.3	4.3	3.0	1.3	12.8	FI
SE	79.3	80.8	62.0	65.4	83.7	86.2	73.8	72.0	1.5	3.4	2.5	-1.7	SE
UK	72.1	76.9	67.5	65.9	77.1	81.3	57.6	69.3	4.8	-1.6	4.3	11.8	UK
NO	76.6	79.2	64.2	65.7	80.8	84.2	69.2	70.5	2.6	1.5	3.4	1.3	NO
EA	64.3	72.3	45.6	50.3	71.6	77.3	49.3	67.7	8.0	4.6	5.7	18.3	EA
EU*	65.3	72.2	48.1	51.9	72.9	77.8	48.9	65.2	6.9	3.8	4.9	16.3	EU*
EU27	64.3	71.3	44.7	49.1	72.3	77.1	47.8	64.5	7.0	4.5	4.8	16.7	EU27

Source: Commission services, EPC.

Table I.2.13: **Share of older workers aged 55 to 64 as a percentage of employed aged 20 to 64**

	Total			Men			Women			
	2016	2030	2070	2016	2030	2070	2016	2030	2070	
BE	14.5	19.2	19.4	15.0	19.6	19.3	14.0	18.7	19.4	BE
BG	18.3	22.3	21.6	17.5	21.5	21.0	19.1	23.2	22.5	BG
CZ	16.0	20.2	20.1	16.2	20.3	19.9	15.6	20.1	20.4	CZ
DK	18.5	20.5	20.9	18.6	20.1	20.5	18.4	20.9	21.3	DK
DE	19.9	21.8	20.3	19.9	21.5	19.8	19.9	22.1	20.9	DE
EE	18.7	19.8	20.6	15.9	18.1	19.6	21.8	21.8	21.8	EE
IE	15.0	19.9	20.4	15.9	19.9	19.9	14.0	19.9	21.0	IE
EL	13.9	23.4	24.4	14.6	22.6	23.2	13.0	24.4	25.9	EL
ES	15.4	26.6	21.3	15.7	26.3	20.2	15.1	26.9	22.5	ES
FR	15.7	18.8	18.4	15.1	18.4	17.9	16.3	19.2	18.9	FR
HR	14.8	15.4	18.3	15.7	14.8	17.9	13.8	16.2	18.8	HR
IT	17.7	28.7	26.8	18.1	27.3	25.5	17.1	30.4	28.4	IT
CY	14.1	15.7	23.0	15.8	16.4	22.9	12.2	14.9	23.2	CY
LV	19.0	21.9	20.3	16.9	19.6	19.8	21.1	24.0	20.8	LV
LT	19.4	22.9	19.6	18.1	20.7	19.3	20.5	24.9	19.9	LT
LU	10.6	12.0	12.8	11.5	12.7	12.8	9.5	11.2	12.8	LU
HU	15.7	23.3	22.2	15.8	22.0	21.4	15.4	24.7	23.0	HU
MT	14.1	15.1	18.3	16.2	16.4	18.5	10.8	13.4	18.0	MT
NL	18.3	19.8	19.9	19.5	20.5	19.9	16.9	19.0	19.8	NL
AT	13.5	15.6	17.1	14.7	17.1	17.1	12.1	14.0	17.1	AT
PL	15.2	15.2	17.7	15.7	16.3	19.5	14.4	13.8	15.4	PL
PT	16.2	22.3	22.1	17.0	22.0	21.7	15.5	22.6	22.5	PT
RO	14.0	19.8	16.9	14.4	20.4	18.2	13.5	19.0	15.1	RO
SI	12.6	19.2	18.5	13.3	18.6	18.0	11.9	19.9	19.0	SI
SK	14.8	17.7	22.6	14.4	16.6	21.2	15.3	19.0	24.3	SK
FI	19.5	18.2	22.7	18.1	17.3	21.8	21.0	19.0	23.6	FI
SE	18.7	19.1	19.4	18.5	19.4	19.6	18.9	18.9	19.3	SE
UK	16.2	18.0	19.7	16.4	17.5	19.2	15.9	18.4	20.3	UK
NO	18.1	19.2	19.9	18.3	19.4	19.9	18.0	19.0	19.9	NO
EA	17.2	22.4	20.9	17.3	22.1	20.3	17.1	22.8	21.6	EA
EU*	16.8	21.0	20.4	16.9	20.7	20.0	16.6	21.2	20.8	EU*
EU27	16.9	21.5	20.5	17.0	21.3	20.2	16.7	21.7	20.9	EU27

Source: Commission services, EPC.

2.7. ECONOMIC DEPENDENCY RATIOS

The economic old age dependency ratio (the ratio between the inactive elderly (65+) and number of employed) is projected to rise significantly from 43.1% in 2016 to 68.5% in 2070 in the EU (employed aged 20 - 64).

Similarly, the ratio between the inactive population and the employment (economic dependency ratio) is going to be largely affected by the ageing processes: steadily increasing from 121.1% to 143.3% at EU level during the projection horizon. Large variability across countries is projected.

An important indicator to assess the impact of ageing on budgetary expenditure, particularly on its pension component, is the economic old age dependency ratio. This indicator is calculated as the ratio between the inactive elderly (65+) and total employment (either 20 - 64 or 20 - 74). The economic old age dependency ratio is projected to rise significantly from 43.1% in 2016 to 68.5% in 2070 in the EU (employed aged 20 - 64). In the euro area, a similar deterioration is projected from 46.1% in 2016 to 69.2% in 2070 (see Table I.2.14).

Across EU Member States, the economic old age dependency ratio is projected to range from a minimum of 54.5% in Sweden to a maximum of 92.5% in Poland in 2070. This ratio is expected to be above or equal to 80% (less than 5 persons employed for 4 inactive persons aged more than 65) in seven EU Member States, namely Bulgaria, Greece, Croatia, Italy, Poland, Portugal and Romania by 2070.

Table I.2.14: **Economic old age dependency ratio**

	Inactive population aged 65 and more over employment (20-64)					Inactive population aged 65 and more over employment (20-74)					
	2016	2030	2070	Change 2016-2030	Change 2030-2070	2016	2030	2070	Change 2016-2030	Change 2030-2070	
BE	45.0	53.1	66.7	8.0	13.6	44.7	51.6	64.6	6.9	13.1	BE
BG	47.7	60.2	86.7	12.5	26.5	46.7	57.8	82.9	11.1	25.1	BG
CZ	36.9	49.2	68.7	12.3	19.5	36.1	48.2	66.7	12.1	18.6	CZ
DK	38.4	44.0	59.4	5.5	15.5	37.1	41.8	54.2	4.6	12.4	DK
DE	41.8	55.0	72.6	13.2	17.6	40.8	52.3	69.1	11.5	16.8	DE
EE	36.0	49.7	71.7	13.7	22.0	34.1	47.3	68.3	13.2	21.0	EE
IE	29.8	40.9	58.8	11.2	17.9	28.9	38.9	55.7	10.0	16.8	IE
EL	62.6	67.8	81.3	5.2	13.5	61.6	65.7	73.4	4.1	7.7	EL
ES	47.4	56.4	60.9	9.0	4.6	47.0	53.4	57.8	6.4	4.4	ES
FR	47.0	58.3	62.3	11.4	4.0	46.4	56.9	60.0	10.5	3.1	FR
HR	50.7	64.3	82.6	13.7	18.3	50.0	62.6	78.7	12.6	16.0	HR
IT	58.3	66.7	85.8	8.4	19.1	57.2	62.5	77.1	5.3	14.6	IT
CY	33.1	40.2	74.6	7.0	34.4	32.4	39.0	68.6	6.6	29.6	CY
LV	41.0	58.2	72.5	17.2	14.3	39.5	54.7	69.1	15.2	14.4	LV
LT	39.0	63.8	72.7	24.8	9.0	37.9	61.8	71.1	23.9	9.3	LT
LU	31.4	39.6	74.0	8.2	34.4	31.3	39.2	73.1	7.9	33.9	LU
HU	40.6	45.9	69.2	5.3	23.2	40.2	44.9	67.1	4.7	22.2	HU
MT	43.7	54.7	74.7	11.0	20.0	43.1	54.2	73.7	11.1	19.5	MT
NL	37.6	47.7	56.7	10.1	9.0	36.7	45.1	52.1	8.4	7.0	NL
AT	38.3	47.2	70.6	8.9	23.4	37.7	45.4	67.1	7.7	21.7	AT
PL	35.1	52.9	92.5	17.8	39.6	34.5	51.0	88.9	16.5	37.8	PL
PT	45.3	55.5	84.1	10.3	28.5	43.5	51.3	75.2	7.8	23.8	PT
RO	39.6	52.9	82.6	13.3	29.7	38.2	50.8	78.5	12.6	27.8	RO
SI	41.8	58.5	71.9	16.7	13.5	41.3	57.3	70.5	16.0	13.2	SI
SK	31.6	48.1	74.3	16.6	26.2	31.3	47.5	68.6	16.1	21.2	SK
FI	46.1	59.1	66.0	13.0	7.0	44.7	57.2	61.2	12.4	4.0	FI
SE	38.6	43.2	54.5	4.6	11.3	37.2	41.6	52.5	4.4	10.9	SE
UK	35.8	44.5	57.8	8.6	13.4	34.6	42.8	54.8	8.2	12.0	UK
NO	31.5	39.6	59.7	8.1	20.1	30.4	38.0	56.9	7.6	18.9	NO
EA	46.1	57.1	69.2	11.0	12.2	45.3	54.5	65.2	9.2	10.7	EA
EU*	43.1	54.0	68.5	10.9	14.5	42.2	51.7	64.8	9.6	13.0	EU*
EU27	44.2	55.6	70.7	11.4	15.1	43.4	53.2	66.8	9.8	13.5	EU27

Source: Commission services, EPC.

Another relevant indicator is the total economic dependency ratio, calculated as the ratio between the total inactive population and employment. It gives a measure of the average number of individuals that each employed 'supports', being relevant when considering prospects for potential GDP per capita growth. It is expected to constantly grow over the projection period, from 121.1% in 2016 in the EU up above 143.3% by 2070. A similar evolution is projected in the euro area. The projected development of this indicator reflects the strong impact of the changes in life expectancy and fertility rates after the middle of the next decade in most EU Member States. However, there are large cross-country differences. In Luxemburg and Poland it is projected to increase by almost 40 pps. or more between 2016 and 2070, while in others (France and Finland) it is projected to remain rather stable (see Table I.2.15).

Table I.2.15: **Total economic dependency ratio**

	Total inactive population over employment (20-64)					Total inactive population over employment (20-74)					
	2016	2030	2070	Change 2016-2030	Change 2030-2070	2016	2030	2070	Change 2016-2030	Change 2030-2070	
BE	139.6	140.1	154.1	0.5	14.1	138.4	136.1	149.5	-2.4	13.4	BE
BG	131.0	147.4	182.4	16.4	35.0	128.3	141.6	174.6	13.3	33.0	BG
CZ	104.2	119.6	144.9	15.4	25.2	101.9	117.2	140.8	15.3	23.6	CZ
DK	103.9	106.9	123.2	3.0	16.3	100.4	101.6	112.3	1.2	10.7	DK
DE	99.7	117.7	138.3	18.0	20.7	97.3	112.0	131.6	14.6	19.6	DE
EE	102.3	119.9	145.6	17.5	25.7	97.0	114.2	138.7	17.2	24.5	EE
IE	130.5	136.8	150.6	6.3	13.8	126.8	129.9	142.7	3.1	12.7	IE
EL	168.0	143.5	152.1	-24.6	8.6	165.2	138.9	137.3	-26.4	-1.5	EL
ES	129.4	125.2	134.4	-4.2	9.2	128.3	118.7	127.5	-9.6	8.8	ES
FR	139.5	145.1	144.7	5.6	-0.4	137.8	141.4	139.2	3.6	-2.3	FR
HR	150.8	153.2	165.5	2.4	12.4	148.8	149.1	157.6	0.3	8.5	HR
IT	156.8	151.3	175.6	-5.5	24.3	153.7	141.7	157.7	-12.0	16.0	IT
CY	114.0	101.6	132.3	-12.4	30.7	111.5	98.8	121.7	-12.7	22.9	CY
LV	110.5	135.2	146.9	24.7	11.7	106.6	127.2	140.1	20.6	12.9	LV
LT	106.6	136.6	142.1	30.0	5.5	103.6	132.3	138.9	28.7	6.5	LT
LU	113.8	121.2	161.4	7.3	40.2	113.4	120.0	159.4	6.5	39.4	LU
HU	118.4	108.9	138.9	-9.4	30.0	117.2	106.6	134.8	-10.6	28.2	HU
MT	124.9	118.9	138.9	-5.9	20.0	123.0	117.8	136.9	-5.2	19.2	MT
NL	102.4	110.6	118.1	8.2	7.5	100.0	104.6	108.5	4.6	3.9	NL
AT	103.4	112.8	134.9	9.4	22.1	101.8	108.6	128.2	6.8	19.6	AT
PL	117.0	131.8	178.8	14.8	47.0	115.1	127.2	171.8	12.1	44.6	PL
PT	118.9	116.1	149.9	-2.8	33.8	114.3	107.3	134.0	-7.0	26.7	PT
RO	133.6	148.2	187.2	14.6	39.0	129.1	142.3	178.0	13.2	35.7	RO
SI	119.3	131.0	150.2	11.7	19.2	118.0	128.3	147.3	10.3	19.0	SI
SK	108.4	121.5	148.1	13.1	26.6	107.5	119.8	136.8	12.3	17.0	SK
FI	120.7	132.5	134.2	11.8	1.7	117.2	128.3	124.4	11.1	-4.0	FI
SE	100.0	107.6	120.2	7.6	12.6	96.4	103.7	115.8	7.4	12.1	SE
UK	107.0	113.3	123.5	6.3	10.2	103.3	109.1	117.1	5.8	8.0	UK
NO	100.5	105.9	126.4	5.4	20.5	96.8	101.5	120.4	4.7	18.9	NO
EA	125.0	131.0	144.6	6.0	13.6	122.7	125.1	136.1	2.4	11.1	EA
EU*	121.1	127.8	143.3	6.7	15.5	118.5	122.4	135.4	4.0	13.0	EU*
EU27	123.3	130.3	147.3	7.0	17.0	120.9	124.7	139.1	3.8	14.4	EU27

Source: Commission services, EPC.

2.8. PROJECTION OF TOTAL HOURS WORKED

Over the entire projection period (i.e. 2016 to 2070), total hours worked are expected to fall by 4.8% in the EU. For the euro area, the projected decline is less marked (2.6% between 2016 and 2070) ([25]).

Total hours worked are projected to increase by 1.2% in the period 2016 to 2030 in the EU (see Table I.2.16) ([26]). However, from 2030 onwards, this upward trend is expected to be reversed and total hours worked are projected to decline by 5.9% between 2030 and 2070. Over the entire projection period (i.e. 2016 to 2070), total hours worked are expected to fall by 4.8% in the EU. For the euro area, the projected decline is less marked (2.6% between 2016 and 2070). These trends in hours worked largely reflect employment trends (see Section 2.6 of this Chapter). In addition, given women's relatively high take-up rates of part-time work, their rising participation rates are expected – through composition effects – to slightly increase the total share of part time in total hours worked

([25]) The projection of weekly hours in Table I.2.16 is calculated using the CSM described in this chapter, which is different from the projection of hours worked in Chapter 3. For the purpose of calculating potential GDP, the estimated potential hours worked using the production function approach were used (see Chapter 3 and Annex 3). Specifically, for the potential GDP projections until 2026, the growth rates of hours worked was estimated using the production function approach are used and thereafter the growth rates estimated with the CSM are used (see Table I.3.2 in Chapter 3). Due to the different data sources and projection models, there may be some differences between the two projections.

([26]) The total number of hours worked is the product between employment and hours worked per person. Regarding hours worked, the following assumptions are made: i) total amount of hours worked per person (in the base year 2016) are kept constant by gender and type of work (part-time versus full time); and ii) the part-time share of total work by gender and age groups (15-24, 25-54 and 55-74) are kept constant over the entire projection period.

Table I.2.16: **Projection of total weekly hours worked (thousands), and their breakdown in full- and part-time work, 2016 - 70 (15 - 74)**

	Total	Full-time	Part-time	Hours per employee	Total	Full-time	Part-time	Total	Full-time	Part-time	Total % change		
	2016				2030			2070			2016-30	2030-70	2016-70
BE	169 770	84.6%	15.4%	34.0	184 945	83.8%	16.2%	198 594	83.9%	16.1%	8.9	7.4	17.0
BG	121 107	98.9%	1.1%	37.1	103 179	98.9%	1.1%	69 362	98.9%	1.1%	-14.8	-32.8	-42.7
CZ	200 849	97.1%	2.9%	37.5	188 911	97.0%	3.0%	159 250	97.0%	3.0%	-5.9	-15.7	-20.7
DK	97 285	86.9%	13.1%	32.0	107 647	87.2%	12.8%	111 046	87.2%	12.8%	10.7	3.2	14.1
DE	1 462 352	85.5%	14.5%	33.9	1 391 901	85.2%	14.8%	1 198 303	85.1%	14.9%	-4.8	-13.9	-18.1
EE	24 386	94.9%	5.1%	35.2	22 137	94.8%	5.2%	18 027	94.8%	5.2%	-9.2	-18.6	-26.1
IE	70 951	87.9%	12.1%	32.5	77 145	86.9%	13.1%	85 760	87.0%	13.0%	8.7	11.2	20.9
EL	147 803	95.2%	4.8%	31.0	159 827	95.0%	5.0%	126 735	95.1%	4.9%	8.1	-20.7	-14.3
ES	684 438	92.2%	7.8%	29.9	746 666	91.9%	8.1%	784 601	91.6%	8.4%	9.1	5.1	14.6
FR	965 830	88.7%	11.3%	32.1	1 014 153	88.5%	11.5%	1 121 475	88.7%	11.3%	5.0	10.6	16.1
HR	61 061	97.1%	2.9%	33.4	58 098	97.1%	2.9%	49 238	97.0%	3.0%	-4.9	-15.3	-19.4
IT	827 777	89.4%	10.6%	32.1	874 691	89.6%	10.4%	752 683	89.7%	10.3%	5.7	-13.9	-9.1
CY	14 129	93.3%	6.7%	32.5	16 935	93.3%	6.7%	16 870	93.1%	6.9%	19.9	-0.4	19.4
LV	34 589	95.8%	4.2%	34.5	28 004	95.7%	4.3%	20 687	95.8%	4.2%	-19.0	-26.1	-40.2
LT	51 776	95.8%	4.2%	35.2	38 087	95.7%	4.3%	26 685	95.8%	4.2%	-26.4	-29.9	-48.5
LU	10 019	89.1%	10.9%	35.3	12 717	88.6%	11.4%	14 752	88.3%	11.7%	26.9	16.0	47.2
HU	170 215	96.9%	3.1%	36.5	175 373	96.6%	3.4%	142 405	96.6%	3.4%	3.0	-18.8	-16.3
MT	7 274	91.9%	8.1%	35.8	8 194	91.3%	8.7%	7 998	90.8%	9.2%	12.6	-2.4	9.9
NL	267 203	66.7%	33.3%	29.5	283 917	66.2%	33.8%	295 900	66.1%	33.9%	6.3	4.2	10.7
AT	149 517	84.2%	15.8%	33.0	162 060	84.2%	15.8%	155 583	83.8%	16.2%	8.4	-4.0	4.1
PL	682 546	96.5%	3.5%	37.3	635 364	96.5%	3.5%	443 398	96.4%	3.6%	-6.9	-30.2	-35.0
PT	177 553	96.0%	4.0%	34.6	176 789	95.5%	4.5%	128 098	95.5%	4.5%	-0.4	-27.5	-27.9
RO	326 207	94.7%	5.3%	36.5	281 732	94.3%	5.7%	206 054	94.4%	5.6%	-13.6	-26.9	-36.8
SI	35 676	95.0%	5.0%	35.9	34 653	94.5%	5.5%	30 101	94.4%	5.6%	-2.9	-13.1	-15.6
SK	96 967	97.3%	2.7%	35.1	92 516	97.2%	2.8%	77 761	97.1%	2.9%	-4.6	-15.9	-19.8
FI	87 825	92.4%	7.6%	32.6	87 749	92.3%	7.7%	87 893	92.3%	7.7%	-0.1	0.2	0.1
SE	173 808	83.8%	16.2%	32.9	192 794	83.7%	16.3%	224 375	83.6%	16.4%	10.9	16.4	29.1
UK	1 141 866	86.4%	13.6%	33.9	1 204 371	86.2%	13.8%	1 309 848	86.1%	13.9%	5.5	8.8	14.7
NO	88 906	84.5%	15.5%	32.0	98 653	84.5%	15.5%	107 456	84.4%	15.6%	11.0	8.9	20.9
EA	5 285 835	87.9%	12.1%	32.4	5 413 087	87.6%	12.4%	5 148 506	87.4%	12.6%	2.4	-4.9	-2.6
EU*	8 260 779	89.2%	10.8%	33.4	8 360 554	88.8%	11.2%	7 863 482	88.3%	11.7%	1.2	-5.9	-4.8
EU27	7 118 912	89.6%	10.4%	33.3	7 156 183	89.3%	10.7%	6 553 634	88.8%	11.2%	0.5	-8.4	-7.9

Source: Commission services, EPC.

from 10.8% in 2016 to 11.7% in 2070 in the EU ([27]).

There are major differences across Member States, reflecting different demographic outlooks. A reduction in total hours worked of 40% or more between 2016 and 2070 is projected for Bulgaria, Latvia and Lithuania. In contrast, for some Member States an increase of 20% or more is projected over the same period, namely for Ireland, Luxemburg, Sweden and Norway.

([27]) Part-time work varies considerably across the EU, accounting for about 1% of total hours worked in Bulgaria to over 30% in the Netherlands.

2.9. COMPARING THE 2018 AND 2015 LABOUR MARKET PROJECTIONS

Improved outturn data for employment and employment rates, compared to the 2015 AR, provide evidence of recovering from the crisis. On average (EU level) the current employment rates for the base year are 1.1 pps. higher than those projected three years ago. By 2060 an improvement in the employment rate of 0.8 pp. is also envisaged.

This section provides a summary comparison of main labour market outcomes between the current 2018 projection exercise and the previous one of 2015. The recovering from the 2008-09 economic recession is clearly visible in the upward revision of the values for labour force, employment and employment rates in 2016 (see Tables I.2.17 to I.2.19)

In the EU, employment rates were revised upwards by 1.1 pps. for the age group 20-64 for 2016, and 0.8 pp. for 2060. A larger revision of the employment rates in the base year is envisaged for the older (+ 1.6 pp. at EU level) (see Table I.2.18). When considering the euro area countries, the improvement by 2060 is even larger (+1.7 pp.).

Using a simple identity ([28]), Table I.2.19 provides a breakdown of changes in employment projections (between rounds 2018 and 2015). Although the situation varies considerably across Member States, EU average employment levels were revised upward for 2060 by 0.4% between the two exercises. This revision results from an increase in the participation rates (+ 0.9%) and the unemployment rate (+0.1) that offset the negative effect related to population (-0.6%) ([29]).

Table I.2.17: **Labour force projections revisions (thousands), 2016-60, 2018 AR-2015 AR**

	Labour Force (20-64)		Employment (20-64)	
	2016	2060	2016	2060
BE	-42.2	-712.0	-129.1	-691.9
BG	-110.8	-206.4	97.5	-178.9
CZ	39.5	-550.2	202.2	-444.1
DK	79.5	82.7	47.1	88.6
DE	739.2	4012.8	1092.3	4023.5
EE	6.0	45.0	20.1	39.9
IE	34.4	205.9	103.6	200.0
EL	-184.1	-249.2	-163.6	-245.7
ES	-229.6	359.0	528.7	250.9
FR	91.1	233.0	9.9	81.4
HR	-1.9	41.2	65.2	154.3
IT	408.9	-3442.0	160.3	-3293.0
CY	-22.3	-54.2	-6.9	-51.3
LV	-17.4	-29.2	10.2	-30.2
LT	16.8	-8.0	91.8	-10.5
LU	15.2	-85.4	0.6	-84.3
HU	192.8	119.2	266.8	205.6
MT	11.0	27.0	11.5	27.5
NL	24.8	1112.8	107.2	1031.5
AT	116.9	266.7	-2.5	213.1
PL	-213.4	-580.8	435.5	-338.9
PT	-17.0	178.2	180.4	149.9
RO	-3.9	-517.4	152.9	-443.9
SI	-6.0	-33.8	9.7	-28.0
SK	32.8	320.2	133.6	289.6
FI	-1.4	-204.5	-28.1	-209.3
SE	109.0	-35.3	41.0	-21.9
UK	661.2	408.7	686.8	347.9
NO	37.5	-660.3	-51.5	-635.3
EA	977.2	1942.5	2129.6	1663.0
EU*	1729.1	704.1	4124.6	1031.8
EU27	1068.0	295.4	3437.8	683.9

Source: Commission services, EPC.

This breakdown illustrates once again the close link between employment/labour force and population variables. In fact, there is a high cross-country correlation between revisions in employment and population projections (see Graph I.2.10). Given the important role played by participation rate projections, Table I.2.20 focus on the extent of their revisions by age groups between the 2018 and 2015 exercises. Using the year 2060 for comparison, in the EU participation rates are almost unchanged for young people (20-24), moderately increased for prime age workers (25-54), and older workers (55-64 and 65-74). The stability of the participation rate for young workers can largely be attributed to base year effects.

([28]) The labour force identity: $L \equiv E + U$ can be written as: $E \equiv P * PR * [1 - UR]$
where L is the labour force; E is employment; U is unemployment; P is population; PR is the participation rate; and UR the unemployment rate.
Taking the logarithm of the above expression, revisions in employment level projections can be approximately as:
$$\log(\frac{E_1}{E_0}) \approx \log(\frac{P_1}{P_0}) + \log(\frac{PR_1}{PR_0}) - (UR_1 - UR_0)$$
where indices 0 and 1 refer to two distinct projection exercises.

([29]) Note the small errors/discrepancy involved in this approximation.

Table I.2.18: **Labour force projections revisions: 2018 AR - 2015 AR (2016 - 60)**

	Employment rate						Participation rate						Unemployment rate		
	(15-64)		(20-64)		(55-64)		(15-64)		(20-64)		(55-64)		(15-64)		
	2016	2060	2016	2060	2016	2060	2016	2060	2016	2060	2016	2060	2016	2060	
BE	-0.9	1.0	-1.0	0.9	-1.2	8.9	-1.2	1.5	-1.3	1.5	-1.0	9.9	-0.3	0.5	BE
BG	2.3	-1.7	2.4	-1.7	4.6	2.7	-1.2	-2.4	-1.2	-2.4	2.1	2.4	-4.9	-0.8	BG
CZ	3.0	0.2	3.1	0.1	7.2	-9.3	1.2	-1.2	1.2	-1.4	6.6	-10.4	-2.5	-1.9	CZ
DK	1.0	0.9	0.5	0.2	2.0	-0.5	1.1	0.7	0.5	-0.1	1.7	-1.0	0.0	-0.3	DK
DE	0.1	-1.3	0.2	-1.4	1.9	-1.4	-0.4	-1.8	-0.4	-2.0	1.1	-2.6	-0.7	-0.6	DE
EE	1.8	-0.8	1.7	-1.6	2.8	-5.7	1.4	-0.5	1.2	-1.4	4.7	-3.4	-0.7	0.4	EE
IE	2.7	2.2	2.6	2.3	2.5	1.4	1.2	2.1	1.1	2.2	1.5	1.2	-2.3	-0.3	IE
EL	-1.4	-1.3	-1.4	-1.4	-6.5	-4.0	-1.9	-1.1	-1.8	-1.1	-5.0	-2.6	-0.1	0.4	EL
ES	1.5	-2.3	1.7	-1.3	-0.7	-0.8	-1.2	-2.1	-1.1	-1.0	-1.1	-0.1	-3.3	0.4	ES
FR	-0.1	0.3	0.0	0.5	2.8	4.6	0.1	0.7	0.2	0.9	3.1	5.2	0.2	0.4	FR
HR	3.6	4.7	3.4	11.0	-0.9	2.7	1.6	5.4	1.4	5.3	-1.1	3.3	-3.5	0.4	HR
IT	0.9	1.8	0.9	1.7	2.8	3.2	0.8	2.3	0.9	2.2	3.1	3.6	-0.2	0.4	IT
CY	1.2	0.0	1.3	-1.9	-2.3	-4.1	-2.8	0.0	-2.8	-2.0	-4.2	-3.8	-4.9	0.0	CY
LV	1.1	1.3	1.0	1.3	3.4	-1.0	0.7	1.7	0.6	1.9	3.6	-0.5	-0.7	0.4	LV
LT	4.1	5.4	4.1	4.5	9.6	4.0	2.8	6.2	2.8	5.3	9.1	5.0	-2.0	0.4	LT
LU	-0.4	-1.4	-0.7	-2.2	-0.6	-4.0	0.1	-0.9	-0.3	-1.8	-0.7	-4.5	0.8	0.7	LU
HU	4.5	5.2	4.6	5.6	1.6	4.3	2.0	3.6	2.0	3.8	0.5	3.7	-3.8	-2.5	HU
MT	3.0	4.6	3.0	4.7	7.1	5.9	1.6	4.0	1.6	4.1	6.1	3.8	-2.3	-1.1	MT
NL	0.4	-1.1	0.5	-1.2	2.1	-1.2	-0.4	-0.7	-0.4	-0.9	2.7	0.2	-1.0	0.6	NL
AT	-1.6	-0.4	-1.4	-0.2	0.4	0.4	-0.5	0.4	-0.2	0.7	1.4	1.1	1.5	1.0	AT
PL	2.7	0.8	2.9	0.9	3.0	-10.6	0.8	-0.4	0.8	-0.4	2.0	-11.9	-2.9	-1.6	PL
PT	2.6	0.8	2.9	1.1	1.2	0.3	0.4	1.3	0.7	1.6	0.8	1.2	-3.1	0.4	PT
RO	1.7	3.2	1.7	3.5	-1.1	2.6	1.1	2.9	1.1	3.2	-1.3	2.6	-1.0	-0.7	RO
SI	0.9	0.0	1.1	0.2	-1.4	-3.6	-0.4	-0.3	-0.3	-0.2	-1.7	-3.3	-1.8	-0.5	SI
SK	3.7	3.0	3.9	3.9	3.9	2.5	1.6	3.5	1.7	4.6	4.0	4.1	-3.1	0.4	SK
FI	-0.6	1.7	-0.7	1.7	0.5	10.2	0.1	2.4	0.1	2.4	1.2	11.3	1.0	0.7	FI
SE	0.0	-0.7	0.0	-0.8	1.3	-1.5	0.1	-0.9	0.2	-1.0	2.1	-1.2	0.2	-0.2	SE
UK	1.1	0.5	1.1	0.4	0.8	-0.1	0.0	0.7	0.2	0.5	0.7	0.6	-1.3	0.1	UK
NO	-1.3	-0.2	-1.1	-0.2	2.6	1.8	-0.5	-0.4	-0.3	-0.4	3.1	1.9	1.1	-0.2	NO
EA	0.6	0.5	0.7	0.5	1.5	1.7	-0.1	0.6	-0.7	0.3	1.4	2.0	-0.9	0.1	EA
EU*	1.0	0.7	1.1	0.8	1.6	0.6	0.1	0.7	0.2	0.7	1.4	0.8	-1.3	-0.1	EU*
EU27	1.0	0.7	1.1	0.8	1.7	0.7	0.1	0.7	0.2	0.7	1.5	0.8	-1.2	-0.2	EU27

Source: Commission services, EPC.

Hence the starting point of the two projection exercise is very similar on average ([30]).

Since the 2009 Ageing Report, many EU Member States have legislated additional pension reforms (see Box I.2.2), which are projected to raise further the participation rate of older workers.

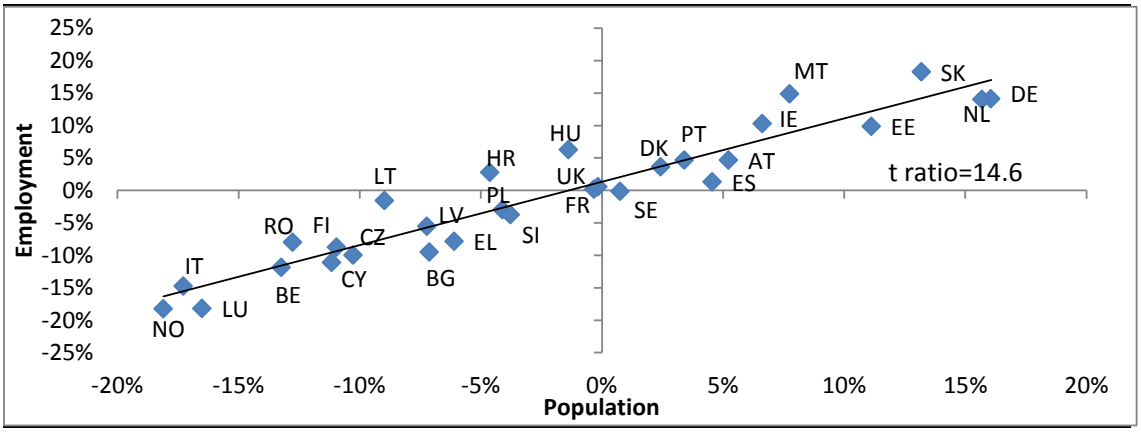
([30]) And possibly also the further lengthening of attending school.

Table I.2.19: **Breakdown of revisions in employment projections for 2060 (2018 AR - 2015 AR) (%)**

	Employment	Population	Participation rate	Unemployment rate	Discrepancy
	(15-64) (1)»(2)+(3)-(4)	(15-64) (2)	(15-64) (3)	(15-64) (4)	
BE	-12.6	-14.2	2.1	-0.5	0.0
BG	-10.0	-7.4	-3.5	0.8	0.1
CZ	-10.5	-10.8	-1.7	1.9	0.1
DK	3.6	2.4	0.9	0.3	0.0
DE	13.2	14.9	-2.3	0.6	0.0
EE	9.4	10.6	-0.7	-0.4	0.0
IE	9.8	6.4	3.0	0.3	0.0
EL	-8.2	-6.3	-1.4	-0.4	0.0
ES	1.3	4.5	-2.7	-0.4	0.0
FR	0.2	-0.3	1.0	-0.4	0.0
HR	2.7	-4.7	7.9	-0.4	0.0
IT	-16.0	-19.0	3.5	-0.4	0.0
CY	-11.8	-11.8	0.0	0.0	0.0
LV	-5.7	-7.5	2.3	-0.4	0.0
LT	-1.6	-9.4	8.3	-0.4	0.0
LU	-20.1	-18.0	-1.3	-0.7	0.0
HU	6.1	-1.4	4.8	2.5	0.2
MT	13.9	7.5	5.2	1.1	0.1
NL	13.1	14.6	-0.8	-0.6	0.0
AT	4.6	5.1	0.5	-1.0	0.0
PL	-3.0	-4.2	-0.6	1.6	0.1
PT	4.6	3.4	1.7	-0.4	0.0
RO	-8.3	-13.7	4.6	0.7	0.0
SI	-3.8	-3.8	-0.5	0.5	0.0
SK	16.8	12.4	4.8	-0.4	0.0
FI	-9.2	-11.6	3.2	-0.7	-0.1
SE	-0.1	0.8	-1.1	0.2	0.0
UK	0.6	-0.2	0.9	-0.1	0.0
NO	-20.2	-20.0	-0.4	0.2	0.0
EA	1.3	0.6	0.8	-0.1	0.0
EU*	0.4	-0.6	0.9	0.1	0.0
EU27	0.4	-0.7	0.9	0.2	0.0

Source: Commission services, EPC.

Graph I.2.10: **Revisions of population and employment projections, 2018 AR - 2015 AR, 2060 (percentage change)**



Source: Commission services, EPC.

Table I.2.20: **Participation rate projections revisions, 2018 AR - 2015 AR, 2060**

	15-64	15-74	20-64	20-24	25-54	55-64	65-74	
BE	1.5	1.7	1.5	-3.2	-0.3	9.9	5.9	BE
BG	-2.4	-2.4	-2.4	-8.4	-2.9	2.4	0.0	BG
CZ	-1.2	-4.0	-1.4	1.3	0.5	-10.4	-12.7	CZ
DK	0.7	-0.1	-0.1	2.8	-0.1	-1.0	-0.6	DK
DE	-1.8	-1.5	-2.0	-0.7	-2.1	-2.6	-0.3	DE
EE	-0.5	-1.1	-1.4	7.3	-2.0	-3.4	-0.2	EE
IE	2.1	-0.1	2.2	1.1	2.7	1.2	0.4	IE
EL	-1.1	-0.5	-1.1	-5.0	0.0	-2.6	3.7	EL
ES	-2.1	-1.8	-1.0	-5.0	0.1	-0.1	-0.1	ES
FR	0.7	1.5	0.9	1.6	-0.5	5.2	5.4	FR
HR	5.4	4.4	5.3	11.2	5.3	3.3	0.9	HR
IT	2.3	2.1	2.2	-0.3	2.0	3.6	3.7	IT
CY	0.0	-3.3	-2.0	-2.8	-1.2	-3.8	-6.4	CY
LV	1.7	-0.9	1.9	0.9	3.1	-0.5	0.3	LV
LT	6.2	1.2	5.3	4.4	5.5	5.0	0.8	LT
LU	-0.9	-2.6	-1.8	3.5	-1.2	-4.5	-0.5	LU
HU	3.6	3.1	3.8	6.3	3.5	3.7	0.5	HU
MT	4.0	2.7	4.1	-3.1	5.7	3.8	0.3	MT
NL	-0.7	0.2	-0.9	-1.8	-1.1	0.2	2.8	NL
AT	0.4	0.1	0.7	-1.7	1.2	1.1	0.5	AT
PL	-0.4	-2.2	-0.4	2.0	3.0	-11.9	-6.5	PL
PT	1.3	1.1	1.6	-0.3	2.0	1.2	0.7	PT
RO	2.9	2.1	3.2	0.5	3.8	2.6	0.6	RO
SI	-0.3	-1.9	-0.2	2.3	0.6	-3.3	-7.5	SI
SK	3.5	4.6	4.6	1.6	5.3	4.1	3.9	SK
FI	2.4	3.3	2.4	0.8	-0.2	11.3	11.3	FI
SE	-0.9	-1.1	-1.0	0.4	-1.1	-1.2	-0.4	SE
UK	0.7	0.4	0.5	-0.2	0.9	0.6	0.2	UK
NO	-0.4	-0.9	-0.4	-4.7	-0.4	1.9	1.2	NO
EA	0.6	0.7	0.7	0.2	0.4	2.0	2.3	EA
EU*	0.7	0.5	0.7	0.5	0.8	0.8	0.8	EU*
EU27	0.7	0.5	0.7	0.6	0.8	0.8	0.9	EU27

Source: Commission services, EPC.

3. LABOUR PRODUCTIVITY AND POTENTIAL GDP

3.1. BACKGROUND AND GENERAL APPROACH

3.1.1. A production function approach for the long-term projection exercise

A production function framework is used to project GDP growth over the long-term using the standard specification of the Cobb-Douglas production function with constant returns to scale. In this framework, potential GDP growth is driven by long-term developments in labour input and labour productivity.

Labour input projections are based on assumptions taken from Eurostat's latest population projections. Labour productivity projections are based on assumptions regarding the long-run developments of its underlying determinants, namely labour-augmenting total factor productivity and the capital stock per worker (also referred to as capital deepening). The long-run projection is based on the central assumption of convergence toward the same value of labour productivity at the end of the projection horizon across all Member States.

A detailed description of the production function framework and the key assumptions underpinning the long-term GDP projections presented in this section is summarised in Annex 3. All assumptions were approved by the EPC, including the T+10 methodology developed by the EPC's Output Gap Working Group (OGWG), and are used in their work by other Council committees.

Following the practice used for the 2015 Ageing Report, the OGWG T+10 methodology is used for projecting potential growth and its components over the medium-term – namely until 2026 (Annex 3). The long-term projections, and T+10 projections, in this report are based on the Commission services spring 2017 forecast. Thus, the EPC's working groups, the OGWG and the AWG, are fully aligned ([31]).

The rest of this section summarises (i) the long-term GDP projections in the baseline and risk scenario; (ii) cross-country differences within the EU; (iii) the main differences between these projections and those of the 2015 Ageing Report.

([31]) The output gap estimates are used to calculate structural budgetary developments, which are used within the framework of the Stability and Growth Pact (SGP).

3.2. MAIN RESULTS OF GDP PROJECTIONS

Relatively stable potential annual GDP growth of around 1 ½% is projected over the long-term in the EU in the baseline scenario, although much lower than in previous decades and with downside risks should future TFP growth develop less favourably than assumed.

3.2.1. Baseline scenario

Annual potential GDP growth rate projections for the EU under the baseline scenario over the period 2016-70 will average 1.4% up to 2020, falling slightly subsequently to 1.3% during 2021-40 before gradually rising to 1.5% by the 2050s, where it is expected to remain through 2070. As a result, average annual potential GDP growth for 2016-70 is projected at 1.4% (see Table I.3.1).

Table I.3.1: **Potential GDP annual growth rate (%)- Period average**

	2016-2020	2021-2030	2031-2040	2041-2050	2051-2060	2061-2070	***2016-2070***	**2016-2070 (TFP risk scenario)**
BE	1.3	1.3	1.5	1.7	1.6	1.7	**1.5**	**1.3**
BG	2.6	1.8	1.2	1.0	1.1	1.2	**1.4**	**1.0**
CZ	2.2	1.7	1.4	1.1	1.3	1.5	**1.5**	**1.1**
DK	1.6	1.6	1.6	1.8	1.6	1.3	**1.6**	**1.3**
DE	1.6	1.1	1.0	1.2	1.1	1.2	**1.2**	**0.9**
EE	2.4	1.9	1.5	1.2	1.1	1.3	**1.5**	**1.2**
IE	4.3	2.0	1.8	1.5	1.8	2.1	**2.1**	**2.0**
EL	-0.5	0.4	0.7	1.0	1.1	1.3	**0.8**	**0.4**
ES	0.8	1.2	1.1	1.4	2.0	2.1	**1.5**	**1.3**
FR	1.2	1.1	1.4	1.9	1.8	1.7	**1.6**	**1.3**
HR	1.0	0.8	1.4	1.7	1.3	1.1	**1.2**	**1.1**
IT	0.2	0.5	0.4	1.0	1.4	1.3	**0.8**	**0.6**
CY	0.9	1.5	1.3	1.8	1.4	1.3	**1.4**	**1.2**
LV	3.3	3.4	1.8	1.3	1.0	1.5	**1.9**	**1.5**
LT	2.2	0.8	0.6	1.0	0.8	1.5	**1.1**	**0.5**
LU	3.6	3.0	2.3	1.9	1.7	1.7	**2.3**	**1.9**
HU	2.1	2.2	1.6	1.3	1.3	1.4	**1.6**	**1.2**
MT	5.1	3.6	2.5	1.5	1.1	1.4	**2.3**	**2.1**
NL	1.4	1.1	1.3	1.8	1.7	1.5	**1.5**	**1.2**
AT	1.5	1.7	1.7	1.5	1.2	1.3	**1.5**	**1.2**
PL	2.8	2.2	1.5	0.9	0.8	1.0	**1.4**	**1.0**
PT	0.8	1.1	0.8	0.9	1.0	0.9	**0.9**	**0.7**
RO	3.5	2.8	1.4	1.2	1.4	1.3	**1.8**	**1.4**
SI	1.7	1.9	1.5	1.2	1.5	1.6	**1.5**	**1.2**
SK	2.7	2.9	2.2	1.3	1.2	1.4	**1.9**	**1.4**
FI	0.7	0.8	1.3	1.5	1.5	1.5	**1.3**	**0.9**
SE	2.4	1.9	2.0	2.0	1.7	1.9	**1.9**	**1.7**
UK	1.5	1.7	1.8	1.9	1.6	1.6	**1.7**	**1.4**
NO	2.1	1.9	1.7	1.8	1.7	1.6	**1.8**	**1.4**
EA	1.2	1.1	1.1	1.4	1.5	1.5	**1.3**	**1.1**
EU*	1.4	1.3	1.3	1.4	1.5	1.5	**1.4**	**1.1**
EU27	1.4	1.2	1.2	1.3	1.4	1.5	**1.3**	**1.1**

Source: Commission services, EPC.

The projections for the euro area follow a similar, if slightly lower trajectory over the projection horizon, with annual growth of 1.2% through 2020, 1.1% in 2021-40 that rises to 1.5% during 2051-70, resulting in average growth rate over the period 2016-70 of 1.3%.

The contribution of labour input – total hours worked – to potential growth in the EU and the euro area is projected to be positive only up to 2020. Thereafter, the demographic assumptions result in a decline in the working-age population and by extension a negative contribution of labour input to potential growth.

On average during 2021-30, total hours worked will be stable in the EU (and slightly negative in the euro area) before falling annually by about 0.2% on average between 2031-50 in both the EU and euro area. The contribution of labour input will subsequently stabilise again by the 2060s (Table I.3.2).

Table I.3.2: **Labour input (total hours worked), annual growth rate - Period average (%)**

	2016-2020	2021-2030	2031-2040	2041-2050	2051-2060	2061-2070	**2016-2070**
BE	0.6	0.5	0.3	0.2	0.1	0.1	**0.3**
BG	0.1	-1.3	-1.3	-1.3	-0.9	-0.5	**-0.9**
CZ	0.6	-0.5	-0.5	-0.7	-0.4	0.0	**-0.3**
DK	0.8	0.5	0.2	0.2	0.1	-0.2	**0.2**
DE	0.5	-0.4	-0.4	-0.3	-0.5	-0.3	**-0.3**
EE	0.8	-0.4	-0.4	-0.7	-0.7	-0.3	**-0.4**
IE	2.1	0.4	0.3	0.0	0.3	0.5	**0.5**
EL	0.4	0.1	-0.5	-0.8	-0.6	-0.4	**-0.4**
ES	0.0	0.2	-0.2	-0.2	0.4	0.6	**0.1**
FR	0.3	0.2	0.2	0.3	0.3	0.2	**0.3**
HR	-0.4	-0.5	-0.1	-0.3	-0.6	-0.6	**-0.4**
IT	0.4	0.2	-0.6	-0.5	-0.2	-0.2	**-0.2**
CY	0.6	1.1	0.3	0.1	-0.3	-0.3	**0.2**
LV	-0.1	-1.3	-1.0	-0.9	-0.9	-0.2	**-0.8**
LT	0.6	-2.0	-1.5	-0.9	-1.0	-0.2	**-0.9**
LU	3.0	1.7	0.8	0.4	0.1	0.2	**0.9**
HU	0.9	0.0	-0.6	-0.7	-0.5	-0.3	**-0.3**
MT	2.6	0.9	0.4	-0.1	-0.5	-0.1	**0.4**
NL	0.8	0.3	0.1	0.3	0.2	0.0	**0.2**
AT	0.6	0.4	0.3	-0.1	-0.3	-0.3	**0.1**
PL	0.2	-0.7	-0.9	-1.1	-1.0	-0.6	**-0.7**
PT	0.2	-0.2	-0.8	-1.0	-0.8	-0.7	**-0.6**
RO	-0.2	-1.1	-1.2	-1.0	-0.5	-0.4	**-0.8**
SI	0.7	-0.2	-0.6	-0.6	-0.2	0.0	**-0.2**
SK	0.4	-0.5	-0.4	-0.6	-0.5	-0.2	**-0.4**
FI	0.4	-0.3	0.1	0.0	-0.1	-0.1	**0.0**
SE	1.1	0.6	0.6	0.4	0.2	0.3	**0.5**
UK	0.8	0.4	0.4	0.3	0.1	0.0	**0.3**
NO	0.9	0.5	0.4	0.3	0.1	0.1	**0.3**
EA	0.4	0.0	-0.2	-0.2	-0.1	0.0	**-0.1**
EU*	0.5	-0.1	-0.2	-0.2	-0.1	-0.1	**-0.1**
EU27	0.4	-0.1	-0.3	-0.3	-0.2	-0.1	**-0.1**

Source: Commission services, EPC.

As a result, potential growth in the EU and euro area – particularly after 2020 - will be driven almost entirely by labour productivity. Annual growth in labour productivity per hour worked is projected to increase in the period to the 2030s from 0.9% to 1.5% and remain fairly stable at around 1.6% thereafter throughout the projection period. As a result, the average annual growth rate is equal to 1.5% over the entire period. A similar trajectory is envisaged in the euro area, with labour productivity rising from 0.7% on average through 2020 to 1.6% by 2040 and growing at this rate through 2070, with an overall average of 1.4% over the period (Table I.3.3).

Table I.3.3: **Labour productivity per hour, annual growth rate - Period average (%)**

	2016-2020	2021-2030	2031-2040	2041-2050	2051-2060	2061-2070	**2016-2070**	**2016-2070 (TFP risk scenario)**
BE	0.7	0.8	1.2	1.5	1.5	1.5	**1.3**	**1.0**
BG	2.4	3.1	2.5	2.3	2.0	1.7	**2.3**	**2.0**
CZ	1.6	2.2	2.0	1.8	1.7	1.6	**1.8**	**1.5**
DK	0.8	1.1	1.4	1.5	1.5	1.5	**1.4**	**1.1**
DE	1.1	1.5	1.5	1.5	1.5	1.5	**1.5**	**1.2**
EE	1.6	2.3	2.0	1.9	1.8	1.6	**1.9**	**1.5**
IE	2.1	1.6	1.4	1.5	1.5	1.5	**1.6**	**1.6**
EL	-0.9	0.3	1.2	1.8	1.8	1.6	**1.1**	**0.8**
ES	0.8	0.9	1.3	1.6	1.6	1.6	**1.3**	**1.1**
FR	0.8	0.9	1.2	1.5	1.5	1.5	**1.3**	**1.1**
HR	1.4	1.3	1.5	2.1	1.9	1.7	**1.7**	**1.5**
IT	-0.2	0.3	0.9	1.5	1.6	1.6	**1.0**	**0.8**
CY	0.3	0.4	1.0	1.7	1.7	1.6	**1.2**	**1.0**
LV	3.4	4.7	2.8	2.2	1.9	1.6	**2.7**	**2.3**
LT	1.6	2.8	2.2	1.9	1.8	1.6	**2.0**	**1.4**
LU	0.6	1.4	1.5	1.5	1.5	1.5	**1.4**	**1.1**
HU	1.2	2.2	2.2	2.0	1.8	1.6	**1.9**	**1.5**
MT	2.4	2.7	2.1	1.6	1.6	1.5	**1.9**	**1.7**
NL	0.6	0.9	1.2	1.5	1.5	1.5	**1.3**	**1.0**
AT	0.9	1.3	1.4	1.5	1.5	1.5	**1.4**	**1.1**
PL	2.5	2.9	2.4	2.0	1.8	1.6	**2.2**	**1.7**
PT	0.5	1.2	1.6	1.8	1.8	1.6	**1.5**	**1.3**
RO	3.6	3.9	2.7	2.2	1.9	1.7	**2.6**	**2.2**
SI	1.0	2.1	2.0	1.8	1.7	1.6	**1.8**	**1.4**
SK	2.3	3.4	2.6	1.9	1.7	1.6	**2.2**	**1.8**
FI	0.4	1.0	1.2	1.5	1.5	1.5	**1.3**	**0.9**
SE	1.3	1.3	1.4	1.5	1.5	1.5	**1.5**	**1.2**
UK	0.7	1.3	1.4	1.5	1.5	1.5	**1.4**	**1.1**
NO	1.2	1.5	1.4	1.5	1.5	1.5	**1.5**	**1.1**
EA	0.7	1.1	1.3	1.6	1.6	1.6	**1.4**	**1.1**
EU*	0.9	1.3	1.5	1.6	1.6	1.6	**1.5**	**1.2**
EU27	0.9	1.3	1.5	1.7	1.6	1.6	**1.5**	**1.2**

Source: Commission services, EPC.

TFP growth explains around two-thirds of labour productivity growth during the projection period. Annual TFP growth converges to 1% by 2070 at the latest for all Member States (Table I.3.4).

For the EU as a whole, TFP growth averages 0.6% per year in 2016-20, rising to 1% by 2031-40 and remains at that level through 2070. The resulting average annual growth rate in 2016-70 is 0.9%,

just under two-thirds of average annual labour productivity growth during this period.

The annual TFP growth rate in the euro area follows a similar path, albeit from a lower starting point in 2016-20 (0.5%) and reaches 1% slightly later (2041-50), but the average over 2016-70 is similar (0.9%), just under two-thirds of labour productivity growth over the projection period.

Table I.3.4: **Annual total factor productivity growth rate - Period average (%)**

	2016-2020	2021-2030	2031-2040	2041-2050	2051-2060	2061-2070	***2016-2070***	**2016-2070 (TFP risk scenario)**
BE	0.4	0.6	0.8	1.0	1.0	1.0	***0.8***	***0.7***
BG	1.6	1.7	1.6	1.5	1.3	1.1	***1.4***	***1.2***
CZ	1.2	1.4	1.3	1.2	1.1	1.0	***1.2***	***0.9***
DK	0.5	0.8	0.9	1.0	1.0	1.0	***0.9***	***0.7***
DE	0.9	0.9	0.9	1.0	1.0	1.0	***1.0***	***0.8***
EE	1.0	1.2	1.3	1.2	1.2	1.0	***1.2***	***0.9***
IE	1.8	1.2	0.9	1.0	1.0	1.0	***1.1***	***1.1***
EL	-0.3	0.3	0.8	1.2	1.2	1.0	***0.8***	***0.5***
ES	0.4	0.6	0.8	1.0	1.0	1.0	***0.9***	***0.7***
FR	0.4	0.6	0.8	1.0	1.0	1.0	***0.8***	***0.7***
HR	0.4	0.6	1.0	1.3	1.2	1.1	***1.0***	***0.9***
IT	-0.1	0.2	0.6	1.0	1.0	1.0	***0.7***	***0.5***
CY	-0.1	0.2	0.6	1.1	1.1	1.0	***0.7***	***0.6***
LV	3.2	3.0	1.8	1.4	1.2	1.1	***1.8***	***1.5***
LT	0.7	1.4	1.4	1.3	1.1	1.0	***1.2***	***0.8***
LU	0.6	0.9	1.0	1.0	1.0	1.0	***0.9***	***0.7***
HU	1.0	1.4	1.5	1.3	1.2	1.1	***1.3***	***0.9***
MT	1.7	1.6	1.3	1.1	1.0	1.0	***1.2***	***1.1***
NL	0.3	0.5	0.8	1.0	1.0	1.0	***0.8***	***0.6***
AT	0.6	0.8	0.9	1.0	1.0	1.0	***0.9***	***0.7***
PL	1.3	1.7	1.5	1.3	1.2	1.1	***1.3***	***1.0***
PT	0.6	0.8	1.0	1.2	1.1	1.0	***1.0***	***0.8***
RO	2.7	2.5	1.7	1.4	1.2	1.1	***1.7***	***1.4***
SI	1.1	1.4	1.3	1.2	1.1	1.0	***1.2***	***0.9***
SK	2.1	2.3	1.7	1.2	1.1	1.0	***1.5***	***1.2***
FI	0.1	0.5	0.8	1.0	1.0	1.0	***0.8***	***0.5***
SE	0.9	0.9	0.9	1.0	1.0	1.0	***1.0***	***0.8***
UK	0.5	0.8	0.9	1.0	1.0	1.0	***0.9***	***0.7***
NO	0.6	0.8	0.9	1.0	1.0	1.0	***0.9***	***0.7***
EA	0.5	0.7	0.9	1.0	1.0	1.0	**0.9**	**0.7**
EU*	0.6	0.8	1.0	1.0	1.0	1.0	**0.9**	**0.8**
EU27	0.6	0.8	1.0	1.1	1.0	1.0	**0.9**	**0.8**

Source: Commission services, EPC.

The contribution of capital deepening to labour productivity for the EU is equal to 0.5% on average per year during 2016-2070 but starts from a lower level of 0.3% on average in 2016-20 (see Table I.3.5). For countries with GDP per capita below the EU average in 2016, the capital deepening contribution is considerably higher than the EU average in the first part of the projection period, reflecting the assumed catching-up process of converging economies.

As explained in Annex 3, the assumption of the "capital rule" with respect to investment rates for all Member States starting in 2034 implies the contribution of capital deepening gradually declines to the steady state value of 0.5%, as the growth in the capital stock adjusts to growth in hours worked. For the euro area, the contribution from capital deepening averages just 0.2% per year during 2016-20 but converges to 0.5% by 2031-40 and thereafter remains stable, with an average of 0.5% for the entire projection period.

Table I.3.5: **Annual contribution of capital deepening - Period average (%)**

	2016-2020	2021-2030	2031-2040	2041-2050	2051-2060	2061-2070	**2016-2070**
BE	0.3	0.2	0.4	0.5	0.5	0.5	***0.4***
BG	0.9	1.4	0.9	0.8	0.7	0.6	***0.9***
CZ	0.3	0.8	0.7	0.6	0.6	0.6	***0.6***
DK	0.3	0.3	0.5	0.5	0.5	0.5	***0.5***
DE	0.2	0.6	0.5	0.5	0.5	0.5	***0.5***
EE	0.6	1.1	0.7	0.7	0.6	0.6	***0.7***
IE	0.3	0.4	0.5	0.5	0.5	0.5	***0.5***
EL	-0.6	0.0	0.4	0.6	0.6	0.6	***0.4***
ES	0.4	0.3	0.4	0.6	0.6	0.5	***0.5***
FR	0.4	0.3	0.4	0.5	0.5	0.5	***0.5***
HR	0.9	0.7	0.5	0.7	0.7	0.6	***0.7***
IT	-0.1	0.1	0.3	0.5	0.6	0.5	***0.4***
CY	0.4	0.3	0.3	0.6	0.6	0.6	***0.5***
LV	0.1	1.7	1.0	0.8	0.7	0.6	***0.9***
LT	0.9	1.4	0.8	0.7	0.6	0.6	***0.8***
LU	0.0	0.5	0.5	0.5	0.5	0.5	***0.5***
HU	0.2	0.8	0.8	0.7	0.6	0.6	***0.7***
MT	0.7	1.1	0.7	0.6	0.6	0.5	***0.7***
NL	0.3	0.3	0.4	0.5	0.5	0.5	***0.5***
AT	0.3	0.4	0.5	0.5	0.5	0.5	***0.5***
PL	1.2	1.2	0.8	0.7	0.6	0.6	***0.8***
PT	-0.1	0.4	0.6	0.7	0.6	0.6	***0.5***
RO	0.9	1.4	1.0	0.8	0.7	0.6	***0.9***
SI	-0.2	0.7	0.7	0.6	0.6	0.6	***0.6***
SK	0.1	1.1	0.9	0.7	0.6	0.6	***0.7***
FI	0.3	0.5	0.4	0.5	0.5	0.5	***0.5***
SE	0.4	0.4	0.5	0.5	0.5	0.5	***0.5***
UK	0.2	0.5	0.5	0.5	0.5	0.5	***0.5***
NO	0.6	0.6	0.5	0.5	0.5	0.5	***0.5***
EA	0.2	0.4	0.5	0.6	0.6	0.5	***0.5***
EU*	0.3	0.5	0.5	0.6	0.6	0.6	***0.5***
EU27	0.3	0.5	0.5	0.6	0.6	0.6	***0.5***

Source: Commission services, EPC.

A summary of the relative contribution to potential GDP growth of labour productivity and labour utilisation (and their determinants) in the baseline scenario over the entire projection horizon 2016-70 can be provided by the standard growth accounting framework (Table I.3.6).

For the EU and for the euro area, the total population and total hours worked over the entire projection period are projected to be stable while an assumed increase on employment rates makes a positive contribution to potential growth (0.1 p.p.). However, this is more than offset by a decline in the share of the working-age population, which is a negative drag on growth by an annual average of -0.2 p.p.

As a result, labour input contributes negatively to annual potential output growth on average over the projection period by 0.1 p.p., in the EU and the euro area. Hence, growth in labour productivity per hour worked becomes the sole source for potential output growth in both the EU and the euro area, averaging 1.5 p.p. and 1.4 p.p. respectively. As a result, annual potential GDP growth in the EU and euro area will average 1.4% and 1.3% over the horizon.

While almost all EU Member States are projected to experience a slowdown in the contribution of labour input (total hours worked) to potential growth rates due to the adverse impact of demographic developments, overall potential growth rates differ substantially across countries, with some increasing over the projection horizon.

Specifically, under the baseline scenario average potential GDP growth rates are expected to increase after 2016-20 in Belgium, Greece, Spain, France, Croatia, Italy, Cyprus, Netherlands, Portugal, Finland, and the UK (see also Table I.3.1). Similarly, for the EU and euro area as a whole, potential GDP growth rates are expected to rise after 2016-20.

By contrast, particularly for countries with GDP per capita below the EU average in 2016, projected growth rates are forecast to fall gradually after 2020 (except Latvia). This is due to the fact that in the first half of the projection period, TFP growth is the main source of discrepancy across countries, reflecting different productivity growth rates at the outset of the projection and the assumed different future paths given the catching-up potential (see description in Box I.3.1). TFP growth is above 1% for those countries with GDP per capita below the EU average in 2016 and thus are assumed to have high catch-up potential. For these countries, annual TFP growth peaks during 2016-30 before gradually falling to 1%. For countries with GDP per capita above the EU average in 2016, annual TFP growth is below 1% before converging to 1% by 2045 and remaining at that level until 2070.

In the latter part of the projection period, developments in labour input have a more dominant role, primarily due to different

Table I.3.6: **Decomposition of potential GDP growth (baseline), 2016-70**

	GDP growth in 2016-2070	***Labour prod. (GDP per hour worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*change in average hours worked*	GDP per capita growth in 2016-2070
Country	**1=2+5**	**2=3+4**	*3*	*4*	**5=6+7+8+9**	*6*	*7*	*8*	*9*	**10=1-6**
BE	**1.5**	**1.3**	0.8	0.4	**0.3**	0.4	0.0	-0.1	0.0	**1.2**
BG	**1.4**	**2.3**	1.4	0.9	**-0.9**	-0.7	0.1	-0.3	0.0	**2.1**
CZ	**1.5**	**1.8**	1.2	0.6	**-0.3**	-0.1	0.0	-0.3	0.0	**1.6**
DK	**1.6**	**1.4**	0.9	0.5	**0.2**	0.3	0.1	-0.2	0.0	**1.3**
DE	**1.2**	**1.5**	1.0	0.5	**-0.3**	-0.1	0.0	-0.2	-0.1	**1.2**
EE	**1.5**	**1.9**	1.2	0.7	**-0.4**	-0.2	0.1	-0.2	0.0	**1.7**
IE	**2.0**	**1.6**	1.1	0.5	**0.5**	0.5	0.1	-0.1	0.0	**1.6**
EL	**0.8**	**1.1**	0.8	0.4	**-0.4**	-0.6	0.5	-0.2	0.0	**1.4**
ES	**1.5**	**1.3**	0.9	0.5	**0.1**	0.1	0.2	-0.2	0.0	**1.3**
FR	**1.6**	**1.3**	0.8	0.5	**0.3**	0.3	0.1	-0.1	0.0	**1.3**
HR	**1.2**	**1.7**	1.0	0.7	**-0.4**	-0.4	0.2	-0.2	0.0	**1.6**
IT	**0.8**	**1.0**	0.7	0.4	**-0.2**	-0.2	0.2	-0.2	0.0	**1.0**
CY	**1.4**	**1.2**	0.7	0.5	**0.2**	0.3	0.2	-0.2	0.0	**1.1**
LV	**1.9**	**2.7**	1.8	0.9	**-0.8**	-0.7	0.2	-0.3	0.0	**2.6**
LT	**1.1**	**2.0**	1.2	0.8	**-0.9**	-0.9	0.3	-0.3	0.0	**2.0**
LU	**2.3**	**1.4**	0.9	0.5	**0.8**	1.1	-0.1	-0.2	0.0	**1.2**
HU	**1.6**	**1.9**	1.3	0.7	**-0.3**	-0.2	0.2	-0.3	0.0	**1.8**
MT	**2.3**	**1.9**	1.2	0.7	**0.4**	0.3	0.4	-0.3	0.0	**2.0**
NL	**1.5**	**1.3**	0.8	0.5	**0.2**	0.3	0.1	-0.2	0.0	**1.2**
AT	**1.5**	**1.4**	0.9	0.5	**0.1**	0.3	0.1	-0.2	-0.1	**1.2**
PL	**1.4**	**2.2**	1.3	0.8	**-0.8**	-0.4	0.0	-0.3	0.0	**1.8**
PT	**0.9**	**1.5**	1.0	0.5	**-0.6**	-0.5	0.1	-0.2	0.0	**1.4**
RO	**1.8**	**2.6**	1.7	0.9	**-0.8**	-0.5	0.0	-0.3	0.0	**2.3**
SI	**1.5**	**1.8**	1.2	0.6	**-0.2**	-0.1	0.1	-0.3	0.0	**1.6**
SK	**1.9**	**2.2**	1.5	0.7	**-0.4**	-0.2	0.2	-0.3	0.0	**2.1**
FI	**1.3**	**1.3**	0.8	0.5	**0.0**	0.0	0.1	-0.2	0.0	**1.2**
SE	**1.9**	**1.5**	1.0	0.5	**0.5**	0.6	0.0	-0.2	0.0	**1.3**
UK	**1.7**	**1.4**	0.9	0.5	**0.3**	0.4	0.1	-0.2	0.0	**1.3**
NO	**1.8**	**1.5**	0.9	0.5	**0.3**	0.5	0.0	-0.2	0.0	**1.2**
EA	**1.3**	**1.4**	0.9	0.5	**-0.1**	0.0	0.1	-0.2	0.0	**1.3**
EU*	**1.4**	**1.5**	0.9	0.5	**-0.1**	0.0	0.1	-0.2	0.0	**1.3**
EU27	**1.3**	**1.5**	0.9	0.5	**-0.2**	0.0	0.1	-0.2	0.0	**1.3**

Source: Commission services, EPC.

demographic developments and the assumptions made on productivity growth rate convergence.

Taking account of the cyclical position of the economy in the long-term projections

In order to bridge the current situation and the assumed longer-term prospects under the baseline scenario, there is a need to take account of the cyclical position of the economy over a short-to-medium term horizon. This is of particular importance at the current juncture, where many Member States still have large output gaps.

In making actual and potential growth rate projections, the general rule is that the output gap is closed at the latest three years after the end of the Spring 2017 forecast, that is, by 2021. Taking account of the negative output gaps prevailing in the Member States, actual growth is assumed to be higher than potential growth until the output gap is closed in 2021 (see Graph I.3.1).

3.2.2. The TFP risk scenario

A risk scenario reflecting more conservative assumptions regarding TFP growth rates is also examined, in light of the trend decline in TFP growth over the last decades (see Box I.3.1).

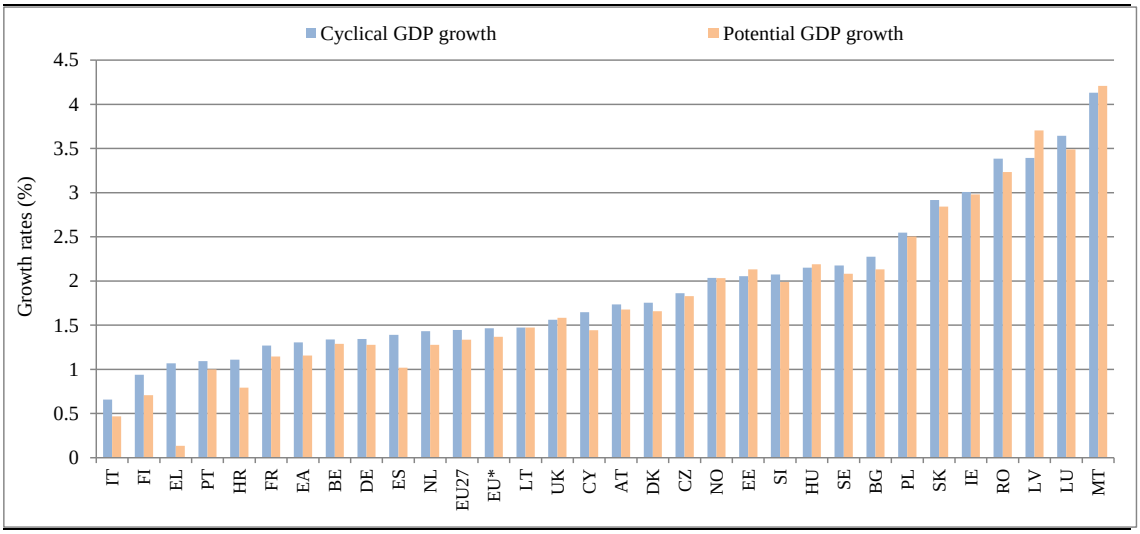
The risk scenario forecasts annual average GDP growth during 2016-70 of 1.1% for the EU and euro area (Table I.3.7), as opposed to 1.4% and 1.3% respectively in the baseline. This is driven by average annual TFP growth over 2016-2070 in the risk scenario of 0.8% and 0.7% respectively, as opposed to 0.9% in the baseline.

Table I.3.7: **Decomposition of potential GDP growth (risk scenario), 2016-70**

	GDP growth in 2016-2070	Labour prod. (GDP per hour worked)	TFP	Capital deepening	Labour input
Country	**1=2+5**	**2=3+4**	*3*	*4*	**5**
BE	**1.3**	**1.0**	0.7	0.4	**0.3**
BG	**1.0**	**2.0**	1.2	0.8	**-0.9**
CZ	**1.1**	**1.5**	0.9	0.5	**-0.3**
DK	**1.3**	**1.1**	0.7	0.4	**0.2**
DE	**0.9**	**1.2**	0.8	0.4	**-0.3**
EE	**1.2**	**1.5**	0.9	0.6	**-0.4**
IE	**2.0**	**1.6**	1.1	0.5	**0.5**
EL	**0.4**	**0.8**	0.5	0.3	**-0.4**
ES	**1.3**	**1.1**	0.7	0.4	**0.1**
FR	**1.3**	**1.1**	0.7	0.4	**0.3**
HR	**1.1**	**1.5**	0.9	0.6	**-0.4**
IT	**0.6**	**0.8**	0.5	0.3	**-0.2**
CY	**1.2**	**1.0**	0.6	0.4	**0.2**
LV	**1.5**	**2.3**	1.5	0.7	**-0.8**
LT	**0.5**	**1.4**	0.8	0.7	**-0.9**
LU	**1.9**	**1.1**	0.7	0.4	**0.8**
HU	**1.2**	**1.5**	0.9	0.5	**-0.3**
MT	**2.0**	**1.7**	1.1	0.6	**0.4**
NL	**1.2**	**1.0**	0.6	0.4	**0.2**
AT	**1.2**	**1.1**	0.7	0.4	**0.1**
PL	**1.0**	**1.7**	1.0	0.7	**-0.8**
PT	**0.7**	**1.3**	0.8	0.4	**-0.6**
RO	**1.4**	**2.2**	1.4	0.8	**-0.8**
SI	**1.2**	**1.4**	0.9	0.5	**-0.2**
SK	**1.4**	**1.8**	1.2	0.6	**-0.4**
FI	**0.9**	**0.9**	0.5	0.4	**0.0**
SE	**1.7**	**1.2**	0.8	0.4	**0.5**
UK	**1.4**	**1.1**	0.7	0.4	**0.3**
NO	**1.5**	**1.1**	0.7	0.4	**0.3**
EA	**1.1**	**1.1**	0.7	0.4	**-0.1**
EU*	**1.1**	**1.2**	0.8	0.4	**-0.1**
EU27	**1.1**	**1.2**	0.8	0.5	**-0.2**

Source: Commission services EPC.

Graph I.3.1: **Average annual cyclical and potential GDP growth projections (2016-2026)**



Source: Commission services, EPC.

Box I.3.1: **Assumptions on the components of the production function used for long-run potential growth projections**

For the years 2019-26 the medium-term potential growth estimation was based on the T+10 methodology described in Annex 3. The long-run projection is based on convergence rules toward the same value of labour productivity at the end of the projection horizon. There is therefore a need to ensure consistency between the medium term projection based on country-specific trends and the long-run projection based on horizontal convergence assumptions. There is also an overriding constraint to ensure comparability across the EU through the use of a common methodology for all Member States.

The key assumptions on Total Factor Productivity developments

Concerning total factor productivity growth, the AWG and EPC decided that the long-run level of annual TFP growth in the baseline scenario should remain as in the 2015 Ageing Report, namely 1%. However, in this report convergence to this annual TFP growth rate is reached at the earliest by 2045, as opposed to 2035 in the 2015 Ageing Report. In addition, due visibility and prominence should also be given to the risk of lower TFP growth in the future, in light of the trend decline on TFP growth performance over the last decades. Thus, a risk scenario should be included, with a lower TFP growth rate (0.8%). In both cases, allowance for higher TFP growth for countries with below average GDP per capita in 2016 is factored in for a period of time, as in the previous projection exercise, to cater for catching-up potential (see Table 1). Similarly, in both scenarios, the labour share is assumed to stay constant at 0.65 over the projection horizon.

Table 1: **GDP per capita in 2016 (Purchasing Power)**

	GDP per capita (PPS)	GDP per capita (PPS,% of EU28)
LU	70.0	257.3
IE	45.4	167.0
NO	44.0	161.6
NL	35.5	130.5
DK	34.6	127.4
SE	34.3	126.3
AT	33.1	121.5
DE	32.8	120.7
BE	31.6	116.1
FI	29.9	109.8
UK	29.2	107.4
EA	28.8	105.9
FR	28.8	105.8
EU	**27.2**	**100.0**
MT	26.4	97.1
IT	26.0	95.5
ES	25.4	93.6
CY	23.5	86.5
CZ	23.1	85.1
SK	22.2	81.6
SI	22.1	81.4
PT	20.8	76.7
LT	20.2	74.3
EL	20.1	74.1
EE	20.1	73.9
PL	19.3	70.9
HU	18.6	68.5
LV	17.2	63.1
RO	16.0	58.8
HR	15.8	58.1
BG	13.3	48.8

Source: AMECO, Commission services.

Baseline scenario

The assumption for TFP is that country-specific TFP growth rates converge to 1% in the baseline scenario. Likewise, the speed and the year of convergence to the long-run TFP growth rate are to be determined by the relative income position in the different Member States (Table 2), and it is assumed that the lower the GDP per capita, the higher the real catching up potential (real convergence process). In the long-term, labour productivity broadly coincides with TFP growth divided by labour share, equalling 1.5%

The specific assumptions agreed for the baseline scenario by the EPC are as follows (Table 2):

- the 'leader' is the group of countries that have a GDP per capita above the EU-28 average. For these countries, TFP growth is assumed to converge from the estimated value in 2027 to a 1% growth rate by 2045;
- the 'follower' group of countries are those with GDP per capita below the EU-28 average, for whom a differentiation is made depending on the distance to the EU average.

TFP risk scenario

The core assumptions for the risk scenario are that (i) country-specific TFP growth rates converge to 0.8%, and (ii) as in the baseline scenario, it is assumed that the lower the GDP per capita, the higher the catch-up potential (Table 3).

(Continued on the next page)

Box (continued)

Table 2: **Baseline scenario TFP (1.0%): assumptions on speed of convergence and criteria for selection - 2018 AR**

GDP per capita (% of EU28), 2016	Countries	Years (from/to)	Values	Years (from/to)	Values
" Leaders" (per capita GDP higher than the EU average)					
Above 100%	LU, IE ,NL, SE, DE, AT, DK, BE, UK,FI, FR	2027 (t+11) to 2045	From value in 2027 (t+11) to 1%, by linear interpolation	2046 to 2070	1.0%
" Followers" (per capita GDP lower than the EU average)					
Below 100%	MT, IT, ES, CY, CZ, SI, SK, PT, LT, EE, EL, PL, HU, LV, HR, RO, BG	2027 (t+11) to 2045	From value in 2027 (t+11) to $\frac{1.5\% * \left(1 - \frac{GDP_{i,t}}{GDP_{eu,t}}\right) + 1\% * \left(\frac{GDP_{i,t}}{GDP_{eu,t}} - 0.5\right)}{0.5}$ by linear interpolation	2046 to 2070	From $\frac{1.5\% * \left(1 - \frac{GDP_{i,t}}{GDP_{eu,t}}\right) + 1\% * \left(\frac{GDP_{i,t}}{GDP_{eu,t}} - 0.5\right)}{0.5}$ to 1%, by linear interpolation

Source: Commission services, EPC.

In the long-term, labour productivity broadly coincides with TFP growth divided by labour share, namely 1.2%.

Specifically, the assumptions agreed for the risk scenario by the EPC are as follows (see Table 3)

- For the 'leader' group, TFP growth is assumed to converge from the estimated value in 2017 to 0.8% by 2045;
- For the 'follower' group, a differentiation is made depending on the distance to the EU-28 average.

Key assumptions regarding capital formation

With regard to capital deepening, the assumption in the previous exercises to keep the long-run capital to labour ratio in efficiency units constant (the 'capital rule') is kept.

It is assumed therefore that in the long-run, the capital stock adjusts to the steady state path according to the "Capital Rule": the growth rate of capital is equal to the sum of growth rate of labour and labour augmenting technical progress.

This fulfils the steady state property, as the ratio of capital to labour expressed in efficiency unit remains constant over time. Consequently, labour productivity growth coincides with that of labour-augmenting technical progress.

Nonetheless, the application of this rule would lead to very sharp shifts in investment rates for many countries the year in which it's applied. For example, the introduction of the rule in 2024 would result in pessimistic productivity projections for a large number of the catching-up Member States whilst making little difference for those countries which are already close to their long-run TFP growth rate.

A transition between the investment rule and the capital rule is therefore applied to smooth the profile of investment:

- First, the transition to the constant capital/labour (in efficiency units) ratio is introduced gradually in the period 2027-2033 in a linear manner *("transition rule")*;
- Second, the capital/labour (in efficiency units) ratio is constant from 2034 *("capital rule")*.

Table 3: **Risk scenario TFP (0.8%): assumptions on speed of convergence and criteria for selection - 2018 AR**

GDP per capita (% of EU28), 2016	Countries	Years (from/to)	Values	Years (from/to)	Values
" Leaders" (per capita GDP higher than the EU average)					
Above 100%	LU, IE ,NL, SE, DE, AT, DK, BE, UK,FI, FR	2017 (t+1) to 2045	From value in 2017 (t+1) to 0.8%, by linear interpolation	2046 to 2070	0.8%
" Followers" (per capita GDP lower than the EU average)					
Below 100%	MT, IT, ES, CY, CZ, SI, SK, PT, LT, EE, EL, PL, HU, LV, HR, RO, BG	2017 (t+1) to 2045	From value in 2017 (t+1) to $\frac{1.3\% * \left(1 - \frac{GDP_{i,t}}{GDP_{eu,t}}\right) + 0.8\% * \left(\frac{GDP_{i,t}}{GDP_{eu,t}} - 0.5\right)}{0.5}$ by linear interpolation	2046 to 2070	From $\frac{1.3\% * \left(1 - \frac{GDP_{i,t}}{GDP_{eu,t}}\right) + 0.8\% * \left(\frac{GDP_{i,t}}{GDP_{eu,t}} - 0.5\right)}{0.5}$ to 0.8%, by linear interpolation

Source: Commission services, EPC.

3.3. COMPARISON WITH THE 2015 LONG-TERM BUDGETARY PROJECTION EXERCISE

Potential GDP growth is slightly lower in the 2018 long-term projections than in the equivalent 2015 exercise mainly due to lower labour productivity, especially during 2016-35.

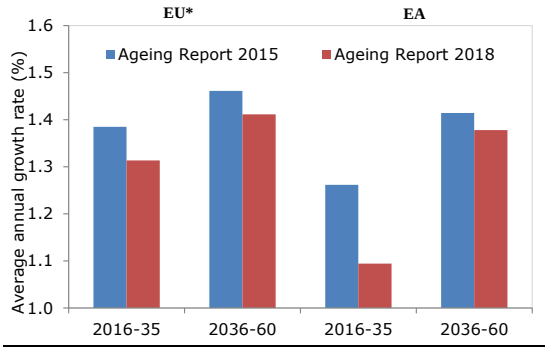
Under the baseline scenario of the 2018 Ageing Report, the annual average potential GDP growth rate over the period 2016-2060 in the EU is projected to be 1.4% - 0.1 p.p. below the forecast in the 2015 Ageing Report - with the same difference (-0.1 p.p.) anticipated for the euro area (Table I.3.8). In both cases, the downward revision is driven by lower labour productivity growth projections as there are minimal differences in the labour input contribution forecasts (0.02 p.p. and 0.01 p.p. respectively).

For the EU the lower annual contribution from labour productivity growth during 2016-60 vis-à-vis the 2015 projections stems almost equally from lower average annual TFP growth (-0.03 p.p.) and capital deepening (-0.02 p.p.). For the euro area, the lower labour productivity growth is primarily due to lower average annual TFP growth (-0.06 p.p.) although the contribution of capital deepening is also lower (-0.03 p.p.). The lower contribution from TFP growth in the 2018 exercise, particularly notable in the euro area, is the consequence of (i) a new (lower) T+10 starting point for TFP growth for some countries; and (ii) the slower convergence to the "steady-state" annual TFP growth rate of 1% assumed in the 2018 Ageing Report (see Box I.3.1).

There is substantial variation across countries in the differences between the 2018 and 2015 potential GDP growth projections under the baseline scenario. The largest downward revisions in average annual potential GDP growth rates are for Italy and Cyprus (both -0.7 p.p) with the contributions of both labour productivity and labour input notably lower than in the 2015 exercise. The largest upward revisions concern Malta (+0.8 p.p.), Slovakia and Latvia (both +0.5 p.p.), with the first two benefiting from both stronger labour productivity and input.

The differences between the 2018 and 2015 potential GDP growth projections under the baseline scenario primarily materialise in the first twenty years of the projections (2016-35), particularly for the euro area (Graph I.3.2).

Graph I.3.2: **Annual GDP growth rates 2016-60 (%) in 2018 and 2015 baseline scenario projections - period average**



Source: Commission services, EPC.

For the EU, annual potential GDP growth over the period 2016-35 is now projected to average 1.31% as opposed to 1.38% in the 2015 projection, while during 2036-60, average GDP growth is projected at 1.46% and 1.42% respectively. For the euro area, annual potential GDP growth over the period 2016-35 is projected in the 2018 Ageing Report to average 1.1% as opposed to 1.26% in the 2015 Ageing Report, while during 2036-60, it is projected at 1.38% and 1.41% respectively.

A comparison between the current *risk scenario* projection and that in the 2015 Ageing Report shows that for the EU and the euro area, annual potential GDP growth is forecast to be on average be 0.1 p.p. lower than in the 2015 projection, with a similar picture for the euro area (Table I.3.9). As under baseline scenario, the downward revisions for the EU and euro area vis-à-vis the 2015 Ageing Report are driven almost entirely by lower labour productivity growth forecasts, with only marginal differences in the labour input contribution (0.02 p.p. and 0.01 p.p. respectively).

The lower labour productivity growth forecasts in the main are due to lower TFP growth. In the EU and euro area, the contribution of average annual TFP growth during 2016-60 is now forecast to be 0.05 p.p. lower than the 2015 Ageing Report forecast while the average capital deepening contribution is forecast to be 0.01 p.p. lower in the EU and 0.02 p.p. lower in the euro area.

Table I.3.8: **Difference between 2018 AR and 2015 AR baseline scenarios, annual average GDP growth, 2016-2060 (p.p.)**

	GDP growth in 2016-2060	Labour prod. (GDP per hour worked)	TFP	Capital deepening	Labour input	Total population	Employment rate	Share of working age population	change in average hours worked	GDP per capita growth in 2016-2060
	1=2+5	2=3+4	3	4	5=6+7+8+9	6	7	8	9	10=1-6
BE	**-0.3**	**-0.1**	0.0	0.0	**-0.2**	-0.3	0.1	0.0	0.0	**0.0**
BG	**0.0**	**0.3**	0.2	0.0	**-0.3**	-0.1	-0.1	0.0	0.0	**0.1**
CZ	**-0.2**	**0.1**	0.1	0.0	**-0.3**	-0.2	-0.1	0.0	0.0	**0.0**
DK	**-0.2**	**-0.2**	-0.1	-0.1	**0.0**	0.1	-0.1	0.0	0.0	**-0.2**
DE	**0.2**	**-0.1**	0.0	-0.1	**0.3**	0.3	0.1	0.0	0.0	**0.0**
EE	**0.1**	**-0.1**	0.0	-0.1	**0.2**	0.2	0.0	0.0	0.0	**-0.1**
IE	**0.3**	**0.1**	0.2	0.0	**0.2**	0.2	0.0	0.0	0.0	**0.1**
EL	**-0.3**	**-0.1**	-0.1	0.0	**-0.1**	-0.1	-0.1	0.0	0.0	**-0.2**
ES	**-0.2**	**-0.1**	-0.1	0.0	**-0.1**	0.2	-0.2	-0.1	0.0	**-0.3**
FR	**-0.1**	**-0.1**	-0.1	0.0	**0.0**	0.0	0.0	0.0	0.0	**-0.1**
HR	**-0.2**	**-0.2**	-0.2	0.0	**0.0**	-0.1	0.1	0.0	0.0	**-0.1**
IT	**-0.7**	**-0.3**	-0.2	-0.1	**-0.3**	-0.3	0.0	-0.1	0.0	**-0.3**
CY	**-0.7**	**-0.3**	-0.2	-0.1	**-0.4**	-0.2	-0.3	0.1	0.0	**-0.6**
LV	**0.5**	**0.5**	0.6	-0.1	**0.0**	0.0	0.0	-0.1	0.0	**0.5**
LT	**-0.1**	**-0.2**	-0.1	-0.1	**0.1**	0.0	0.1	0.0	0.0	**-0.1**
LU	**-0.2**	**0.1**	0.1	0.0	**-0.3**	-0.3	-0.1	0.0	0.1	**0.1**
HU	**0.2**	**0.1**	0.1	0.0	**0.1**	0.0	0.1	0.0	0.0	**0.2**
MT	**0.8**	**0.5**	0.3	0.2	**0.3**	0.2	0.2	0.0	0.0	**0.6**
NL	**0.2**	**-0.1**	-0.1	0.0	**0.3**	0.3	0.0	0.0	0.0	**-0.1**
AT	**0.0**	**0.0**	0.0	0.0	**0.1**	0.1	0.0	0.0	-0.1	**-0.1**
PL	**0.0**	**0.1**	0.1	0.1	**-0.1**	0.0	-0.1	0.0	0.0	**0.0**
PT	**-0.1**	**-0.1**	-0.1	-0.1	**0.0**	0.1	0.0	0.0	0.0	**-0.2**
RO	**0.3**	**0.5**	0.4	0.1	**-0.2**	-0.2	0.2	0.0	0.0	**0.5**
SI	**0.1**	**0.1**	0.2	0.0	**0.0**	0.0	0.0	0.0	0.0	**0.2**
SK	**0.5**	**0.2**	0.1	0.1	**0.3**	0.2	0.1	0.0	0.0	**0.3**
FI	**-0.2**	**-0.1**	-0.1	0.0	**-0.1**	-0.2	0.1	0.0	0.0	**0.0**
SE	**-0.1**	**-0.1**	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	**-0.1**
UK	**0.0**	**0.0**	0.1	0.0	**0.0**	0.0	0.0	0.0	0.0	**0.1**
NO	**-0.5**	**-0.1**	-0.1	0.0	**-0.4**	-0.4	0.0	0.0	0.0	**-0.1**
EA	**-0.1**	**-0.1**	-0.1	0.0	**0.0**	0.0	0.0	0.0	0.0	**-0.1**
EU*	**-0.1**	**-0.1**	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	**-0.1**

Source: Commission services, EPC.

Table I.3.9: **Difference between 2018 AR and 2015 AR TFP risk scenarios, annual average GDP growth, 2016-2060 (p.p.)**

	GDP growth in 2016-2060	Labour prod. (GDP per hour worked)	TFP	Capital deepening	Labour input	Total population	Employment rate	Share of working age population	change in average hours worked	GDP per capita growth in 2016-2060
	1=2+5	2=3+4	3	4	5=6+7+8+9	6	7	8	9	10=1-6
BE	**-0.3**	**0.0**	0.0	0.0	**-0.3**	-0.3	0.0	0.0	0.0	**-0.1**
BG	**-0.1**	**0.2**	0.1	0.0	**-0.3**	-0.1	-0.1	0.0	0.0	**0.0**
CZ	**-0.3**	**0.0**	0.0	0.0	**-0.3**	-0.2	-0.1	0.0	0.0	**-0.1**
DK	**-0.2**	**-0.3**	-0.2	-0.1	**0.0**	0.1	-0.1	0.0	0.0	**-0.3**
DE	**0.2**	**-0.1**	0.0	-0.1	**0.3**	0.3	0.1	0.0	0.0	**0.0**
EE	**0.0**	**-0.2**	-0.2	-0.1	**0.2**	0.2	0.0	0.0	0.0	**-0.3**
IE	**0.6**	**0.4**	0.4	0.0	**0.2**	0.2	0.0	0.0	0.0	**0.4**
EL	**-0.3**	**-0.2**	-0.1	0.0	**-0.1**	-0.1	-0.1	0.0	0.0	**-0.2**
ES	**-0.2**	**-0.1**	-0.1	0.0	**-0.1**	0.2	-0.2	-0.1	0.0	**-0.3**
FR	**-0.1**	**-0.1**	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	**0.0**
HR	**-0.1**	**0.0**	-0.1	0.0	**0.0**	-0.1	0.1	0.0	0.0	**0.0**
IT	**-0.6**	**-0.2**	-0.2	-0.1	**-0.3**	-0.3	0.0	-0.1	0.0	**-0.2**
CY	**-0.7**	**-0.3**	-0.2	-0.1	**-0.4**	-0.2	-0.3	0.1	0.0	**-0.5**
LV	**0.2**	**0.2**	0.4	-0.2	**0.0**	0.0	0.0	-0.1	0.0	**0.1**
LT	**-0.7**	**-0.7**	-0.5	-0.2	**0.1**	0.0	0.1	0.0	0.0	**-0.6**
LU	**-0.3**	**0.0**	0.0	0.0	**-0.3**	-0.3	-0.1	0.0	0.1	**0.0**
HU	**-0.1**	**-0.2**	-0.1	0.0	**0.1**	0.0	0.1	0.0	0.0	**-0.1**
MT	**0.8**	**0.5**	0.3	0.2	**0.3**	0.2	0.2	0.0	0.0	**0.6**
NL	**0.2**	**-0.1**	-0.1	0.0	**0.3**	0.3	0.0	0.0	0.0	**-0.1**
AT	**0.0**	**-0.1**	-0.1	0.0	**0.1**	0.1	0.0	0.0	-0.1	**-0.1**
PL	**-0.3**	**-0.2**	-0.2	0.0	**-0.1**	0.0	-0.1	0.0	0.0	**-0.3**
PT	**-0.1**	**-0.1**	-0.1	-0.1	**0.0**	0.1	0.0	0.0	0.0	**-0.2**
RO	**0.2**	**0.4**	0.3	0.1	**-0.2**	-0.2	0.2	0.0	0.0	**0.4**
SI	**0.0**	**0.0**	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	**0.0**
SK	**0.2**	**-0.1**	-0.1	0.0	**0.3**	0.2	0.1	0.0	0.0	**0.0**
FI	**-0.4**	**-0.3**	-0.2	0.0	**-0.1**	-0.2	0.1	0.0	0.0	**-0.1**
SE	**0.0**	**0.0**	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	**-0.1**
UK	**-0.1**	**-0.1**	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	**-0.1**
NO	**-0.6**	**-0.2**	-0.2	0.0	**-0.4**	-0.4	0.0	0.0	0.0	**-0.2**
EA	**-0.1**	**-0.1**	-0.1	0.0	**0.0**	0.0	0.0	0.0	0.0	**-0.1**
EU*	**-0.1**	**-0.1**	0.0	0.0	**0.0**	0.0	0.0	0.0	0.0	**-0.1**

Source: Commission services, EPC.

4. INTEREST RATES

Similarly to the 2015 exercise, the long-term interest rate used for the Ageing Report 2018 is assumed to converge linearly to 3% real (5% nominal, given an inflation rate of 2%) in ten years' time, staying constant thereafter.

The interest rate assumptions currently underpinning the Ageing Report long-term projections contain elements dating back to 2006. In the 2012 and 2015 Ageing Report long-term projection exercises the AWG-EPC decided to hold the real long-term interest rate at 3% real (5% nominal, given the usual 2% inflation rate assumption), as it was the case in the previous 2006 and 2009 projection rounds ([32]). Yet, while in the 2006 and 2009 rounds this value was constant over the entire projection period, a gradual convergence to it was agreed in the 2012 and 2015 projection exercises, with faster linear convergence (until T+5) in 2012 and slower convergence (until T+10) in 2015. In all cases long-term interest rates were kept constant beyond the convergence year.

For the Ageing Report 2018 the AWG decided to maintain identical interest rate assumptions to those applied in the previous edition, conjecturing that the real long-term interest rate would converge linearly to 3% real (5% nominal, given an inflation rate of 2%) in ten years' time, from current country-specific levels. The value of 3% real (5% nominal) would be maintained thereafter. Inflation is assumed to reach 2% from current country-specific levels after five years (in 2021), when the output gap is assumed to be closed.

The (linear) convergence principle from current country-specific levels has the advantage of accounting for country idiosyncrasies in the short-run, while still maintaining the assumption of a common real interest rate in the long-run.

The chosen target level suggests that, albeit interest rates are currently low, the AWG deems current conditions to be cyclical and it expects EU interest rates to return to their historical average in ten years' time, on the back of economic recovery. Table I.4.1 illustrates that the level proposed to be reached by T+10 is consistent with the historical averages of real long-term interest rates in selected EU economies since the 1970s. Maintaining this level ensures consistency of interest rate assumptions over time. Moreover, this interest rate assumption reflects the fact that, though revised somewhat downwards, the growth assumptions in the Ageing Report 2018 are probably higher than those implicit in the current yield curve.

Table I.4.1: **Real long-term market interest rates over different horizons in selected countries (%, simple averages)**

	BE	DK	DE	IE	FR	IT	Avg
1970-2016	3.4	4.2	3.2	2.6	2.8	1.9	2.9
1970-2008	3.9	5.0	3.8	2.3	3.1	1.8	3.2
	NL	**AT**	**FI**	**SE**	**UK**	**US**	**Avg**
1970-2016	3.0	3.0	2.6	2.5	2.1	2.8	2.9
1970-2008	3.3	3.5	3.1	2.9	2.4	3.2	3.2

(1) The real long-term interest rate corresponds to an aggregate measure of government bond yields (generally 10-year maturity), deflated by the GDP deflator. Data for Western Germany until 1991; data for IE from 1971.
Source: AMECO and European Commission staff calculations.

For the purpose of the long-term projections, the AWG agreed that the real rate of return on funded pensions should be equal to the real long-term interest rate for all Member States. Similarly to the past, in the current pension projection exercise private pension projections are voluntary. Likewise, for those Member States that project taxes on pensions, it was agreed that they should specify the assumptions underlying those projections. In some cases, this may require a projection of the evolution of private funded pensions, where the assumed rate of return is an important determinant.

([32]) EPC and European Commission (2005), "The 2005 projections of age-related expenditure (2004-2050) for the EU-25 Member States: underlying assumptions and projection methodologies" *European Economy*, Special Report No 4/2005; EPC and European Commission (2008) "The 2009 Ageing Report: underlying assumptions and projection methodologies for the EU-27 Member States (2007-2060)" *European Economy* 7/2008. European Commission (DG ECFIN) and Economic Policy Committee (AWG), 2012, "*2012 Ageing Report: Economic and budgetary projections for the 27 EU Member States*", European Economy, No. 2/2012.

5. SENSITIVITY TESTS

5.1. INTRODUCTION

The baseline projections provide an illustration of how population ageing can influence economic and budgetary developments over the long term. However, given the inherent uncertainty of the assumptions underpinning any long-run projections, it is essential to carry out a number of sensitivity tests so as to quantify the responsiveness of projection results to changes in key underlying assumptions.

The sensitivity tests introduce a change or shock to an underlying assumption/parameter in the projection framework. For each sensitivity test, a uniform shock is applied to all Member States. The presentation and assessment of the impact of ageing populations on particular age-related expenditure items should be made with reference to all scenarios (baseline plus sensitivity tests): this is needed so that a clear picture emerges of the key factors driving the projection results and the potential sources of risk to future public expenditure developments.

The sensitivity tests provide useful information on the dynamics of the projections' results with respect to feasible changes in the key underlying assumptions. The relative impact can also be read as an 'elasticity' parameter. Thus, the sensitivity tests enable an assessment of the impact of any possible policy changes with a quantifiable effect on key assumption variables.

The tests would also be applied to the other age-related public expenditure items, as was the case in the 2015 Ageing Report.

5.2. MACRO-ECONOMIC PROJECTIONS UNDER DIFFERENT SENSITIVITY SCENARIOS

The macroeconomic projections under the different sensitivity scenarios are given in Table I.5.2 through Table I.5.6. The assumptions under the policy-change scenario are described in the following section and summarised in Table I.5.7.

To produce the overall set of assumptions, a bottom-up approach was followed, i.e. from population projections through labour input and to GDP growth projections. Therefore, each sensitivity test may involve the recalculation of all assumptions and the re-running of the labour force and productivity function-based models, in order to keep a consistent macroeconomic framework.

Drawing on past experience, the sensitivity scenarios considered in the AR 2015 proved being well suited for a sensitivity analysis of pension expenditures. Reproducing these sensitivity tests would ensure consistency and would allow for comparison between projection exercises. At the same time, experience warrants a number of modifications.

There is considerable uncertainty as regards future migration flows, and it is therefore important that the impact of higher or lower net migration is appropriately analysed. It is proposed therefore that the migration scenario is two-sided in order to cater for both positive and negative shocks in the net migration flows, and the size of the sensitivity scenarios are also increased to take account of the considerable uncertainty concerning migration flows. Moreover, as small changes in the trend in fertility can generate large variations in the future size of the population, an additional demographic scenario based on *lower fertility* is done. Furthermore, given the considerable uncertainty as regards future TFP (and labour productivity) growth a 'high' and a 'low' TFP growth scenario are carried out. Finally, a lower employment rates scenarios was additionally run.

Sensitivity scenarios

The following sensitivity scenarios have been formulated.

Life expectancy: mortality rates are adjusted so as to achieve an increase in life expectancy at birth of about two years by 2070 compared to the baseline. Specifically, it would be introduced by decreasing the age-specific mortality rates linearly over the period 2015-2070.

Net migration: A lower migration sensitivity test was introduced in the 2015 Ageing Report. For this report, it is proposed that the sensitivity test be carried out with both higher and lower migration, where migration flows would be one third (33 per cent) higher/lower than in the baseline scenario

Table I.5.1: **Overview of the sensitivity tests**

Population			Labour force		Productivity		Policy-change scenario
High life expectancy	**Lower/higher net migration**	**Lower fertility**	**Higher/lower employment rate**	**Higher employment rate older workers**	**Higher/lower TFP growth**	**TFP risk scenario**	**Linking retirement age (policy scenario)**
Increase of life expectancy at birth of about **two years** by 2070 compared with the baseline projection.	33**% less/more net** migration compared with the baseline over the entire projection horizon.	20**% lower** fertility compared with the baseline over the entire projection horizon.	Employment rate **2 p.p. higher/lower** compared with the baseline projection for the age-group 20-64.	Employment rate of older workers (55-74) **10 p.p. higher** compared with the baseline projection.	TFP growth is assumed to converge by 2045 to a growth rate which is **0.4 percentage points higher/lower** than in the baseline scenario (0.6% and 1.4% respectively). As for the baseline scenario, a period of fast convergence for 'followers' is assumed (i.e. rising by up to 0.6+0.5 and 1.4+0.5, respectively).	TFP growth assumed to converge to **0.8%** (instead of 1%). As for the baseline scenario, a period of fast convergence for 'followers' is assumed (i.e. rising by up to 0.8+0.5).	Retirement ages shifted year-over-year in line with change in life expectancy at current retirement ages (in the Cohort Simulation Model).
			The increase/decrease is introduced linearly over the period 2018-2030 and remains 2 p.p. higher/lower thereafter.	*The increase is introduced linearly over the period 2018-2030 and remains 10 p.p. higher thereafter.*	*The increase/decrease is introduced linearly during the period 2026-2045.*	*Convergence to the target rate in 2045 from the latest outturn year, i.e. 2016.*	
			The higher/lower employment rate is assumed to be achieved by lowering/increasing the rate of structural unemployment (the NAWRU).	*The higher employment rate of this group of workers is assumed to be achieved through a reduction of the inactive population.*			

Source: Commission services, EPC.

over the entire projection horizon. This would allow highlighting the impact of alternative migratory population developments on economic and budgetary systems.

Lower fertility: a scenario is proposed where fertility rate is assumed to be 20% lower compared to the baseline scenario over the entire projection horizon until 2070. As it is the case for the net migration scenarios, it would allow highlighting the impact of alternative natural population developments on economic and budgetary systems.

Total employment rate: the structural unemployment rate is changed so as to increase/decrease the employment rate (for the age group 20-64) by 2 pp between 2018 and 2030 compared to the baseline, and then to keep it at this higher value until 2070.

Older workers employment rate: through a reduction in inactive population, increase the employment rate of older workers (55 to 74) by 10 pp between 2018 and 2030 compared to the baseline, and thereafter keep it at this higher value until 2070.

Higher/lower TFP growth: a 'high' and a 'low' scenario was run. In these scenarios, total factor productivity growth are assumed to converge by 2045 to a steady-state growth rate which is 0.4 percentage points higher/lower than in the baseline scenario (0.6% and 1.4% respectively in the two alternative scenarios). As for the baseline scenario, a period of fast convergence for 'followers' is assumed (i.e. rising by up to 0.6+0.5 and 1.4+0.5, respectively).

TFP risk scenario: TFP growth is assumed to reach a 0.8% growth rate (instead of 1% in the baseline scenario). Convergence to the 'target growth rate' is assumed to take place from 2016 (the base year) until 2045 (it was assumed to reach 0.8% in 2035 in the 2015 Ageing Report). As for the baseline scenario, a period of fast convergence for 'followers' is assumed (i.e. rising by up to 0.8+0.5).

Table I.5.2: **Sensitivity test: Higher life expectancy**

		Due to growth in:								
	GDP growth in 2016-2070	***Productivity (GDP per hour worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	***GDP per capita growth in 2016-2070***
Country	**1=2+5**	**2=3+4**	3	4	**5=6+7+8+9**	6	7	8	9	**10=1-6**
BE	**1.5**	**1.3**	0.8	0.4	**0.3**	0.4	0.0	-0.2	0.0	**1.1**
BG	**1.4**	**2.3**	1.4	0.9	**-0.9**	-0.7	0.1	-0.4	0.0	**2.0**
CZ	**1.5**	**1.8**	1.2	0.6	**-0.3**	-0.1	0.0	-0.3	0.0	**1.5**
DK	**1.6**	**1.4**	0.9	0.5	**0.3**	0.4	0.1	-0.2	0.0	**1.3**
DE	**1.2**	**1.5**	1.0	0.5	**-0.3**	0.0	0.0	-0.3	-0.1	**1.2**
EE	**1.5**	**1.9**	1.2	0.7	**-0.4**	-0.2	0.1	-0.3	0.0	**1.7**
IE	**2.0**	**1.6**	1.1	0.5	**0.5**	0.5	0.1	-0.1	0.0	**1.5**
EL	**0.8**	**1.1**	0.8	0.3	**-0.3**	-0.6	0.5	-0.3	0.0	**1.4**
ES	**1.5**	**1.3**	0.9	0.5	**0.1**	0.2	0.2	-0.3	0.0	**1.3**
FR	**1.6**	**1.3**	0.8	0.5	**0.3**	0.3	0.1	-0.1	0.0	**1.3**
HR	**1.2**	**1.7**	1.0	0.7	**-0.4**	-0.3	0.2	-0.2	0.0	**1.6**
IT	**0.9**	**1.0**	0.7	0.4	**-0.1**	-0.1	0.2	-0.2	0.0	**1.0**
CY	**1.5**	**1.2**	0.7	0.5	**0.3**	0.4	0.2	-0.3	0.0	**1.1**
LV	**1.9**	**2.7**	1.8	0.9	**-0.8**	-0.7	0.2	-0.3	0.0	**2.6**
LT	**1.1**	**2.0**	1.2	0.8	**-0.9**	-0.9	0.3	-0.3	0.0	**2.0**
LU	**2.3**	**1.4**	0.9	0.5	**0.8**	1.1	-0.1	-0.2	0.0	**1.1**
HU	**1.6**	**1.9**	1.3	0.7	**-0.3**	-0.1	0.2	-0.3	0.0	**1.8**
MT	**2.3**	**1.9**	1.2	0.7	**0.4**	0.4	0.4	-0.3	0.0	**1.9**
NL	**1.5**	**1.3**	0.8	0.5	**0.2**	0.3	0.1	-0.2	0.0	**1.2**
AT	**1.5**	**1.4**	0.9	0.5	**0.1**	0.3	0.1	-0.3	-0.1	**1.1**
PL	**1.4**	**2.2**	1.3	0.8	**-0.8**	-0.3	0.0	-0.4	0.0	**1.8**
PT	**0.9**	**1.5**	1.0	0.5	**-0.6**	-0.4	0.1	-0.3	0.0	**1.3**
RO	**1.8**	**2.6**	1.7	0.9	**-0.8**	-0.5	0.0	-0.3	0.0	**2.3**
SI	**1.5**	**1.8**	1.2	0.6	**-0.2**	-0.1	0.1	-0.3	0.0	**1.6**
SK	**1.9**	**2.2**	1.5	0.7	**-0.3**	-0.1	0.2	-0.4	0.0	**2.1**
FI	**1.3**	**1.3**	0.8	0.5	**0.0**	0.1	0.2	-0.2	0.0	**1.2**
SE	**1.9**	**1.5**	1.0	0.5	**0.5**	0.7	0.0	-0.2	0.0	**1.3**
UK	**1.7**	**1.4**	0.9	0.5	**0.3**	0.4	0.0	-0.2	0.0	**1.3**
NO	**1.8**	**1.5**	0.9	0.5	**0.3**	0.6	0.0	-0.2	0.0	**1.2**
EA	**1.3**	**1.4**	0.9	0.5	**0.0**	0.1	0.1	-0.2	0.0	**1.2**
EU*	**1.4**	**1.5**	0.9	0.5	**-0.1**	0.1	0.1	-0.2	0.0	**1.3**
EU27	**1.3**	**1.5**	0.9	0.5	**-0.1**	0.0	0.1	-0.2	0.0	**1.3**

Source: Commission services, EPC.

Policy scenario: linking retirement ages with increases in life expectancy

As for the 2015 Ageing Report, in addition to the sensitivity tests described above, an additional scenario is considered, so as to quantify the impact of possible future policy changes that have yet to be enacted. Specifically, it entails a link between the retirement age and life expectancy.

The scenario considers the adoption of an automatic mechanism revising the retirement age with the evolution of life expectancy. For those countries where a link between retirement age and increase in life expectancy is already legislated (hence integral part of the baseline), no deviations are expected in terms of expenditure over GDP ([33]).

Finally, in order to cater for the potential negative effect of retirement age increase on the labour market for older workers, the potential increase in labour supply due to the automatic mechanism is reduced by 25%, and this is simulated by increasing the number of older unemployed persons in a proportional manner.

([33]) The same applies if the legislation contemplates increases in statutory retirement that are higher than the gains in life expectancy.

Table I.5.3: **Sensitivity test: Higher migration**

		Due to growth in:								
	GDP growth in 2016-2070	***Productivity (GDP per hour worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	***GDP per capita growth in 2016-2070***
Country	**1=2+5**	**2=3+4**	3	4	**5=6+7+8+9**	6	7	8	9	**10=1-6**
BE	**1.7**	**1.2**	0.8	0.4	**0.4**	0.5	0.0	-0.1	0.0	**1.1**
BG	**1.3**	**2.3**	1.4	0.9	**-1.0**	-0.7	0.1	-0.3	0.0	**2.1**
CZ	**1.5**	**1.8**	1.2	0.6	**-0.3**	0.0	0.0	-0.3	0.0	**1.6**
DK	**1.7**	**1.3**	0.9	0.4	**0.4**	0.5	0.1	-0.2	0.0	**1.2**
DE	**1.3**	**1.5**	1.0	0.5	**-0.1**	0.1	0.0	-0.2	-0.1	**1.2**
EE	**1.5**	**1.9**	1.2	0.7	**-0.3**	-0.2	0.1	-0.2	0.0	**1.7**
IE	**2.1**	**1.6**	1.1	0.5	**0.5**	0.6	0.1	-0.1	0.0	**1.6**
EL	**0.8**	**1.1**	0.8	0.4	**-0.3**	-0.6	0.5	-0.2	0.0	**1.4**
ES	**1.6**	**1.3**	0.9	0.5	**0.3**	0.3	0.2	-0.2	0.0	**1.4**
FR	**1.6**	**1.3**	0.8	0.5	**0.3**	0.3	0.1	-0.1	0.0	**1.3**
HR	**1.3**	**1.7**	1.0	0.7	**-0.4**	-0.3	0.2	-0.2	0.0	**1.6**
IT	**1.0**	**1.0**	0.7	0.4	**0.0**	0.0	0.2	-0.2	0.0	**1.0**
CY	**1.6**	**1.2**	0.7	0.4	**0.4**	0.5	0.2	-0.2	0.0	**1.1**
LV	**1.8**	**2.7**	1.8	0.9	**-1.0**	-0.8	0.2	-0.3	0.0	**2.6**
LT	**0.9**	**2.1**	1.2	0.9	**-1.2**	-1.2	0.3	-0.3	0.0	**2.1**
LU	**2.5**	**1.4**	0.9	0.4	**1.1**	1.4	-0.1	-0.2	0.0	**1.1**
HU	**1.7**	**1.9**	1.3	0.6	**-0.2**	-0.1	0.2	-0.3	0.0	**1.8**
MT	**2.5**	**1.9**	1.2	0.7	**0.5**	0.5	0.4	-0.3	0.0	**1.9**
NL	**1.6**	**1.2**	0.8	0.4	**0.3**	0.4	0.1	-0.2	0.0	**1.2**
AT	**1.7**	**1.4**	0.9	0.5	**0.3**	0.5	0.1	-0.2	-0.1	**1.2**
PL	**1.4**	**2.2**	1.3	0.8	**-0.7**	-0.4	0.0	-0.3	0.0	**1.8**
PT	**1.0**	**1.5**	1.0	0.5	**-0.5**	-0.4	0.1	-0.2	0.0	**1.4**
RO	**1.7**	**2.6**	1.7	0.9	**-0.9**	-0.6	0.0	-0.3	0.0	**2.3**
SI	**1.7**	**1.8**	1.2	0.6	**-0.1**	0.0	0.1	-0.2	0.0	**1.6**
SK	**1.9**	**2.2**	1.5	0.7	**-0.3**	-0.1	0.2	-0.3	0.0	**2.1**
FI	**1.4**	**1.3**	0.8	0.5	**0.1**	0.1	0.1	-0.2	0.0	**1.2**
SE	**2.1**	**1.4**	1.0	0.5	**0.7**	0.8	0.0	-0.2	0.0	**1.3**
UK	**1.8**	**1.4**	0.9	0.5	**0.4**	0.5	0.0	-0.1	0.0	**1.3**
NO	**1.9**	**1.4**	0.9	0.5	**0.5**	0.7	0.0	-0.2	0.0	**1.2**
EA	**1.4**	**1.3**	0.9	0.5	**0.1**	0.2	0.1	-0.2	0.0	**1.3**
EU*	**1.5**	**1.5**	0.9	0.5	**0.0**	0.1	0.1	-0.2	0.0	**1.3**
EU27	**1.4**	**1.5**	0.9	0.5	**0.0**	0.1	0.1	-0.2	0.0	**1.3**

Source: Commission services, EPC.

Table I.5.4: **Sensitivity test: Lower migration**

		Due to growth in:								
	GDP growth in 2016-2070	***Productivity (GDP per hour worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	***GDP per capita growth in 2016-2070***
Country	**1=2+5**	**2=3+4**	3	4	**5=6+7+8+9**	6	7	8	9	**10=1-6**
BE	**1.4**	**1.3**	0.8	0.5	**0.1**	0.2	0.0	-0.2	0.0	**1.2**
BG	**1.4**	**2.3**	1.4	0.9	**-0.9**	-0.7	0.1	-0.3	0.0	**2.1**
CZ	**1.4**	**1.8**	1.2	0.6	**-0.4**	-0.2	0.0	-0.3	0.0	**1.6**
DK	**1.5**	**1.4**	0.9	0.5	**0.1**	0.2	0.1	-0.2	0.0	**1.3**
DE	**1.0**	**1.5**	1.0	0.5	**-0.5**	-0.2	0.0	-0.2	-0.1	**1.2**
EE	**1.5**	**1.9**	1.2	0.7	**-0.4**	-0.2	0.1	-0.2	0.0	**1.7**
IE	**2.0**	**1.6**	1.1	0.5	**0.4**	0.4	0.1	-0.1	0.0	**1.6**
EL	**0.7**	**1.1**	0.8	0.3	**-0.4**	-0.6	0.5	-0.2	0.0	**1.4**
ES	**1.3**	**1.3**	0.9	0.5	**0.0**	0.0	0.2	-0.2	0.0	**1.3**
FR	**1.5**	**1.3**	0.8	0.5	**0.2**	0.2	0.1	-0.1	0.0	**1.3**
HR	**1.2**	**1.7**	1.0	0.7	**-0.5**	-0.4	0.2	-0.2	0.0	**1.6**
IT	**0.7**	**1.1**	0.7	0.4	**-0.4**	-0.3	0.2	-0.2	0.0	**1.0**
CY	**1.2**	**1.2**	0.7	0.5	**0.0**	0.2	0.2	-0.3	0.0	**1.1**
LV	**2.0**	**2.7**	1.8	0.8	**-0.6**	-0.6	0.2	-0.3	0.0	**2.6**
LT	**1.3**	**2.0**	1.2	0.8	**-0.7**	-0.7	0.2	-0.3	0.0	**2.0**
LU	**1.9**	**1.5**	0.9	0.5	**0.5**	0.7	-0.1	-0.2	0.0	**1.2**
HU	**1.5**	**1.9**	1.3	0.7	**-0.4**	-0.3	0.2	-0.3	0.0	**1.8**
MT	**2.1**	**2.0**	1.2	0.7	**0.1**	0.1	0.4	-0.3	0.0	**2.0**
NL	**1.3**	**1.3**	0.8	0.5	**0.0**	0.1	0.1	-0.2	0.0	**1.2**
AT	**1.3**	**1.4**	0.9	0.5	**-0.2**	0.1	0.1	-0.3	-0.1	**1.2**
PL	**1.4**	**2.2**	1.3	0.8	**-0.8**	-0.4	0.0	-0.3	0.0	**1.8**
PT	**0.8**	**1.5**	1.0	0.5	**-0.7**	-0.5	0.1	-0.3	0.0	**1.4**
RO	**1.8**	**2.6**	1.7	0.9	**-0.7**	-0.4	0.0	-0.3	0.0	**2.3**
SI	**1.4**	**1.8**	1.2	0.6	**-0.4**	-0.2	0.1	-0.3	0.0	**1.6**
SK	**1.8**	**2.3**	1.5	0.7	**-0.4**	-0.2	0.2	-0.3	0.0	**2.1**
FI	**1.2**	**1.3**	0.8	0.5	**-0.1**	0.0	0.1	-0.2	0.0	**1.2**
SE	**1.8**	**1.5**	1.0	0.5	**0.3**	0.4	0.0	-0.2	0.0	**1.3**
UK	**1.6**	**1.4**	0.9	0.5	**0.2**	0.3	0.1	-0.2	0.0	**1.3**
NO	**1.6**	**1.5**	0.9	0.6	**0.1**	0.4	0.0	-0.2	0.0	**1.2**
EA	**1.2**	**1.4**	0.9	0.5	**-0.2**	-0.1	0.1	-0.2	0.0	**1.3**
EU*	**1.3**	**1.5**	0.9	0.5	**-0.2**	-0.1	0.1	-0.2	0.0	**1.3**
EU27	**1.2**	**1.5**	0.9	0.6	**-0.3**	-0.1	0.1	-0.2	0.0	**1.3**

Source: Commission services, EPC.

Table I.5.5: **Sensitivity tests: Higher employment**

		Due to growth in:								
	GDP growth in 2016-2070	***Productivity (GDP per hour worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	***GDP per capita growth in 2016-2070***
Country	**1=2+5**	**2=3+4**	3	4	**5=6+7+8+9**	6	7	8	9	**10=1-6**
BE	**1.5**	**1.3**	0.8	0.5	**0.2**	0.4	0.0	-0.1	0.0	**1.1**
BG	**1.3**	**2.3**	1.4	0.9	**-1.0**	-0.7	0.0	-0.3	0.0	**2.1**
CZ	**1.4**	**1.8**	1.2	0.6	**-0.4**	-0.1	0.0	-0.3	0.0	**1.5**
DK	**1.6**	**1.4**	0.9	0.5	**0.2**	0.3	0.0	-0.2	0.0	**1.2**
DE	**1.1**	**1.5**	1.0	0.5	**-0.3**	-0.1	0.0	-0.2	-0.1	**1.2**
EE	**1.5**	**1.9**	1.2	0.7	**-0.4**	-0.2	0.0	-0.2	0.0	**1.7**
IE	**2.0**	**1.6**	1.1	0.5	**0.4**	0.5	0.0	-0.1	0.0	**1.5**
EL	**0.8**	**1.2**	0.8	0.4	**-0.4**	-0.6	0.4	-0.2	0.0	**1.4**
ES	**1.4**	**1.4**	0.9	0.5	**0.1**	0.1	0.2	-0.2	0.0	**1.3**
FR	**1.5**	**1.3**	0.8	0.5	**0.2**	0.3	0.1	-0.1	0.0	**1.3**
HR	**1.2**	**1.7**	1.0	0.7	**-0.5**	-0.4	0.2	-0.2	0.0	**1.6**
IT	**0.8**	**1.1**	0.7	0.4	**-0.3**	-0.2	0.1	-0.2	0.0	**1.0**
CY	**1.4**	**1.2**	0.7	0.5	**0.2**	0.3	0.1	-0.2	0.0	**1.0**
LV	**1.9**	**2.7**	1.8	0.9	**-0.8**	-0.7	0.2	-0.3	0.0	**2.6**
LT	**1.0**	**2.0**	1.2	0.8	**-1.0**	-0.9	0.2	-0.3	0.0	**2.0**
LU	**2.2**	**1.4**	0.9	0.5	**0.8**	1.1	-0.1	-0.2	0.0	**1.1**
HU	**1.6**	**1.9**	1.3	0.7	**-0.3**	-0.2	0.1	-0.3	0.0	**1.8**
MT	**2.3**	**2.0**	1.2	0.7	**0.3**	0.3	0.3	-0.3	0.0	**1.9**
NL	**1.4**	**1.3**	0.8	0.5	**0.2**	0.3	0.1	-0.2	0.0	**1.2**
AT	**1.4**	**1.4**	0.9	0.5	**0.0**	0.3	0.0	-0.2	-0.1	**1.1**
PL	**1.4**	**2.2**	1.3	0.9	**-0.8**	-0.4	-0.1	-0.3	0.0	**1.8**
PT	**0.9**	**1.5**	1.0	0.5	**-0.6**	-0.5	0.1	-0.2	0.0	**1.4**
RO	**1.8**	**2.6**	1.7	0.9	**-0.8**	-0.5	0.0	-0.3	0.0	**2.3**
SI	**1.5**	**1.8**	1.2	0.6	**-0.3**	-0.1	0.1	-0.3	0.0	**1.6**
SK	**1.8**	**2.3**	1.5	0.7	**-0.4**	-0.2	0.1	-0.3	0.0	**2.0**
FI	**1.2**	**1.3**	0.8	0.5	**-0.1**	0.0	0.1	-0.2	0.0	**1.2**
SE	**1.9**	**1.5**	1.0	0.5	**0.4**	0.6	0.0	-0.2	0.0	**1.3**
UK	**1.7**	**1.4**	0.9	0.5	**0.3**	0.4	0.0	-0.2	0.0	**1.3**
NO	**1.8**	**1.5**	0.9	0.6	**0.3**	0.5	-0.1	-0.2	0.0	**1.2**
EA	**1.3**	**1.4**	0.9	0.5	**-0.1**	0.0	0.1	-0.2	0.0	**1.2**
EU*	**1.3**	**1.5**	0.9	0.5	**-0.1**	0.0	0.1	-0.2	0.0	**1.3**
EU27	**1.3**	**1.5**	0.9	0.5	**-0.2**	0.0	0.1	-0.2	0.0	**1.3**

Source: Commission services, EPC.

Table I.5.6: **Sensitivity tests: Lower employment**

		Due to growth in:								
	GDP growth in 2016-2070	***Productivity (GDP per hour worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	***GDP per capita growth in 2016-2070***
Country	**1=2+5**	**2=3+4**	3	4	**5=6+7+8+9**	6	7	8	9	**10=1-6**
BE	**1.5**	**1.3**	0.8	0.5	**0.2**	0.4	0.0	-0.1	0.0	**1.1**
BG	**1.3**	**2.3**	1.4	0.9	**-1.0**	-0.7	0.0	-0.3	0.0	**2.1**
CZ	**1.4**	**1.8**	1.2	0.6	**-0.4**	-0.1	0.0	-0.3	0.0	**1.5**
DK	**1.6**	**1.4**	0.9	0.5	**0.2**	0.3	0.0	-0.2	0.0	**1.2**
DE	**1.1**	**1.5**	1.0	0.5	**-0.3**	-0.1	0.0	-0.2	-0.1	**1.2**
EE	**1.5**	**1.9**	1.2	0.7	**-0.4**	-0.2	0.0	-0.2	0.0	**1.7**
IE	**2.0**	**1.6**	1.1	0.5	**0.4**	0.5	0.0	-0.1	0.0	**1.5**
EL	**0.8**	**1.2**	0.8	0.4	**-0.4**	-0.6	0.4	-0.2	0.0	**1.4**
ES	**1.4**	**1.4**	0.9	0.5	**0.1**	0.1	0.2	-0.2	0.0	**1.3**
FR	**1.5**	**1.3**	0.8	0.5	**0.2**	0.3	0.1	-0.1	0.0	**1.3**
HR	**1.2**	**1.7**	1.0	0.7	**-0.5**	-0.4	0.2	-0.2	0.0	**1.6**
IT	**0.8**	**1.1**	0.7	0.4	**-0.3**	-0.2	0.1	-0.2	0.0	**1.0**
CY	**1.4**	**1.2**	0.7	0.5	**0.2**	0.3	0.1	-0.2	0.0	**1.0**
LV	**1.9**	**2.7**	1.8	0.9	**-0.8**	-0.7	0.2	-0.3	0.0	**2.6**
LT	**1.0**	**2.0**	1.2	0.8	**-1.0**	-0.9	0.2	-0.3	0.0	**2.0**
LU	**2.2**	**1.4**	0.9	0.5	**0.8**	1.1	-0.1	-0.2	0.0	**1.1**
HU	**1.6**	**1.9**	1.3	0.7	**-0.3**	-0.2	0.1	-0.3	0.0	**1.8**
MT	**2.3**	**2.0**	1.2	0.7	**0.3**	0.3	0.3	-0.3	0.0	**1.9**
NL	**1.4**	**1.3**	0.8	0.5	**0.2**	0.3	0.1	-0.2	0.0	**1.2**
AT	**1.4**	**1.4**	0.9	0.5	**0.0**	0.3	0.0	-0.2	-0.1	**1.1**
PL	**1.4**	**2.2**	1.3	0.9	**-0.8**	-0.4	-0.1	-0.3	0.0	**1.8**
PT	**0.9**	**1.5**	1.0	0.5	**-0.6**	-0.5	0.1	-0.2	0.0	**1.4**
RO	**1.8**	**2.6**	1.7	0.9	**-0.8**	-0.5	0.0	-0.3	0.0	**2.3**
SI	**1.5**	**1.8**	1.2	0.6	**-0.3**	-0.1	0.1	-0.3	0.0	**1.6**
SK	**1.8**	**2.3**	1.5	0.7	**-0.4**	-0.2	0.1	-0.3	0.0	**2.0**
FI	**1.2**	**1.3**	0.8	0.5	**-0.1**	0.0	0.1	-0.2	0.0	**1.2**
SE	**1.9**	**1.5**	1.0	0.5	**0.4**	0.6	0.0	-0.2	0.0	**1.3**
UK	**1.7**	**1.4**	0.9	0.5	**0.3**	0.4	0.0	-0.2	0.0	**1.3**
NO	**1.8**	**1.5**	0.9	0.6	**0.3**	0.5	-0.1	-0.2	0.0	**1.2**
EA	**1.3**	**1.4**	0.9	0.5	**-0.1**	0.0	0.1	-0.2	0.0	**1.2**
EU*	**1.3**	**1.5**	0.9	0.5	**-0.1**	0.0	0.1	-0.2	0.0	**1.3**
EU27	**1.3**	**1.5**	0.9	0.5	**-0.2**	0.0	0.1	-0.2	0.0	**1.3**

Source: Commission services, EPC.

Table I.5.7: **Sensitivity tests: Higher employment rate of older workers**

	GDP growth in 2016-2070	Due to growth in:								GDP per capita growth in 2016-2070
		Productivity (GDP per hour worked)	TFP	Capital deepening	Labour input	Total population	Employment rate	Share of working age population	Change in average hours worked	
Country	1=2+5	2=3+4	3	4	5=6+7+8+9	6	7	8	9	10=1-6
BE	1.6	1.2	0.8	0.4	0.4	0.4	0.1	-0.1	0.0	1.2
BG	1.5	2.3	1.4	0.8	-0.8	-0.7	0.2	-0.3	0.0	2.2
CZ	1.5	1.8	1.2	0.6	-0.3	-0.1	0.1	-0.3	0.0	1.6
DK	1.7	1.3	0.9	0.4	0.3	0.3	0.2	-0.2	0.0	1.3
DE	1.2	1.4	1.0	0.5	-0.2	-0.1	0.1	-0.2	-0.1	1.3
EE	1.6	1.9	1.2	0.7	-0.3	-0.2	0.2	-0.2	0.0	1.8
IE	2.1	1.6	1.1	0.5	0.6	0.5	0.2	-0.1	0.0	1.6
EL	0.8	1.1	0.8	0.3	-0.2	-0.6	0.6	-0.2	0.0	1.5
ES	1.5	1.3	0.9	0.4	0.2	0.1	0.3	-0.2	0.0	1.4
FR	1.6	1.3	0.8	0.4	0.3	0.3	0.2	-0.1	0.0	1.3
HR	1.3	1.6	1.0	0.6	-0.3	-0.4	0.3	-0.2	0.0	1.7
IT	0.9	1.0	0.7	0.3	-0.1	-0.2	0.3	-0.2	0.0	1.1
CY	1.5	1.1	0.7	0.4	0.3	0.3	0.3	-0.2	0.0	1.1
LV	2.0	2.7	1.8	0.8	-0.7	-0.7	0.3	-0.3	0.0	2.7
LT	1.1	2.0	1.2	0.8	-0.9	-0.9	0.4	-0.3	0.0	2.1
LU	2.3	1.4	0.9	0.4	0.9	1.1	0.0	-0.2	0.0	1.2
HU	1.7	1.9	1.3	0.6	-0.2	-0.2	0.3	-0.3	0.0	1.9
MT	2.4	1.9	1.2	0.7	0.4	0.3	0.5	-0.3	0.0	2.0
NL	1.5	1.2	0.8	0.4	0.3	0.3	0.2	-0.2	0.0	1.3
AT	1.5	1.4	0.9	0.5	0.1	0.3	0.2	-0.2	-0.1	1.2
PL	1.5	2.1	1.3	0.8	-0.7	-0.4	0.1	-0.3	0.0	1.9
PT	1.0	1.5	1.0	0.5	-0.5	-0.5	0.2	-0.2	0.0	1.5
RO	1.9	2.5	1.7	0.9	-0.7	-0.5	0.1	-0.3	0.0	2.4
SI	1.6	1.7	1.2	0.5	-0.1	-0.1	0.2	-0.3	0.0	1.7
SK	1.9	2.2	1.5	0.7	-0.3	-0.2	0.3	-0.3	0.0	2.1
FI	1.3	1.2	0.8	0.5	0.1	0.0	0.2	-0.2	0.0	1.3
SE	2.0	1.4	1.0	0.5	0.6	0.6	0.1	-0.2	0.0	1.4
UK	1.8	1.4	0.9	0.5	0.4	0.4	0.1	-0.2	0.0	1.4
NO	1.9	1.4	0.9	0.5	0.4	0.5	0.1	-0.2	0.0	1.3
EA	1.4	1.3	0.9	0.4	0.0	0.0	0.2	-0.2	0.0	1.3
EU*	1.4	1.4	0.9	0.5	0.0	0.0	0.2	-0.2	0.0	1.4
EU27	1.4	1.4	0.9	0.5	-0.1	0.0	0.2	-0.2	0.0	1.4

Source: Commission services, EPC.

Table I.5.8: **Sensitivity tests: Lower fertility**

	GDP growth in 2016-2070	Due to growth in:								GDP per capita growth in 2016-2070
		Productivity (GDP per hour worked)	TFP	Capital deepening	Labour input	Total population	Employment rate	Share of working age population	Change in average hours worked	
Country	1=2+5	2=3+4	3	4	5=6+7+8+9	6	7	8	9	10=1-6
BE	1.3	1.3	0.8	0.4	0.0	0.1	0.0	-0.1	0.0	1.2
BG	1.0	2.3	1.4	0.9	-1.3	-1.0	0.0	-0.3	0.0	2.1
CZ	1.2	1.8	1.2	0.6	-0.6	-0.4	0.0	-0.3	0.0	1.5
DK	1.3	1.4	0.9	0.5	-0.1	0.1	0.1	-0.2	0.0	1.3
DE	0.9	1.5	1.0	0.5	-0.6	-0.3	0.0	-0.2	-0.1	1.2
EE	1.2	1.9	1.2	0.7	-0.7	-0.5	0.0	-0.2	0.0	1.7
IE	1.8	1.6	1.1	0.5	0.2	0.2	0.1	-0.1	0.0	1.6
EL	0.5	1.1	0.8	0.4	-0.6	-0.9	0.5	-0.2	0.0	1.4
ES	1.2	1.3	0.9	0.5	-0.1	-0.1	0.2	-0.2	0.0	1.4
FR	1.2	1.3	0.8	0.5	-0.1	0.0	0.1	-0.1	0.0	1.3
HR	0.9	1.7	1.0	0.7	-0.7	-0.7	0.2	-0.2	0.0	1.6
IT	0.6	1.0	0.7	0.4	-0.4	-0.4	0.2	-0.2	0.0	1.0
CY	1.2	1.2	0.7	0.5	0.0	0.1	0.2	-0.2	0.0	1.1
LV	1.5	2.7	1.8	0.9	-1.2	-1.0	0.2	-0.3	0.0	2.6
LT	0.7	2.0	1.2	0.8	-1.4	-1.3	0.2	-0.3	0.0	2.0
LU	2.0	1.4	0.9	0.5	0.6	0.9	-0.1	-0.2	0.0	1.1
HU	1.3	1.9	1.3	0.7	-0.6	-0.5	0.2	-0.3	0.0	1.8
MT	2.0	1.9	1.2	0.7	0.1	0.1	0.3	-0.3	0.0	1.9
NL	1.2	1.3	0.8	0.5	-0.1	0.0	0.1	-0.2	0.0	1.2
AT	1.2	1.4	0.9	0.5	-0.2	0.1	0.0	-0.2	-0.1	1.1
PL	1.1	2.2	1.3	0.8	-1.1	-0.7	-0.1	-0.4	0.0	1.7
PT	0.7	1.5	1.0	0.5	-0.9	-0.7	0.1	-0.2	0.0	1.4
RO	1.4	2.6	1.7	0.9	-1.2	-0.8	0.0	-0.3	0.0	2.3
SI	1.2	1.8	1.2	0.6	-0.5	-0.4	0.1	-0.2	0.0	1.6
SK	1.6	2.2	1.5	0.7	-0.7	-0.5	0.2	-0.3	0.0	2.0
FI	1.0	1.3	0.8	0.5	-0.3	-0.2	0.1	-0.2	0.0	1.2
SE	1.7	1.5	1.0	0.5	0.2	0.3	0.0	-0.1	0.0	1.3
UK	1.4	1.4	0.9	0.5	0.0	0.1	0.0	-0.1	0.0	1.3
NO	1.5	1.5	0.9	0.5	0.1	0.3	-0.1	-0.2	0.0	1.2
EA	1.0	1.4	0.9	0.5	-0.3	-0.2	0.1	-0.2	0.0	1.3
EU*	1.1	1.5	0.9	0.5	-0.4	-0.2	0.1	-0.2	0.0	1.3
EU27	1.0	1.5	0.9	0.5	-0.4	-0.3	0.1	-0.2	0.0	1.3

Source: Commission services, EPC.

Table I.5.9: **Sensitivity tests: TFP risk**

		Due to growth in:								
	GDP growth in 2016-2070	***Productivity (GDP per hour worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	***GDP per capita growth in 2016-2070***
Country	**1=2+5**	**2=3+4**	3	4	**5=6+7+8+9**	6	7	8	9	**10=1-6**
BE	**1.3**	**1.0**	0.7	0.4	**0.3**	0.4	0.0	-0.1	0.0	**0.9**
BG	**1.0**	**2.0**	1.2	0.8	**-0.9**	-0.7	0.1	-0.3	0.0	**1.7**
CZ	**1.1**	**1.5**	0.9	0.5	**-0.3**	-0.1	0.0	-0.3	0.0	**1.2**
DK	**1.3**	**1.1**	0.7	0.4	**0.2**	0.3	0.1	-0.2	0.0	**0.9**
DE	**0.9**	**1.2**	0.8	0.4	**-0.3**	-0.1	0.0	-0.2	-0.1	**1.0**
EE	**1.2**	**1.5**	0.9	0.6	**-0.4**	-0.2	0.1	-0.2	0.0	**1.4**
IE	**2.0**	**1.6**	1.1	0.5	**0.5**	0.5	0.1	-0.1	0.0	**1.6**
EL	**0.4**	**0.8**	0.5	0.3	**-0.4**	-0.6	0.5	-0.2	0.0	**1.1**
ES	**1.3**	**1.1**	0.7	0.4	**0.1**	0.1	0.2	-0.2	0.0	**1.1**
FR	**1.3**	**1.1**	0.7	0.4	**0.3**	0.3	0.1	-0.1	0.0	**1.1**
HR	**1.1**	**1.5**	0.9	0.6	**-0.4**	-0.4	0.2	-0.2	0.0	**1.4**
IT	**0.6**	**0.8**	0.5	0.3	**-0.2**	-0.2	0.2	-0.2	0.0	**0.8**
CY	**1.2**	**1.0**	0.6	0.4	**0.2**	0.3	0.2	-0.2	0.0	**0.9**
LV	**1.5**	**2.3**	1.5	0.7	**-0.8**	-0.7	0.2	-0.3	0.0	**2.2**
LT	**0.5**	**1.4**	0.8	0.7	**-0.9**	-0.9	0.3	-0.3	0.0	**1.4**
LU	**1.9**	**1.1**	0.7	0.4	**0.8**	1.1	-0.1	-0.2	0.0	**0.8**
HU	**1.2**	**1.5**	0.9	0.5	**-0.3**	-0.2	0.2	-0.3	0.0	**1.4**
MT	**2.0**	**1.7**	1.1	0.6	**0.4**	0.3	0.4	-0.3	0.0	**1.7**
NL	**1.2**	**1.0**	0.6	0.4	**0.2**	0.3	0.1	-0.2	0.0	**1.0**
AT	**1.2**	**1.1**	0.7	0.4	**0.1**	0.3	0.1	-0.2	-0.1	**0.9**
PL	**1.0**	**1.7**	1.0	0.7	**-0.8**	-0.4	0.0	-0.3	0.0	**1.4**
PT	**0.7**	**1.3**	0.8	0.4	**-0.6**	-0.5	0.1	-0.2	0.0	**1.1**
RO	**1.4**	**2.2**	1.4	0.8	**-0.8**	-0.5	0.0	-0.3	0.0	**1.9**
SI	**1.2**	**1.4**	0.9	0.5	**-0.2**	-0.1	0.1	-0.3	0.0	**1.3**
SK	**1.4**	**1.8**	1.2	0.6	**-0.4**	-0.2	0.2	-0.3	0.0	**1.6**
FI	**0.9**	**0.9**	0.5	0.4	**0.0**	0.0	0.1	-0.2	0.0	**0.9**
SE	**1.7**	**1.2**	0.8	0.4	**0.5**	0.6	0.0	-0.2	0.0	**1.1**
UK	**1.4**	**1.1**	0.7	0.4	**0.3**	0.4	0.1	-0.2	0.0	**1.0**
NO	**1.5**	**1.1**	0.7	0.4	**0.3**	0.5	0.0	-0.2	0.0	**0.9**
EA	**1.1**	**1.1**	0.7	0.4	**-0.1**	0.0	0.1	-0.2	0.0	**1.0**
EU*	**1.1**	**1.2**	0.8	0.4	**-0.1**	0.0	0.1	-0.2	0.0	**1.1**
EU27	**1.1**	**1.2**	0.8	0.5	**-0.2**	0.0	0.1	-0.2	0.0	**1.1**

Source: Commission services, EPC.

Table I.5.10: **Sensitivity tests: Higher TFP growth**

		Due to growth in:								
	GDP growth in 2016-2070	***Productivity (GDP per hour worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	***GDP per capita growth in 2016-2070***
Country	**1=2+5**	**2=3+4**	3	4	**5=6+7+8+9**	6	7	8	9	**10=1-6**
BE	**1.9**	**1.6**	1.1	0.6	**0.3**	0.4	0.0	-0.1	0.0	**1.5**
BG	**1.8**	**2.7**	1.7	1.0	**-0.9**	-0.7	0.1	-0.3	0.0	**2.5**
CZ	**1.9**	**2.2**	1.4	0.8	**-0.3**	-0.1	0.0	-0.3	0.0	**2.0**
DK	**2.0**	**1.8**	1.2	0.6	**0.2**	0.3	0.1	-0.2	0.0	**1.6**
DE	**1.6**	**1.9**	1.2	0.6	**-0.3**	-0.1	0.0	-0.2	-0.1	**1.6**
EE	**1.9**	**2.3**	1.4	0.9	**-0.4**	-0.2	0.1	-0.2	0.0	**2.1**
IE	**2.4**	**2.0**	1.3	0.6	**0.5**	0.5	0.1	-0.1	0.0	**2.0**
EL	**1.2**	**1.5**	1.0	0.5	**-0.4**	-0.6	0.5	-0.2	0.0	**1.8**
ES	**1.9**	**1.7**	1.1	0.6	**0.1**	0.1	0.2	-0.2	0.0	**1.7**
FR	**1.9**	**1.7**	1.1	0.6	**0.3**	0.3	0.1	-0.1	0.0	**1.7**
HR	**1.6**	**2.0**	1.2	0.8	**-0.4**	-0.4	0.2	-0.2	0.0	**2.0**
IT	**1.2**	**1.4**	0.9	0.5	**-0.2**	-0.2	0.2	-0.2	0.0	**1.4**
CY	**1.8**	**1.6**	1.0	0.6	**0.2**	0.3	0.2	-0.2	0.0	**1.5**
LV	**2.4**	**3.2**	2.2	1.0	**-0.8**	-0.7	0.2	-0.3	0.0	**3.2**
LT	**1.5**	**2.4**	1.5	0.9	**-0.9**	-0.9	0.3	-0.3	0.0	**2.4**
LU	**2.6**	**1.8**	1.2	0.6	**0.8**	1.1	-0.1	-0.2	0.0	**1.5**
HU	**2.0**	**2.3**	1.5	0.8	**-0.3**	-0.2	0.2	-0.3	0.0	**2.2**
MT	**2.7**	**2.3**	1.5	0.8	**0.4**	0.3	0.4	-0.3	0.0	**2.3**
NL	**1.8**	**1.7**	1.1	0.6	**0.2**	0.3	0.1	-0.2	0.0	**1.6**
AT	**1.9**	**1.8**	1.2	0.6	**0.1**	0.3	0.1	-0.2	-0.1	**1.6**
PL	**1.8**	**2.6**	1.6	1.0	**-0.8**	-0.4	0.0	-0.3	0.0	**2.2**
PT	**1.3**	**1.9**	1.3	0.6	**-0.6**	-0.5	0.1	-0.2	0.0	**1.8**
RO	**2.3**	**3.1**	2.0	1.1	**-0.8**	-0.5	0.0	-0.3	0.0	**2.8**
SI	**1.9**	**2.2**	1.4	0.7	**-0.2**	-0.1	0.1	-0.3	0.0	**2.0**
SK	**2.3**	**2.7**	1.8	0.9	**-0.4**	-0.2	0.2	-0.3	0.0	**2.5**
FI	**1.7**	**1.7**	1.0	0.6	**0.0**	0.0	0.1	-0.2	0.0	**1.6**
SE	**2.3**	**1.8**	1.2	0.6	**0.5**	0.6	0.0	-0.2	0.0	**1.7**
UK	**2.1**	**1.8**	1.2	0.6	**0.3**	0.4	0.1	-0.2	0.0	**1.7**
NO	**2.2**	**1.9**	1.2	0.7	**0.3**	0.5	0.0	-0.2	0.0	**1.6**
EA	**1.7**	**1.7**	1.1	0.6	**-0.1**	0.0	0.1	-0.2	0.0	**1.7**
EU*	**1.8**	**1.9**	1.2	0.7	**-0.1**	0.0	0.1	-0.2	0.0	**1.7**
EU27	**1.7**	**1.9**	1.2	0.7	**-0.2**	0.0	0.1	-0.2	0.0	**1.7**

Source: Commission services, EPC.

Table I.5.11: **Sensitivity tests: Lower TFP growth**

		Due to growth in:								
	GDP growth in 2016-2070	***Productivity (GDP per hour worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	***GDP per capita growth in 2016-2070***
Country	**1=2+5**	**2=3+4**	3	4	**5=6+7+8+9**	6	7	8	9	**10=1-6**
BE	**1.1**	**0.9**	0.6	0.3	**0.3**	0.4	0.0	-0.1	0.0	**0.8**
BG	**0.9**	**1.9**	1.2	0.7	**-0.9**	-0.7	0.1	-0.3	0.0	**1.6**
CZ	**1.1**	**1.4**	0.9	0.5	**-0.3**	-0.1	0.0	-0.3	0.0	**1.2**
DK	**1.2**	**1.0**	0.7	0.3	**0.2**	0.3	0.1	-0.2	0.0	**0.9**
DE	**0.8**	**1.1**	0.7	0.4	**-0.3**	-0.1	0.0	-0.2	-0.1	**0.8**
EE	**1.1**	**1.5**	0.9	0.6	**-0.4**	-0.2	0.1	-0.2	0.0	**1.3**
IE	**1.7**	**1.2**	0.8	0.4	**0.5**	0.5	0.1	-0.1	0.0	**1.2**
EL	**0.4**	**0.7**	0.5	0.2	**-0.4**	-0.6	0.5	-0.2	0.0	**1.0**
ES	**1.1**	**0.9**	0.6	0.3	**0.1**	0.1	0.2	-0.2	0.0	**0.9**
FR	**1.2**	**0.9**	0.6	0.3	**0.3**	0.3	0.1	-0.1	0.0	**0.9**
HR	**0.8**	**1.2**	0.7	0.5	**-0.4**	-0.4	0.2	-0.2	0.0	**1.2**
IT	**0.4**	**0.7**	0.4	0.2	**-0.2**	-0.2	0.2	-0.2	0.0	**0.6**
CY	**1.0**	**0.8**	0.5	0.3	**0.2**	0.3	0.2	-0.2	0.0	**0.7**
LV	**1.5**	**2.3**	1.6	0.7	**-0.8**	-0.7	0.2	-0.3	0.0	**2.3**
LT	**0.7**	**1.6**	0.9	0.7	**-0.9**	-0.9	0.3	-0.3	0.0	**1.6**
LU	**1.9**	**1.0**	0.7	0.3	**0.8**	1.1	-0.1	-0.2	0.0	**0.8**
HU	**1.2**	**1.5**	1.0	0.5	**-0.3**	-0.2	0.2	-0.3	0.0	**1.4**
MT	**1.9**	**1.6**	1.0	0.6	**0.4**	0.3	0.4	-0.3	0.0	**1.6**
NL	**1.1**	**0.9**	0.6	0.3	**0.2**	0.3	0.1	-0.2	0.0	**0.8**
AT	**1.1**	**1.0**	0.7	0.4	**0.1**	0.3	0.1	-0.2	-0.1	**0.8**
PL	**1.0**	**1.8**	1.1	0.7	**-0.8**	-0.4	0.0	-0.3	0.0	**1.4**
PT	**0.5**	**1.1**	0.7	0.4	**-0.6**	-0.5	0.1	-0.2	0.0	**1.0**
RO	**1.4**	**2.2**	1.4	0.8	**-0.8**	-0.5	0.0	-0.3	0.0	**1.9**
SI	**1.1**	**1.4**	0.9	0.4	**-0.2**	-0.1	0.1	-0.3	0.0	**1.2**
SK	**1.5**	**1.9**	1.3	0.6	**-0.4**	-0.2	0.2	-0.3	0.0	**1.7**
FI	**0.9**	**0.9**	0.5	0.3	**0.0**	0.0	0.1	-0.2	0.0	**0.8**
SE	**1.5**	**1.1**	0.7	0.4	**0.5**	0.6	0.0	-0.2	0.0	**0.9**
UK	**1.3**	**1.0**	0.7	0.4	**0.3**	0.4	0.1	-0.2	0.0	**0.9**
NO	**1.4**	**1.1**	0.7	0.4	**0.3**	0.5	0.0	-0.2	0.0	**0.8**
EA	**0.9**	**1.0**	0.6	0.3	**-0.1**	0.0	0.1	-0.2	0.0	**0.9**
EU*	**1.0**	**1.1**	0.7	0.4	**-0.1**	0.0	0.1	-0.2	0.0	**0.9**
EU27	**0.9**	**1.1**	0.7	0.4	**-0.2**	0.0	0.1	-0.2	0.0	**0.9**

Source: Commission services, EPC.

Table I.5.12: **Alternative policy scenario: linking retirement age to life expectancy**

		Due to growth in:								
	GDP growth in 2016-2070	***Productivity (GDP per hour worked)***	*TFP*	*Capital deepening*	***Labour input***	*Total population*	*Employment rate*	*Share of working age population*	*Change in average hours worked*	***GDP per capita growth in 2016-2070***
Country	**1=2+5**	**2=3+4**	3	4	**5=6+7+8+9**	6	7	8	9	**10=1-6**
BE	**1.6**	**1.3**	0.8	0.4	**0.3**	0.4	0.1	-0.1	0.0	**1.2**
BG	**1.6**	**2.3**	1.4	0.9	**-0.7**	-0.7	0.3	-0.3	0.0	**2.3**
CZ	**1.6**	**1.8**	1.2	0.6	**-0.2**	-0.1	0.2	-0.3	0.0	**1.7**
DK	**1.6**	**1.4**	0.9	0.5	**0.2**	0.3	0.1	-0.2	0.0	**1.3**
DE	**1.3**	**1.5**	1.0	0.5	**-0.2**	-0.1	0.2	-0.2	-0.1	**1.3**
EE	**1.7**	**1.9**	1.2	0.7	**-0.2**	-0.2	0.3	-0.2	0.0	**1.9**
IE	**2.1**	**1.6**	1.1	0.5	**0.6**	0.5	0.2	-0.1	0.0	**1.7**
EL	**0.8**	**1.1**	0.8	0.4	**-0.4**	-0.6	0.5	-0.2	0.0	**1.4**
ES	**1.5**	**1.3**	0.9	0.5	**0.2**	0.1	0.3	-0.2	0.0	**1.4**
FR	**1.6**	**1.3**	0.8	0.5	**0.3**	0.3	0.2	-0.1	0.0	**1.3**
HR	**1.4**	**1.7**	1.0	0.7	**-0.3**	-0.4	0.3	-0.2	0.0	**1.7**
IT	**0.8**	**1.0**	0.7	0.4	**-0.2**	-0.2	0.2	-0.2	0.0	**1.0**
CY	**1.4**	**1.2**	0.7	0.5	**0.2**	0.3	0.2	-0.2	0.0	**1.1**
LV	**2.1**	**2.7**	1.8	0.9	**-0.6**	-0.7	0.4	-0.3	0.0	**2.8**
LT	**1.2**	**2.0**	1.2	0.8	**-0.8**	-0.9	0.5	-0.3	0.0	**2.2**
LU	**2.4**	**1.4**	0.9	0.5	**1.0**	1.1	0.1	-0.2	0.0	**1.3**
HU	**1.8**	**1.9**	1.3	0.7	**-0.1**	-0.2	0.3	-0.3	0.0	**1.9**
MT	**2.4**	**1.9**	1.2	0.7	**0.5**	0.3	0.5	-0.3	0.0	**2.1**
NL	**1.5**	**1.3**	0.8	0.5	**0.2**	0.3	0.1	-0.2	0.0	**1.2**
AT	**1.6**	**1.4**	0.9	0.5	**0.2**	0.3	0.2	-0.2	-0.1	**1.3**
PL	**1.6**	**2.2**	1.3	0.8	**-0.6**	-0.4	0.2	-0.3	0.0	**2.0**
PT	**1.0**	**1.5**	1.0	0.5	**-0.5**	-0.5	0.2	-0.2	0.0	**1.5**
RO	**2.0**	**2.6**	1.7	0.9	**-0.6**	-0.5	0.2	-0.3	0.0	**2.5**
SI	**1.6**	**1.8**	1.2	0.6	**-0.1**	-0.1	0.2	-0.3	0.0	**1.7**
SK	**1.9**	**2.2**	1.5	0.7	**-0.4**	-0.2	0.2	-0.3	0.0	**2.1**
FI	**1.3**	**1.3**	0.8	0.5	**0.0**	0.0	0.1	-0.2	0.0	**1.2**
SE	**2.1**	**1.4**	1.0	0.5	**0.6**	0.6	0.2	-0.2	0.0	**1.4**
UK	**1.8**	**1.4**	0.9	0.5	**0.4**	0.4	0.2	-0.2	0.0	**1.4**
NO	**1.9**	**1.4**	0.9	0.5	**0.5**	0.5	0.1	-0.2	0.0	**1.4**
EA	**1.4**	**1.4**	0.9	0.5	**0.0**	0.0	0.2	-0.2	0.0	**1.3**
EU*	**1.5**	**1.5**	0.9	0.5	**0.0**	0.0	0.2	-0.2	0.0	**1.4**
EU27	**1.4**	**1.5**	0.9	0.5	**-0.1**	0.0	0.2	-0.2	0.0	**1.4**

Source: Commission services, EPC.

ANNEX 1

Projecting labour force developments using the cohort simulation model (CSM)

Overall approach of the CSM

The CSM calculates entry and exit rates in the labour market by gender and cohort ([34]).

The dynamic cohort approach is based on the estimates of exit and entry rates in the labour market of a "synthetic" generation/cohort. The cohort is "synthetic" because, due to lack of individual longitudinal data on labour market transitions, the same individual cannot be followed over time. Instead, it is assumed that those individuals aged x+1 at year t+1 are representative of the same generation observed in the previous year (aged x at time t). Due to the lack of specific information on each individual's behaviour, this assumption neglects inflows and outflows from the labour market that cancel out ([35]).

Participation rate projections are produced by applying the average entry and exit rates observed over the period 2007-2016 by gender and single age to the period 2016-2070. Specifically, average entry rates for the period 2007-2016 are kept constant over the entire projection period. For example, average entry rates for persons aged x, calculated for the period 2007 to 2016 (with x varying between 15 and 74 years of age), are applied to persons aged X over the projection horizon of 2016 to 2070 in order to calculate future participation rates. In this way, the CSM captures "cohort effects", namely those resulting from the stronger attachment of younger women of more recent cohorts to the labour market.

The CSM is also able to incorporate a broad typology of pension reforms, inter alia, increases in the statutory retirement age, the convergence of women's lower statutory retirement age to that of men's, the linking of the statutory retirement age to changes in life expectancy, the tightening of conditions for early retirement, and changes in (price) incentives affecting the retirement decision.

([34]) See Burniaux et al. (2003) and Carone, G. (2005).

([35]) For example, this means that if in year t there are 100 persons aged x in the labour force and next year (when aged x+1) these same individuals leave the labour force (for whatever reason, such as discouragement, having died or emigrated), but they are replaced by other 100 individuals aged x+1, previously out of the labour force, we do not observe any change in the size of our "synthetic" cohort. As a consequence, our calculated net rates of exit and entry are equal to zero, while the actual (gross) value is 100 per cent.

The likely impact of pension reforms is incorporated in the labour force projections by appropriately changing average labour market exit probabilities calculated for the period 2007 to 2016.

The calculation of entry rates

Entry rates from inactivity to the labour market are calculated as follows.

The calculation of the number of persons that enter the labour market (coming from inactivity) takes into account the size of each gender/age group. It can be expressed as:

$$NLF_x^{t+1} = (Pop\max_{wa} - LF_x^t) - (Pop\max_{wa} - LF_{x+1}^{t+1})$$

where $LF_x^t + NLF_{x+1}^{t+1} \le Pop\max_{wa}$

where NLF is the number of people expected to become active between ages x and x+1; $Pop\max_{wa}$ is the maximum population in working age that can potentially enter the labour force (which is usually slightly lower than the overall civilian population of working age, due for example to illness/inability) and LF is the number of active persons (in labour force) aged x in year t and aged x+1 in year t+1.

Multiplying and dividing by the population aged x at time t (which is supposed to remain the same as the population aged x+1 at time t+1), the following equation is obtained:

$$NLF_x^{t+1} = \left[\ (\mathrm{Pr}_{\max} - \mathrm{Pr}_x^t) - (\mathrm{Pr}_{\max} - \mathrm{Pr}_{x+1}^{t+1}) \ \right] * Pop_x^t$$

where Pr_{max} is the upper limit to the participation rate (0.99 for both men and women). Thus, we can calculate the rate of entry, *Ren* by dividing the number of people expected to become active by the number of people inactive at time t, that is:

$$\mathrm{Ren} = \frac{NLF_x^{t+1}}{Pop_{\max_{wa}} - LF_x^t} = \left[\ (\mathrm{Pr}_{\max} - \mathrm{Pr}_x^t) - (\mathrm{Pr}_{\max} - \mathrm{Pr}_{x+1}^{t+1}) \ \right] * \frac{Pop_x^t}{Pop_{\max_{wa}} - LF_x^t}$$

which, taking into account that $PR_x^t = \frac{Pop_x^t}{LF_x^t}$ and $\mathrm{Prmax} = \frac{Pop\max_{wa_x}^t}{Pop_x^t}$ can be reformulated as:

$$\mathrm{Ren}_{x+1} = \left[(\mathrm{Pr}_{\max} - \mathrm{Pr}_x^t) - (\mathrm{Pr}_{\max} - \mathrm{Pr}_{x+1}^{t+1})\right] * \frac{1}{(\mathrm{Pr}_{\max} - \mathrm{Pr}_x^t)}$$

$$\text{or} \quad \mathrm{Ren}_{x+1} = \left[1 - \frac{(\mathrm{Pr}_{\max} - \mathrm{Pr}_{x+1}^{t+1})}{(\mathrm{Pr}_{\max} - \mathrm{Pr}_x^t)}\right] \geq 0$$

$$\text{or} \quad \mathrm{Ren}_{x+1} = \frac{(\mathrm{Pr}_{x+1}^{t+1} - \mathrm{Pr}_x^t)}{(1 - \mathrm{Pr}_x^t)} \;] \geq 0 \quad \text{when} \quad \mathrm{Pr}_{\max} = 1$$

After re-arranging, we obtain the analytical formulation used for projecting participation rates. Thus, projections of participation rates based on these entry rates are:

$$PR_{x+1}^{t+1} = \mathrm{Re}\, n_{x+1} * (PR\max - PR_x^t) + PR_x^t$$

Thus, projections of participation rates for each single-year cohort (x+1) can be calculated by applying the entry rates observed in a given year or period over the period of projections (t=2016-2070). In practical terms, the entry rates for each age have been calculated on the basis of the average of the participation rates observed over the period 2007-2016.

The calculation of exit rates

In the same way, when participation rates for two adjacent single-year age groups are falling, we calculate an exit rate (that is the net reduction in the labour force relative to the number of people who were initially in the labour force in the same cohort the year before) as follows.

The number of persons that leave the labour market at time t+1 is equivalent to:

$$OP_x^{t+1} = LF_x^t - LF_{x+1}^{t+1}$$

where OP are the number of individuals expected to become inactive between age x and x+1, and LF is the number of active persons (in the labour force) aged x in year t and aged x+1 in year t+1.

Multiplying and dividing by the population aged x at time t, which is supposed to remain the same as the population aged x+1 at time t+1, we get:

$$OP_x^{t+1} = \left(PR_x^t - PR_{x+1}^{t+1} \right) * Pop_x^t$$

where PR are the participation rates.

Thus, we can calculate the (conditional) rate of exit, *Rex* by dividing the number of people that become inactive at time t+1 by the number of people active at time t, that is

$$\mathrm{Re}\, x = \frac{OP_x^{t+1}}{LF_x^t} = \left[PR_x^t - PR_{x+1}^{t+1}\right] * \frac{Pop_x^t}{LF_x^t}$$

which can also be re-arranged as:

$$\mathrm{Re}\, x = \frac{OP_x^{t+1}}{LF_x^t} = 1 - \frac{PR_{x+1}^{t+1}}{PR_x^t}$$

Thus, we can use this *Rex* to project participation rates of older workers as:

$$PR_{x+1}^{t+1} = (1 - \mathrm{Re}\, x_{x+1}) * PR_x^t$$

and

$$PR_{x+n}^{t+n} = (1 - \mathrm{Re}\, x_{x+1}) * (1 - \mathrm{Re}\, x_{x+2}) * .. * (1 - \mathrm{Re}\, x_{x+n-1}) * PR_x^t$$

ANNEX 2
Estimation of the average exit age from the labour market

Average exit age from the labour force

In order to estimate the "average exit age" from the labour force, the CSM is used, which is basically a probabilistic model using gender/single year participation rates ([36]). The methodology is based on the comparison of labour force participation rates over time.

The conditional probability for each person to stay in the labour force at age *a* in year *t*, (conditional upon staying in the labour force in year t-1), can be calculated using the observed activity rates (*Pr*) as follows:

Probability to stay

$$cProb_{a,t}^{stay} = \frac{\mathbf{Pr}_a^t}{\mathbf{Pr}_{a-1}^{t-1}}$$

where $0 \le cprob_{a,t}^{stay} \le 1$

Thus, at time *t*, the conditional probability for each person to exit at age *a* ($cprob^{ex}$ a, t) is simply equal to:

Probability of exit

$$cProb_{a,t}^{ex} = 1 - \frac{\mathbf{Pr}_a^t}{\mathbf{Pr}_{a-1}^{t-1}} = 1 - cProb_{a,t}^{stay}$$

where $0 \le cprob_{a,t}^{ex} \le 1$

Assuming that nobody retires before the minimum age *m* (e.g. before m=60), the (unconditional) probability that any person will still be in the labour force (that is the probability of not retiring before a given age *a* can be calculated as the product of all the conditional probabilities to stay in the labour force from age *m* to age *a*-1):

Probability of not retiring before

$$prob_{a,t}^{notret} = \prod_{i=m}^{a-1} cprob_i^{stay}$$

Thus, the probability of retiring at age *a* can be calculated as the product of the unconditional probability of not retiring from age *m* to *a* and the (conditional) probability of exit, that is:

Probability of retiring

$$prob_{a,t}^{ret} = prob_{a,t}^{notret} cprob_{a,t}^{ex}$$

By assuming that everybody will be retired at a given age *M* (e.g. *M= 75)*, the sum of the probability of retiring between the minimum age *m* and the maximum age *M* is equal to 1:

$$\sum_{a=m}^{M} prob_a^{ret} = 1$$

The "*average exit age*" or effective age of retirement from the labour market is then calculated as the weighted sum of the retirement ages (between the minimum and the maximum age of retirement , say 60-74), where the weights are the probability of retiring at each age *a*, as follows:

Average exit age

$$Aea = \sum_{a=m}^{M} prob_a^{ret} * a$$

([36]) See Carone, G. (2005).

ANNEX 3
Methodology underpinning potential GDP growth projections

A3.1. DESCRIPTION OF THE PRODUCTION FUNCTION FRAMEWORK

The production function framework used is based on the standard specification of the Cobb-Douglas production with constant returns to scale, where potential GDP can be expressed formally as total output represented by a combination of factor inputs multiplied with total factor productivity (TFP), which embeds the technological level ([37]).

$$Y = TFP * L^{\beta} * K^{1-\beta} =$$

$$\left(TFP^{\frac{1}{\beta}} * L \right)^{\beta} * K^{1-\beta} =$$

$$(E * L)^{\beta} * K^{1-\beta}$$

where:

Y is total output (GDP);

L is the supply of labour (total hours worked);

K is the stock of capital;

E is the labour-augmenting technical progress (i.e. Harrod-neutral technical progress).

$E.L$ is then interpretable as total labour in efficiency units. TFP and the labour-augmenting technical progress are linked with a simple relationship: $TFP = (E)^{\beta}$

β is the labour share, i.e. the share of labour costs in total value-added. It is set at 0.65 ([38]).

As a result, potential labour productivity growth comes down to the following expression (where Y, L, E and TFP denote potential output, potential labour, trend labour-augmenting technical progress and trend TFP).

Thus, the projection of TFP growth and the growth in capital per hour worked, so called *capital deepening*, are the key drivers of projected labour productivity over the medium run.

In the long-run, according to the standard neo-classical growth model ([39]), the economy should reach its equilibrium, also called steady state or balanced growth path, where the ratio of capital stock to labour expressed in efficiency unit, K/(L.E), remains constant over time. As a result, the capital stock per hour worked grows at the same pace as labour augmenting technical progress E. Therefore, labour productivity growth (i.e. output per hour worked growth) coincides with TFP growth divided by the labour share:

$$\left(\frac{\dot{Y}}{L}\right) = \left(\frac{\dot{K}}{L}\right) = \dot{E} = \frac{\dot{TFP}}{\beta}$$

It should also be noted that, in the steady state, the contribution of capital deepening to output growth is a simple function of TFP([40]), which becomes the single driver of labour productivity ([41]).

$$contrib\left(\frac{\dot{K}}{L}\right) = (1-\beta)\left(\frac{\dot{K}}{L}\right) = \frac{(1-\beta)}{\beta}\dot{TFP}$$

([37]) See K. Havik, K. Mc Morrow, F. Orlandi, C. Planas, R. Raciborski, W. Röger, A. Rossi, A. Thum-Thysen, V. Vandermeulen, "The Production Function Methodology for Calculating Potential Growth Rates & Output Gaps", European Economy Economic Papers No. 535, 2014.

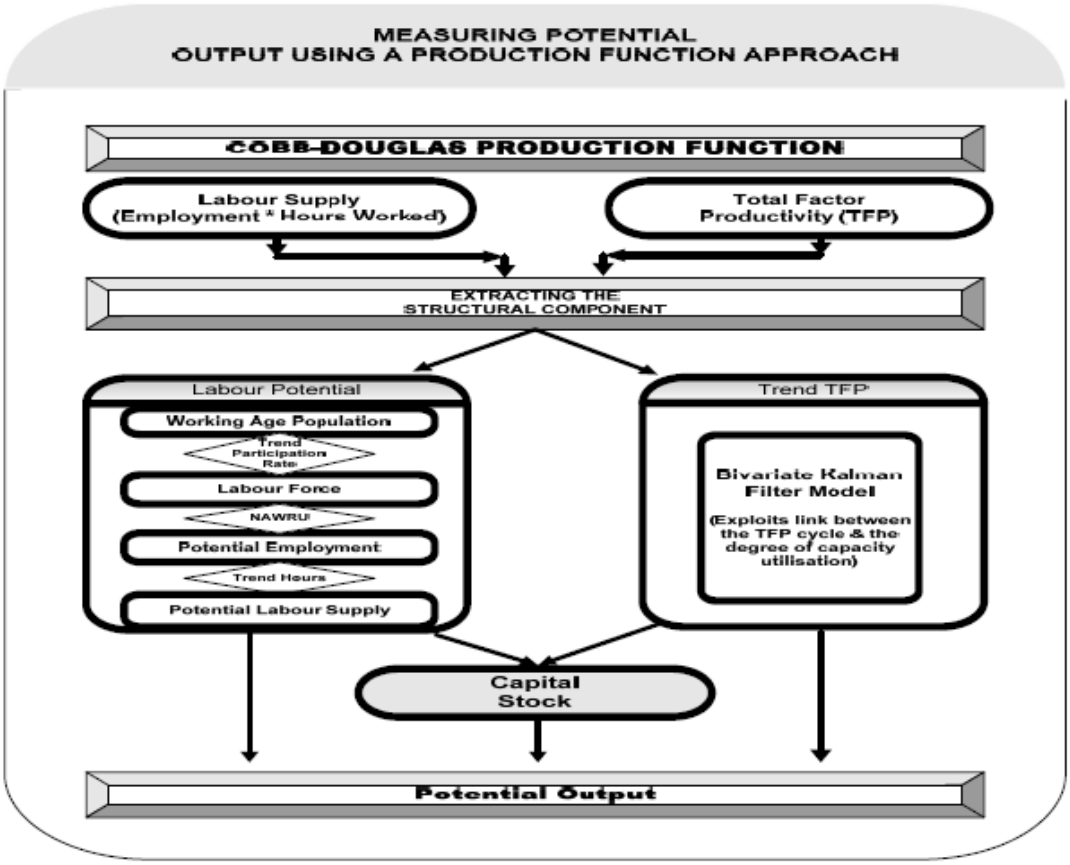
([38]) Although there is some debate about the recent and observed decline of the labour share, most economists assume that it will remain broadly constant in a long run perspective, while allowing for a variation in the short-term. This rule is uniformly applied in the projections to all Member States in order to allow for consistent cross-country comparisons of the results. The assumption is also well-founded in economic theory. If the real wage is equal to the marginal productivity of labour, it follows that under the standard features of the production function, real wage growth is equal to labour productivity growth and real unit labour costs remain constant.

([39]) Also known as the Solow growth model - See Solow R. (1956) "A contribution to the theory of economic growth". Quarterly Journal of Economics. ***70*** *(1)*: 65-94

([40]) With the assumption of a long-run TFP growth rate equivalent to 1% per annum in the baseline scenario (see section 3.5), this implies a long-run contribution of capital deepening to labour productivity growth equal to 0.5% and hence a labour productivity growth rate of 1.5%.

([41]) This in turn implies that, in the long run, the growth rate of the capital stock is set equal to the sum of the growth rate of labour and labour-augmenting technological progress, the so-called "capital rule".

Graph I.A3.1: **Overview of the production function approach**



Source: European Economy Economic Papers No. 535, November 2014

As all these variables can be influenced by the business cycle in the short term, it is safer to project the potential output, i.e. the output adjusted for cyclical movements in the economy. This requires estimating the trend components for the individual production factors, except for the capital stock, which can only adjust in the long run.

Estimating potential output therefore amounts to removing the cyclical component from both TFP and labour. Trend TFP is obtained using a detrending technique. Potential labour input is the total labour obtained when the unemployment rate equals the structural unemployment rate (NAWRU). It equals *LF*(1-NAWRU)*Hours*, where *LF* stands for total labour force and *Hours* for average hours worked per worker. The potential output denoted *Yp* can be expressed in logarithm as the sum (in logarithm) of *trend TFP*, potential labour input weighted by the labour share in total value-added and the total capital stock multiplied by one minus the labour share. More formally, we get:

$$Log(Yp)=Log(trendTFP)+\beta Log(LF*(1-Nawru)*Hours)+(1-\beta)logK)$$

Graph I.A3.1 illustrates the building blocks of the production function used in the medium-term potential growth projection and the T+10 methodology developed by the Commission and EPC (Output Gap Working Group).

Following the practice used for the 2015 Ageing Report, the AWG and EPC decided to use the OGWG methodology for potential growth and its components until T+10 (2026), see section A3.2 for details.

A3.2. POTENTIAL GDP PROJECTIONS FOR THE FIRST TEN YEARS ('T+10' PROJECTIONS)

The T+10 methodology was first used for the 2015 Ageing Report for projecting potential GDP growth for the initial ten years of the forecast because it had a number of advantages vis-à-vis previous approaches:

More structural information: The T+10 approach marks an improvement with respect to the incorporation of additional information regarding the structural determinants of growth. This is explicitly the case with respect to the T+10 NAWRU anchor and is implicitly driving the rationale behind the capital formation and participation rate forecasts over the period T+6 to T+10. There are clear advantages from introducing more structural information into the T+10 methodology, including (i) it's easier to explain country differences; and (ii) it permits a quantitative evaluation of structural reforms.

T+10 NAWRU anchor versus reversion to a pre-crisis NAWRU level: The T+10 NAWRU anchor represents a significant methodological improvement over the previous method by anchoring medium term NAWRU developments to a long run unemployment rate which is estimated from the main structural determinants of labour market trends. Alternative approaches that do not rely on economic information were discussed and eventually abandoned. In particular, approaches relying on the concept of a return to the pre-crisis level for the NAWRU appeared impractical.

"Structural" approach to investment: The debate in relation to the assumption to be used for the T+10 capital formation projections was initiated with a discussion on the relative merits of pursuing a structural model of investment. This option was not pursued however since there would be only limited gains relative to the "capital rule" approach which was finally adopted. The latter approach effectively amounts to a structural model of investment since it links investment to its fundamental long run drivers, namely labour supply and TFP.

A more credible evolution for the path of participation rates: The approach adopted for projecting participation rates up to T+10 constitutes a balanced mixture of the information emanating from time series trends with the solid structural information derived from the cohort method. An important improvement is the introduction of a technical transition rule for smoothing the unacceptable breaks in participation rates which occurred in the forecasts using the T+5 and the T+10 methodologies.

Internally consistent TFP projections up to T+10: Despite the fact that attempts to anchor the trend TFP projections using policy and structural variables (which have been identified in the literature as relevant determinants of long run TFP growth) have, for the moment, being abandoned, nevertheless the current Spring 2017, T+6 to T+10 TFP projections, are arguably superior to those used in the 2012 Ageing Report since the T+5 & T+10 estimates are now both produced with the same bivariate Kalman filter approach & consequently are internally consistent.

The T+10 methodology has been changed slightly since the 2015 Ageing Report with respect to NAWRU estimation. The revised NAWRU approach involves using additional long run information, specifically the structural unemployment rate from the T+10 calculations, to anchor the short and medium-term NAWRU estimates. This change will result in less pro-cyclical NAWRU estimates – ie actual unemployment and NAWRU series will tend to track each other less closely than with the previous model. Moreover, by integrating the structural unemployment estimates from the T+10 exercise into the calculations for the short and medium-term NAWRU estimates, more comprehensive recognition will be given to Member States' efforts to implement structural reforms in their respective labour markets.

Following these changes to the methodology, the AWG and the EPC endorsed the use of the Spring 2017 T+10 potential GDP growth projections for the 2018 Ageing Report.

Part II

Age-related expenditure items: coverage, projection methodologies and data sources

1. PENSIONS

1.1. INTRODUCTION

Despite different arrangements in health-care, long-term care, education and unemployment benefits systems, the Commission services (DG ECFIN) in cooperation with the AWG, have been able to develop common models to carry out long-term projections for these government budget's components. On pension items, as the specificities of pension systems across EU countries proved to be difficult to capture in one single framework, the EPC, since the beginning of the activity of the AWG, opted for a different approach. Pension expenditure projections are made by the Member States using national models based on commonly agreed assumptions (see Part I).

1.2. MAIN FEATURES OF PENSION PROJECTIONS

The diversity of pension systems existing in the Member States represents a challenging issue when dealing with expenditure projections.

On the basis of the commonly agreed underlying assumptions described in Part I of this report, national models are used for projecting public pension expenditure, reflecting in detail the institutional features of the pension systems in individual countries ([42]).

Using different, country-specific projection models, despite relying on an agreed common methodology, may introduce an element of non-comparability of the results. Still, this approach was chosen by the Commission and EPC because pension systems and arrangements are very diverse in the EU Member States, making it extremely difficult to reliably project pension expenditure on the basis of one common model, to be used for all the 28 EU Member States.

To ensure high quality and comparability of the pension projection results, an in-depth peer review is being carried out by the AWG members and the Commission. The projected figures are discussed and validated with regard to adherence to the agreed methodology and macroeconomic assumptions and interpretation of the legislation in force in each Member State. When deemed necessary, the peer group can ask the Member State for a revision of the projection.

1.3. COVERAGE OF PENSION PROJECTIONS

The core of the pension projection exercise remains *government expenditure on pensions* for *both the private and public sectors* (see Annex 3 for a for a comprehensive description of the pension schemes covered by the projections). In line with previous exercises, the members of the AWG agreed to provide pension projections for the following items:

- Gross pension expenditure;
- Benefit ratio and gross average replacement rates;
- Number of pensions/pensioners;
- Revenues from contributions and the number of contributors;
- Decomposition of new pension expenditure (earnings related).

According to the principle of not changing the modality of the variables that were classified as voluntary in the previous exercise, the items above are projected on a voluntary basis for private occupational and private individual pension schemes. Moreover, the breakdown by age of the total number of pensions and the total number of pensioners and the taxes on pension are classified as voluntary ([43]).

In the current exercise the distinction between earnings-related pension and non-earnings-related pension is less pronounced, indeed the distinction

([42]) For a complete description of pension schemes in the EU Member States, please see the PENSREF database, available at: https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases_en

([43]) With the exception of the value of taxes on pensions for the base year (2016). For those MSs that have difficulties in providing the requested information on taxes on pensions in the base year, detailed information of the tax system are included in the pension country fiches.

is not applied any longer to disability and survivor pension. In the meantime, the old-age and early pension are now disentangled in flat component or basic pension (if any), earnings-related and minimum pension.

Moreover, in order to have a complete overview of pension related items in the base year, it has been agreed to report lump-sum pension expenditure for the specific year 2016. Taxes on pensions for the base year are also to be provided on a mandatorily base (see footnote [1]).

In order to focus more attention on some driving forces of future pension expenditure, a block reporting the indexation values that have been applied to many expenditure items has been added to the reporting framework.

The section on new pension expenditure for "point system scheme" has been streamlined to template a core set of requirements for countries applying this system (CY, DE, HR, RO, SK and partially FR). Some flexibility in the reporting requirements is needed to take into account country specificities to the extent that it does not jeopardise the overall purpose of the decomposition. Member States have been given the possibility to provide additional relevant figures in the "additional information" section of the reporting sheet.

Therefore, the part of the reporting sheet that is common to all pension schemes (see Annex 1, Table II.A.1.1) consists of 145 variables to be projected; 58 are to be provided on a voluntary basis and 5 are input data provided by the Commission services. A complete list of items covered by the 2018 pension projection exercise, including the blocks for new pension decomposition, is presented in Annex 1.

1.3.1. Building on and extending the 2015 reporting framework

In the previous pension projection exercise (2015), several improvements were introduced that form a solid point of departure for the current round of projections. Still, a few changes in the 2015 pension reporting framework are introduced. All of the amendments were duly discussed by AWG delegates and Commission services (DG ECFIN), and reflect the need to better understand recent developments and the expected changes over the projection period with regard to the main features of the pension systems in the Member States.

The amendments to the reporting framework mainly stem from the following considerations:

– Enhancing the transparency of the projections. Enhanced data availability can have an impact on the effectiveness of the peer review process by facilitating information exchange, highlighting best practices, as far as projection methodologies are concerned, and facilitating benchmarking of Member States when it comes to judging the viability of projection results. Moreover, it will enrich the contents of the forthcoming 2018 Ageing and Sustainability reports.

– The reporting sheet has been modified in order to avoid the distinction between earnings-related benefit and non-earnings-related ones. When collecting information on disability, survivor or other pensions, the figures are supposed to include both the benefits that are provided through the pension system and the social assistance. When projecting old-age and early pension, earnings related pension are kept separated from flat component (or basic pensions) and minimum pension (including minimum income guarantee paid to people age more than 65).

– In order to shed additional light on the future levels of pensions – which are also relevant for the policy debate on the adequacy of pensions in the future – a block reporting figures on the indexation factors applied to many expenditure items has been added to the reporting framework.

– The disaggregation of the projected annual flow of earnings-related pensions to new pensions in their main drivers contributes to the understanding of the future functioning of pension systems. A section on flat component (if any) is now included on top of the variables explaining earnings-related new pensions.

– In order to further harmonise the provided information, as already mentioned in the previous paragraph, a single decomposition of new pensions for the point scheme has been

agreed. Hence, on top of the common content of the questionnaires three differentiated sections on new pension decomposition exist depending on whether the adopted scheme is a DB, an NDC or a PS. Some flexibility is still allowed for the points systems (see previous section).

To sum up, the 2018 reporting sheet is organised in 9 broad groups of information to be provided:

1. Pension expenditure
2. Benefit ratio
3. Gross average replacement rates (at retirement)
4. Number of pensions
5. Number of pensioners
6. Contributions
7. Number of contributors to pension schemes
8. Indexation factors
9. Decomposition of new public pensions (earnings-related pensions)

1.4. DEFINITIONS OF THE VARIABLES

1.4.1. Reporting norms and input data

Member States will run projections for the period from 2016 up to 2070. The data to be provided is annual data for each year of the projections. Both the historical data for the years 2000-2015 and the projections for years 2016-2070 have to be presented in current prices. The base year of the projections is 2016.

The GDP projections for each country over the period 2016-2070 are those generated by the Commission services (DG ECFIN) using the production function model on the basis of the agreed assumptions.

The change in total gross wage is projected for each country in accordance with labour productivity growth and changes in the hours worked ([44]).

The average wages are calculated as the ratio of total gross wages from national account data and employed persons (both employees and self-employed) of age 15 to 74. The average wage is projected to increase in line with the labour productivity growth rate.

Figures on the economy-wide average wage at retirement is reported. The assumptions used when projecting this variable should be reported separately and will also be subject to peer review.

Values are expressed in millions of Euros. For countries which are not part of the euro area, the conversion should be made on the basis of the average exchange rate for 2016, except for the ERM II countries for which the conversion is based on the central rates.

Member States should report, in the country fiche accompanying the pension projection data, outturn data back to 2000 and also comment on actual developments since 2000 to clarify the reasons behind specific changes and the overall evolution of pension spending in the past and their implications for the projections.

The pension projections include the impact of the most recent pension reforms that will have entered into legislation before the cut-off date for the submission of the pension projections by delegates. To this end, Member States will provide detailed descriptions of the projections, including recently introduced reforms, their implementation and their impact on the projection outcome in their updated country fiches.

1.4.2. Variables definitions and clarifications

Pension expenditure

Definition: Pension expenditure should cover pensions and equivalent cash benefits granted for a long period (over one year) for old-age, early retirement, disability, survivors (widows and orphans) and other specific purposes which should be considered as equivalents or substitutes for

([44]) In line with the assumption of constant labour share. Gross wages includes employers' social security contributions.

above-mentioned types of pensions, i.e. pensions due to reduced capacity to work or due to labour market reasons.

Clarification: Pensions should include earnings-related pensions, flat-rate, means-tested benefits that aim to provide a social minimum pension and supplements which are a part of the pension and are granted for an indefinite period on the basis of certain criteria but which are not directly linked to the remuneration of costs (i.e. supplements aimed at supporting the purchase of home or health care services). Pensions and benefits can be paid out from specific schemes or directly from government budgets. In particular, social assistance should be included if it is equivalent to minimum pension (as for non-earning-related minimum pension). Instead, housing subsidies should be excluded from pensions and considered as other means-tested social transfers.

Pension expenditures are projected accordingly to the current legislation in place. Special consideration needs to be taken when projecting minimum pensions or equivalent so as to ensure that the function of minimum income of the elderly is respected.

Short-term disability benefits should be considered as sickness benefits, while prolonged unemployment benefits for older workers should be considered within unemployment benefits.

Pensions should not include (additional) benefits in the form of reimbursements for certain costs to beneficiaries or directly provided goods and services for the specific needs of beneficiaries. Also, they should not include social security contributions paid by pension schemes on behalf of their pensioners to other social protection schemes, notably to health schemes.

Pension expenditure by age

Many countries have introduced pension reforms that will increase the retirement age. To better understand the impact of these reforms, pension expenditure disaggregated by 5 year age groups - 54 and 75 will be provided by the Member States with regards to public pensions and all pensions([45]). This break-down will increase transparency and consistency between population, labour force and pensioners projections. The sum of (public or total) pension expenditures for all age groups should be equal to the overall projected values for (public or total) pension expenditures.

New pension expenditure

To ensure transparency, Member States will provide annual projections on new pension expenditure for each of the pension schemes. New pension expenditures for old age and early earnings-related pensions should match with decomposed new pension expenditure results as described in the pension questionnaire (see Table II.A.1.2 – Table II.A.1.5 in Annex 1).

Gross pension expenditure

Pensions should be recorded as gross pension expenditure, i.e. without a deduction by beneficiaries of tax and compulsory social security contributions paid on benefits. In those countries where pensions are non-taxable income, gross pensions are equal to net pensions.

Net pension expenditure

Pensions should be recorded as net pensions, once deducting tax on pensions and compulsory social security contributions paid by beneficiaries from gross expenditure. Projections should be made for overall net public pension expenditure as well as the absolute share of non-earnings related pensions including minimum pensions and minimum income guarantees.

Taxes on pensions

In the 2018 projection round, taxes on public, private occupational, private individual and total pensions are to be reported in case countries provide net pension expenditure projections. Results for taxes on pensions should also undergo the peer review process during the pension projection exercise. Attention ought to be paid to progressivity of the tax system on this source of public revenue. Taxes should be projected by keeping tax revenues as a share of pension

([45]) The age groups younger than 54 and older than 75 should also be reported separately.

expenditures constant over time. This implicitly means that "value" parameters, such as tax allowances or tax contribution ceilings, are adjusted annually in line with pension expenditures, while "rate" parameters, such as the implicit average tax rate on pensions remains unchanged.

Countries that provide figures for taxes on private occupational and private individual pensions are asked to provide all other data on private occupational and private individual pensions on a mandatory basis (otherwise voluntary for all other countries) as well as a decomposition of new pension expenditures for private occupational and private individual pensions in order to increase the transparency and check the consistency of private pension taxation.

Categories of pension expenditure

Many EU countries have a variety of pension schemes in place (e.g. for employees in different sectors). The parameters across systems might differ and the share of population covered by each system might change over time. To address these issues, Member States should fill the questionnaire for each scheme separately, in addition to summing up all public pension expenditure.

Public schemes and other non-occupational public pensions

Definition: Public schemes and other public pensions are the schemes that are statutory and that the general government sector administers ([46]).

Clarification: The aim is to cover those pension schemes that affect public finances, in other words schemes that are considered to belong to the general government sector in the national account system. Usually, there is a specific or general social security contribution to the scheme, which is defined as part of total taxes in the national accounting system. However, the scheme can also be financed, either partially or fully, by general taxes. Thus, ultimately, the government bears the financial cost and risk attached to the scheme. The pensions provided by the social security schemes can be either earnings-related, flat-rate or means-tested. In addition, this category should cover pensions that are paid directly from the state or other public sector entity budget without forming a specific scheme such as special pensions to public sector and armed force's employees. Cash benefits equivalent to pensions, notably social assistance to older persons (people aged over statutory retirement age, usually 65 years), should be included in this category.

Regarding the borderlines between public and occupational pensions as well as the identification of pension schemes within these categories, see Annex 3.

The statutory funded part of old-age pension schemes that are attached to notional defined contribution schemes in some countries should be excluded from social security schemes and included in the private sector schemes in accordance with the Eurostat decision([47]).

Occupational private pensions

Definition: Pensions provided by occupational schemes are those that, rather than being statutory

([46]) In line with Eurostat (2004) "If a government unit is responsible for the management of a defined-contribution funded scheme for which no government guarantee exists for the risks of defaulting payments covering the majority of the participants, the scheme is not treated in the national accounts as a social security scheme in the government sector. In such schemes, the schemes are not financed by the government nor does the government define the level of pensions to be paid (the members have a say in how much they contribute and how their contributions are invested). Thus, the contributions and payments in respect of such schemes have no impact on the EDP deficit, as they are stripped out of general government revenue and general government expenditure, respectively". Moreover the same source, with regards to funded schemes underlines that "In recent years, some countries have set up defined-contributions funded pension schemes (or identifiable as such – see below) where a government imposes or encourages participation, collects contributions from employers and pays pension benefits to households, fixes the level of contributions and maybe change the rules, but where it is explicitly stated that pension benefits will predominantly depend on accumulated assets. Under these conditions, it seems that all ESA95 criteria for classifying such schemes as social security schemes are not fulfilled, as government is not fixing the level of the pension benefit and it is difficult to consider that it is "financing" the scheme. Further information can be find in Eurostat (2004). "Classification of funded pension schemes and impact on government finance", Economy and finance Collection: Methodologies and working papers, Luxemburg.

([47]) Classification of funded pension schemes in case of government responsibility and guarantee, Eurostat 30/2004, 2 March 2004.

by law, are linked to an employment relationship with the scheme provider. They are based on contractual agreements between employers and employees, either at the company level or their organisations at the union level. The schemes are run by private sector pension funds, insurance companies or the sponsoring companies themselves (in balance sheets). Some countries, such as the United Kingdom, have occupational pension schemes where the employer happens to be the government ([48]).

Clarification: These schemes can be quasi-mandatory in the sense that, on the basis of a nation- or industry-wide bargaining agreement, the employers are obliged to provide an occupational pension scheme to their employees. On the contrary, participation of an individual remains voluntary. Occupational schemes can be equivalent to statutory earnings-related pension schemes or complementary to them. In particular, it is important to include in the projections the schemes that play a role equivalent to social security schemes in the pension provision. The AWG agreed that, for the projection of private pensions, the real rate of return on private funded pensions should be equal to the real interest rate of 3% (see Chapter 4 in Part 1).

Private individual pensions

For the most part, private individual pension schemes are non-mandatory but they can be also mandatory. The insured persons have the ownership of pension assets. This means that the owner enjoys the rewards and bears the risks regarding the value of the assets. The insurance contract specifies a schedule of contribution in exchange of which benefits will be paid when the members reach a specific retirement age. The scheme provider administers the scheme by managing the pension assets through a separate account on behalf of its members. The access to such a scheme does not require an employment relationship, even though in some cases the contribution may be set on the basis of the wage.

([48]) The UK firmly considers these to be occupational pension schemes, relating to conditions of employment, which do not form part of the social security system – regardless of whether or not they happen to be statutory.

Mandatory private individual pensions

Definition: Mandatory private pension schemes are similar to public schemes. Transactions occur between the individual and the insurance provider. Transactions are not recorded as government revenues or government expenditure and, therefore, do not have an impact on government surplus or deficit. Pension expenditure projections should cover the individual schemes that switch at least in part, either voluntarily or statutorily (especially to new entrants to the labour market), from the current social security scheme to private funds. Such schemes have an increasing relevance in a number of countries.

Clarification: In some cases, there are government guarantees to these pension schemes. Nevertheless, such a guarantee is a contingent liability by nature and these liabilities are not considered as economic transactions until they materialise. Thus, the Eurostat decision further specifies that a government guarantee is not an adequate condition to classify such schemes as social security schemes.

Non-mandatory individual private pensions

Definition: Non-mandatory private pensions are based on individual insurance contracts between the individual and the private pension scheme provider, usually an insurance company or a pension fund. The category of individual schemes includes pension schemes for which membership is not required by law and is independent of any employment link (even if members are mostly employed people). However, employers or the State may in some cases contribute to the plan. Such schemes may also be adhered to through membership in an association.

Clarification: The main difficulty in analysing individual provision stems from the fact that it is difficult to distinguish among different types of savings those that are clearly for retirement purposes. Part of the savings that are not specifically labelled as pension savings may be used for retirement purposes, whereas part of the savings collected by retirement schemes may – depending on national rules – in fact be used for other purposes than providing periodic retirement income (one-off lump sum benefits, early withdrawal options). The extent to which these

schemes are used for retirement savings depends notably on the conditions attached to them, e.g. tax incentives linked to the condition that the bulk of such savings must be used for a regular income (annuity) rather than for paying out a lump sum or the minimum age at which a person can access such retirement savings. In some cases, pension instruments are rather used as investment vehicles with noticeable tax advantages, for instance when a number of years are requested for the plan participation in order to benefit from the lower tax rate.

Breakdown of public pensions

The general classification of pension schemes based on the specific risk assessed: old-age and early pension, disability, survivor and other, is adopted.

Old-age and early pensions

Old-age and early pensions should be considered as a single category of pensions due to the fact that in many countries a proper distinction between these two components cannot be made, either because the early retirement is built-in in the old-age pension system, or because the standard retirement age varies between gender and will increase or become more flexible with time. Early pensions should include – in addition to genuine (actuarial) early retirement schemes – other early pensions schemes that are granted, primarily on the basis of reduced work capacity or labour market reasons, to a specified (age) group at an age below the statutory retirement age (different from disability pensions to be reported separately).

Old-age and early pensions include earnings-related pensions and non-earnings-related ones. Earnings-related pensions reflect all those pensions for which entitlements are dependent on personal earnings/contributions to the old-age and early pension scheme. Non-earnings-related pensions are often social assistance benefit financed with taxes that matches the definition of pension expenditure.

Earnings-related pension may include a flat component or a basic pension that could be non-contributory. Whether this is the case, the expenditure should be included in the old-age pension expenditure but projected separately from the earning related component.

The adopted classification is effective in representing pension expenditure in those countries where the qualifying condition to be entitled to a pension are based on residency (i.e. DK, IE, NL).

Minimum pensions/minimum income guarantee for persons at or over statutory retirement age should be included in the reporting framework. Social assistance benefits, if equivalent to minimum pension and targeted to people aged over 55, must be included in the projections. As for the flat component, minimum pension (non-contributory) is to be projected separately.

Disability pensions

Expenditures related with disability should consider both earnings-related pensions and flat-rate or means-tested minimum pensions of this type. Some countries for instance consider disability pensions (benefits) as part of their sickness insurance scheme while in others they belong to the pension scheme. While, in some countries, the pension retains the same classification from the time when it is first granted until payments end, in most countries, an early disability pension is transformed into an old-age pension when the beneficiary reaches the standard old-age retirement age.

These issues that are key to understand the evolution of disability pension expenditure, together with assumptions on disability rates, should be made clear and subject to peer review. Take-up ratios of disability pensions are supposed to stay broadly constant over time in the case of no reforms affecting retirement ages though a small decreasing variation may occur due to cohort effect.

In line with the agreement regarding health care and long-term care projection methodologies (see chapter 2 and 3 in Part II), care allowances (benefit paid to disabled people who need frequent or constant assistance to help them meet the extra costs of attendance) and economic integration of the handicapped (allowances paid to disabled people when they undertake work adapted to their condition, normally in a sheltered workshop, or

when they undergo vocational training) have to be considered as long-term care expenditure and, hence, should not be included when calculating disability pensions.

Survivor's pension

Survivors' pensions, without any age limit, must be included in the projections. These should include both earnings-related pensions and flat-rate or similar means-tested minimum pensions.

A detailed description of the assumptions behind the projection of survivor pension expenditure in terms of household composition, joint probability to survive, etc. should be contained in the country fiche.

Other

The category 'other' is used for pension or social assistance with a similar purpose that cannot be easily targeted according to the adopted classification described above.

1.4.3. Benefit ratio and replacement rate at retirement

For a better understanding of projected expenditure, the following components of the reporting framework are key.

Benefit ratio

Definition: The benefit ratio is the average pension benefit (including all its components i.e. contributory and non-contributory) divided by an economy-wide average wage, as calculated by the Commission.

Clarification: the evolution of the benefit ratio is crucial to analyse and understand the projection results as it reflects the features of the legal framework of pension systems as far as the calculation and indexation rules are concerned.

The benefit ratio captures several features at the same time. Firstly, it reflects the assumed increases in average pensions due to indexation rules, the maturation of the pension system and longer contribution periods. Secondly, it reflects the changes in average wages driven by the assumptions on labour productivity growth rates. Thirdly, it also captures the changes in the structure of the respective population groups, in particular the share of pensioners and wage earners in each year of the projection exercise.

1.4.4. Gross average replacement rate at retirement

Definition: The gross average replacement rate at retirement is the ratio of the first pension of those who retire in a given year over the average wage at retirement. The (economy-wide) average wage of old people at their retirement usually differs from the overall economy-wide average wage, unless a flat wage profile over the entire working career is assumed in the projection exercise. As already underlined in section 1.2.1, in order to insure the consistency of the projected replacement at retirement, the series on the economy-wide average wage at retirement is included in the reporting framework. This wage series is the one to be taken into account when projecting the replacement rate and the adopted assumptions will be part of the peer review of the projection exercise.

Clarification: In case of social security pension schemes, the gross average replacement rate (at retirement) reflects both the earnings related pensions and flat component (if any).

Gross average replacement rates (at retirement) are provided for all schemes, if possible.

1.4.5. Decomposition into stock and flows of pension expenditure

New public earnings-related pensions

Definition: New pensions expenditure is to be calculated separately for those who retire in the considered year.

New pensions expenditures can be decomposed as follows:

$$P_{new} = \overline{C}_{new} \overline{A}_{new} \overline{PE}_{new} N_{new} \qquad [1.1]$$

where P_{new} is the overall spending on new pensions, $\overline{C}_{new}$ is the average contributory period

or the average years of service of the new pensions, $\overline{A}_{new}$ is the average accrual rate of the new pensions, $\overline{\overline{PE}}_{new}$ is the average pensionable earning over the contributory period related to the new pensions and N_{new} is the number of new pensions (pensioners).

Changes in the flows of pensions and pension expenditure over time should properly reflect the impact of recently legislated reforms in the functioning of pension systems and would provide useful insights on their impact.

Clarification: Publicly provided earnings-related pension schemes can be classified in the following three broad schemes: *defined benefit* (DB), *notional defined contribution* (NDC) and *points system* (PS). According to Table II.1.1, 19 out of 28 Member States have broadly public DB schemes, 6 of them have NDC and 5 are based on a PS ([49]).

In order to accommodate every single different scheme into the agreed reporting a simple and stylised version of these schemes can be used ([50]):

For every single person who retires, a simple defined-benefit plan pays an average accrual rate, *a*, for each year of service. The accrual rate is calculated on (lifetime) average re-valued earnings.

Table II.1.1: **Pension schemes across Member States**

Country	Type	Country	Type
BE	DB	LU	DB
BG	DB	HU	DB
CZ	DB	MT	Flat rate + DB
DK	DB	NL	DB
DE	PS	AT	DB
EE	DB	PL	NDC
IE	Flat rate + DB	PT	DB
EL[1]	Flat rate + DB + NDC	RO	PS
ES	DB	SI	DB
FR[2]	DB + PS	SK	PS
HR	PS	FI	DB
IT	NDC	SE	NDC
CY	PS	UK	DB
LV	NDC	NO	NDC
LT	DB		

(1) The NDC is an auxiliary mandatory pension scheme; (2) PS refers to the complementary schemes AGIRC and ARRCO.
Source: Commission services, EPC.

The pension benefit can therefore be written as:

Defined benefit

$$P = \sum_{t=0}^{T} w_t (1+v_t)^{T-t} a_t \qquad [1.2]$$

here *w* are individual earnings (or contribution bases) in year *t*, *T* is the year of retirement and *v* is the factor by which earlier years' earnings are re-valued ([51]).

Notional defined contribution schemes

In notional defined contribution schemes, the financing inflow over the contribution period is given by wages multiplied by the contribution rate (*c*). This notional capital is increased each year by the notional interest rate, β. At retirement, the accumulated notional capital is divided by a notional annuity factor, *A*. The pension benefit for a single person can be written as:

$$P = \frac{\sum_{t=0}^{T} w_t c_t (1+\beta_t)^{T-t}}{A_T} \qquad [1.3]$$

([49]) Counting twice France, once into DB group and once in the PS group, and Greece, once in the DB group and once in the NDC one.

([50]) The approach is largely based on Whitehouse (2010), "Decomposing National Defined-Contribution Pensions: Experience of OECD Countries' Reforms", *OECD Social, Employment and Migration Working Paper*, n. 109, OECD.

([51]) In most MSs this is the growth of economy-wide average earnings.

Points Systems

In a points system, pension points (w/k) are calculated by dividing earnings (w) by the cost of the pension point (k). The pension benefit then depends on the value of a point (v) at the time of retirement. This last variable is upgraded over time according with the parameter δ in the following equation. Thus, the pension benefit can be written as:

$$P = \sum_{t=0}^{T} \frac{w_t v_t}{k_t} (1+\delta_t)^{T-t} \qquad [1.4]$$

If the rule for indexing earlier years' earnings in DB systems is the same as for notional interest rate and for the upgrading procedure for the pension point (i.e., $v = \beta = \delta$), then the structure of the three equations is similar. If this is the case, the accrual rate (a) under a generic defined-benefit scheme is equivalent to the ratio of the pension-point value to its cost (v/k) and to the ratio of the notional-accounts contribution rate to the annuity factor (c/A). So, for $v = \beta = \delta$, then:

$$a = \frac{v}{k} = \frac{c}{A} \qquad [1.5]$$

Moreover, pensionable earnings in the three schemes are calculated as the sum over the contributory period (years of service) of the valorised wages. Finally T is the contributory period.

As underlined by Whitehouse (2010), this approach has two implications for the comparison of these three different types of earnings-related pension scheme:

- it allows to calculate effective accrual rate for pension-point schemes and notional-accounts schemes;

- the valorisation procedure in defined-benefit plans, the upgrading policy for the pension-point value and the setting of the notional interest rate are to be seen as similar policies.

In the case the old-age pension includes a flat component or a basic pension (contributory or non-contributory), it has to be projected separately but included in the aggregated new pension expenditure (see Table II.A.1.2 – Table II.A.1.4 in Annex 1).

The projected data should include only new entitlements and not previously awarded pension that is transformed into an old age one once that the retirement age is reached (i.e. as it is often the case with previously awarded disability benefit).

To deal with the three different schemes the block collecting data on *Decomposition of new public pension expenditure – earning related* is divided into three subgroups related to DB, PS and NDC (see Table II.A.1.2 – Table II.A.1.4 in Annex 1). Member States will provide information on their own system in accordance with the structure of the specific subgroup. In particular, for those who adopt a NDC system, the components of the average accrual rate are to be provided: *notional accounts contribution rate (c)* and *annuity factor (A)*.

Building up on the experience of the 2015 Ageing Report the decomposition of new pension expenditure for PS systems has been streamlined to a single template. Some flexibility is still allowed and MSs, if needed, can provide projections of additional figures through the additional information section of the reporting framework.

To assure the sustainability of their pension systems, several EU countries introduced automatic balancing mechanisms that we referred to as "sustainability/adjustment factors". The way these factors operate has to be taken into account when dealing with new pension expenditure projections, according to their specific rules. Member States will also provide information about the evolution of the adjustment factors when reporting new pensions expenditures.

As not all the new pensioners will retire on the first of January, the simple formula proposed refers to the average monthly new pension. To be consistent with the data on the total expenditure on new pensions (line 15 and line 17 in the reporting sheet – Annex 1 Table II.A.1.1), and to allow for a check of the reported data, countries are asked to provide the average number of months of pension paid the first year. If there is no specific constraint due to

legislation, the new pensioners are spread over the year according to some distribution. If a symmetrical distribution over the year is assumed (or empirically fitted the data), the average number of months of pension paid the first year turns out to be 6. If the distribution is asymmetrical, the average should be calculated according with the distribution considered. If there is a single retirement date fixed by law, the average number of months of pension paid the first year turns out to be the difference with the end of the year. If more than one retirement date is fixed by law, the average number of months of pension paid the first year should be calculated as an average of the remaining months (difference from 12 and the month of retirement), weighted by the number of people that retire on each specific date (if available, or assuming a distribution of new retired among the dates).

An alternative use of the data on new public earning-related pension is that of analysing the development and internal consistency of the stock of old pensions (those already existing at the beginning of the year to be calculated as the difference between the total and the "new" pensions in the reporting sheet). At every point in time *t*, the projection of average pension expenditure related to "old pensions" must be close to the value of the average pension expenditure at the year *t-1* indexed by the rule applied in each country and scheme, and thus:

$$\frac{(P_{t-1}/N_{t-1})(1+\varepsilon)}{P_t^{old}/N_t^{old}} \approx 1 \qquad [1.6]$$

where:

P_{t-1} is the projection of total public earning-related pensions expenditure (including flat component) at time *t-1*(line 16 + line 18);

N_{t-1} is the number of pensioners entitled to a public earning-related pension at time *t-1*(line 87);

$(1+\varepsilon)$ is the pension indexation rule applied in each country and scheme;

P_t^{old} is the projection of the "old" pensions expenditure at time *t* [total public earning-related pensions expenditure (including flat component - line 16 + line 18) minus the expenditure related to "new" public earning-related pensions (including flat component - line 17 + line 19)];

N_t^{old} is the number of old pensioners at time *t*. This is to be calculated as the difference between total pensioners entitled to a public earning-related pension (line 87) minus the new pensioners in the same typology of pension as reported in the last block of the reporting sheet.

Such an indicator is expected to take value close to 1 if projections are internally consistent and the distribution of the retired people has not been selected by mortality([52]).

Furthermore, as mentioned in section 1.2.1, it is agreed that the new pension expenditure by men and women should also be projected according to the proposed decompositions (as described in Eq. 1.1 till Eq. 1.4). This, as already underlined, improves the transparency of projections as gender inequalities in the labour market and different pension rules may result in quite different dynamics of pension entitlements among men and women.

1.4.6. Additional information on number of pensioners, contributors and contributions to pension schemes and applied indexation

The number of pensions

The number of pensions reflects the number of cases in which a pension is paid off to an individual. Each type of pension should be considered separately.

([52]) If the assumption of orthogonally between mortality and pension distribution is removed, we are left with the empirical evidence that mortality rates are higher for older people, and that these people receive, on average, smaller pensions. This will results in P_t^{old}/N_t^{old} being larger than P_{t-1}/N_{t-1}. In terms of the proposed indicator a value smaller than 1 (but still close to) is to be expected.

The number of all pensions and public pensions has to be reported by age groups. This break-down, whose provision is mandatory with regard to the public scheme, will increase transparency and consistency between population, labour force and pension projections.

The number of pensioners

The number of pensioners for each type of pension should be considered separately, allowing for the fact that the same person may be a recipient of several types of pensions, for instance, a recipient of a social security pension and a private mandatory pension. Thus, the detailed lines should reflect the number of the recipients of the specific pension but the figures on summary lines, in particular the number of all pensioners, are not likely to match the summing up of the subtotals. Ideally, the number of all pensioners (line 110) should be the number of persons who receive pension benefits but calculated only once in case of a receipt of multiple pensions. If an exact figure is not available, an estimate is preferred to the mere summing up. If such a rule is applied, a minimum requirement of the projections is that the number of pensioners should be smaller than the number of pensions.

In the projections, the ratio between pensions and pensioners should be held constant if there is no reform affecting the pension take-up ratio or any process of merging/closing of pension schemes. Any departure from this hypothesis should be documented and will be part of the peer review process.

The overall number of pensioners by age group should be consistent with agreed figures on labour force. The share of pensioners in each age group should be below but very close to the number of inactive population in the same group.

A break-down of pensioners by age and sex will be provided by Member States with regards to public pensions and all pensions. This break-down is needed to increase transparency and consistency between population, labour force and pensioners projections. In particular, it will allow for a consistency check between gender-specific labour force participation rates and gender-specific pensioners. Some form of correlation should be evident, once mortality rates have been taken into account, between today's participation rates and pensioners groups projected 30/40 years in the future. This data should be particularly interesting when analysing the effects of reforms with regards to the effective retirement age. Also, the overall number of the pensioners can be compared with the number of inactive population, for different age-groups so as to gain further insights.

The availability of data on pensioners (or pensions as a second best) is particularly relevant when decomposing pension expenditure on GDP. In particular they allow for the calculations of the coverage ratio.

The coverage ratio effect is defined as the number of pensioners of all ages to population over 65 years or any other defined age threshold. The analysis of the coverage ratio provides information about how the developments of the effective exit age and the percentage of population covered impact on pension spending. The coverage ratio should also be disentangled by age groups and be calculated in relation to inactive population (to check the consistency with labour force projections).

Contributions to pension schemes

Contributions to pension schemes paid both by employers and employees as well as self-employed persons provide information on whether or not there is a potential future financial gap in the pension system. If the pension contribution is part of a broader social security contribution rate, an estimate should be provided, if possible, for the share of the pension contribution, e.g. on the basis of the most recent expenditure structure. In case that the pension is financed by general tax revenues, this should be considered as State contribution (line 126). The share of pension contribution or implicit contribution rate paid by the employers and employees is assumed to stay constant over the projection horizon. Any alternative assumption should be duly documented and will be assessed during the peer review process.

In order to complete the picture on the financing of the system, contributions from "Other revenues" (i.e. pension funds, nuisance charges, tax) on top of employer, employee and state contribution is also to be separately projected.

When dealing with State contributions it should be made clear whether an obligation exists for the State to cover any possible future financing gap of the system or whether a buffer fund exists in order to take into account the effects of employment fluctuations. The effects of the framework in place should be duly reflected in the evolution of State contribution.

Estimates of pension contributions to public and private mandatory schemes, notably concerning the category of old-age and early pensions, are relevant. With regards to other pensions, such as disability and survivors' pensions, contributions should be reported voluntarily and separately only if these pensions are managed by separate specific schemes by means of the additional information space considered in the reporting sheet. In the case where they are part of the old-age pension scheme, no separation of contributions between different types of pensions is requested but the total contribution should be presented in the context of old-age and early pensions.

Number of contributors

As is the case with the number of pensioners, the number of contributors to each type of pension should be considered separately, allowing for the fact that the same person may be a contributor to several schemes. This is the case, for instance, for pension systems in which a part from a public scheme is switched to a private (mandatory) pension scheme. However, the line of total pensions contributors should count contributors only once in case where the person contributes to more than one scheme at the same time. Thus, the number of contributors should be close to the number of employed persons or active-age population as projected by the Commission services and AWG.

As for contributions, it would be important to provide estimates of the numbers of contributors to social security and private mandatory schemes, notably concerning the category of old-age and early pensions. The number of contributors to other schemes should be presented only in case of separate schemes for these purposes.

The number of contributors should correspond to an estimate of the number of persons covered by pension schemes without regard to the amount of the contribution. Thus, a contributor in a short-term contract should count as a contributor in a permanent (full-time) contract. However, in practice, a contributor in a short-term contract may appear as a contributor several times during a year and it may not be possible to separate the number of contributors during a year from the number of contribution periods. Therefore, a better proxy for the number of persons covered by pension schemes should be the number of contributors at a given point of time, e.g. at the end of the year.

Applied indexation

In the 2018 Ageing Report a plain recording of the indexation used in the projection of pension expenditure (block 1 of the questionnaire) has been included in the reporting framework. The indexation effectively applied to project the expenditure on public pensions, old age pensions, earnings related pensions, flat component of old age pensions and minimum pensions are provided. This is particularly relevant for pension components for which legally stipulated and effective future indexation differ. For example, while legally foreseen indexation rule of the basic or minimum pension may officially follow the general rule applied to all pension categories, it is often the case that pension benefits under these categories representing minima are in practice revised more in line with wages than prices to maintain their adequacy over time.

2. HEALTH CARE

2.1. INTRODUCTION

Health care services represent a high and increasing share of government spending and of total age-related expenditure. Furthermore, the ageing of the EU population may entail additional government expenditure. This makes public spending on health care an integral part of the debates on long-term sustainability of public finances.

This chapter presents twelve scenarios to project public expenditure on health care in the 28 Member States of the EU and Norway up to 2070. The general methodology is explained below.

2.2. GENERAL METHODOLOGY TO PROJECT PUBLIC EXPENDITURE ON HEALTH CARE

The Commission services (DG ECFIN) simulation model will be used to project health expenditure, as in Ageing Report 2015.

These simulation models assume that the whole population is divided into groups which are assigned certain characteristics (e.g. age, sex, per capita expenditure, health status, etc.) ([53]). Changes in these groups lead to expenditure changes over time. These types of models are widely used when running long-term expenditure projections, especially when the precise micro information on the individuals and their transition rates from one health status to another is missing or not reliable.

The choice of methodology and various scenarios is constrained by the availability, accessibility and quality of health care data. Therefore, the models may not include all the relevant factors identified as affecting health care spending.

In general, the long-term budgetary projections and certainly the base-case scenario illustrate a policy-neutral situation. This is the situation where future possible changes in government policy are not considered. In other words, any potential future institutional or legal changes to the financing and organisation of health care systems are not reflected in the methodology used for projecting expenditure. Such institutional and legal changes would include for example changes in the degree of regulation of markets for pharmaceuticals or the introduction of referral systems. Instead, the only changes modelled in these projections are those deemed automatic and adequate responses to new needs resulting directly from changes in population structure, health status or income. Therefore, the determinants of expenditure considered in the projections can be seen as mostly independent of government activity or public policy.

The general methodology used to project public expenditure on health care is articulated as follows (See Graph II.2.1):

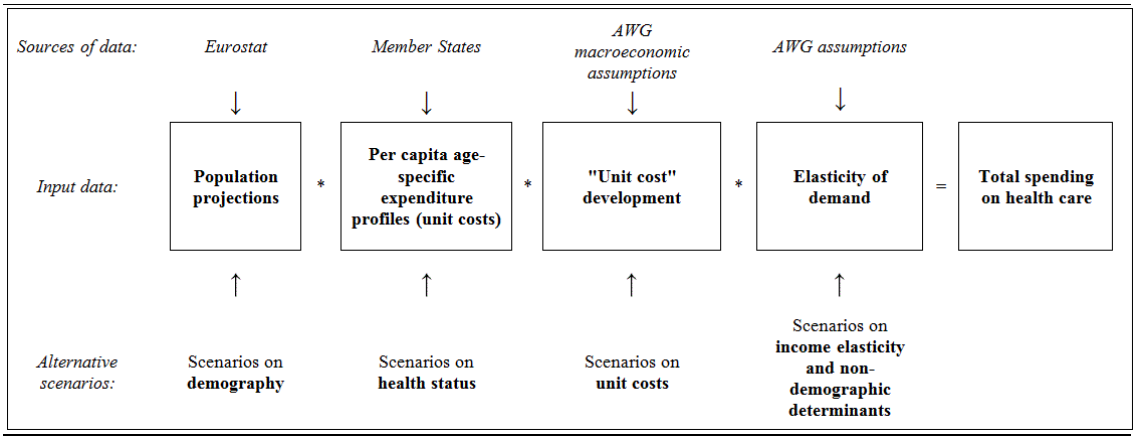
- ***Step 1***: take baseline population projection (i.e. number of individuals) by age and sex provided by Eurostat for each year up to 2070;
- ***Step 2***: take age/sex specific public expenditure per capita on health care i.e. the so called age/sex specific expenditure profiles provided by Member States;
- ***Step 3***: calculate age/sex expenditure profiles for each projection year up to 2070 on the basis of various assumptions i.e. the projection scenarios;
- ***Step 4***: for each projection year, multiply the projected number of people in each age/sex group by the respective age/sex expenditure profiles;
- ***Step 5***: for each projection year, sum all the groups' expenditure to obtain total projected public expenditure on health care.

There are three important aspects of the projection exercise to be stressed.

Firstly, the analysis assumes that the determinants of public expenditure on health care, such as government health policy and actions by any individual participant in the health market stay constant. This means that changes in the way health systems are financed and organised are not

([53]) For the most recent projections, see: "The 2015 Ageing Report Economic and budgetary projections for the 28 EU Member States (2013-2060)", European Economy, No 3/2015.

Graph II.2.1: **Schematic presentation of the projection methodology**



Source: European Commission.

modelled. The adjustments observed relate to health care provision adjusting automatically to needs resulting from changes in population structure and health status, and changes in income. It is assumed that such changes force an automatic change in the amount of goods and services provided to the population by the publicly financed health system. As such, most scenarios should be considered as "no-policy change" scenarios ([54]).

Secondly, many of the determinants of expenditure described in the previous section, notably supply side determinants of spending are either not quantifiable or depend on ad hoc policy decisions. This is why the methodology used in the previous 2015 EPC-EC Ageing Report to project public health care expenditure and used again here reflected mainly demand-side factors such as demographic structure, income and health status of the population. Nevertheless, a regression analysis attempts to quantify the impact of non-demographic factors such as technology and institutional settings, while controlling for income and the demographic structure of the population. It is proposed to use a similar strategy in the current exercise.

Thirdly, the analysis tries to identify the impact of each quantifiable determinant separately on the basis of hypothetical assumptions (estimated guess or a "what if" scenario). Therefore, the results of the projections should not be interpreted as forecasts of expenditure.

The proposed methodology for the coming projection exercise builds on the 2015 EPC-EC projections exercise and maintains the existing scenarios and sensitivity tests. The schematic methodology to project health care expenditure is presented in Graph II.2.1 above.

As in 2015, the projections on health care need to be viewed in the context of the overall projection exercise. Consequently, the common elements of all scenarios will be the 2015-based population projections provided by Eurostat and the baseline assumptions on labour force and macroeconomic variables agreed by the EC and the AWG-EPC. The age and sex-specific per capita public expenditure (on health care) profiles are provided by Member States. They are applied to the population projections provided by Eurostat to calculate nominal spending on health care. In a further step, the age profiles applied to the population structure are adjusted to add up to the total expenditure on health care in the specific year of reference ([55]). It was agreed for previous exercises to do this adjustment by keeping the base year proportions between specific age cohorts

([54]) Only the "*EU28 cost convergence scenario*" can be considered as a policy change scenario for the countries with below the EU average public spending on health care in the base year.

([55]) Total headline data on total expenditure may differ from the figures resulting from the combination of age profiles with underlying population. Discrepancies between the two measures on health expenditure can result from differences in their computation. While total expenditure is calculated from aggregate budgetary perspective, cost per capita is in many countries estimated on the basis of hospital inpatient data, in most countries based on the diagnosis-related groups.

constant while adjusting the total (calculated as sum of per capita weighted by population in each cohort) to correspond to the aggregate figure as reported to the international databases and confirmed by the AWG delegates in the health care questionnaire.

To reflect the effects of the different determinants on public expenditure on health care, changes are made to three main inputs: 1) the population projections, 2) the age-related expenditure profiles (capturing unit costs), and 3) assumptions regarding the development of unit costs over time driven by the macroeconomic variables or assumptions on health status for example. As in the 2015 projections exercise, the list of determinants to be modelled is not exhaustive. The different scenarios are summarised in Table II.2.1. and explained in the next section.

Finally, country-specific information regarding any relevant recent reforms legislated and/or implemented that could have an impact on health care expenditure (e.g. binding spending ceilings, etc.) will be taken into account in the current projections, according to technical feasibility.

2.3. MAIN DRIVERS OF HEALTH CARE EXPENDITURE AND PROJECTION SCENARIOS

The purpose of the health care systems is to "improve the health of the population they serve; respond to people's expectations and provide financial protection against the costs of ill-health"([56]). In the WHO report health systems are attributed four vital functions: 1) service provision i.e. the delivery of personal and non-personal health services; 2) financing i.e. the revenue collection, the pooling of funds (insurance function) and purchasing of services (the process by which pooled funds are paid to providers in order to deliver the health interventions to care users); 3) resource creation i.e. investment in equipment, buildings and people (training) and 4) stewardship or oversight of all the functions i.e. the careful and responsible management of the health system.

In this context, public expenditure on health care depends on a number of factors which affect the demand and supply of health services and goods. These include:

- the health status of the population;
- economic growth and development;
- new technologies and medical progress;
- the organisation and financing of the health care system;
- health care resource inputs, both human and capital.

The long-term projections, explained below, capture demand and supply-side factors, and include demographic and non-demographic variables ([57]).

([56]) World Health Organization (2000), "Health Systems: Improving Performance", The World Health Report 2000, p.8.

([57]) See also annex 6 Mathematical illustration of the health care scenarios.

Table II.2.1: **Overview of scenarios to project health care expenditure**

	Demographic scenario	High life expectancy scenario	Constant health scenario	Death-related costs scenario	Income elasticity scenario	EU28 cost convergence scenario	Labour intensity scenario	Sector-specific composite indexation scenario	Non-demographic determinants scenario	AWG reference scenario	AWG risk scenario	TFP risk scenario
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Population projection	Eurostat 2015-based population projections	Alternative higher life expectancy scenario (+2 years)	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections
Age-related expenditure profiles	2016 profiles held constant over the projection period	2016 profiles held constant over the projection period	2016 profiles shift in line with changes in age-specific life expectancy	2016 profiles split into profiles of decedents and survivors and adjusted in line with changes in age-specific life expectancy	2016 profiles held constant over the projection period	Individual EU28 profiles converging upwards to the EU28 average profile over the projection period	2016 profiles held constant over the projection period	2016 profiles held constant over the projection period	2016 profiles held constant over the projection period	Intermediate scenarios I and III, whereby 2016 profiles shift by half the change in age-specific life expectancy	Intermediate scenarios I and III, whereby 2016 profiles shift by half the change in age-specific life expectancy	Intermediate scenarios I and III, whereby 2016 profiles shift by half the change in age-specific life expectancy
Unit cost development	GDP per capita	GDP per capita	GDP per capita	GDP per capita	GDP per capita	GDP per capita	GDP per hours worked	Input-specific indexation	GDP per capita	GDP per capita	GDP per capita	GDP per capita
Elasticity of demand	1	1	1	1	Cost sensitivity of 1.1 in 2016 converging to 1 by 2070	1	1	1	Cost sensitivity of 1.4 in 2016 converging to 1 by 2070	Cost sensitivity of 1.1 in 2016 converging to 1 by 2070	Cost sensitivity of 1.4 in 2016 converging to 1 by 2070	Cost sensitivity of 1.1 in 2016 converging to 1 by 2070

Source: Commission services, EPC.

2.3.1. Demographic scenario

The aim of a *"demographic scenario"* is to estimate in isolation the effect of an ageing population on future public expenditure on health care. It assumes that age/sex specific morbidity rates and provision structure of health treatments do not change over time. This, in turn, means that age/sex specific per capita public expenditure (on health care) profiles can be considered as proxies for the morbidity rates ([58]), remain constant in real terms over the whole projection period. It also assumes a gradual increase in life expectancy on the basis of underlying population projections. An increase in life expectancy and no changes in health status as compared to today's health status mean that all the gains in life expectancy are implicitly assumed to be spent in bad health. The number of years spent in good health remains constant. This is in line with the *expansion of morbidity* hypothesis, which suggests that falling mortality is largely due to a decreasing fatality rate of diseases and is therefore accompanied by an increase in morbidity and disability.

To calculate future public expenditure on health care, the age/sex specific per capita public expenditure profiles are multiplied by the respective age/sex population group in each projection year. These age/sex groups change in line with the population projections up to 2070. This scenario also assumes that "unit costs" – i.e. the health care expenditure per capita for each year of age – evolves in line with GDP per capita. Such cost development applied to the baseline age/sex-specific per capita public expenditure profiles can be considered to be neutral in macroeconomic terms – if no change in the age structure of the population occurred, the share of public expenditure on health care to GDP would remain the same over the projection period.

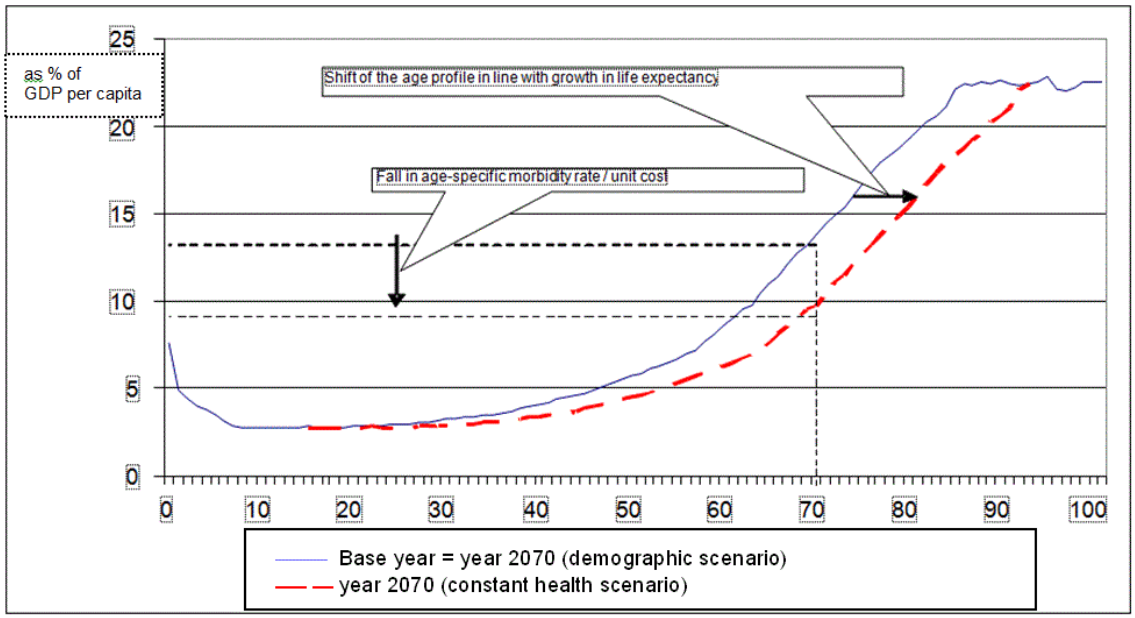
2.3.2. High life expectancy scenario

A variant of the demographic scenario is the "*high life expectancy scenario*". This is a sensitivity test to measure the impact of alternative assumptions on mortality rates. This scenario assumes, as in the sensitivity tests run for pension projections, that life expectancy at birth in 2070 exceeds the projected life expectancy used in the "*demographic scenario*" by two years. This scenario is methodologically identical to the "*demographic scenario*", but alternative demography and GDP data are used ([59]).

([58]) Strictly speaking, age profiles of expenditure illustrate exclusively public health care spending per person of a given age cohort. As such it is not a measure of health status or morbidity. However, given the lack of a reliable and comparable data on the latter, one can plausibly assume that the shape of the profile follows the evolution of health status over the lifespan, i.e., over time, we assume that the same segments of the curve (early childhood, old age and motherhood) follow the same pattern.

([59]) Based on the approach applied to assess the sensitivity of pension spending, GDP data captures the life expectancy

Graph II.2.2: **Stylised illustration of the constant health scenario using age-profiles of health care costs**



Source: Commission services.

2.3.3. Constant health scenario

The "*constant health scenario*" is based on the *relative compression of morbidity* hypothesis. It mimics improving health status in line with declines in mortality rates and increasing life expectancy. It assumes that the number of years spent in bad health during a life time remains constant over the whole projection period. This means that all future gains in life expectancy are spent in good health. Consequently, the morbidity rate and therefore the age/sex specific per capita public expenditure profiles are declining with the mortality rate.

Within this scenario, the country specific age/sex per capita expenditure profiles are progressively shifted outwards, in line with increasing life expectancy ([60]). This "outward" shift is proportional to the projected gains in life expectancy. First, for each projection year the change in life expectancy in relation to the base year in calculated. For example, the life expectancy of a 50-year-old man is expected to increase by 4 years from 30 years in year *t* to 34 years in year *t+20* in a specific Member State. Then, the scenario assumes that in *t+20* a 50-year-old man will have a per capita public expenditure profile of a (50-4) = 46-year old men in year *t* (the latter adjusted as usual with the GDP per capita growth rate over the last 20 years).

In Graph II.2.2 the dotted line illustrates the new age-specific per capita public expenditure profile that would be applied in each projection year up to the year 2070. As in the "*demographic scenario*", each age and sex group in each projection year is multiplied by the modified age/sex specific per capita public expenditure profiles to calculate the future public expenditure on health care.

2.3.4. Death-related costs scenario

The "*death-related costs scenario*" employs an alternative method to project public expenditure on health care. The methodology links per capita public expenditure on health care to the number of remaining years of life. Indeed, there is empirical evidence that a large share of the total expenditure on health care during a person's life is

change through the impact of the latter on the labour force projections.

([60]) The method is applied to those age/gender groups where expenditure per capita is growing. For the young and the oldest old, the reference age/gender and therefore age/gender per capita public expenditure profile remains the same over the whole projection period.

concentrated in the final years of life ([61]). As life expectancy increases and mortality rates decline, a smaller share of each age cohort is in a terminal phase of life and mortality is concentrated in very old age cohorts. If more people die at very old ages there may be a reduction in public expenditure on health care because per capita public expenditure in very old ages does actually decrease.

In practical terms, for countries which provide the relevant data for running the model, it is proposed to use an average profile of *death-related costs by age*.

Next, the age/sex specific mortality rates are used as probabilities, to split each age group into two sub-groups according to the number of remaining years of life: 1) that of decedents, i.e. those who are expected to die within a certain number of years, and 2) that of survivors, i.e. those who are not expected to die within those number of years.

Each of the two sub-groups within each age/sex group is assigned a specific and different per capita public expenditure profile – the *death-related costs* profiles, ideally differentiating expenditure occurring a full year before for decedents versus survivors. The ratio between the health costs of survivors and decedents is called the k-ratio.

Then the number of individuals in each subgroup of decedents and survivors is multiplied by its respective per capita public expenditure profile. This gives the total public expenditure of each age group in each year.

Summing total expenditure of each age group in a given year corresponds to the total public expenditure on health care in that year.

Note that the death-related costs profiles are as usual indexed to GDP per capita growth as in the previous scenarios.

As in the 2015 EPC/EC Ageing Report, the k-ratio is projected according to a cohort approach. This allows capturing changes in perceived health care needs and therefore treatment expectations of the very old as life expectancy increases.

The k-ratio decreases in the older ages, where the probabilities of death increase dramatically. This is due to the fact that normal and death-related costs have different correlations with age. In particular, while the former are likely to increase along with age because of the progressive worsening of health status, the latter are likely to follow an opposite path insofar as the event of death, in the case of elderly people, is not as costly as in the case of younger ones. Such results are confirmed by empirical evidence from a number of studies ([62]).

Therefore, the k-ratio cost profile varies over time, as longevity increases. Essentially, this means that it is the distance to time period before death rather than age per se which influences the k-ratio for people of a specific age/sex group.

Keeping unchanged the relationship between the k-ratio and life expectancy, as observed in the base year (cross-sectional analysis), implies that the age profile of the k-ratio moves over time according to changes in longevity (intertemporal analysis).

2.3.5. Income elasticity scenario

The *"income elasticity scenario"* attempts to capture the effect of changes in national income on demand for health care goods and services. This effect is the result of a number of factors: higher living standards, the fulfilment of the basic needs and therefore growing expectations and social pressure to catch-up with the health care quality and coverage provided in richer neighbouring countries ([63]).

To calculate the possible effect of income, one can use different levels of income elasticities to the basic GDP per capita evolution path. More specifically, this scenario shows the effect of an

([61]) For an overview of empirical studies, see: Raitano M. (2006), "The Impact of Death-Related Costs on Health-Care Expenditure: A Survey", ENEPRI Research Report No 17.

([62]) Aprile, R. (2013); Gabriele et al. (2005); Lubitz and Riley (1993); Van Vliet and Lamers (1998); Madsen (2004); Raitano (2006).

([63]) The demand for higher quality care may translate into demand for the most modern medical knowledge and technologies. In this context the impact of income could to a certain extent capture the impact of technology. The impact of technological development is assessed in a separate scenario, using econometric analysis of past trends in public expenditure on health care, demographic, income and non-income variables.

income elasticity of demand higher than 1, i.e. ε = 1.1, on the evolution of public expenditure on health care. An income elasticity exceeding 1 is an indicator that health care is considered by society as a 'luxury good'. An elasticity of 1.1 at the beginning of the period is chosen on the basis of existing reviews of empirical evidence gathered over the recent decades ([64]). It is also assumed that economic growth and process of real convergence between countries over the long run will drive elasticity down towards common unity level, by 2070 ([65]).

This scenario is identical to the "*demographic scenario"* except that the income elasticity of demand is set equal to 1.1 in the base year (rather than 1 in the case of the *"demographic scenario"*), converging in a linear manner to 1 by the end of projection horizon in 2070.

2.3.6. EU28 cost convergence scenario

The "*EU28 cost convergence scenario*" is a policy change scenario meant to capture the possible effect of an upward convergence in real living standards (which emerges from the macroeconomic assumptions) on health care spending. In other words, this scenario proposes to take into account the convergence of citizens' expectations towards a similar basket of (health) goods.

This scenario considers the convergence of all countries that are below the EU28 average in terms of percent of GDP per capita health expenditure to that average. This would be illustrated as follows: the relative age/sex per capita public expenditure profiles below the corresponding (calculated) EU28 average age/sex per capita public expenditure in the base year would be assumed to progressively increase to this EU28 average age/sex specific per capita public expenditure profile (as a percent of GDP per capita). The convergence will be achieved by 2070. As a result, the convergence speed for all the countries below the EU28 average would take into account the differences in the initial situation, i.e. the extent of the initial gap between country-specific and EU28 average profile.

2.3.7. Labour intensity scenario

The "*labour intensity scenario*" is an attempt to estimate the evolution of public expenditure on health care taking into account that health care is and will remain a highly labour-intensive sector. Consequently, unit costs (and therefore the age/sex specific per capita public expenditure profiles) are assumed to evolve in accordance with changes in labour productivity, rather than growth in GDP per capita. This assumption implies that the cost of public provision of health care is supply-driven rather than demand-driven. In practical terms, the proposed scenario is similar to the "*demographic scenario*" except that unit costs are assumed to evolve in line with the evolution of GDP per hours worked (which is usually higher than GDP per capita) ([66]).

As wages are projected to grow in line with productivity and generally faster than GDP per capita, this scenario provides an insight into the effects of unit costs in the health care sector being driven mostly by increases in wages and salaries. Note that this scenario still assumes that wages in the health sector grow at the same rate as wages in the whole economy, and that wages in the whole economy generally follow the trend of economy-wide productivity. Hence, expenditures per head are assumed to grow at the same rate as productivity in the whole economy.

2.3.8. Sector-specific composite indexation scenario

Given the special character of the health care sector (high level of government regulation, investment in new technologies, high labour intensity), it might be preferable to use sector-specific rather than economy-wide elements as determinants of unit costs in the model. While a significant share of public expenditure on health corresponds to expenditure on staff (wages), we could go further and consider other inputs and therefore sectoral components of public

([64]) See Getzen T. E. (2000), "Health care is an individual necessity and a national luxury: Applying multilevel decision models to the analysis of health care expenditures", Journal of Health Economics, Vol. 19(2), pp. 259-270.

([65]) This is also a common technical assumption in many long-run projection models, to avoid "explosive" path of some of the variables used in the exercise.

([66]) The 2009 "*labour intensity scenario*" used GDP per worker.

expenditure on health care. These components may have evolved at a pace different from that of wages. The scenario called "s*ector-specific composite indexation scenario*" tries to capture the importance and evolution of various components to health care provision. This scenario looks at each of these different components separately and indexes each of them in a separate/different way, creating a sort of composite indexation for "unit cost development".

In order to capture the importance and evolution of various components, we start by choosing a set of such components and calculate their respective share in public expenditure on health care. We consider that expenditure on health care can be disaggregated in its different components, broadly reflecting the different sectors of the health system: 1) inpatient care, 2) outpatient care and ancillary services, 3) pharmaceuticals and therapeutic appliances, 4) preventive care, 5) capital investment, and 6) other factors ([67]). For each of these components we calculate its share in total public expenditure on health care and then apply the share to the age-specific per capita expenditure. In doing this, we (mechanically) divide each age-specific per capita expenditure into six sub-items of expenditure.

We then look at the past evolution of public expenditure on each of those inputs. In other words, we calculate the average annual growth of the expenditure associated with each of those components for the past 10 years ([68]). We further calculate the ratio of each of these growth rates to the growth rate of GDP per capita.

We then multiply each sub-item of the age-specific per capita expenditure by this growth ratio. This allows for different evolution patterns for each component of expenditure so that in the future the share of each of these components is allowed to change, something which was not captured by previous scenarios. We then assume that the growth ratio multiplying each sub-item of expenditure converges to 1 in a certain year in the future (i.e. grows at the same pace as productivity or GDP per capita) ([69]).

As to the pattern of convergence, past observations are used to determine the convergence pattern of the growth ratios. It is assumed that for all components the ratio converges to 1 in 2070. Different convergence patterns for each component can also be assumed ([70]).

2.3.9. Non-demographic determinants scenario

Since the second half of the 20th century, health care expenditure has been growing faster than income. Econometric studies show that demographic factors (e.g. ageing) have a positive but relatively minor impact on spending when compared with other drivers, such as income, technology, relative prices and institutional settings ([71]). In the 2015 EPC/EC Ageing Report, the non-demographic scenario for healthcare expenditure was projected to have a substantial impact, relatively to the reference scenario, raising public health expenditure in the EU (over the 2013-60 period) by 1.6 pps. of GDP in the EU28 compared with only 0.9 pp. in the reference

([67]) In the 2015 EPC/EC Ageing Report the expenditure on health care were disaggregated in the following inputs: 1) staff, to which corresponds expenditure on wages, 2) pharmaceuticals, 3) therapeutic appliances, 4) capital investment, and 5) other factors. Due to data limitations, the input categories have been changed. In the current projection exercise, they are largely based on the SHA 2011 classification of health care functions (see Annex 5, Table II.A5.2).

([68]) Due to current data limitations for building 10-year time series from data based on the SHA 2011 classification, data from COFOG categories in correspondence to the SHA 2011 health care functions will be used for the calculation of the average annual expenditure growth for each sub-item.

([69]) Let us assume that per capita public expenditure on health care for 20-year old men is €2000 in year t. Assume too, that in line with total public expenditure on health care, 40% is inpatient care, 30% outpatient care and ancillary services, 5% capital investment, 17% pharmaceuticals and therapeutic appliances, 3% preventive care, and 5% other inputs. Therefore, per capita public expenditure is divided into 6 sub-items: €800 in for inpatient care, €600 outpatient care and ancillary services, €100 capital investment, €340 in pharmaceuticals and therapeutic appliances, €60 preventive care and €100 in other inputs. Then in year t+1 we have that expenditure increases as follows (numbers are just illustrative): €800x1.2 + €600x1.1 + €100x1.4 + €340x1.3 + €60x1.1 + €100x1, where 1.2, 1.1, 1.4, 1.3, 1.1 and 1 are the (past observed) growth ratios of each component. As to the pattern of convergence, we can use past observations to determine the convergence pattern of the growth ratios.

([70]) When extrapolating past trends, caution is called for in its interpretation as there may be methodological breaks in the series or policy changes, affecting e.g. pharmaceuticals.

([71]) Maisonneuve C. and Martins J.O. (2013), "A projection method of public health and long-term care expenditures", OECD Economic Department WP No 1048.

scenario ([72]). By ignoring the effects due to non-ageing drivers, the AWG reference scenario implicitly assumes a substantial progressive downward tilt of past trends in healthcare spending, flattening out at the end of the period ([73]).

In order to address this critical aspect of past exercises and following analytical work carried out for the 2009 Ageing Report ([74]) and for the 2015 Ageing Report ([75]), this scenario reassesses the impact of non-demographic factors (NDF) (e.g. technology, relative prices) on healthcare expenditure. It uses the *residual approach* to identify the impact of NDF on health care spending. In practice, the effect of demographic changes is subtracted from the total increase in expenditure and the remaining part (i.e. the residual) is attributed to changes in NDF ([76]).

This scenario uses panel regression techniques to estimate country-specific non-demographic cost (NDC) of healthcare. NDC is defined as the excess of growth in real per-capita healthcare expenditure over the growth in real per-capita GDP after controlling for demographic composition effects. Alternatively, results can also be expressed in terms of country-specific "average" income elasticities of health care expenditure.

Panel regressions are run using data in growth rates ([77]) and assuming country fixed effects.

Multiple model specifications were tried using the datasets, namely estimates including and excluding country-fixed effects and a period dummy.

Econometric results obtained are similar to those carried out for the NDC scenario of the 2015 Ageing Report.

As regards the implementation of the NDD scenario, and based on the technical work carried out by Commission Services for the 2012 Ageing Report, the AWG decided to use a common elasticity (η) of 1.4 ([78]) throughout the projection period, which will be reduced to 1 in 2070.

2.3.10. AWG reference scenario

The *"AWG reference scenario"* is used as the central scenario when calculating the overall budgetary impact of ageing. It is the point of reference for comparisons with the 2015 Ageing Report. In this scenario health care expenditures are driven by the assumption that half of the future gains in life expectancy are spent in good health and an income elasticity of health care spending is converging from 1.1 in 2016 to unity in 2070.

2.3.11. AWG risk scenario

The "*AWG risk scenario*", as the "AWG reference scenario", keeps the assumption that half of the future gains in life expectancy are spent in good health but attempts to take into account technological changes and institutional mechanisms which have stimulated expenditure growth in recent decades, following the same approach as described in the "non-demographic determinants scenario". A proxy for the non-demographic costs (NDC) with estimated EU average elasticity of 1.4, based on Commission

([72]) European Commission and Economic Policy Committee (2015), "The 2015 Ageing Report Economic and budgetary projections for the 28 EU Member States (2013-2060)", European Economy, No. 3/2015.

([73]) The reason for the convergence of the elasticity is that only a partial continuation of past trends related to non-demographic determinants in the future is expected. In the past, extensions of insurance to universal coverage of the population were an important trigger of increases in public health expenditures. As universal coverage is nearly reached in the EU, this one-time shock will not occur again in the future. Note that by "coverage" is not only meant coverage in terms of percentage of population covered, but also in terms of the "depth" of the coverage, i.e. the size of the benefits basket and the coverage rates of benefits. However, data availability at the level of individual countries to correct for coverage effects is suboptimal.

([74]) Dybczak K. and Przywara B. (2010), "The role of technology in health care expenditure in the EU", European Economy, Economic Papers No 400.

([75]) Medeiros J. and Schwierz C. (2013), "Estimating the drivers and projecting long-term public health expenditure in the European Union: Baumol's 'cost disease' revisited", European Economy, Economic Papers No 507.

([76]) Ideally, in order to identify the impact of technology on healthcare expenditure, besides income one should also control for other non-demographic factors, such as the health status, relative prices, and institutional variables. Limitations on data coverage prevent us from using a broader set of regressors. However, in some specifications a proxy variable for relative prices of healthcare goods and services will also be used.

([77]) This avoids the difficult and largely unsettled issue in the literature regarding the co-integration of healthcare expenditure and income variables.

([78]) Corresponding to the weighted median of country-specific estimates.

research ([79]) and endorsed by the Ageing Working Group, is used in 2016, which then converges to 1 until the end of the projection period ([80]). This elasticity is added to the effect of ageing as modelled in the "demographic scenario".

2.3.12. AWG total factor productivity (TFP) risk scenario

The *"Total factor productivity risk scenario"* explores the risk that Total Factor Productivity growth may decline in the future below the assumptions of the "AWG reference scenario". This is plausible in light of the trend decline of TFP growth performance over the last decades. This scenario assumes that TFP converges to a growth rate of 0.8% (vs 1% for the baseline scenario). In both cases, allowance for higher TFP growth for countries with below average GDP per capita is factored in for a period of time, as in the previous projection exercise, to reflect the potential that these countries have for a catching-up with the rest.

2.4. QUANTIFYING THE EFFECTS OF HEALTH CARE REFORMS

Policy reforms may impact on the future path of health care reforms. Wage adjustments of medical and non-medical personnel, changing prices of medical goods, capital investments, legislated changes in targets for future health care expenditure will impact the growth rate of health care expenditure. This needs to be taken into account in the projection framework.

In the 2015 EPC/EC Ageing Report, recently legislated policy reforms were quantified – where possible – and were taken into account in the projections. Specifically, Member States provided data on legislated cost changes, both increases and reductions - per component of health care expenditure ([81]).

The annual percentage reduction was deducted from the level of spending by component, effectively changing the level of total health care spending. Further, the age-cost profiles were adjusted proportionally to the change in the level of spending.

For the 2018 Ageing Report, Member States again provide data on legislated and/or implemented reforms in the health care sector. The legislated cost changes (increases or reductions) can refer to the following cost components ([82]): Inpatient care; Outpatient care and Ancillary services; Pharmaceuticals and Therapeutic appliances; Preventive care; Governance and administration; and Capital investments. If the fiscal effects of the reforms are quantifiable, these will be translated into adjusted age-cost profiles. These in turn will impact upon the projected path of health care expenditure.

2.5. DATA SOURCES

Data collection

The data required to run long-term public expenditure projections in the field of health care includes:

- per capita public expenditure on health care by age and sex cohorts (age/sex specific expenditure profiles);
- sex specific per capita public expenditure on health care borne by decedents and survivors decomposed by the number of remaining years

([79]) Medeiros J. and Schwierz C. (2013), "Estimating the drivers and projecting long-term public health expenditure in the European Union: Baumol's 'cost disease' revisited", European Economy, Economic Papers No 507.

([80]) Ideally, in order to identify the impact of NDD on health care expenditure one should also control for other variables, such as the health status, relative prices, and institutional variables. However, limitations on data and methodological concerns prevent the use of a broader set of regressors.

([81]) The components used in the 2015 EPC/EC Ageing Report, largely based on the SHA 1.0 classification, were: Wages; Pharmaceuticals and non-durables (HC.5.1); Therapeutical appliances and other durables (HC.5.2); Capital Formation (HC.R.1); and Prevention and public health services (HC.6).

([82]) The components for the 2018 Ageing Report are largely based on the SHA 2011 and COFOG classifications. More specifically, these are: Inpatient care (HC.1); Outpatient care and Ancillary services (HC.2 + HC.4); Pharmaceuticals and Therapeutic appliances (HC.5); Preventive care (HC.6); Governance and administration and other services (HC.7 + HC.9); and Capital investments (COFOG GF07 – GF0705).

of life required to run the *death-related costs* scenario; and

- public expenditure on health care.

The data collection procedure has taken two steps. First, Commission Services (DG ECFIN) pre-filled data on the basis of existing international databases managed by international organisations (Eurostat, OECD, AMECO). The questionnaire was then circulated to the Member States, to endorse the pre-filled figures and complement these with data from national sources if no data was available from international sources. The completed data questionnaires were used for conducting the projections.

Note that age/sex specific per capita public expenditure on health care and sex specific per capita public expenditure on health care borne by decedents and survivors decomposed by the number of remaining years of life were not available in any common international databases. Therefore, they were provided exclusively by AWG delegates and are based on national sources.

Computing total public expenditure on health care

In order to calculate total public expenditure on health care, the sum of the following two components is used:

1) Public current expenditure on health care – computed as the sum of all "core" health care System of Health Accounts 2011 (SHA 2011) functions/expenditure categories HC.1 to HC.9, excluding HC.3 (defined as "Long-Term Care (health)" in SHA 2011) ([83]).

2) Public expenditure on gross capital formation in health from the COFOG GF07 "Health" function excluding the GF0705 "R&D Health" category. In order to smooth the volatility inherent to capital formation, the average value for the last four years is used.

More specifically, for the current public expenditure on health care the following SHA 2011 categories are used: Inpatient curative care (HC.1); and Rehabilitative care (HC.2); Ancillary services (HC.4); Medical goods (HC.5); Preventive care (HC.6); Governance, and health system and financing administration (HC.7); Other health care services not elsewhere classified (HC.9).

SHA data by function/expenditure category and respective sub-functions is available on OECD Health Data, Eurostat NewCronos and WHO Data for All. Most recent data refers to 2015 on OECD Health Data and to 2014 on Eurostat NewCronos. Eurostat reports data for all Member States and Norway, while data for five EU Member States non-OECD members (Bulgaria, Croatia, Cyprus, Malta, and Romania) is not reported on OECD Health Data.

On top of these components, COFOG data on capital formation from Eurostat NewCronos is added. Most recent data refers to year 2015.

In comparison to the 2015 EPC/EC Ageing Report, there are two changes in the data sources used to compute total public expenditure on health care: 1) ESSPROS data is no longer used, as all EU Member States and Norway are now reporting data on health expenditure under the EU Implementing Regulation 2015/359 ([84]) and SHA 2011 classification; 2) SHA 1.0 data for the HCR.1 category on gross capital formation was replaced by data from COFOG for the GF07 "Health" function excluding the GF0705 "R&D Health" category.

([83]) See the SHA Manual 2011 edition, "A System of Health Accounts", available at: http://ec.europa.eu/eurostat/en/web/products-manuals-and-guidelines/-/KS-30-11-270. The manual contains guidelines for reporting health expenditure.

([84]) Commission Regulation (EU) 2015/359 on healthcare expenditure and financing statistics, available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015R0359&from=EN

3. LONG TERM CARE

3.1. INTRODUCTION

This chapter presents 10 different scenarios and sensitivity tests designed to assess the potential impact of each of the determinants of long-term care expenditure on future public expenditure. These are broadly similar to those used for the 2015 AR.

3.2. OVERVIEW OF THE PROJECTION METHODOLOGY

3.2.1. Structure of the model

The methodology to project long-term care (LTC) expenditure is based on a simple macro-simulation model, in a similar way as in previous projection exercises conducted jointly by the European Commission (EC) and the Ageing Working Group (AWG). This model is based on the assumption that the whole population is divided into groups which are assigned certain characteristics (e.g. age, gender, per capita expenditure, health status, need for care and type of care, etc.). When over time the (relative) size or features of these groups change, the long-term care expenditure changes in line with the change in those characteristics. These types of models are often used in long-term expenditure projections, in particular in cases where precise information at micro level on the individuals and their transition from one status to the next are not available or unreliable.

The choice for the methodology to be used and the various scenarios to be run is limited by the availability, accessibility and quality of long-term care data. For the projection exercise SHA data is used where available – complemented with some proxies calculated on the basis of categories from the European System of Integrated Social Protection Statistics (ESSPROS) and supplemented by national data sources when necessary ([85])([86]). Therefore, the models may not include all the relevant factors identified as affecting health and long-term care spending.

The projection model will be based on that used in previous exercises ([87]). The approach aims to examine as many of the factors affecting future LTC expenditure as is possible. At the same time, it is necessary to ensure the necessary data to run the projections is available for a large number of Member States. A schematic presentation of the projected methodology can be found in graph II.3.1 below. Specifically, the methodology aims at analysing the impact of changes in the assumptions made about:

- the number of elderly people (through changes in the population projections used);
- the number of dependent elderly people (changes to the prevalence rates of dependency);
- the balance between formal and informal care provision (assuming a given shift in demand or exogenous changes in the availability of informal carers);
- the balance between home care and institutional care within the formal care system;
- the unit costs of care.

The methodology allows projecting the future need for long-term services in terms of number of people who are assumed to need long-term care services. This is done by using dependency rates, to estimate the fraction of the elderly population which is dependent, i.e. with a severe disability requiring the provision of a care service.

Firstly, a projection is made of the dependent population, on the basis of the baseline population projection and dependency rates. Secondly, the dependent elderly population is split, by age and gender, following the type of care received (informal, formal at home, formal in institutions). Thirdly, average expenditure (i.e. age-sex profiles) is calculated for both types of formal care, and then multiplied by the projected number of recipients to obtain the projected public

([85]) The data relies on the updated SHA 2011 classification data. This is in contrast to AR 2015, which used SHA 1.0 as SHA 2011 data wasn't available for all EU Member States. See the annex to this chapter on sources of data.

([86]) For dependency rates, EU-SILC data are used (EU-SILC: The European Statistics on Income and Living Conditions; see the Eurostat website at: http://epp.eurostat.ec.europa.eu/ortal/page/portal/microdata/eu_silc).

([87]) Based on a proposal by Comas-Herrera et al. (2005).

expenditure. More specifically, the necessary steps are:

Step 1: taking the baseline population projection (by age and gender), a projection is made of the dependent population, who are assumed to need some form of long-term care service, and the non-dependent population who are assumed not to be in need of long-term care services. This projection is made by taking age and gender-specific dependency rates at the value observed in the base year estimated using existing indicators of disability from comparable sources) and applying them to the baseline population projection. More specifically, dependency rates refer to the concept of ADL-dependency which refers to difficulties in performing at least one Activity of Daily Living (ADL) (Katz et al., 1963) ([88]). EU-SILC data is used to obtain a proxy of "ADL-dependency" rates. For these dependency rates an average over the last five years will be used, based on availability.

In the model it is being assured that the projected amount of dependent citizens (i.e. citizens with a severe disability) will not decrease due to increasing life expectancy. Where such a decrease would be observed, adjustments will be made so that the amount of dependent citizens in a five-year age class cannot be inferior to that in the preceding one. Note that the practical implications of this adjustment may be rather small.

Step 2: the projected dependent elderly population is split, by age and gender, into three groups depending on the type of care they receive, namely (i) informal care, which is assumed to have no impact on public spending, (ii) formal care at home and (iii) formal care in institutions (both of which impact on public spending but their unit costs may differ). The model implicitly assumes that all those receiving home care or institutional care have difficulties with one or more ADLs, and that all persons deemed ADL-dependent either receive informal care, home care or institutional care. The split by type of care received is made by calculating the "probability of receiving different types of long-term care by age and gender". This is calculated for a base year using data on the numbers of people with dependency (projected in step 1), and the numbers of people receiving formal care at home and in institutions (provided by Member States). It is assumed that the difference between the total number of dependent people and the total number of people receiving formal care (at home or in institutions) is the number of people who rely exclusively on informal care.

Step 3: involves the calculation of average public spending for the two types of formal LTC services: (i.e. "age-sex profiles of expenditure") for a base year using data on total public expenditure in home care and institutional care and the numbers of people receiving formal care at home and in long-term care institutions (provided by Member States). Two assumptions are required:

- it is implicitly assumed that current expenditure in services divided by the number of users equals the long-run unit costs of services;
- it is assumed that average expenditure per user increases with the age of the user ([89]), in contrast to the average expenditure per head of population.

Step 4: involves the calculation of public spending for the two types of formal long-term care services, by multiplying the number of people receiving formal care (at home and in institutions) by the average age-specific public expenditure (respectively at home and in institutions) per year and per user. By adding up the expenditure on formal care at home and in institutions, total public expenditure on long-term care services ("in-kind benefits") is obtained.

([88]) Activities of Daily Living (ADL) are the things people normally do in daily living including any daily activity they perform for self-care (such as feeding, bathing, dressing, grooming), work, homemaking and leisure (see: Webster's New World Medical Dictionary, Wiley Publishing, 2008). If a person has difficulty in performing at least one of them, he is considered as ADL-dependent.

([89]) In practice, average expenditure (aged 15 and above), for each type of service, is decomposed into average expenditure by age groups, by assuming the same rate of increase in spending by age as in the age-related expenditure profile. It is important to note that the age-related expenditure profile provides information on spending in formal care by age, without distinction between care provided at home and in institutions (unless newly provided by Member States). The model uses average public expenditure in formal care to project future expenditure in both types of services.

Step 5: public expenditure on cash benefits for people with ADL-dependency is added to the expenditure on services, in order to obtain total public expenditure on long-term care. Note that cash benefits are assumed to grow in line with the numbers of people with dependency ([90]).

3.2.2. Estimating dependency

Overall, given the availability of a numerical measure of disability, the projection methodology described above is more precise than that used for health care expenditure where there is no direct indicator of health status and the age-related expenditure profile is used as a proxy. However, an important caveat to note is that while dependency rates are an indicator of the need for care, those needs may not necessarily translate into actual public expenditure, for at least two reasons.

Firstly, the links between disability levels and demand/use of long-term care are not straightforward. Each step involves some uncertainty. There are many people with some form of disability who can lead completely independent lives without the need for care services. Furthermore, dependency also depends on a person's perception of their ability to perform activities associated with daily living. On the one hand, survey data can underestimate some forms of disability. People may not report certain socially stigmatised conditions, such as alcohol and drug related conditions, schizophrenia, and mental degeneration. On the other hand, disability data can be too inclusive and measure minor difficulties in functioning that do not require provision of community care. In order to attempt to minimise these potential issues, the focus is on those dependency levels reported as "severe" ([91]) according to EU-SILC.

Secondly, most long-term care is still provided by unpaid informal carers. Expenditure profiles contain information about the propensity to receive paid formal care, which depends on a number of factors other than dependency that affect demand for paid care such as household type, availability of informal carers, income or housing situation. Most of these factors, in turn, are also correlated with age.

3.2.3. Country-specific legislation on indexation of LTC benefits

The impact of country-specific legislation on the indexation of LTC benefits will be taken into account in the reference scenario of the Ageing Report.

Where countries can demonstrate that they apply price indexation for cash benefits, this is allowed for a period of 10 years from the base year of the projections. There are however two exceptions where the impact of legislation is modelled for the whole projection period.

For Germany, this relates to the impact of German legislation on the ceiling of LTC expenditure. According to the standard assumptions (explained below), unit costs are indexed to GDP per hours worked or GDP per capita. Under current rules in Germany, both in-kind and cash long-term care benefits are indexed to prices. With contribution rates indexed by inflation, LTC expenditure shares would be almost unchanged until 2070. The difference between the amounts financed by the State and the costs of long term care are either recovered by private insurance or are paid by the beneficiaries themselves.

For France, this relates to the fact that several, but not all, cash benefits are legislated to be indexed according to prices.

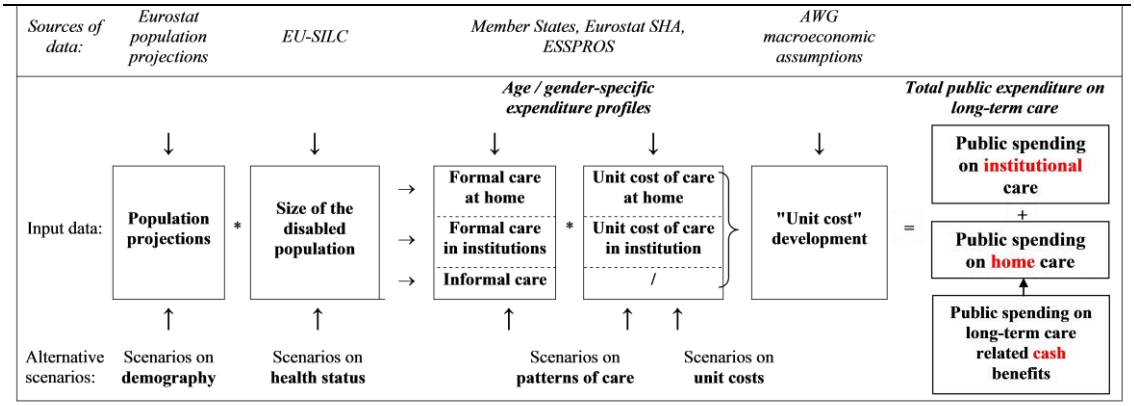
However, indexing all benefits to prices for the duration of the projection period could lead to a radical reduction in real-terms expenditure per capita. This would represent a de facto policy change scenario and break the no-policy change scenario requirement.

To account for this legislation and the financial precaution principle while preserving the realism of the projections, the following assumptions are used:

(i) For Germany, 2/3 of in-kind benefit expenditure are indexed in line with the Ageing Report (AR) standard assumptions and the remaining 1/3 in line with prices. For cash benefits, 2/3 of expenditure will be indexed in line with prices and the

([90]) For more details on the cash benefits data, see the section below, which is specifically dedicated to this subject.
([91]) As these people are most in need of income support and services, such as long term care.

Graph II.3.1: **Schematic presentation of the projection methodology / in-kind LTC benefits**



(1) As in 2015, the projections need to be viewed in the context of the overall projection exercise. Consequently, the common elements of all scenarios will be the population projections provided by Eurostat and the baseline assumptions on labour force and macroeconomic variables agreed by the EC and the AWG-EPC. The age and gender-specific per capita public expenditure (on long-term care) profiles are provided by Member States. They are applied to the demographic projections provided by Eurostat to calculate nominal spending on long-term care.
(2) This schematic representation shows the methodology for projecting in-kind benefits. Total public expenditure on long-term care is the sum of public expenditure on long-term care in-kind plus public expenditure on long-term care in cash benefits. Therefore, to the projections of long-term care expenditure on benefits in kind, one needs to add the projected cash benefits calculation.
Source: Commission Services.

Table II.3.1: **Overview of the different scenarios to project long-term care expenditure**

	Demographic scenario	**Base case scenario**	**High life expectancy scenario**	**Constant disability scenario**	**Shift to formal care scenario**	**Coverage convergence scenario**	**Cost convergence scenario**	**Cost and coverage convergence scenario**	**Reference scenario**	**Risk scenario**
	I	II	III	IV	V	VI	VII	VIII	IX	X
Population projection	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Alternative higher life expectancy scenario	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections	Eurostat 2015-based population projections
Dependency status	2012-2016 average dependency rates held constant over projection period	2012-2016 average dependency rates held constant over projection period	2012-2016 average dependency rates held constant over projection period	All projected gains in life expectancy are spent without disability	2012-2016 average dependency rates held constant over projection period	2012-2016 average dependency rates held constant over projection period	2012-2016 average dependency rates held constant over projection period	2012-2016 average dependency rates held constant over projection period	Half of projected gains in life expectancy are spent without disability.	Half of projected gains in life expectancy are spent without disability.
Age-related expenditure profiles	Latest cost profiles	Latest cost profiles	Latest cost profiles	Latest cost profiles	Latest cost profiles	Latest cost profiles	Cost profiles per Member State converge upwards to the EU28 average by 2070	Cost profiles per Member State converge upwards to the EU28 average by 2070	Latest cost profiles	Cost profiles per Member State converge upwards to the EU28 average by 2070
Policy setting / Care mix	Probability of receiving each type of care held constant at 2016 level	Probability of receiving each type of care held constant at 2016 level	Probability of receiving each type of care held constant at 2016 level	Probability of receiving each type of care held constant at 2016 level	Gradual increase (1% per year during 10 years) of the share of the disabled population receiving formal care (at home or in an institution).	Probability of receiving any type of formal care (in-kind or cash) converging until 2070 upwards to the EU28 average.	Probability of receiving each type of care held constant at 2016 level	Probability of receiving any type of formal care (in-kind or cash) converging until 2070 upwards to the EU28 average.	Probability of receiving each type of care held constant at 2016 level	Probability of receiving any type of formal care (in-kind or cash) converging until 2070 upwards to the EU28 average.
Unit cost development	GDP per capita	*In-kind* : GDP per hours worked; *cash benefits* : GDP per capita	*In-kind* : GDP per hours worked; *cash benefits* : GDP per capita	*In-kind* : GDP per hours worked; *cash benefits* : GDP per capita	*In-kind* : GDP per hours worked; *cash benefits* : GDP per capita	*In-kind* : GDP per hours worked; *cash benefits* : GDP per capita	*In-kind* : GDP per hours worked; *cash benefits* : GDP per capita	*In-kind* : GDP per hours worked; *cash benefits* : GDP per capita	*In-kind:* GDP per hours worked; *cash benefits:* GDP per capita	*In-kind:* GDP per hours worked; *cash benefits:* GDP per capita
Elasticity of demand	1	1	1	1	1	1	1	1	1 for MS in highest LTc expenditure quartile in 2016, for the rest 1.1 in 2016 converging to 1 by 2070	1

* Alternative indexation rules for unit costs in the "Reference scenario" in order to reflect the specific institutional arrangements of specific countries are discussed in Section 3.1.2
Source: Commission services.

remaining 1/3 in line with AR standard assumptions. This applies for the entire projection period.

(ii) For France, price indexation would be applied to 11.5% of LTC expenditure, with the rest being indexed according to standard assumptions. This applies for the entire projection period.

(iii) Any further exceptions will be made explicit in the main Ageing Report.

3.3. DIFFERENT SCENARIOS FOR PROJECTING LONG-TERM CARE EXPENDITURE

Several scenarios and sensitivity tests are made to assess the potential impact of each of the determinants of long-term care expenditure on future public expenditure on long-term care.

The examination of different scenarios enables identifying how sensitive the projections are to changes in key assumptions such as the evolution of dependency rates, unit costs and policy settings. Building on the 2015 Ageing Report ([92]), the present exercise maintains most of the existing scenarios and sensitivity tests while attempting to improve the specification of some of the scenarios. The overview of the scenarios is presented in table II.3.1 above ([93]). The analysis tries to identify the impact of each quantifiable determinant separately, on the basis of hypothetical assumptions like an estimated guess or a "what if" situation. Therefore, the results of the projections should not be interpreted as forecasts of expenditure as, for example, particular policy/institutional settings in Member States or policy reforms are not taken into account.

3.3.1. Demographic scenario

The "demographic scenario" assumes that the shares of the older disabled population who receive either informal care, formal care at home or institutional care are kept constant over the projection period. Those constant shares are then applied to the projected changes in the dependent population. Since the prevalence of ADL-dependency is also kept constant over the projection horizon, the dependent population evolves precisely in line with the total elderly population. This implies that, in practice, none of the gains in life expectancy translate in an improvement of health. Arguably, it is a pessimistic scenario with respect to dependency status, since it assumes that average lifetime consumption of LTC services will increase over time. It is a “no policy change scenario” as the probability of receiving care (either at home or in an institution) is assumed to remain constant at the 2016 level. The scenario is similar to the analogous scenario for health care expenditure, and costs are also assumed to evolve in line with GDP per capita growth (for all types of long-term care expenditure).

3.3.2. Base case scenario

While in the above-mentioned elements the "demographic scenario" is similar to the analogous scenario for health care expenditure, the actual "base case scenario" is slightly different, as it was agreed already in previous exercises to link long-term care unit cost to GDP per worker, rather than to GDP per capita. Indeed, there exists a current imbalance of care mix, with a relative deficit of formal care provision. Further, this sector is highly labour-intensive and productivity gains can be expected to be particularly slow in this sector. Therefore, public expenditure on long-term care is expected to be rather more supply than demand-driven. For that reason, GDP per worker (which is also assumed to reflect wage evolution in all sectors, including in the care sector), rather than GDP per capita had been chosen as the main (but not only) driver of unit costs. In this sense, it is more similar to the "labour intensity scenario" run for the health care expenditure projections.

Similar to the 2015 exercise, the projections will link unit cost to GDP per hours worked for in-kind benefits (services), while unit cost of cash benefits will evolve in line with GDP per capita growth (as cash benefits are more related to a form of income support).

3.3.3. High life expectancy scenario

The "high life expectancy scenario" presents the budgetary effects of an alternative demographic scenario which assumes life expectancy to be higher for all ages than in the baseline scenario. This scenario is methodologically identical to the base case scenario, but alternative demography and GDP data are used (in the same way that it is used to assess the sensitivity of pension and health expenditure to higher life expectancy). The rationale is twofold. First, the marked increase in public expenditure with older age (i.e. 80 and more). In fact, the age profile for LTC expenditure is much steeper than that for health expenditure, partly because the costs related to LTC are very high for institutionalised individuals, and the share

([92]) See European Commission (DG ECFIN) and Economic Policy Committee (AWG), (2015).
([93]) See also Annex 7 Mathematical illustration of the long-term care scenarios.

of institutionalised individuals increases sharply among persons aged over 80. Second, the higher age groups are also the part of the demographic projections which are likely to be the most uncertain. Adjustments have been made so that the value in a five-year age class cannot be inferior to that in the preceding one.

3.3.4. Constant disability scenario

This scenario reflects an alternative assumption about trends in age-specific ADL-dependency rates. Being inspired by the so-called "relative compression of morbidity", it is analogous to the "constant health scenario" performed in the framework of health care expenditure projections in that the number of years spent in bad health remains constant over the projection period. The age-sex specific dependency rates are shifted in line with changes in life expectancy (e.g. if life expectancy for a 50-year old person has increased by 2 years in year 2030, then the dependency rate of a 50-year old man in 2030 is that of a 48-year old man today). This results in a gradual decrease over time in the prevalence of disability for each age cohort, as the increase in life expectancy adds new cohorts and the total number of years in bad health remains the same. Lower dependency rates over the whole population translate in lower proportional demand for and therefore lower expenditure on LTC services. As in the "base case scenario", public expenditure on LTC in-kind services is assumed to evolve in line with GDP per hours worked, while expenditure on cash benefits evolves in line with GDP per capita.

3.3.5. Shift to formal care scenario

Ultimately, the public funding of LTC – and the policy orientation – will determine whether future needs for LTC translate into (direct) public expenditure or not, as neither informal care provision nor private expenditure on LTC are formally part of public expenditure on LTC.

Indeed, pressure for increased public provision and financing of LTC services may grow substantially in the coming decades, especially in Member States where the bulk of LTC is currently provided informally ([94]). To illustrate the impact of possible future policy changes, such as Member States deciding to provide more formal care services to the elderly, additional scenarios have been prepared.

This policy-change scenario is run to assess the impact of a given – demand-driven – increase in the (public) provision of formal care replacing care provided in informal setting. In particular, this sensitivity test examines the budgetary impact of a progressive shift into the formal sector of care of 1% per year of disabled elderly who have so far received only informal care. This extra shift compared to the "base case scenario" takes place during the first ten years of the projection period only, thus it adds up to about 10% shift from informal to formal care.

The shift from informal to formal care is considered to be in line with the current shares of home care and institutional care in total formal care. In other words, if currently 10% of the dependents receiving care receive care at home, the shift/increase will also go for 10% to home care (and 90% to institutional care).

3.3.6. Coverage convergence scenario

This scenario, similar to the one in the 2015 Ageing Report, assumes that the real convergence across Member States, the exchange of best practices and growing expectations of the populations will drive an expansion of publicly financed formal care provision into the groups of population that have not been covered by the public programmes so far. Note that "formal coverage" covers any of the three types of formal LTC: institutional care, formal home care, and cash benefits. Similarly to the scenarios assessing the effect of a shift from informal to formal 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.

The scenario is meant to take into account the high diversity of country-specific current care-mix. The

([94]) Another reason being the difficulties of the private insurance market for long-term care to develop in most Member States (see Cremer & Pestieau, 2009).

Member States where the formal coverage rate is below the EU-28 average in the starting year would be assumed to converge to the average by 2070.

Convergence would be calculated for each age group and relative proportions of each type of formal care are kept constant. As in the "base case scenario", public expenditure on LTC in-kind services is assumed to develop in line with GDP per hours worked, while expenditure on cash benefits evolves in line with GDP per capita. More specifically, the Member States where the formal coverage rate – i.e. referring to any of the three types of formal care described above – is below the EU28 average in the starting year are assumed to converge to this average by 2070. In contrast, for countries with coverage above the EU average in the base year this scenario is equivalent to the base case scenario.

3.3.7. Cost convergence scenario

This scenario is proposed in parallel with the scenario on health care expenditure projections, similar to the 2015 Ageing Report. For those Member States with high levels of informal care, and therefore relatively low costs for LTC, an increase in public expectations for more formal care (and therefore an increase in the average cost of LTC) might be expected. For example, an increase in the costs of care (as percent of GDP per capita) towards the average for EU Member States could be expected. The "cost convergence scenario" is meant to capture the possible effect of a convergence in real living standards (which emerges from the macroeconomic assumptions) on LTC spending. It assumes an upward convergence of the age-sex specific per beneficiary expenditure profiles (as percent of GDP per capita) of all countries below the corresponding EU28 average to the EU28 average, for each type of formal care coverage (i.e. formal care in institutions, formal care at home and cash benefits). Note that the convergence is calculated for each age group separately, on the basis of the coverage gap for all services in kind. Again, for countries with unit costs above the EU average in the base year, this scenario is equivalent to the base case scenario.

3.3.8. Cost and coverage convergence scenario

This scenario combines the coverage convergence scenario and the cost convergence scenario, as described in the sections above.

It assumes a shift in the current long-term care provision policy leading to an upward coverage convergence to the EU28 average by 2070. More specifically, the Member States where the formal coverage rate – i.e. referring to any of the three types of formal care described above – is below the EU28 average in the starting year are assumed to converge to this average by 2070. In addition this scenario assumes an upward convergence of the expenditure profiles (as percent of GDP per capita) of all countries below the corresponding EU28 average to the EU28 average. This is done for each type of formal care coverage separately (i.e. formal care in institutions, formal care at home, cash benefits).

This scenario is a balanced and plausible distribution of risks stemming from future needs to converge both costs and coverage matching future LTC needs. From the perspective of country-specific needs in these convergence processes, it is evident that countries are affected highly unequally by these convergence processes. For countries with coverage and unit costs above the EU average in the base year, this scenario is equivalent to the base case scenario.

3.3.9. Reference scenario

The "AWG reference scenario" is the "central scenario" used by the AWG to calculate the overall budgetary impact of ageing. It shows the combined effect of a set of interrelated determinants of public expenditure on long-term care, while other scenarios measure the separate effect of individual determinants and therefore provide only a partial analysis. It is meant to provide a plausible course of development in the underlying variables, while acknowledging that the projection outcome is subject to uncertainty.

The AWG reference scenario combines the assumptions of the "base case scenario" and the "constant disability scenario". It assumes that half of the projected longevity gains up to the end of the projection period will be spent in good health

and free of disability/ dependency. Accordingly, age-specific disability rates shift along the age profile by half of the projected increase in life expectancy. Furthermore, the unit costs are linked to GDP per hour worked in case of LTC in-kind services and to GDP per capita in case of cash benefits ([95]).

In the AR 2018 a new feature has been added to this scenario in order to take into account the fact that, as countries become richer, they are likely to spend a larger proportion of their GDP on LTC. Indeed, across the EU, Member States with higher levels of GDP per capita tend to spend a greater share of their GDP on LTC.

This is modelled by including the assumption that income elasticity starts at 1.1 in the base year of 2013, falling to 1 by the end of the projection period. Since the GDP projections include a degree of catching-up, this leads to a degree of convergence in LTC expenditure, albeit more moderate than in the cost and coverage convergence scenario.

To take into account the fact that this increase in LTC expenditure may not affect countries that already have highly developed LTC systems, those EU Member States in the highest quartile of LTC expenditure as a proportion of GDP in the base year are excluded from this and therefore their income elasticity will be assumed to remain 1.

3.3.10. Risk scenario

There is considerable uncertainty as to future developments of age-related public expenditure, in particular related to the challenge to cope with trend increases in public spending and in particular on health care and long-term care expenditure. For this reason and in order to contribute to the wider policy debate on fiscal challenges the EU will be facing in the future, an AWG risk scenario will be prepared for the Ageing Report.

The "AWG risk scenario" keeps the assumption that half of the future gains in life expectancy are spent without care-demanding disability, as in the "AWG reference scenario". In addition, it combines this scenario 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. In comparison to the "AWG risk scenario" for HC, this scenario models the impact that increased GDP has on expenditure in a different more specific way, by first modelling the impact on coverage and unit costs and then deriving from this the increase in expenditure.

([95]) With the specific exceptions set out in Section 3.1.2.

3.4. DATA SOURCES

In order to assure the best possible comparability of data, it was already agreed in the previous projections exercises to rely, to the extent possible, on:

a) common methodologies and definitions (i.e. the System of Health Accounts - SHA) agreed by international institutions (Eurostat, OECD and WHO);

b) data gathered through the joint data collection exercise (i.e. joint OECD-Eurostat-WHO questionnaire) and reported in Eurostat (Cronos) and OECD (Health Data) databases ([96]).

Unlike in the 2015 exercise, SHA 2011 data is now available for every EU Member State.

For the 2018 exercise, the aim is to improve further the level of consistency as compared to that of the 2015 and earlier rounds of projections. Nevertheless, the choice of the best option is still dependent on the availability of data in the international databases. When information is missing in the international databases, it has to be provided by each Member State individually. The detailed analysis of available data and classifications carried out ([97]) led to the following agreement. The definitions and data sources should remain very similar to those used in the 2015

([96]) See the SHA 2011 Manual (OECD, Eurostat, WHO (2011)). The manual contains guidelines for reporting health expenditure according to an international standard. It proposes a common boundary of health care as well as a comprehensive and detailed structure for classifying the components of total expenditure on health.

([97]) See the note for the attention of the Ageing Working Group of the EPC: European Commission–DG ECFIN (2017).

Ageing Report, but reflecting the availability of new data and its specificities. Indeed, SHA 2011 data is now available for every EU MS. However, SHA data does not cover all the data needs of the projections and all relevant SHA variables are not always populated for every Member State, which requires the use of alternative data sources and national data. Annex 5, on sources of data, gives an overview of the combinations of data sources for the 2015 projections exercise.

The data collecting procedure covers the same steps as for health care (see chapter 2 on health care), with the same questionnaire being used to report the data required for both health and long-term care expenditure projections.

For the Commission Services (DG ECFIN) to be able to calculate the proposed scenarios and run the relevant sensitivity tests, the AWG delegates provide the following information in the framework of the long-term care expenditure projections:

- total number of dependent people receiving long-term care a) in institutions and b) at home, by sex and single age or five-year cohorts;
- total number of recipients of long-term care-related cash benefits, by sex and single age or five-year cohorts, and the eligibility conditions;
- possible overlapping between the recipients of cash benefits and the recipients of LTC services (legal possibility + numbers);
- total number and categories of informal caregivers;
- public expenditure per user (patient) on long-term care, by sex and single age or five-year cohorts (so-called "age-related expenditure profiles");

In addition, the Commission Services (DG ECFIN) pre-filled (according to the data availability) the following items, which the AWG delegates had to verify/confirm:

- total public spending on long-term care, disaggregated, if possible, into services of long-term nursing care (classified as HC.3 in the System of Health Accounts) and social services of long-term care (classified as HC.R.1);
- further disaggregation of total public spending on long-term care into spending on services in kind and spending on long-term care-related cash benefits, by sex and single age or five-year cohorts;
- further disaggregation of total public spending on services in kind into spending on services provided in the institutions (HC.3.1 + HC.3.2 + a fraction of HC.3.3) and services provided at home (a fraction of HC.3.3 and HC.3.4), by sex and single age or five-year cohorts;
- disability rates by sex and five-year cohorts (based on EU-SILC data).

3.4.1. Public expenditure on long-term care

According to the System of Health Accounts classification, public expenditure on long-term care is defined as the sum of the following publicly financed items:

- services of long-term nursing care (HC.3) (which is also called "the medical component of long-term care" or "long-term health care", and includes both nursing care and personal care services);
- social services of long-term care (HC.R. 1 in SHA 2011), which represents both the "assistance services" part, relating primarily to assistance with IADL tasks as well as related cash benefits.

Together these should represent the total benefits allocated to dependent people, although, as explained below, this data has to be supplemented to different degrees with ESSPROS data to fulfil the projection needs.

The medical component of long-term care (HC.3) is a range of services required by persons with a reduced degree of functional capacity, physical or cognitive, and who are consequently dependent on help with basic activities of daily living (ADL), such as bathing, dressing, eating, getting in and out of bed or chair, moving around and using the

bathroom. The underlying physical or mental disability can be the consequence of chronic illness, frailty in old age, mental retardation or other limitations of mental functioning and/or cognitive capacity. In addition, it comprises help with monitoring status of patients in order to avoid further worsening of ADL status.

This main personal care component is frequently provided in combination with help with basic medical services such as help with wound dressing, pain management, medication, health monitoring, prevention, rehabilitation or services of palliative care. Depending on the setting in which long-term care is provided and/or national programme design, long-term care services can include lower-level care of home help or help with instrumental activities of daily living (IADL) more generally, such as help with activities of housework, meals, shopping, transport and social activities.

The notion of long-term health care services usually refers to services delivered over a sustained period of time, sometimes defined as lasting at least six months.

Social long term care benefits (HC.R.1 in SHA 2011) comprises cash benefits as well as services of home help and residential care services: care assistance which are predominantly aimed at providing help with IADL restrictions to persons with functional limitations and a limited ability to perform these tasks on their own without substantial assistance, including supporting residential services (in assisted living facilities and the like).

As in the case of health care, the figures on public expenditure on long-term care are available in two separate databases: EUROSTAT database available at NewCronos website and a parallel OECD database "OECD Health Data". SHA data on HC.3 is available for all member states. Data on HC.R.1 is available for 19 Member States and Norway. As a proxy to HC.R.1 data, the agreement is to use ESSPROS items, comprising the benefits in kind from three ESSPROS functions:

- the sickness function;
- the disability function;
- the old-age function ([98]).

The proxy for public expenditure on long-term care is calculated as the sum of: a) sickness/health care function – "other benefits in kind"; b) disability function – "benefits in kind" ("accommodation" + "rehabilitation" + "home help/assistance in carrying out daily tasks" + "other benefits in kind"); c) old age function – "benefits in kind" ("accommodation" + "home help/assistance in carrying out daily tasks" + "other benefits in kind").

3.4.2. Public expenditure on cash benefits

Public spending on cash benefits is projected separately from expenditure on long-term care services, or "benefits in kind", provided at home or in an institution. The cash benefits include social programmes offering care allowances. Care allowances were introduced in a number of countries in order to allow households for more choice over care decisions, and to support care provided at home. They are mainly addressed to persons with long-term care needs who live in their own homes. However, the design of these programmes varies widely across countries, which reduces the comparability between them. Illustrating this variety of systems, it is noteworthy that some countries account for nursing allowances in the HC.3 category.

At least three types of cash-benefit programmes and/or consumer-choice programmes can be distinguished:

- personal budgets and consumer-directed employment of care assistants;
- payments to the person needing care who can spend it as she/he likes, but has to acquire sufficient care;
- payments to informal caregivers as income support.

([98]) It is possible that the proxy for HC.R.1 includes some data which corresponds to HC.3 in the SHA joint questionnaire. Therefore, whenever the ESSPROS proxy for expenditure on "LTC in-kind" i.e. HCR.1 in-kind is higher than that home care expenditure reported in HC.3, we deduct HC.3 expenditure from the ESSPROS proxy. This ad-hoc procedure may not be fully accurate but it is a way to remove double counting due to in-kind benefits.

Data from two databases are combined. In contrast to the data used in the 2015 Ageing Report, (SHA 1.0 variables HCR.6 and HCR.7), SHA 2011 HCR.1 figures include cash benefits, so it is not necessary to use ESSPROS data to provide a proxy for cash benefits. However, HC.R.1 does not allow for a clear differentiation between in-kind care expenditure related and cash benefits expenditure.

In contrast, LTC-related cash benefits as a % of GDP are available for the same year as of SHA joint questionnaire data (or for the latest year available) within two ESSPROS functions: disability and old age. Both periodic and lump-sum parts of care allowances in the disability function, as well as periodic care allowance in the old-age function, are compared to the total LTC expenditure in ESSPROS in order to calculate the proportions of cash benefits vs. in-kind benefits.

For countries not reporting HCR.1, the ESSPROS proxy can be split into its components according to the in-kind benefits/cash benefits proportion in the relevant ESSPROS categories.

While this may not be exactly accurate it represents a pragmatic way of using available data to estimate this split of LTC expenditure.

3.4.3. Home care and institutional care expenditure

Long-term care is provided in a variety of settings. It can be provided at home and in the community, or in various types of institutions, including nursing homes and long-stay hospitals. Mixed forms of residential care and (internally or externally provided) care services exist in the form of assisted living facilities, sheltered housing, etc., for which a wide range of national arrangements and national labels exist.

Services at home include services provided by external home care providers, both public and private, in a person's private home on a long-lasting basis. This includes living arrangements in specially designed or adapted flats for persons who require help on a regular basis, but where this living arrangement still guarantees a high degree of autonomy and self-control over other aspects of a person's private life. Also included are services received on a day-case basis or in the form of short-term stays in institutions, for example in the form of respite care. During these stays, persons are not considered as 'institutionalised', but rather receiving temporarily services, which support their continued stay at home. They also include tele-care where the care is provided in the home of the patient through IT.

Services in institutions include services provided to people with moderate to severe functional restrictions who live permanently or for an extended period of time (usually for six months or longer) in specially designed institutions, or in a hospital-like setting where the predominant service component is long-term care, although this may frequently be combined with other services (basic medical services, help with getting meals, social activities, etc.). In these cases, eligibility is often explicitly assessed and defined by level (severity) of dependency and level of care needs.

A necessary step for the purpose of the long-term projections is therefore to calculate the amount of long-term care expenditure associated with institutional care and that associated with home care. This requires some further data reclassification. For all the countries information on HC.3 (services of long-term nursing care) is available for: HC.3.1 (In-patient long-term nursing care); HC.3.2 (day-cases of long-term nursing care); HC.3.3 (outpatient long-term care, including both regular outpatient visits and the provision of remote monitoring services for LTC patients) and HC.3.4 (long-term nursing care: home care).

According to the above definitions, HC.3.1 and HC.3.2 are types of care that are provided in the institutions or in the community facilities (in any case not at beneficiary's home), while HC.3.4 is provided at home. This delimitation is used as a distinction between the "medical" components of long-term care being provided in institutional and home care respectively. The case of HC.3.3 is different, as the SHA 2011 definition for this category includes both activities that would be defined as residential care (as care would be provided in outpatient facilities, similar to day care) as well as activities that would be defined as "home care" (such as remote monitoring services for LTC patients).

With regards to the part of HC.R.1 which constitutes home care and the part which

constitutes institutional care, this breakdown is not available.

Therefore, as above, the shares of home care and institutional care can be calculated in ESSPROS. These shares are then applied to the information provided by the countries according to the SHA joint questionnaire for HC.R.1. While not fully accurate it is the best way currently available to divide HC.R.1 expenditure into home and institutional care.

For those countries which do not report HC.R.1, again the ESSPROS proxy can be split into its components according to the home care/cash benefits proportion in the relevant ESSPROS categories.

3.4.4. Disability rates

Similarly to the 2012 and 2015 Ageing Reports projections' exercises, disability rates will be derived from EU-SILC data and more specifically data reported by the Global activity limitation indicator (GALI), on severe "Limitations in activities because of health problems [for at least the last 6 months]" ([99]). EU-SILC data, used to to construct the GALI indicator, is available for all EU Member States and Norway by age-sex group and has a disability measure which allows us to identify severe (strongly limited) as well as moderate limitations (limited).

This is considered an adequate measure of dependency with a high degree of data availability and comparability. Indeed, it is available for 28 EU Member States and Norway, by age-sex group for people aged 15+ ([100]). A moving average of the 4 most recent years of data available will be constructed and used for the projections, in a similar way to the 2015 Ageing Report.

([99]) The person's self-assessment of whether they are hampered in their daily activity by any ongoing physical or mental health problem, illness or disability. An activity is defined as: "the performance of a task or action by an individual" and thus activity limitations are defined as "the difficulties the individual experience in performing an activity". Limitations should be due to a health condition. The activity limitations are assessed against a generally accepted population standard, relative to cultural and social expectations by referring only to activities people usually do. This is a self-perceived health question and gives no restrictions by culture, age, sex or the subject's own ambition. The purpose of the instrument is to measure the presence of long-standing limitations, as the consequences of these limitations (e.g. care, dependency) are more serious. A 6 months period is often used to define chronic or long-standing diseases in surveys.

([100]) For those aged 0-14 years, either national data is used if available or the rate is assumed to equal those aged 15-19.

4. EDUCATION

4.1. INTRODUCTION

The projection exercise aims at assessing the impact of demographic changes per se on general government education expenditure. Therefore, projections are carried out under the assumption of "no policy change" ([101]).

Table II.4.1: **Education expenditure, % of GDP**

Country	2002	2005	2010	2015	Avg. 2002 - 2015
BE	5.8	5.7	6.0	6.4	6.0
BG	3.8	4.2	3.6	4.0	3.8
CZ	4.9	4.8	5.1	4.9	5.0
DK	6.6	6.4	7.1	7.0	6.7
DE	4.1	4.1	4.4	4.2	4.2
EE	7.0	6.0	6.6	6.1	6.3
IE	4.3	4.4	5.0	3.7	4.7
EL	3.9	4.2	4.1	4.3	4.1
ES	4.0	3.9	4.5	4.1	4.2
FR	5.8	5.5	5.6	5.5	5.5
HR	5.2	4.9	5.1	4.7	4.9
IT	4.5	4.5	4.4	4.0	4.3
CY	5.5	5.8	6.7	5.7	6.0
LV	5.7	5.4	6.2	6.0	5.9
LT	6.0	5.4	6.4	5.4	5.8
LU	4.7	5.1	5.8	5.2	5.2
HU	5.6	6.0	5.5	5.2	5.4
MT	5.8	5.4	5.6	5.5	5.6
NL	5.1	5.2	5.6	5.4	5.4
AT	5.2	4.8	5.1	5.0	5.0
PL	6.2	6.1	5.5	5.2	5.6
PT	7.0	7.1	7.6	6.0	6.8
RO	4.0	3.6	3.3	3.1	3.6
SI	6.4	6.6	6.5	5.6	6.3
SK	3.3	3.8	4.2	4.2	3.9
FI	6.1	6.1	6.6	6.2	6.2
SE	6.9	6.7	6.5	6.5	6.6
UK	5.6	5.6	6.5	5.1	5.7
NO	5.8	5.2	5.3	5.5	5.2
EU	5.1	5.0	5.3	4.9	5.1
EA	4.8	4.7	5.0	4.7	4.8

Source: Eurostat.

A priori, the impact of ageing on public education expenditure is undetermined, somewhat contrasting with the expected increasing effect of ageing on other major expenditure items, such as on pensions and health. In fact, on the one hand, the expected decline in the number of young people is likely to allow for some savings, but on the other, the trends of higher enrolment rates, longer periods spent in education, and persistently rising costs of tertiary education might put upward pressure on total education expenditure. The methodology used is highly stylised and as such it cannot fully reflect the complexities of Member States education systems. It has been set out with a view to use harmonised datasets, secure equal treatment across countries, and be consistent with wide labour market developments, particularly on participation rates.

On average in the 2002-2015 period, education expenditure represented 5.1% of GDP in the EU (around 10.7% of total general government expenditure) ([102]). Expenditure ratios vary considerably across Member States from a minimum of 3.6% of GDP in Romania to a maximum of 6.8% in Portugal (see Table II.4.1). Projection of education expenditure requires consideration of a number of important methodological issues, namely (i) the definition (or perimeter) of education activities; (ii) considering that studying can take place on a part time basis after compulsory education; and (iii) considering that there are various outlays for public spending on education ([103]).

4.2. METHODOLOGY TO PROJECT EXPENDITURE ON EDUCATION

The methodology uses a "quasi-demographic" approach, meaning that not only demographic projections are used but also participation rate projections. A strong point of the methodology is

([101]) Many other factors have also an important bearing on government education expenditure, such as the involvement of the general government in the education system, the duration of mandatory education, progress in enrolment rates in upper secondary and tertiary education, relative wages in the education sector, the average size of classes, discretionary saving measures to curb expenditure trends, etc.

([102]) Classification of the functions of government (COFOG) data. In the same period, 2002-2015, health expenditure represented 6.8% of GDP (and 14.4% of total general government expenditure), while 'social protection' represented 18.3% (and 38.9% of total general government expenditure). 'Social protection' includes the 'old age' (pensions) function.

([103]) The latter takes two main forms: (i) direct purchases by the government of educational resources to be used by educational institutions (e.g. direct payments of teachers' wages by the education ministry); or (ii) payments by the government to educational institutions that have the responsibility for purchasing educational resources themselves (e.g. a block grant to a university).

the use of the UOE ([104]) data collection, which covers enrolment rates, staff levels, the labour force status of students (i.e. part time versus full time), and detailed data on total public expenditure. Data are disaggregated by single age and international standard classification of education (ISCED) levels. As in the 2015 Ageing Report, projections should be run separately for four ISCED groupings, representing primary education (ISCED 1), lower secondary education (ISCED 2), upper secondary education (ISCED 3 and 4), and tertiary education (ISCED 5 and 8).

In order to simplify, it is assumed that enrolment in primary and lower secondary education levels is compulsory ([105]), while enrolment in upper secondary and tertiary education levels depends on labour market outcomes, as changes in participation rates affect enrolment rates (in the opposite direction).

Projections are broken down basically in two components: (1) number of students; and (2) per capita expenditure per student (see Graph II.4.1 for an illustration).

4.2.1. Number of students

Compulsory levels

Enrolment rates per single age are assumed to remain constant at the level observed in a base period/year for the compulsory levels considered (ISCED 1 and 2). In order to obtain the projected number of students enrolled in ISCED levels 1 and 2, demographic projections are multiplied by enrolment rates in the base period.

Non-compulsory levels

Enrolment rates for ISCED groupings 3-4 and 5-8 take into account labour market developments according to the formula (see section 4.5 for a derivation):

$$e_{i,t} = \frac{1-p_{i,t}-i^*_{i,t}}{1-\alpha_{i,t}} \qquad 4.1$$

where $e_{i,t}$ is the total enrolment rate (both full and part-time students) for single age cohort *i* in period *t*; $p_{i,t}$ is the participation rate; $\alpha_{i,t}$ is the fraction of part-time students in the total; and $i^*_{i,t}$ is the fraction of inactive individuals minus full-time students over the total population.

Actually, equation (4.1) will be implemented in terms of differences to a base period (*b*):

$$e_{i,t} - e_{i,b} = -\frac{\overline{\kappa}_{i,b}}{1-\overline{\alpha}_{i,b}} * \left(p_{i,t} - p_{i,b}\right) \qquad 4.2$$

where

$$0 \leq \overline{\kappa}_{i,b}, \overline{\alpha}_{i,b} \leq 1$$

where $\overline{\kappa}_{i,b}$ is the ratio between full-time students and total inactive individuals; $\overline{\alpha}_{i,b}$ is the fraction of part-time students over the total number of students. These two ratios are assumed to remain constant throughout the projection period.

According to equation 4.2, an increase in the participation rate leads to a decrease in the enrolment rate ([106]).

Enrolment rates per age are then broken down into ISCED levels (3-4 and 5-8) values, based on student shares in the base period/year.

4.2.2. Expenditure per student

Annual expenditure per student on public educational institutions varies significantly across education level and country (see Table II.4.2) ([107]). This variability reflects a number of factors, such as labour costs of teachers and non-teaching staff, different class sizes, differences in capital

([104]) UNESCO-UIS/OECD/Eurostat Data Collection on Education Statistics.

([105]) In the baseline scenario, enrolment rates for the two compulsory groupings are fixed at their historical levels.

([106]) To the extent that individuals entering the labour force are likely to have been previously involved in education activities. The LFS variable MAINSTAT, which describes the main labour market status, was used to assess the distribution of inactive individuals by age, distinguishing between schooling and other forms of inactivity, such as retirement and domestic tasks. Given that MAINSTAT is an optional variable, there are no data for DE and the UK.

([107]) For those countries where data are missing for the base period, AWG delegates will be asked to provide them to the Commission.

expenditure, as well as particular national circumstances ([108]).

Table II.4.2: **Annual expenditure on public education institutions per pupil in EUR PPS (1) in 2014**

Country	Isced 1	Isced 2	Isced 3 - 4	Isced 5 - 8	Total*
BE	7546.9	9435.6	9942.3	13568.5	9060.6
BG	2230.0	2682.6	2899.5	5751.7	3383.0
CZ	3766.0	6275.9	5785.6	7831.8	5391.8
DK	...	...	...	...	...
DE	6541.7	8113.0	9898.7	13459.3	8984.6
EE	5166.6	5088.8	4551.8	5741.2	4308.7
IE	5906.4	7745.4	8073.0	10070.8	7255.0
EL	...	...	...	...	...
ES	5891.1	6884.0	6966.6	9593.9	6775.0
FR	5505.0	7753.2	10434.0	12530.7	7968.4
HR	...	...	...	...	...
IT	6312.8	7494.3	8149.5	9548.8	7272.6
CY	8555.0	11444.7	12122.6	9869.6	9314.2
LV	4795.5	4781.1	5083.9	5304.1	4753.8
LT	3818.8	3670.2	4328.8	5905.9	4184.3
LU	15273.9	16299.5	15442.1	33706.8	16613.9
HU	3931.1	2868.3	3103.4	5323.0	3617.2
MT	4407.4	6722.8	4409.6	6908.7	8344.0
NL	6241.0	9426.5	9830.1	14799.8	9206.9
AT	7811.1	10667.8	10418.1	12342.4	9773.9
PL	5363.7	5662.4	5050.1	6546.3	5464.9
PT	6059.9	8222.6	8764.9	8960.3	7391.7
RO	1387.8	2496.5	2357.0	4212.4	2319.6
SI	7021.5	7845.7	5612.0	7661.8	6938.7
SK	4887.9	4961.2	5423.6	9228.9	5580.6
FI	6279.0	9811.4	7024.5	14672.9	8493.1
SE	7885.2	8328.2	7995.0	17841.1	9790.5
UK	8380.5	9199.0	9167.4	19241.4	10152.9
NO	9622.9	10262.3	11781.2	15372.3	11400.4

(1) Public expenditure on education per pupil/student based on FTE by education level and programme orientation, 'educ_uoe_fine09'. Based on full time equivalent. The category "Total" includes pre-primary education (ISCED 02). Data for EE, HU, AT and FI refer to 2013.
Source: Eurostat.

4.2.3. Expenditure to GDP ratios are calculated using indexes

As a rule, expenditure data for the last available year, generally 2014 and 2015, are chosen. Then, it is uprated until the base year using COFOG data ([109]). Total public expenditure on education is broken down into four components: i) expenditure on staff compensation (i.e. gross wages and salaries of teaching and non-teaching staff); ii) other current expenditure; iii) capital expenditure; and iv) transfers (e.g. scholarships and public subsidies to private education institutions).

The objective is to project the total (education) expenditure to GDP ratio. The ISCED levels considered are: ISCED 1, ISCED 2, ISCED 3-4, and ISCED 5-8 ([110]).

$$\frac{\sum_i EDU_t^i}{GDP_t} = \frac{\sum_i \left[W_t^i + O_t^i + K_t^i + R_t^i\right]}{GDP_t} \qquad 4.3$$

where EDU_t^i is expenditure on education in ISCED level i and year t; W_t^i is expenditure on staff compensation; O_t^i is other current expenditure; K_t^i is capital expenditure; R_t^i is transfers; and i stands for the ISCED groups: 1, 2, 3-4, and 5-8.

In the baseline scenario, the main assumptions are the following:

Per-capita costs grow in line with labour productivity. Per-capita values are defined either in terms of education staff or students. Specifically, the average compensation is defined per member of staff: $\left({W_t^i}/{T_t^i}\right)$, while the other three expenditure variables are defined in terms of student ratios:

$$\left({O_t^i}/{S_t^i}, {K_t^i}/{S_t^i}, {R_t^i}/{S_t^i}\right)$$

Where T and S are the numbers of workers in the education sector and students, respectively ([111]).

The education staff to student ratio will remain constant over the projection period, which implies that staff adjusts instantaneously and fully to demographic and macroeconomic changes.

([108]) For example, small EU Member States tend to send abroad a higher fraction of their tertiary students. Other things being equal, this tends to raise expenditure levels.

([109]) If data for 2016 is not available, the latest available public expenditure data as a share of GDP is used.

([110]) It should be stressed that no attempt is made to project total expenditure on education, as ISCED 0 level expenditure (pre-primary and not allocated by level) is not covered by the analysis.

([111]) These modelling assumptions involve considerable simplifications of the determinants of the unit costs of education. A key variable missing is class size. Research suggests that costs tend to change discontinuously with the creation/destruction of classes. Given the difficulty in obtaining data on the relationship between class size and costs, a reasonable approximation may be that of using student-to-staff ratios.

Assuming that per capita variables grow in line with labour productivity is sufficient to derive the following compact general formula for the expenditure in education to GDP ratio:

$$\frac{\sum_i EDU_t^i}{GDP_t} = \left[\frac{\sum_i W_0^i}{GDP_0} * \overline{IT}_t + \frac{\sum_i \left[O_0^i + K_0^i + R_0^i\right]}{GDP_0} * \overline{IS}_t\right] * \frac{IP_t}{IG_t} + CE_t \quad 4.4$$

Where IT_t^i, IS_t^i, IP_t^i, and IG_t^i are indexes of respectively, staff, students, labour productivity, and GDP ([112]). A bar over an index represents one calculated over all ISCED levels considered ([113]). *CEt* is the composition effect, which is usually a small number compared with the total expenditure-to-GDP ratio ([114]).

Equation 4.4 expresses the expenditure in education-to-GDP ratio as a function of base period ratios, and indexes for staff, students, labour productivity and GDP.

In the baseline scenario, which assumes a constant ratio of staff-to-students (i.e $IT_t^i = IS_t^i$), equation 4.4 can be further simplified to:

$$\frac{\sum_i EDU_t^i}{GDP_t} = \frac{\sum_i EDU_0^i}{GDP_0} * \frac{\overline{IS}_t * IP_t}{IG_t} + CE_t \quad 4.5$$

Equivalently, equation 4.5 can also be written as:

$$\frac{\sum_i EDU_t^i}{GDP_t} = \frac{\sum_i EDU_0^i}{GDP_0} * \frac{\overline{IS}_t}{IE_t} + CE_t \approx \frac{\sum_i EDU_0^i}{GDP_0} * \frac{\overline{IS}_t}{IE_t} \quad 4.6$$

where *IEt* is the employment index ([115]).

In the baseline scenario, equation 4a allows the following straightforward interpretation: projections for the expenditure-to-GDP ratio are obtained by "inflating" base period values by a students and labour productivity indexes and by "deflating" them by a GDP index ([116]). There are two sources for the increase in expenditure (ratios): the (average) number of students and per-capita costs that are assumed to grow in line with labour productivity, conversely GDP growth "deflates" expenditure ratios.

4.3. DATA

Eurostat will be the main provider of data, mainly through the UOE data collection ([117]). The average for the years 2013-2014 (or more recent data if available) should be used as the base period of the projections. For those countries where data are missing for the base period, AWG delegates could be asked to provide them to Commission Services.

Specifically, by country, year, and ISCED groupings (1, 2, 3-4, 5-8), the following information from the UOE dataset will be used:

- Total number of students by single age;
- Number of working students by single age;
- Numbers of teachers and non-teaching staff;
- Total expenditure in public wages;
- Other current (excluding wages) and capital expenditure;
- Share of transfers over total public education expenditure ([118]);
- Share of publicly funded education.

Furthermore, and to secure full consistency of the long-term budgetary exercise, the common AWG macroeconomic assumptions for the following variables are used:

- Total population per single age;

([112]) An index measures the ratio between the values of variable X in the current period t and in the base period *0:* $IX_t = \frac{X_t}{X_0}$

([113]) $\overline{IT}_t = \frac{\sum_i T_t^i}{\sum_i T_0^i}$ and $\overline{IS}_t = \frac{\sum_i S_t^i}{\sum_i S_0^i}$.

([114]) The composition effect is given by: $CE_t = \left[\frac{\sum_i W_0^i * \left\{IT_t^i - \overline{IT}_t\right\}}{GDP_0} + \frac{\sum_i \left[O_0^i + K_0^i + R_0^i\right] * \left\{IS_t^i - \overline{IS}_t\right\}}{GDP_0}\right] * \frac{IP_t}{IG_t}$

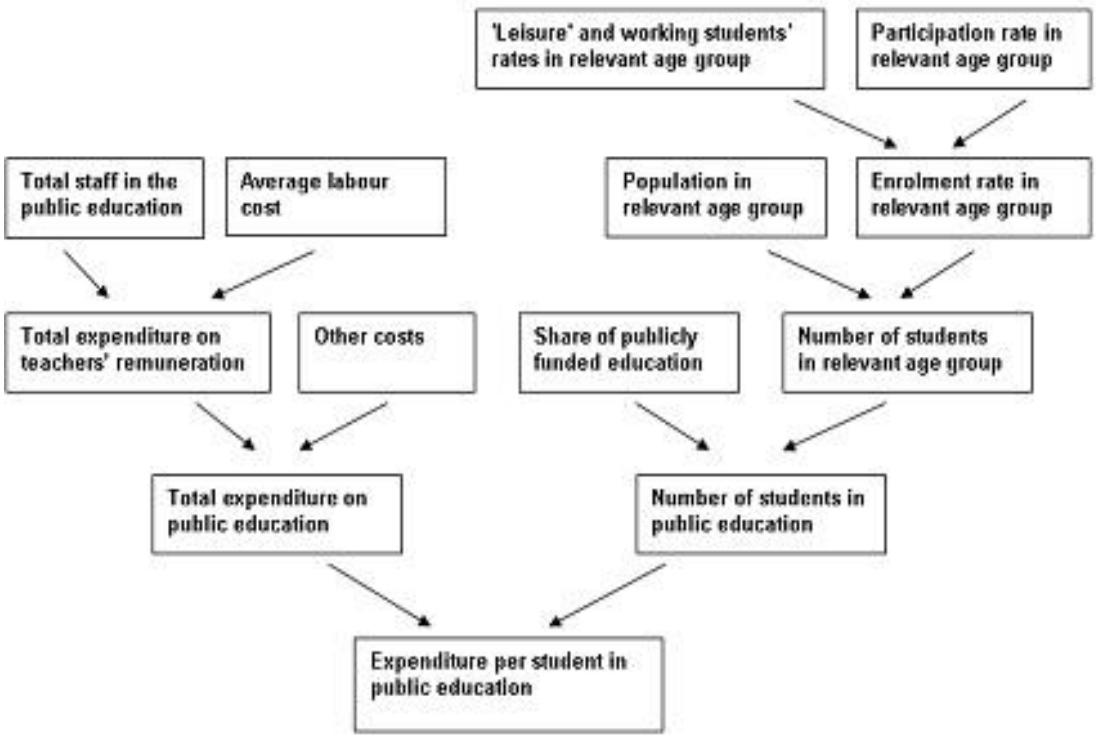
([115]) The approximation assumes that CE_t is a small number.

([116]) The discrepancy being given by the composition effect (CE_t).

([117]) The objective of the UNESCO-UIS/OECD/EUROSTAT (UOE) data collection on education statistics is to provide internationally comparable data on key aspects of education systems, specifically on the participation and completion of education programmes, as well as the cost and type of resources dedicated to education (http://www.oecd.org/dataoecd/32/53/33712760.pdf).

([118]) From the OECD, Education at a Glance.

Graph II.4.1: **Implicit decomposition of expenditure per student**



Source: Commission services, EPC.

– Labour force per single age;

– GDP per worker;

– GDP.

4.4. SENSITIVITY ANALYSIS

In addition to the baseline scenario described above, a sensitivity test is run.

High enrolment rates – as done in the 2015 Ageing Report, a sensitivity analysis of the impact of a gradual upward convergence is performed (to be completed by 2045); namely a demand shock that raises the enrolment rates in ISCED levels 3-4 and 5-6 towards the average of the 3 best performers in the EU.

Box II.4.1: **Derivation of the enrolment rate**

Starting with the labour market identity:

$$E_{i,t} + U_{i,t} + I_{i,t} \equiv P_{i,t} \qquad (1)$$

where $E_{i,t}$, $U_{i,t}$, $I_{i,t}$ and $P_{i,t}$ are respectively employment, unemployment, inactive and the population for age cohort i in period t.

After adding and subtracting the number of full-time students ($SF_{i,t}$), and of part-time students ($SP_{i,t}$):

$$SF_{i,t} + SP_{i,t} - SP_{i,t} + E_{i,t} + U_{i,t} + I_{i,t} - SF_{i,t} \equiv P_{i,t} \qquad (2)$$

Let us use the definition of total students $ST_{i,t} \equiv SF_{i,t} + SP_{i,t}$, labour force $LF_{i,t} \equiv E_{i,t} + U_{i,t}$, and inactive minus full-time students $I^{*}_{i,t} \equiv I_{i,t} + SF_{i,t}$:

$$ST_{i,t} - SP_{i,t} + LF + I^{*}_{i,t} \equiv P_{i,t} \qquad (3)$$

Dividing equation (1) by the population ($P_{i,t}$), and defining

$$\alpha_{i,t} \equiv \frac{SP_{i,t}}{SF_{i,t} + SP_{i,t}} = \frac{SP_{i,t}}{ST_{i,t}}$$

as the fraction of part-time students in the total number of students, the following identity is obtained:

$$\frac{ST_{i,t}}{P_{i,t}} - \frac{SP_{i,t}}{ST_{i,t}} * \frac{ST_{i,t}}{P_{i,t}} + \frac{LF_{i,t}}{P_{i,t}} + \frac{I^{*}_{i,t}}{P_{i,t}} \equiv 1 \qquad (4)$$

Equation 4 can be rearranged as:

$$e_{i,t} = \frac{1 - p_{i,t} - i^{*}_{i,t}}{1 - \alpha_{i,t}} \qquad (5)$$

where the enrolment rate for total students is;

$$e_{i,t} \equiv \frac{ST_{i,t}}{P_{i,t}}$$

and the participation rate is;

$$p_{i,t} \equiv \frac{LF_{i,t}}{P_{i,t}}$$

$$i^{*}_{i,t} \equiv \frac{I^{*}_{i,t}}{P_{i,t}}$$

is the fraction of inactive minus full-time students over the population.

(Continued on the next page)

Box (continued)

In equation 5, enrolment rates are inversely related to the participation and the (adjusted) inactivity rates.

In most EU Member States, the LFS MAINSTAT variable can be used to assess the distribution of inactivity by age, distinguishing between schooling and other forms of inactivity. ([1])

Assume that the ratio between full-time students and the total inactive ($\overline{\kappa}_{i,b}$) is constant over time at the value observed in the base period (*b*):

$$\frac{SF_{i,t}}{I_{i,t}} = \frac{SF_{i,b}}{I_{i,b}} = \overline{\kappa}_{i,b} \Rightarrow \frac{I^*_{i,t}}{P_{i,t}} = \left(1 - \overline{\kappa}_{i,b}\right) * \frac{I_{i,t}}{P_{i,t}} \Rightarrow i^*_{i,t} - i^*_{i,b} = \left(1 - \overline{\kappa}_{i,b}\right) * \left(i_{i,t} - i_{i,b}\right) \qquad (6)$$

Where:

$\overline{\kappa}_{i,b} \leq 1$;

$i_{i,t} \equiv \frac{I_{i,t}}{P_{i,t}}$,

$i^*_{i,t} \equiv \frac{I^*_{i,t}}{P_{i,t}}$

are the inactivity and the adjusted inactivity rates, respectively. A bar over a variable indicates that it is constant (i.e. time invariant).

Enrolment rates are projected by expressing equation 5 in terms of differences to the base period, substituting equation 6, and using the identity $\left(p_{i,t} - p_{i,b}\right) + \left(i_{i,t} - i_{i,b}\right) \equiv 0$:

$$e_{i,t} - e_{i,b} = -\frac{\overline{\kappa}_{i,b}}{1 - \overline{\alpha}_{i,b}} * \left(p_{i,t} - p_{i,b}\right) \qquad (7)$$

where $\overline{\kappa}_{i,b} = \frac{SF_{i,b}}{I_{i,b}}$; $\overline{\alpha}_{i,b} \equiv \frac{SP_{i,b}}{SF_{i,b} + SP_{i,b}} = \frac{SP_{i,b}}{ST_{i,b}}$,

and $0 \leq \overline{\kappa}_{i,b}, \overline{\alpha}_{i,b} \leq 1$

A value for $\overline{\kappa}_{i,b}$ lower than one means that changes in the labour force do not necessary reduce one by one enrolment rates, because some people coming from inactivity were not involved in education activities.

([1]) However, given that the MAINSTAT variable, which describes the main labour market status is an optional one, there are no data for DE and the UK.

5. UNEMPLOYMENT BENEFITS

5.1. INTRODUCTION

Although largely driven by (short- and medium-term) cyclical fluctuations rather than by (long-term) demographic waves, unemployment benefits (UB) projections are carried out in order to preserve the comprehensive nature of the long-term budgetary exercise. In addition, and for underperforming countries, UB projections largely depend on the assumption of how unemployment rates will develop. As for the previous rounds of projections, a convergence assumption to some EU wide ceiling/benchmark is taken (see Chapter I.2). It results in unemployment rate being on a declining path, implicitly anticipating the future implementation of structural reforms in labour markets.

UB projections are based on three elements: i) calibration of UB expenditure for a recent base year/period; ii) assumption of an UR trajectory up to 2070; and iii) the assumptions of constant replacement and coverage rates of UB systems. The driving variable of the UB projections is the unemployment rate scenario commonly agreed in the AWG. The main assumption of the methodology is one of unchanged policies throughout the projection period, implying a constant replacement and coverage rates of UB systems after a given data (usually from the start of the projection period if no change in policies has been announced).

In order to apply the methodology described here and secure the comparability of projections across countries, data are taken from Eurostat's Social Protection Statistics (ESSPROS) ([119]). Furthermore, expenditure data on unemployment benefits should cover the most recent years, possibly 2015 and 2016. Given the delays involved in the official publication of these values by Eurostat, EPC/AWG delegates were requested to assist Commission Services (DG ECFIN) in building the necessary dataset ([120]).

5.2. THE METHODOLOGY

The methodology uses the unemployment rate scenario described in Chapter I.2 (as the driving variable) and UB expenditure in the base period to extrapolate future expenditure levels ([121]).

The methodology is derived from the following identity:

$$UB_t \equiv UB_t^{pb} * B_t \qquad 5.1$$

where total expenditure in unemployment benefits (UB_t) is broken down in average expenditure per beneficiary (UB_t^{pb}) and the number of beneficiaries (B_t).

Unemployment expenditure per beneficiary is a fraction of average wages in the economy:

$$UB_t^{pb} = RR_t * \frac{W_t}{E_t} \qquad 5.2$$

where RR_t is the replacement rate; W_t is the wage bill; and E_t is employment.

Substituting equation 2 into equation 1:

$$UB_t \equiv RR_t * \frac{W_t}{E_t} * \frac{B_t}{U_t} * U_t \qquad 5.3$$

where U_t is unemployment.

Dividing equation 5.3 by GDP_t and rearranging:

$$\frac{UB_t}{GDP_t} \equiv RR_t * CR_t * WS_t * \frac{u_t}{1-u_t} \qquad 5.4$$

where $CR_t \equiv \frac{B_t}{U_t}$ is the coverage rate or the take-up rate of unemployment benefits; $WS_t \equiv \frac{W_t}{GDP_t}$ is the

([119]) The European System of integrated Social PROtection Statistics (ESSPROS).

([120]) If data based on ESSPROS definition are not available, delegates can provide national figures. If ESSPROS and national figures differ substantially, the Commission Services (DG ECFIN) make a proposal on how to reconcile them.

([121]) Using multi annual averages can limit the impact of any given year on the final results, which is desirable in periods of strong economic fluctuations and possible statistical errors. Although a too long period should be avoided in order to reflect recent policy changes and limit discontinuities between actual data and projections.

wage share in income; and u_t is the unemployment rate ([122]).

Equation 5.4 shows that the ratio between UB expenditure and GDP is determined by four parameters/variables: i) the replacement rate of UB (*RR*); ii) the coverage/take-up rate of UB (*CR*); iii) the wage share in income (*WS*); and iv) the unemployment rate (*u*).

In order to generalise the formulation, let us assume that policies have been announced for the replacement and coverage rates:

$$RR_t = (1 + \eta_t) * RR_b \qquad 5.5$$

$$\lim_{t \to \infty} \eta_t = \overline{\eta}$$

$$CR_t = (1 + \lambda_t) * CR_b \qquad 5.6$$

$$\lim_{t \to \infty} \lambda_t = \overline{\lambda}$$

were *b* is a base year/period. Policy changes are assumed to converge to steady state values.

The wage share is assumed to be constant throughout the projection horizon at the level observed in the base period/year (*b*).

$$WS_t = WS_b \qquad 5.7$$

Using equations 5.4 to 5.7, the UB-to-GDP ratio ($\frac{UB_t}{GDP_t}$) is calculated as:

$$\frac{UB_t}{GDP_t} = \frac{UB_b}{GDP_b} * (1 + \eta_t) * (1 + \lambda_t) * \frac{1-u_b}{u_b} * \frac{u_t}{1-u_t} \qquad 5.8$$

"Historical" values (i.e. base period) are taken from the ESSPROS database for the UB-to-GDP ratio ($\frac{UB_t}{GDP_t}$). During the projection period, the trajectory for the unemployment rate (u_t) is derived using the methodology agreed in the AWG (convergence of underperforming MS to an EU median), and using the latest European Commission's Economic Forecast available.

Announced policy changes are incorporated through the variables η_t (change in the replacement rate) and λ_t (change in the coverage rate).

In the more common scenario of no policy changes, we assume $\eta_t = 0$ and $\lambda_t = 0$. This approximation should be neutral not leading to any systematic bias in the projections.

It is easy to see that changes in the UB-to-GDP ratio can be approximated by:

$$ln\left(\frac{UB_t}{GDP_t}\right) - ln\left(\frac{UB_b}{GDP_b}\right) \approx \eta_t + \lambda_t + \frac{1}{1-u_t}\frac{u_t-u_b}{u_b} \qquad 5.9$$

This means that reducing the unemployment rate pays a "double dividend" in terms of lowering the UB-to-GDP ratio. For similar changes in the unemployment rate ($\frac{u_t-u_b}{u_b}$), countries with a higher unemployment rate (u_t) will record a larger variation in the UB-to-GDP ratio ([123]).

([122]) Given that $E = LF * (1 - u)$ and $U = LF * u$ then $\frac{U}{E} = \frac{u}{1-u}$; where uppercase variables *E*, *U*, *LF* are respectively, employment, unemployment and the labour force; and lowercase *u* the unemployment rate.

([123]) This methodology is non-linear for high levels of the UR. For countries starting with a high UR, its reduction pays a double dividend: i) lowering unemployment benefits, and; ii) increasing GDP. For countries starting with not too "extreme" URs, the impact of a reduction in the UR on UB is approximately linear. This reflects the fact that two channels affect the UB to GDP ratio: expenditure (the numerator) which varies with the unemployment rate; and GDP (the denominator) which is adversely affected by the unemployment rate.

ANNEX 1
Pension projection reporting sheet

Table II.A1.1: **Pension projection reporting sheet: blocks common to all schemes**

European Commission
DG ECFIN Unit C2
Draft reporting framework: Pension expenditure and contributions - in millions EUROs, current prices

Country:
Scenario:
Pension scheme:
Voluntary

A. Fixed table

		2016	2020	2030	2040	2050	2060	2070
		Base year	Projections in current prices					
	GDP (ECFIN projection, in current prices - billions EUR)							
1	**GDP (used in projections, in current prices)**							
2	**GDP deflator**							
3	**Economy-wide average gross wage (current prices - billions €)**							
4	**Average gross wage (current prices - 1000 €)**							
5	**Consumer price inflation**							
	0 - AVERAGE GROSS WAGE AT RETIREMENT							
6	**Average gross wage at retirement (current prices - 1000 €)**							
	1 - PENSION EXPENDITURES (Gross, in millions €)							
7	**Public pensions scheme, gross (8+9+10+11+12+13) (14+22+24+26)**							
	Of which							
8	aged -54							
9	aged 55-59							
10	aged 60-64							
11	aged 65-69							
12	aged 70-74							
13	aged 75+							
14	Old-age and early pensions (16+18+20)							
15	*Of which new pensions*							
16	*Of which flat component (basic pension)*							
17	*Of which new pensions (168*169)*							
18	*Of which earnings related pensions*							
19	*Of which new pensions (162*163*164*165*166*167)*							
20	*Of which minimum pensions (non-contributory) i.e.minimum income guarantees for people above 65*							
21	*Of which new pensions*							
22	Disability							
23	*Of which new pensions*							
24	Survivors							
25	*Of which new pensions*							
26	Other pensions							
27	*Of which new pensions*							
28	**Private occupational scheme, gross**							
29	*Of which new pensions (170*171*172*173*174*175)*							
30	**Private individual scheme gross (32+34)**							
31	*Of which new pensions (176*177*178*179*180*181)*							
32	*Mandatory private individual scheme*							
33	*Of which new pensions*							
34	*Non-mandatory private individual scheme*							
35	*Of which new pensions*							
36	**Total pension expenditure, gross (37+38+39+40+41+42) (7+28+30)**							
	Of which							
37	*aged -54*							
38	*aged 55-59*							
39	*aged 60-64*							
40	*aged 65-69*							
41	*aged 70-74*							
42	*aged 75+*							
43	**Public pension scheme, tax revenues**							
44	**Private occupational scheme, tax revenues**							
45	**Private individual scheme, tax revenues**							
46	**Total pension, tax revenues (43+44+45)**							
47	**Public pensions scheme, net**							
48	*Of which minimum pensions (non-contributory) i.e.minimum income guarantees for people above 65*							
49	**Private occupational scheme, net**							
50	**Private individual scheme, net**							
51	**Total pension expenditure, net (47+49+50)**							
	2 - BENEFIT RATIO							
52	**Public pensions (7/87)/4**							
53	Of which old-age earnings-related pensions (including the flat component) ((16+18)/101)/4							
54	**Private occupational pensions (28/106)/4**							
55	**Mandatory private individual pensions (32/108)/4**							
56	**Non-mandatory private individual pensions (34/109)/4**							
57	**Total benefit ratio (36/110)/4**							
	3 - GROSS AVERAGE REPLACEMENT RATES (at retirement)							
58	**Public pensions**							
59	Of which old-age earnings-related pensions (including the flat component) ((15+17)/162)/6							
60	**Private occupational pensions (29/170)/6**							
61	**Private individual pensions (31/177)/6**							
62	**Total gross replacement rate**							

(Continued on the next page)

Table (continued)

	4 - NUMBER OF PENSIONS (in 1000)							
63	**Public pensions (64+65+66+67+68+69) (70+73+74+75)**							
	Of which							
64	aged -54							
65	aged 55-59							
66	aged 60-64							
67	aged 65-69							
68	aged 70-74							
69	aged 75+							
70	Old-age and early pensions (71+72)							
71	Of which earnings related pensions							
72	Of which minimum pensions (non-contributory) i.e.minimum income guarantees for people above 65							
73	Disability							
74	Survivors pensions							
75	Other pensions							
76	**Private occupational pensions**							
77	**Private individual pensions (78+79)**							
78	*Mandatory private individual*							
79	*Non-mandatory private individual*							
80	**All pensions (63+76+77) (81+82+83+84+85+86)**							
	Of which							
81	aged -54							
82	aged 55-59							
83	aged 60-64							
84	aged 65-69							
85	aged 70-74							
86	aged 75+							
	5 - NUMBER OF PENSIONERS (in 1000)							
87	**Public pensions (88+90+92+94+96+98) (100+103+104+105)**							
	Of which							
88	aged -54							
89	*Of which female*							
90	aged 55-59							
91	*Of which female*							
92	aged 60-64							
93	*Of which female*							
94	aged 65-69							
95	*Of which female*							
96	aged 70-74							
97	*Of which female*							
98	aged 75+							
99	*Of which female*							
100	Old-age and early pensions (101+102)							
101	Of which earnings related pensions							
102	Of which minimum pensions (non-contributory) i.e.minimum income guarantees for people above 65							
103	Disability							
104	Survivors pensions							
105	Other pensions							
106	**Private occupational pensions**							
107	**Private individual pensions (108+109)**							
108	*Mandatory private individual*							
109	*Non-mandatory private individual*							
110	**All pensioners (87+106+107) (111+113+115+117+119+121)**							
	Of which							
111	aged -54							
112	Of which female							
113	aged 55-59							
114	Of which female							
115	aged 60-64							
116	Of which female							
117	aged 65-69							
118	Of which female							
119	aged 70-74							
120	Of which female							
121	aged 75+							
122	Of which female							
	6 - CONTRIBUTIONS (employee+employer, in millions €)							
123	**Public pensions (124+125+126+127)**							
124	Employer							
125	Employee							
126	State							
127	Other revenues, i.e. pension funds, nuisance charges							
128	**Private occupational pensions**							
129	**Private individual pensions (130+131)**							
130	*Mandatory private individual*							
131	*Non-mandatory private individual*							
132	**Total pension contributions (123+128+129)**							
	7 - NUMBER OF CONTRIBUTORS (employees, in 1000)							
133	**Public pensions**							
134	**Private occupational pensions**							
135	**Private individual pensions (136+137)**							
136	*Mandatory private individual*							
137	*Non-mandatory private individual*							
138	**All pensions (133+134+135)**							
	8 - INDEXATION FACTORS (percentage)							
139	Indexation factor public pensions							
140	Indexation factor old age pensions							
141	Indexation factor earnings related pensions							
142	Indexation factor flat component							
143	Indexation factor minimum pensions							
	For Memory							
144	**Consumer price inflation**	**0.1**	**1.8**	**2.0**	**2.0**	**2.0**	**2.0**	**2.0**
145	**Average nominal wage growth rate**	**2.1**	**2.5**	**3.1**	**3.3**	**3.6**	**3.6**	**3.6**

(1)The green lines are provided on a voluntary basis.
Source: Commission services, EPC.

Table II.A1.2: **Pension projections reporting sheet: decomposition of new public pensions expenditure - earnings related for defined benefit (DB) schemes**

	9- DECOMPOSITION OF NEW PUBLIC PENSIONS EXPENDITURES - OLD AGE EARNINGS RELATED (Refer to lines 15 and 17)	2016	2020	2030	2040	2050	2060	2070
	TOTAL							
	Earnings related pension							
162	Number of new pensions (in 1000)							
163	Average contributory period (in years)							
164	Average accrual rate (including contributory and flat rate component - if applicable)							
165	Monthly average pensionable earning							
166	Sustainability/adjustment factors							
167	Average number of months paid the first year							
	Flat component (basic pension)							
168	Number of new pensions (in 1000)							
169	Average new pension							

(1) Data to be provided also by gender.
Source: Commission services, EPC.

Table II.A1.3: **Pension projection reporting sheet: decomposition of new public pension expenditure - earnings related for notional defined contribution (NDC) schemes**

	9- DECOMPOSITION OF NEW PUBLIC PENSIONS EXPENDITURES - OLD AGE EARNINGS RELATED (Refer to lines 15 and 17)	2016	2020	2030	2040	2050	2060	2070
	TOTAL							
	Earnings related pension							
166	Number of new pensions (in 1000)							
167	Average contributory period (in years)							
168	Average accrual rate (c/A)							
169	Notional-accounts contribution rate (c)							
170	Annuity factor (A)							
171	Monthly average pensionable earning							
172	Sustainability/adjustment factors							
173	Average number of months of pension paid the first year							
	Flat component or basic pension							
174	Number of new pensions (in 1000)							
175	Average new pension							

(1)Data to be provided also by gender.
Source: Commission services, EPC.

Table II.A1.4: **Pension projection reporting sheet: decomposition of new public pension expenditure - earnings related for point schemes (PS)**

	9- DECOMPOSITION OF NEW PUBLIC PENSIONS EXPENDITURES - OLD AGE EARNINGS RELATED (Refer to lines 15 and 17)	2016	2020	2030	2040	2050	2060	2070
	TOTAL							
	Earnings related pension							
166	Number of new pensions (in 1000)							
167	Total pension points at retirement							
168	Average pension points accumulated per year or average contributory period							
169	Average accrual rate (=V/K)							
170	Point value (V)							
171	Point cost (K)							
172	Sustainability/adjustment factors							
173	Average number of months paid the first year							
	Flat component or basic pension							
174	Number of new pensions (in 1000)							
175	Average new pension							

(1) Data to be provided also by gender.
Source: Commission services, EPC.

Table II.A1.5: **Pension projections reporting sheet: decomposition of new private pension expenditure**

	Private occupational scheme	2016	2020	2030	2040	2050	2060	2070
	TOTAL							
170	Number of new pensions (in 1000)							
171	Average contributory period (in years)							
172	Average accrual rate							
173	Monthly average pensionable earning							
174	Sustainability/adjustment factors							
175	Average number of months paid the first year							
	Private individual scheme							
	TOTAL							
176	Number of new pensions (in 1000)							
177	Average contributory period (in years)							
178	Average accrual rate							
179	Monthly average pensionable earning							
180	Sustainability/adjustment factors							
181	Average number of months paid the first year							

(1) This block is to be provided on a voluntary basis.
Source: Commission services, EPC.

ANNEX 2
Overview of pension systems in the Member States

Table II.A2.1: **Pension schemes in EU Member States and projection coverage**

		Public pensions[3]					Private pension scheme		
Country	**Pension scheme**	**Minimum Pension[4]**	**Old-age pensions**	**Early retirement pensions**	**Disability pensions**	**Survivors' pensions**	**Occupational pension scheme**	**Mandatory private individual**	**Voluntary private individual**
BE	DB	MT - SA	ER	ER	ER priv FR self-emp	ER	M* priv V* self-emp	X	Yes*
BG	DB	MT - SA	ER	ER	ER	ER	V*	Yes*	Yes*
CZ	DB	X	ER	ER	ER	ER	X	X	Yes*
DK	DB	FR & MT suppl.	FR & MT suppl.	V	FR	FR	Quasi M	X	Yes*
DE	PS	MT - SA*	ER	ER	ER	ER	V*	X	Yes*
EE	DB	MT - SA	ER	ER	ER	ER	M*	Yes*	Yes*
IE	Flat rate + DB	MT - FR & SA	FR	FR - MT	FR - MT	FR - MT	M pub V* priv	X	Yes*
EL[1]	Flat rate + DB + NDC	MT - FR	FR - ER	FR - ER	FR - ER	FR - ER	X	X	Yes*
ES	DB	MT	ER	ER	ER	ER	V	X	Yes
FR[2]	DB + PS	MT - SA	ER	ER	ER	ER	V*	X	Yes*
HR	PS	ER	ER	ER	ER	ER	M*	X	Yes*
IT	NDC	MT - SA	ER	ER	ER	ER	V*	X	Yes*
CY	PS	MT & ER	ER	ER	ER	ER	M* - pub V* - priv	X	X
LV	NDC	FR - SA	ER	ER	ER	ER	X	Yes*	Yes*
LT[6]	DB	SA	ER	ER	ER	ER	X	Quasi M	Yes*
LU	DB	MT - SA*	ER	ER	ER	ER	V*	X	Yes*
HU	DB	MT - SA	ER	ER	ER	ER	V*	X	Yes*
MT	Flat rate + DB	MT - SA	FR & ER	X	FR & ER	FR & ER	V*	X	Yes*
NL	DB	SA	FR	X	ER	FR	M	X	Yes*
AT	DB	MT - SA	ER	ER	ER	ER	V*	X	Yes*
PL	NDC	ER	ER	ER	ER	ER	V*	Yes*	Yes*
PT	DB	MT - SA[5]	ER	ER	ER	ER	M	X	Yes*
RO	PS	SA	ER	ER	ER	ER	X	Yes*	Yes
SI	DB	MT - SA*	ER	ER	ER	ER	V*	X	Yes*
SK	PS	MT - SA	ER	ER	ER	ER	X	X	Yes*
FI	DB	MT	ER	ER	ER	ER	V*	X	Yes*
SE	NDC	MT	ER	ER	ER	ER	Quasi M	Yes*	Yes
UK	DB	FR & MT - SA	ER - V	X	ER*	ER	V*	X	Yes*
NO	NDC	FR	ER	X	ER	ER	M*	X	Yes*

(1) The public supplementary pension fund is NDC since 2015.
(2) Point system refers to the ARRCO and AGIRC pension schemes
(3) Public pension expenditure include all public expenditure on pension and equivalent cash benefits granted for a long period, see Annex 2 for details on the coverage of the projections of public pension expenditure.
(4) Minimum pension corresponds to Minimum pension and other social allowances for older people not included elsewhere.
(5) Include all pensions of the non-earning related scheme such as old-age, disability and survivors pensions and the social supplement (equal to the difference between the guaranteed minimum amount and pension benefits calculated according to the rules) granted to the earning-related pensioners.
(6) The current DB system will be replaecd by a DB+PS system in 2018.
DB: Defined benefit system.
NDC: Notional defined contribution scheme.
PS: Point system.
MT - Mean-tested
FR - Flat rate
ER - Earnings related
SA - Social allowance/assistance
V - Voluntary
M - Mandatory
X - Does not exist
* Not covered in the projection
Source: Commission services, EPC.

Table II.A2.2: **Statutory retirement ages, early retirement (in brackets) and incentives to postpone retirement**

	Statutory retirement age (early retirement age)								Incentives	
	MALE				FEMALE					
	2016	2030	2050	2070	2016	2030	2050	2070	Penalty	Bonus
BE	65 (62)	67 (63)	67 (63)	67 (63)	65 (62)	67 (63)	67 (63)	67 (63)		
BG	63.9 (63.9)	65 (65)	65 (65)	65 (65)	61.1 (61.1)	63.3 (63.3)	65 (65)	65 (65)		X
CZ	63.1 (60)	65 (60)	65 (60)	65 (60)	60.5 (57.5)	64.7 (60)	65 (60)	65 (60)	X	X
DK*	65 (61.5)	68 (65)	71.5 (68.5)	74 (71)	65 (61.5)	68 (65)	71.5 (68.5)	74 (71)		
DE	65.5 (63)	67 (63)	67 (63)	67 (63)	65.5 (63)	67 (63)	67 (63)	67 (63)	X	X
EE	63 (60)	65 (62)	65 (62)	65 (62)	63 (60)	65 (62)	65 (62)	65 (62)	X	X
IE	65.4 (65.4)	68 (68)	68 (68)	68 (68)	65.4 (65.4)	68 (68)	68 (68)	68 (68)		
EL*	67 (62)	68.7 (63.7)	70.5 (65.5)	72.6 (67.6)	67 (62)	68.7 (63.7)	70.5 (65.5)	72.6 (67.6)	X	
ES	65.3 (63)	67 (63)	67 (63)	67 (63)	65.3 (63)	67 (63)	67 (63)	67 (63)	X	X
FR	66.3 (61.3)	67 (62)	67 (62)	67 (62)	66.3 (61.3)	67 (62)	67 (62)	67 (62)	X	X
HR	65 (60)	65 (60)	67 (62)	67 (62)	61.5 (56.5)	65 (60)	67 (62)	67 (62)	X	X
IT*	66.6 (63.6)	66.9 (63.9)	69.6 (66.6)	71.1 (68.1)	66.6 (63.6)	66.9 (63.9)	69.6 (66.6)	71.1 (68.1)		
CY*	65 (65)	66 (66)	68 (68)	70 (70)	65 (65)	66 (66)	68 (68)	70 (70)	X	X
LV	62.8 (60.8)	65 (63)	65 (63)	65 (63)	62.8 (60.8)	65 (63)	65 (63)	65 (63)		
LT	63.3 (58.3)	65 (60)	65 (60)	65 (60)	61.7 (56.7)	65 (60)	65 (60)	65 (60)	X	X
LU	65 (57)	65 (57)	65 (57)	65 (57)	65 (57)	65 (57)	65 (57)	65 (57)		
HU	63.1 (63.1)	65 (65)	65 (65)	65 (65)	63.1 (63.1)	65 (65)	65 (65)	65 (65)		X
MT	62.4 (61)	65 (61)	65 (61)	65 (61)	62.4 (61)	65 (61)	65 (61)	65 (61)		X
NL*	65.7 (65.7)	67.7 (67.7)	69.5 (69.5)	71.2 (71.2)	65.7 (65.7)	67.7 (67.7)	69.5 (69.5)	71.2 (71.2)		
AT	65 (60)	65 (60)	65 (60)	65 (60)	60 (55)	63.5 (60)	65 (60)	65 (60)	X	X
PL	65 (65)	65 (65)	65 (65)	65 (65)	60 (60)	60 (60)	60 (60)	60 (60)		
PT*	66.2 (60)	67.2 (60)	68.4 (60)	69.6 (60)	66.2 (60)	67.2 (60)	68.4 (60)	69.6 (60)	X	X
RO	64.8 (59.8)	65 (60)	65 (60)	65 (60)	60.4 (55.4)	63 (58)	63 (58)	63 (58)		
SI	65 (59.3)	65 (60)	65 (60)	65 (60)	63 (59)	65 (60)	65 (60)	65 (60)	X	X
SK*	62 (60)	64.2 (62.2)	66.8 (64.8)	69.1 (67.1)	60.2 (58.2)	64.2 (62.2)	66.8 (64.8)	69.1 (67.1)	X	X
FI*	66 (63)	67.1 (64.1)	69.2 (66.2)	71 (68)	66 (63)	67.1 (64.1)	69.2 (66.2)	71 (68)	X	X
SE	67 (61)	67 (61)	67 (61)	67 (61)	67 (61)	67 (61)	67 (61)	67 (61)		
UK	65.4 (65.4)	66 (66)	67.3 (67.3)	68 (68)	63.1 (63.1)	66 (66)	67.3 (67.3)	68 (68)		X
NO	67 (62)	67 (62)	67 (62)	67 (62)	67 (62)	67 (62)	67 (62)	67 (62)		

(1) BG - the latest pension reform included a provision for further link retirement ages to life expectancy as from 2037.
CZ - Statutory retirement age depending on the number of children. Values for women with 2 children are reported.
DK – increase in the retirement age subject to Parliamentary decision.
IT - In 2016, female SRA refers to public sector employees (for the female self-employed and female private sector employees they are, respectively, 66.1 and, 65.6, both aligned to other workers as of 2018). In bracket the minimum age for early retirement under the NDC system (a minimum amount of pension of 2.8 times the old age allowance is also required). Early retirement is also allowed regardless of age, with a contribution requirement of 42.8 years (41.8 for female) in 2016, indexed to changes in life expectancy (44.2 in 2030, 45.8 in 2050 and 47.3 in 2070; one year less for females).
PT - Early retirement due to long contributory period suspended in the social security scheme in 2012. Since January 2015 early-retirement is possible for workers aged 60 or more and 40 or more years of contributory career. The pension benefit is reduced by 0.5% for each month of anticipation to statutory retirement age (penalty) and multiplied by the sustainability factor. If the contributory career is higher than 40 years, for each year above the 40 years the statutory retirement age is reduced by 4 months.
SE - Retirement age flexible from age of 61 without an upper limit. Under the Employment Protection Act, an employee is entitled to stay in employment until his / her 67th birthday.

*Countries where statutory retirement age is legislated to increase in line with increase in life expectancy. Reported retirement ages calculated according to life expectancy increases as from Eurostat population projections.
Actuarial equivalence is not considered as a penalty/bonus.
Source: Commission services, EPC.

Table II.A2.3: **Key indexation and valorisation parameters of pension system in Europe (old-age pensions)**

Country	Pensionable earnings reference	General valorisation variable(s)	General indexation variable(s)
BE	Full career	Prices	Prices and living standard
BG	Full career	Wages	Prices and wages
CZ	Full career	Wages	Prices and wages
DK	Years of residence	Not applicable	Wages
DE	Full career	Wages	Wages plus sustainability factor
EE	Full career	Social taxes	Prices and social taxes
IE	Flat rate	Not applicable	No fixed rule
EL	Full career	Price and wages	Prices and GDP (max 100% prices)
ES	Last 25 years	Wages	Index for pension revaluation
FR	25 best years (CNAVTS)	Prices	Prices
HR	Full career	Wages and prices	Prices and wages
IT	Full career	GDP	Prices
CY	Full career	Wages	Prices and wages
LV	Full career	Contribution wage sum index	Prices and wages
LT	Full career	Wages	Wage sum
LU	Full career	Wages	Wages
HU	Full career	Wages	Prices
MT	10 best of last 41 years	Cost of living	Prices and wages
NL	Years of residence	Not applicable	Wages
AT	Full career	Wages	Prices
PL	Full career	NDC 1st: Wages, NDC 2nd: GDP	Prices and wages
PT	Full career up to a limit of 40 years	Prices	Prices and GDP
RO	Full career	Prices and wages until 2030	Prices and wages until 2030
SI	Best consecutive 24 years	Wages	Prices and wages
SK	Full career	Wages	Prices and wages
FI	Full career	Prices and wages	Prices and wages
SE	Wages	Wages	Wages
UK	Years of insurance contributions	Prices, wages and GDP	Prices, wages and GDP
NO	Full career	Wages	Wages

(1) BG Pensionable earnings reference is full career starting from 1997. 3 Best years before 1997
CZ Pensionable earnings reference is full career back to 1986. Currently 30 years to be considered.
IE A price and wage indexation rule has been assumed in the projections.
EL Pensionable earnings reference is full career taking into account wages/income from 2002 onwards.
ES Pensionable earnings reference is last 25 years as of 2022. The maximum value of the valorisation rule is close to prices. The IPR is established annually at a level consistent with a balanced budget of the Social Security system over the medium run. Depending on the balance of the system the indexation will be less than price (budget deficit) or price + 0.5% (budget balance).
FR The pensionable earnings reference is full career in AGIRC and ARRCO. Valorisation rule and indexation rules are price – 1pp. in both AGIRC and ARRCO in 2014-15, and also in 2016-18 but with a floor at 0. AGIRC: Association générale des institutions de retraite des cadres; ARRCO: Association pour le régime de retraite complémentaire des salariés; CNAVTS: Caisse nationale de l'assurance vieillesse des travailleurs salariés.
LT Pensionable earnings reference is full career back to 1994. Pensions are indexed to the seven-year average of the wage sum growth over the current, previous three and (projected) upcoming three years. The index is applied in case of balanced budget of Pension Social Security System in 2 consecutive years and conditioning positive growth of GDP or Wage Sum.
LU Indexation rule is wages if sufficient financial resources available, otherwise only cost of living indexation.
HU Pensionable earnings reference is full career back to 1988.
MT Pensionable earnings reference rule applies to people born as of 1969
PT Pensionable earnings reference is full career as of 2002. 10 best years out of last 15 before 2002. Price and wage valorisation rule applies to earnings registered between 2002 and 2011
RO Price valorisation and indexation after 2030.
SK Pensionable earnings reference is full career back to 1984. From 2018 onwards, pension are indexed on CPI for pensioners.(consumption basket for pensioners).
NO Indexation rule is wage growth minus 0.75 p.p.
UK Triple-lock indexation (highest of average earnings, CPI or 2.5%) is a commitment of the current government, but is not enshrined in law.
Source: Commission services, EPC.

Table II.A2.4: **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

(1) 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, EPC.

Table II.A2.5: **Contribution rates to public pension system**

Country	Contribution rate: employers	Contribution rate: employees	State contributions		Contribution rate: self-employed
			Contribution rate	Other provisions	
BE	24.92% (for all Social security schemes)	13.07% (for all Social security schemes)	-	In the wage earners' scheme, social spending is also funded by State subsidies (10.5% of total in 2016) and alternative funding (10.4%) - mainly share of VAT revenues.	In 2017, 21% for revenues from 13,296 to 57,416 EUR and 14.16% for revenues from 57,416 to 84,613 EUR.
BG	7.7% in 2016 and 8.3% in 2018 (born after December 1959) / 10.5% in 2017 and 11.1% in 2018 (born before January 1960)	6.1 in 2017 and 6.5% in 2018% (born after December 1959) / 8.3% in 2017 and 8.7% in 2018 (born before January 1960)	-	State commitment for covering the deficit on an annual basis.	For persons born before January 1, 1960, 18.8% of declared covered earnings in 2017 and 19.8% in 2018; for persons born after December 31, 1959, is 13.8% in 2017 and 14.8% of declared covered earnings
CZ	21.5%	6.5%	-	Balance of pension system is part of general governement budget.	28%
DK	-	-	-	-	0
DE	9.45%	9.45%	-	State subsidies with annual indexation. "Sustainability fund" fluctuating between 0.2 and 1.5 of monthly pension expenditures. Contribution rate is set to meet this requirement.	18.70%
EE	20% (if not participant to the 2nd pillar); 16% (if participant to the second pillar)	-	-	-	20%
IE	Varies	Varies	-	Social Insurance Fund and Social Assistance Fund (used to finance other social benefits in addition to pensions). Shortfalls met by Exchequer.	4% of covered income
EL	Main pensions 13.33%; Auxiliary pensions: 3%	Main pensions 6.67%; Auxiliary pensions: 3%	-	National budget / other sources	20%
ES	Private sector: 23.6%	Private sector: 4.7%	-	Central governement transfers amount to 12.16% of total expenditure.	29.80%
FR	Private sector (CNAV): 10.45% up to the Social Security Ceiling (SSC), plus 1.9% above the SSC in 2017	Private sector (CNAV): 7.3% up to the social security ceiling (SSC), 0.4% above the SSC in 2017. Reduced contribution rates are applied to some specific groups (artists, journalists and part-time medical workers)		Pensions Reserve Fund and Old-age solidarity fund.	17.75% up to the SSC, plus 0.6% above the SSC in 2017
HR	-	20% (public PAYG scheme participants only); 15% (participants in both public PAYG scheme and mandatory fully-funded DC scheme)	-	Government committed to cover deficits.	17.75% up to the SSC, 0.6% above the SSC in 2017
IT	23.81%	9.19%	-	Residual fuding (pension expenditure exceeding contributions) funding by the State.	Around 22.2% in 2014, gradually increasing to24% in 2018, 23.1% in 2016
CY	7.8%	7.8%	4.6%	Reserve fund.	14.6% of insurable income
LV	20% (if no participant of 2nd tier) or 16% (if participant of 2nd tier)	-	-	-	30.58%
LT	22.3%	3% (1% for participant in the private 2nd pillar)	1%	-	25.3% based on 50% of declared earnings
LU	8%	8%	8%	Buffer fund of at least 1.5 times the amount of annual benefits.	16%
HU	27%	10%	-	-	10% of declared monthly earnings and 27% of declared monthly earnings in the form of a social contribution tax.
MT	10%	10%	10%	-	15% of the annual income that is subject to the same ceiling that applies to employees
NL	-	17.9%	-	Government supplements shortfall between expenditure and funds raised by the 17.9% tax levy.	17.90%
AT	Between 12.55% and 20% (according to status)	10.25%	The differences to the standard contribution rate of 22.8% for farmers, self-employed in the liberal proffesions are borne by federal transfers.	Federal budget covers the deficits in public pension schemes.	18.50%
PL	9.76%	9.76%	-	Demographic Reserve Fund.	19.52%
PT	23.75%	11%	-	Social Security Trust Fund.	29.6% or 34.75%
RO	Between 15.8% and 25.8% (according to working conditions)	10.50%	-	State provides funds from the national budget to cover the public pension system deficit.	10.5% or 26.3%
SI	8.85%	15.50%	-	State provides funds from the national budget and other sources to cover the difference between the Institute's revenues from contributions and other sources, and the Institute's expenditures.	24.35%
SK	Varies according to status and participation to the 2nd pillar. 14% if not participating to II pillar	Varies according to status and participation to the 2nd pillar . 4% if not participating to II pillar	Varies according to status and participation to the 2nd pillar	-	18%
FI	National pensions: abolished in 2010. Earnings-related pensions: from 17.75% to 23.7% (according to sector)	Earnings-related pensions: 5.55% (18-52 years old) / 7.05% (53-68 years old)	20.4% for State pensions	Nations pensions: funding from the State at 100%. Earnings-related pensions: 25% of private sector pension are prefunded.	
SE	9.04%	6%	"Employer contribution" for social insurances	Buffer funds.	17.21%
UK	13.80%	Varies according to status and earnings	-	Occasional top-ups to the National Insurance Fund if reserves fall below a thresehold recommended by the Government Actuary Department.	From 9%
NO	PAYG system without earmarked tax going to pensions.	PAYG system without earmarked tax going to pensions	PAYG system without earmarked tax going to pensions	State Pension Fund contributes to financing governement (pension and other) expenditures.	11.40%

(1) When several schemes prevail, the information reported refers to the main (general regime) pension scheme.
EL: Main pensions: unified rates from 2022 onwards. Auxiliary pensions: 2016-18: 3.5%, 2019-21: 3.25%.

Source: Commission services, EPC

ANNEX 3
Coverage and specification of pension schemes

Table II.A3.1: **Pension schemes included in the projections**

	Schemes covered in the projections	Schemes <u>not</u> covered
BE	***Public pensions: old-age and early pensions*** Means-tested minimum benefits: 65+; 66+ as of 2025; 67+ as of 2030. Wage earners: e-r old-age (63+ and 41 career years in 2018 and 63+ and 42 career years as of 2019[(a)]), widows. Self-employed: e-r old-age (63+ and 41 career years in 2018 and 63+ and 42 career years as of 2019[(a)]), widows. Civil servants: e-r old-age (63+ and 41 career years in 2018 and 63+ and 42 career years as of 2019[(a)]), widows, disability. Unemployment with company allowance (wage earners): 62+ (as of 2015) and 40 career years (for men as of 2015 and for women as of 2024), until the age of 64 (65 as of 2025, 66 as of 2030). Unemployment with company allowance for heavy work (wage earners): in 2016 and 2017, 58+ and 35 career years; as of 2018, 59+ and 35 career years, until the age of 64 (65 as of 2025, 66 as of 2030). Unemployment with company allowance (wage earners) for companies undergoing restructuring or in difficulty (55+ in 2016; 56+ in 2017 and 2018; 60+ as of 2020), until the age of 64 (65 as of 2025, 66 as of 2030). ***Public pensions: disability*** Wage earners, disability pensions: -64; -65 as of 2025; -66 as of 2030. Self-employed, disability pensions: -64; -65 as of 2025; -66 as of 2030. [(a)]Some exceptions: 61 and 43 career years, 60 and 44 career years.	***Public pensions scheme*** Unemployment with company allowance only includes the part paid from unemployment benefit scheme, not the allowance paid by the employer. ***Private occupational pensions scheme*** Wage earners. Self-employed. ***Private individual pensions scheme*** Non-mandatory.
BG	***Public pensions: old age and early pensions*** E-r Old Age Pensions (including farmers and military officials). ***Public pensions: other*** E-r Disability Pensions due to General Disease (including farmers and military officials). E-r Disability Pensions due to Work Injury and Professional Disease (including farmers and military officials). E-r Survivors Pensions according to relationship with the deceased – widows, children, parents. Pensions not related to employment – social pensions, special merits pensions, pensions by Decree. a) There are some exceptions: 61 and 43 career years; and 60 and 44 career years.	***Supplementary mandatory pension schemes:*** Supplementary life-long old-age pensions - Universal Pension Funds (UPF). Early retirement pensions for a limited period of time for persons working in hazardous conditions - Professional Pension Funds (PPF). ***Supplementary voluntary pension schemes – individual private and occupational pensions.*** ***Teachers Pension Fund.***

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Table (continued)

CZ	***Public pensions: old age and early pensions*** E-r old-age pensions (all sectors except armed forces, all ages). Early pensions with permanent reductions (all sectors except armed forces, all ages). ***Public pensions: other*** Disability pensions (all three types of disability, all sectors except armed forces, all ages). Widows and widowers pensions (all ages). Orphans pensions (all ages).	***Individual private schemes:*** Voluntary fully funded scheme.
DK	***Public pensions: old age and early pensions*** Public flat-rate old-age pensions and means-tested. supplements, all citizens 65+. Civil servants old-age pensions 65+, central and Local government. Voluntary early retirement schemes, all wage earners. ***Public pensions: other*** Disability pensions, -64. ***Occupational pensions*** Labour market pensions. Individual, private pensions. Labour market supplementary pensions, ATP. Employees' capital fund (LD) .	
DE	***Public pensions: old age and early pensions*** E-r old-age, widows and disability schemes, all ages. General scheme and civil servants. Early pensions for long-time workers. Early pensions for severely handicapped. ***Public pensions: other*** (covered above; not shown separately)	Means tested minimum benefits to elderly (social assistance); 0.1% of GDP (2015). Farmers pensions (0.09% of GDP) (2015). ***Occupational pensions*** Annual contributions. Pension expenditure 1.3% of GDP in 2015. *Individual funded and state subsidised private pension (Riester-Rente)*, schemes at a building stage, only contributions to the schemes.

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Table (continued)

EE	***Public pensions: old age and early pensions*** Minimum flat-rate pensions, all citizens. E-r old-age pensions; length-of-service component to 60+w and 63+m in 2007, 65+ for both sexes as of 2026, all sectors (Pension Ins. Fund). Early pensions (possible to retire 3 years before the statutory retirement age), all sectors. ***Public pensions: other*** Disability and widows' pensions, all ages, all sectors (Pension Insurance Fund). ***Private mandatory pensions*** Mandatory funded pensions, mandatory for young people born 1983.	
IE	***Public pensions: old age and early pensions*** Minimum flat-rate old-age non-contributory pensions, 66+[(b)] (also includes widow(er)s non-contributory pensions, deserted wives, 66+), all sectors[(c)]. Carers, 66+, all sectors[(c)]. Flat-rate contributory 66+, private sector, self-employed and some civil servants[(d)]. Widow(er)s contributory pensions, 66+, all sectors. Carers and deserted wives [i], 66+, private sector, self-employed and some civil servants[(d)]. ***Public pensions: others*** Widow(er)s non-contributory pensions, 65-, all sectors[(c)]. Blind persons, carers, 65-, all sectors[(c)]. Pre-retirement allowance, 55-65, all sectors [(c)][ii]. Disability pensions, 65-, and invalidity pensions 65-, private sector, self-employed, some civil servants [(d)]. Carers, contributory, 65-, private sector, self-employed, some civil servants[(d)]. Widow(ers) contributory pension, 65-, all sectors. ***Public sector (occupational) pensions*** Pensions, lump sums and spouses, Civil service, defence, police, education, health and local authorities, non-commercial state bodies.	*Occupational pensions:* Private sector schemes and public sector commercial bodies.

[i] • Deserted Wife's Benefit was closed to new applications in January 1997, some women have continued to get Deserted Wife's Benefit because they qualified for the payment before 2 January 1997 and have continued to meet the qualifying criteria.

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Table (continued)

EL	***Public pensions: old age and early pensions*** Main pension: Private sector (employees, self-employed and farmers) and public sector: national pension (flat-rate) and (e-r) proportionate amount on the basis of their total period of insurance for all insured (statutory retirement age 67+), (including transitional period for old system). Means tested flat rate pensions of uninsured over aged individuals 67+. Auxiliary pensions: NDC system, (including transitional period for old DB system). Disability pensions, 15-67. Survivor pensions, all ages. Early pensions 62+, transition period. ***Public pensions: other*** EKAS (Pensioners Social solidarity Fund -provided up to 2019).	Welfare benefits Occupational and private pension schemes.
ES	***Public pensions: old age and early pensions*** E-r old-age and early retirement pensions for private sector employees, the self-employed, regional and local and central government and the military. Means-tested minimum pension supplements (contributory). Means-tested minimum pension scheme (non-contributory). War pensions. ***Public pensions: other*** Disability (-64) and survivors' pensions (all ages) for private sector employees, self-employed, regional, local and central government and the military. Means-tested minimum pension supplements (contributory). Means-tested minimum pension scheme (non-contributory). ***Private pensions*** Private (supplementary and voluntary) pension schemes: occupational and individual.	

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Table (continued)

FR	**Public pensions scheme - Earnings-related** E-r private sector pensions scheme for private sector wage-earners and non-civil servants public sector workers (CNAV). E-r complementary pension scheme for private wage-earners (Agirc, for executives, and Arrco, for all workers). E-r agricultural sector pension scheme (MSA). E-r public sector pension schemes (CNRACL, for civil servants in local administrations or hospitals, and SRE, for civil servants in state administration and military). E-r public sector complementary pension schemes (Ircantec, for non-civil servants public sector workers). E-r basic pension scheme for licensed workers (RSI, for professions such as craftsmen, tradesmen...). E-r pension scheme for law professions (CNAVPL, CNBF specifically for lawyers). E-r pension schemes for other specific professions (railwayman, etc.). **Non-earning-related pensions** General "old age solidarity fund" scheme (FSV). **Disability (e-r and non-earning-related)** pensions (benefits) covered by the health insurance scheme.	**Public pensions scheme - Earnings-related** E-r public sector complementary pension schemes (RAFP, for all civil servants): < 0.02% of GDP in 2015. E-r complementary pension scheme for licensed workers (RCI, for professions such as craftsmen, tradesmen...): 0.1% of GDP in 2015. **Occupational and private pension schemes** (PERP, PERCO, PERE, PREFON): <0.3% of GDP in 2015.
HR	***PAYG DB public pension scheme (I pillar)*** Old-age and early retirement pensions. Disability pensions. Survivors' pensions. Minimum pensions (no means-tested). Pensions of persons who could be granted benefits from PAYG public pension scheme under more favourable conditions (e.g. military officers, police officers and authorized officials, war veterans from the Homeland War). ***Mandatory fully funded defined-contribution (DC) scheme based on individual savings accounts (II pension pillar)*** Pensions for members of the first pillar under the age of 40 and members between 40 and 50 years of age who opted to be insured in II pension pillar.	***Voluntary fully funded pension scheme DC or DB (III pension pillar)*** have not been covered in the pensions projections.

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Table (continued)

IT	***Public Pension System - Public pensions and social assistance benefits (pay-as-you-go):*** Old-age and early retirement pensions. Disability pensions. Survivors' pensions. Old age allowances and social assistance additional lump sums (State budget).	***Occupational pensions schemes (funded).*** They are not included in the definition of "Public pension system" (which is utilized for the analysis of the sustainability of public finances) insofar as: i) they are never mandatory; ii) they provide a supplement of pension which corresponds to a minor fraction of the pension guaranteed by the public pension system and never replace it. No risk is taken by the State on investment returns.
CY	***Public pensions: old age and early pensions*** General Social Insurance Scheme (GSIS) covering the following pension benefits: early and old-age, invalidity, widows' and orphan's. Government Employees Pension Scheme (GEPS) covering old-age, widows' and disability pensions. Social pension scheme and special allowances to pensioners.	***Occupational funded pension plans:*** DB pension schemes for semi-state and private sector employees DC Provident funds for private sector employees
LV	***Public pensions: old age and early pensions:*** Old-age minimum pension, 63 + (65+ as of 2025). E-r old age DB pensions, granted -1995. E-r old age NDC pensions, 63 + (65+ as of 2025), granted 1996+ (included early retirement). Service pensions (early pensions), selected professions, public sector (during the transition period). Disability pensions, granted – 1995 and not transformed to old-age pensions. Survivor's pensions (for widows during the transition period). ***Public pensions: other*** Disability pensions – 63, (– 65 as of 2025). Survivor's pensions – 24. ***Private mandatory pensions:*** Individual funded old-age, mandatory for persons born 1971+. ***Social pension*** (public benefit, if the person's insurance record <15 years (<20 years from 2025), paid from the state basic budget).	***Voluntary private funded pension scheme*** ***Specific public sector service pensions schemes*** (paid from state basic budget)

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Table (continued)

LT	***Public pensions: old age and early pensions*** Social assistance pensions, w61.7+/m63.3+ (65+ as of 2026); (State budget). E-r old-age pensions, w61.7+/m63.3+ (65+ as of 2026), all sectors (Soc insurance scheme). Special public service (state) pensions for selected professions (scientists, judges) (State budget); state pensions of the first and second degree of the Republic of Lithuania (State budget); state pensions of deprived persons (State budget) w61.7+/m63.3+ (65+ as of 2026). Early retirement pensions (possible to retire 5 years before the statutory retirement age), all sectors (Soc insurance scheme). Officials and military personnel pensions for service, public sector (State budget); length of service pensions, compensation for extraordinary working conditions (Soc. insurance. scheme). ***Public pensions: disability pensions*** Social assistance disability pensions (State budget). E-r disability pensions, all sectors (Soc. Insurance scheme). Officials and military personnel disability pensions, public sector (State budget). ***Public pensions: other*** Social assistance survivors pensions (State budget). Survivors pensions, all sectors (Soc. Insurance scheme). Officials and military personnel survivors pensions, public sector (State budget). ***Private mandatory pensions:*** Individual funded old-age pension, voluntary, all sectors.	
LU	***Public pensions: old age and early pensions*** E-r old-age, early retirement and disability pensions, 65+, private sector & self-employed (general pension scheme). E-r old-age, early retirement and disability pensions, 65+ , public sector (special pension scheme), state budget. ***Public pensions: other*** Disability (-64 years) and survivors' pensions, all sectors	Minimum benefits (RMG, social assistance)

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Table (continued)

HU	***Public pensions: old age and early pensions:*** Social allowances close to minimum pensions to persons above retirement age. E-r old-age and anticipatory old-age pensions, all sectors. Survivors pensions, above retirement age, all sectors. Disability pensions, above retirement age, all sectors. ***Public pensions: other*** Disability pensions, below retirement age, all sectors. Survivors pensions, below retirement age, all sectors. Pension-like regular social allowances, below retirement age. ***Private mandatory pensions:*** Individual funded pensions, voluntary to persons. People entering the labour market before 2010 and chose to remain in private pension system, can have some entitlements also from that scheme.	Handicap support, political compensation allowances Voluntary private pension schemes
MT	***Public pensions: old age and early pensions:*** Two-thirds pension scheme (incorporating two-thirds retirement pension, national minimum pension, increased national minimum pension, and decreased national minimum pension), currently 62, 63 in 2019, 64 in 2023 and 65 in 2027. ***Public pensions: other*** Pensions other than those listed above, notably disability and survivors' pensions and some pensions, including Treasury Pensions (a DB pension scheme open for Public Officers who joined the Public Service of Malta prior to 15th January 1979 and that is closed to new members) and increased retirement pension, which will be phased out over a transition period, to specific groups of pensioners. Public pensions: disability: Decreased national invalidity pension, national minimum invalidity pension Public pensions: survivors: early survivorship pension, national minimum widows' pension, survivors pension	
NL	***Public pensions: old age and early pensions:*** Public flat-rate old-age pensions, 65+, all citizens (AOW). Widows pensions, w55+, all sectors (ANW). ***Public pensions: other*** Disability benefits, all sectors (WAO (being phased out), WIA, WaJong). ***Occupational pensions*** Occupational old-age pensions, 65+, all sectors.	

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Table (continued)

AT	***Public pensions: old age and early pensions*** E-r regular old-age pensions: **Private sector (including blue and white collar workers, self-employed and farmers):** f60/m65 (female retirement age will be gradually raised to 65 years from 2024 to 2033; by ½ year steps). **Public sector:** f65/m65. E-r early retirement pensions (private sector): **Corridor pension scheme ("Korridorpension"):** f62/m62 (for women this gets relevant only by 2028); required insurance years = 40 (in 2017); 5.1% deduction per year before the regular retirement age (for persons born after January 1st, 1955). **Early old-age pension for long-term contributors ("Hacklerregelung"):** f57/m62 (for women born after January 1st, 1959/for men born after January 1st, 1954); retirement age for women will be gradually raised to 62; required contribution years for men = 45, the required contribution years for women will be gradually raised from 42 to also 45; 4.2% deduction per year before the regular retirement age (for men born after January 1st, 1954/for women at the age of 62 born after January 1st, 1966). **Heavy worker regulation ("Schwerarbeitspension"):** f60/m60 (for women this gets relevant only by 2024); required insurance years = 45, at least 10 years of „hard labour" within 20 years before retirement; 1.8% deduction per year before the regular retirement age (for persons born after January 1st, 1955). **Early old-age pension for long-term contributors in combination with heavy worker regulation ("Hackler-Schwerarbeit"):** f55/m60 (for women born between January 1st, 1959 and December 31st, 1963/ for men born between January 1st, 1954 and December 31st, 1958); required insurance years for women = 40 and for men = 45; 1.8% deduction per year before the regular retirement age. ***Public pensions: other*** **Survivors' pensions (widow/widower and orphans):** all sectors. **Invalidity and occupational disability pensions:** only in case of permanent disability; the temporary invalidity pension was replaced by medical and job-related rehabilitation and was completely abolished for people born after December 31st, 1963 (therefore, the temporary invalidity pension will fade out in the coming years); all sectors.	**2nd pillar (occupational old age provisions).** **3rd pillar (private pension provisions).** **Minimum guarantee pensions:** no legal minimum pension in Austria; if individual pension claims are lower than legally defined thresholds the gap will be closed by federal budget contributions to guarantee a minimum income for pensioners (equalising allowance; "Ausgleichszulage"); all sectors. **Prisoner of war compensation**

(Continued on the next page)

Table (continued)

PL	***Public pensions: old age and early pensions*** E-r DB old-age, w60+/m65+, disability, widows, private and public sector, self-employed (ZUS, Social ins. Institution). E-r NDC old-age,, w60+/m65+ to persons born 1949- , private and public sector, self-employed (ZUS, Social ins. Institution). E-r NDC bridging-pensions (employment in special conditions or character) w55/m60+, expiring scheme. E-r DB old-age, disability and widows pensions, all ages, farmers (KRUS, Farmers social ins. scheme). Armed forces old-age pensions (State budget). ***Public pensions: other*** Disability and survivors' pensions, -54, private and public sector, self-employed (ZUS). ***Private quasi mandatory pensions*** DC funded old-age pensions. Includes supplements to ensure minimum pensions.	***Private individual pensions*** Private individual (non-mandatory) pension schemes (including the remaining part of the former mandatory FDC pillar). Private (non-mandatory)occupational pension schemes
PT	***Public pensions: old age and early pensions:*** General social security scheme (employees and self-employed of private sector and public employees since 2006): 66 years and 2 months in 2016 (evolves with the average life expectancy at age 65) and includes supplements to ensure minimum pensions value; 60 years or older for early pensions for long contributory careers; 57 years or older for early pensions for long time unemployment. Social pensions (non-contributory and means-tested): 66 years and 2 months in 2016 (evolves with the average life expectancy at age 65); RESSAA (spec. soc. sec. scheme for agriculture workers): 66 years and 2 months in 2016 (evolves with the average life expectancy at age 65). CGA (Pension scheme of civil servants hired until December 2005): old-age and early pensions, disability pensions – all ages. Includes supplements to ensure minimum pensions values. Income supplement for the elderly (non-contributory means tested scheme designed to help pensioners aged statutory retirement age or more and low incomes): 66 years and 2 months in 2016. ***Public pensions other*** General social security scheme & RESSAA & social pensions: disability - less than 65 years; survivors' pensions – all ages. CGA scheme: survivors' pensions – all ages. ***Private occupational pensions:*** Banking sector DB schemes and other DB schemes and DC schemes financed by pension funds.	***Private individual pensions:*** Individual (non-mandatory) private pension schemes.

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Table (continued)

RO	***Public pensions Old Age Pensions*:** w 60+/63, m 65, standard contribution period w 30+/35, m 35. ***Early and Partial early retirement:*** 5 years before the statutory retirement age, provided the full contribution period is exceeded by at least 8 (for Early retirement) / less than 8 (for Partial Early retirement) years. ***Survivors pensions:*** Children and spouse. ***Disability Pension:*** Persons who lost at least half of their capacity of work. ***Private mandatory pension*** Compulsory for eligible people under the age of 35; voluntary for age group 35/45. ***Private facultative pension***	Also including farmers; military are no longer included in the projections, as from 2016 their pensions are paid from the State's Budget, instead of the State's Social Insurance Budget. No contribution period requirements for work accidents, professional disease, neoplasms, schizophrenia and AIDS. For ordinary disease and accidents not related to work, a minimum contribution period is required. Contribution up to 15% of the gross income.
SI	Old age pension (60+/40 Y of service ; 65+/min. 15 Y of insurance period) Early pension (60+/40 Y of pensionable period with purchased years) Special compulsory (occupational) pensions for workers in high-risk occupations, private and public sector Disability pensions Survival pensions Widower pensions Flat-rate pensions for farmers Pensions (supplements) for the military personnel of the Yugoslav army and retirees from other republics of former SFRY. Others Social security: annual allowance for pensioners	National (state) pensions (State budget) – from 1. June 2011 governed by public act (excluded from Pension and Disability Act) Mandatory collective supplementary pensions for public employees Non-mandatory collective supplementary pensions (private sector) - based on collective agreements Private non-mandatory individual supplementary pensions (private and public sector)

(Continued on the next page)

Table (continued)

SK	***Public pensions: old age and early pensions*** Statutory retirement age was 62 years and 76 days for men in 2017; for women it depends on the number of children and it is gradually increasing until 2024, then unified. As from 2017, the retirement age for both sexes is automatically annually increased by the y-o-y difference of 5-year moving average of the unisex life expectancy. Early retirement is possible 2 years before the statutory retirement age. ***Public pensions: other*** Disability, widows/er pensions, orphans pensions, minimum pension, Christmas bonus. ***Private mandatory pensions*** Individual funded old-age pension, covers voluntarily insured persons that decided to take part in the scheme, or those that have been included in the scheme while it was mandatory (prior to 2008) and did not exit during any of the openings (in 2008,2009,2012 and 2015).	Voluntary pension funded DC scheme introduced in 1996. Third pillar of the pension scheme. ***A special pension system of the armed forces and police.***
FI	***Public pensions: old age and early pensions*** 1) National pension (Nat. pension insurance) 62+ . Disability pension for persons aged between (16) 21 and 64 years. Old-age pension for long-term unemployed persons aged 62 years or over. Early old-age pension for persons aged 63 years or over. Old-age pension for persons aged 65 years or over. 2) Guarantee pension (guaranteed minimum amount) 65+ . 3) E-r old-age, 63+, early, private sector and the self-employed: TyEL (private sector employees), YEL (self-employed), MYEL (farmers), the public sector: JuEL (central government, municipal sector and church employees). ***Public pensions: other*** National (minimum) disability and survivors' pension, 16-64. E-r disability for 18-62 year-olds and survivors pensions, all sectors (early pensions change into old- age pensions at the age of 63 and, then, included in the above category).	*Occupational and voluntary pensions:* Collective and voluntary supplementary schemes.

(Continued on the next page)

Table (continued)

SE	***Public pensions: old age and early pensions:*** Minimum pension, housing supplement for pensioners, maintenance support for the elderly (State budget), 65+ E-r NDC old-age pensions, flexible age from 61 (including old transitional DB system), all sectors (Social insurance scheme) ***Public pensions: other*** Disability pensions, 19-64 Survivors benefits, all ages (State budget) ***Occupational pensions:*** Occupational (supplementary) DC and DB pensions, all sectors ***Private mandatory pensions:*** Individual mandatory fully funded old-age pension, flexible age from 61, all sectors (Social insurance scheme) ***Private non-mandatory pensions:*** Tax-deductible pension savings (from 2016 only deductible for self-employed).	
UK	***Public pensions (and other public) pensions: old age and early pensions*** Basic state pensions based on national insurance contributions. Winter Fuel Payments are non contributory and were introduced to give older people reassurances in keeping warm in winter without worrying about the cost. Eligibility is based on having reached women State Pension age. (It is not a pension or social assistance). Pension Credit is a non contributory means tested benefit which provides a guaranteed minimum income level for the UK's poorest pensioners and helps maintain pensioner adequacy levels in the UK. Additional State pension. State second pension (S2P)/ State earnings-related pensions (SERPS), linked to National Insurance Contributions. New state pension replacing basic and additional state pension for those reaching state pension age on or after 6 April 2016. Pension Credit will be available but is currently being reformed. Winter Fuel Payments will still be available; however this has been reformed and will only be paid in more specific circumstances. ***Public pensions: other***	***Public pensions*** Disability benefits to people below State Pension Age and for some beyond SPA. Pension Credit non contributory non taxable means tested benefit. ***Occupational schemes*** Non-mandatory occupational pensions for both private and public sector employers. Occupational schemes for public service do not form part of the UK social security system and have not been covered in the pensions projections.

(Continued on the next page)

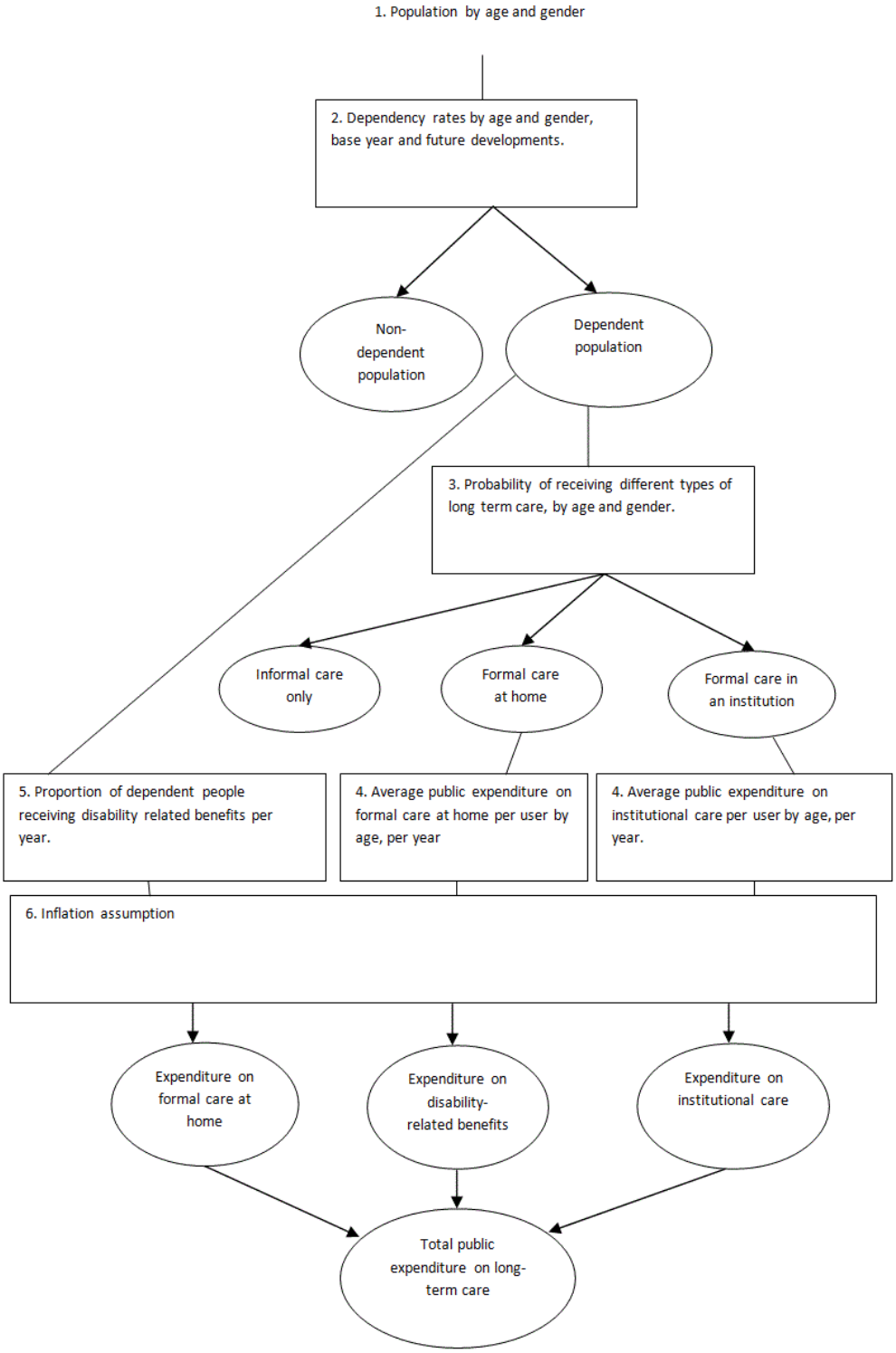
Table (continued)

NO	***Public pensions: old age and early pensions:*** Minimum income guarantee. Earnings-related benefits. ***Public pensions: other*** Disability pensions. Survivors pensions.	Central government occupational pension scheme financed by employee contributions and transfers from State budget. Supplement to public old age pension. Local government occupational pension schemes are funded schemes. Supplement to public old age pension. Mandatory private sector occupational schemes are funded defined contribution schemes. Supplement to public old age pension. Private non-mandatory defined benefits (and from 2001 also defined contribution) schemes.

Source: Commission services, EPC.

ANNEX 4
Long-term care model structure

Graph II.A4.1: **Long-term care model structure**



(1) The square boxes indicate data used in the model, while the round boxes indicate calculations that are performed for each year of the projection period.
Source: Commission services.

ANNEX 5

Sources of data to compute health care and long-term care according to data availability

Table II.A5.1: **Sources of data to compute health care and long-term care according to data availability**

Preferred solution: SHA, COFOG and ESSPROS, when data is available (CZ, DK, DE, ES, FR, HU, LV, LT, LU, NL, PT, RO, SI, FI, SE and NO)

HC	LTC (health)	LTC (social)	LTC (institutional care)	LTC (home care)	LTC (cash benefits)
SHA: HC.1 + HC.2 + HC.4 + HC.5 + HC.6 + HC.7 + HC.9 + **COFOG**: Gross capital formation in GF07 "Health" function (excluding GF0705 R&D Health).	**SHA**: HC.3	**SHA**: HCR.1	**SHA**: HC.3.1 + HC.3.2 + share of HCR.1 and HC.3.3 according to the split in benefits in-kind in **ESSPROS** data	SHA: HC.3.4 + share of HCR.1 and HC.3.3 according to the split in benefits in-kind in **ESSPROS** data	share of HCR.1 according to the split in benefits in **ESSPROS** data

Alternative: When data on HCR.1 is not available, a proxy is constructed based on ESSPROS data (AT, BE, BG, CY, EE, EL, HR, IE, IT, MT, PL, SK and UK)

HC	LTC (health)	LTC (social)	LTC (institutional care)	LTC (home care)	LTC (cash benefits)
		ESSPROS: cash and in-kind benefits according to Sickness/Health care, Disability and Old age functions, including Accommodation, Rehabilitation, Home help, Periodic care allowance, and Other benefits in-kind.			

Source: Commission Services.

Table II.A5.2: **Data sources for the health care sector-specific indexation components**

Inpatient care (curative and rehabilitative care)	Outpatient care (curative and rehabilitative care) + Ancillary services	Medical goods (pharmaceuticals and therapeutic appliances)	Preventive care	Governance and administration	Capital formation
HC.1.1 + HC.1.2 + HC.2.1 + HC.2.2	(HC.1.3 + HC.1.4 + HC.2.3 + HC.2.4) + HC.4	HC.5	HC.6	HF.7 + HF.9	GF07 "Health" function excluding GF0705 "R&D Health"
SHA (1)	SHA (1)	SHA (1)	SHA (1)	SHA (1)	COFOG
Eurostat or OECD	Eurostat or OECD	Eurostat or OECD	Eurostat or OECD	Eurostat or OECD	Eurostat

(1) COFOG categories from the GF07 "Health" function in correspondence with the respective SHA 2011 functions are used for building 10-year time series for calculation of the average annual grow rate of expenditure of the component.
Source: Commission services.

ANNEX 6
Mathematical illustration of the health care scenarios

The formal illustration of the scenarios to project public expenditure on health care are presented in the following sections.

I. Demographic scenario

The *"demographic scenario"* estimates the effect of an ageing population on future public expenditure on health care. It assumes that age/sex-specific morbidity rates and provision structure of health treatments remain constant in real terms over the whole projection period. It also assumes a gradual increase in life expectancy on the basis of underlying population projections.

To calculate future public expenditure on health care, the age/sex-specific per capita public expenditure profiles are multiplied by the respective age/sex population group in each projection year.

The age/sex specific public expenditure profiles, showing the average public spending on health care per capita for each year of age (from 0 to 100, according to data availability), are assumed to grow over time in line with GDP per capita. Therefore, the per capita cost (expenditure) in a projected year t is:

$$\begin{aligned} c^{d}_{g,a,0} &= c_{g,a,0} && t = 0 \\ c^{d}_{g,a,t} &= c^{d}_{g,a,t-1} \cdot \left(1 + \Delta Ypc_{t}\right) && t > 0 \end{aligned} \qquad \text{II.A6.1}$$

where:

d stands for demographic scenario;

$c_{g,a,t-1}$ is the cost per capita of a person of a given sex *g* and age *a* in period *t-1*;

ΔYpc_t is GDP per capita growth rate in year *t*.

$$\Delta Ypc_{t} = \left(\frac{Y_t}{P_t} - \frac{Y_{t-1}}{P_{t-1}}\right) \Big/ \left(\frac{Y_{t-1}}{P_{t-1}}\right) \qquad \text{II.A6.2}$$

with Y_t *and* P_t representing GDP and total population in projection year *t*;

Hence, this "adjusted" per capita unit cost, $c^{d}_{g,a,t}$, is the cost per capita of a person of sex *g* and age *a* in year *t* of the projection period, following the adjustment to GDP per capita growth.

Next, in each year the respective unit cost is multiplied by the projected population of each age group (using the baseline population projections) to obtain the total public spending for each age/sex group:

$$S^{d}_{g,a,t} = c^{d}_{g,a,t} \cdot p_{g,a,t} \qquad \text{II.A6.3}$$

where:

$S^{d}_{g,a,t}$ is public spending on health care for all persons of sex *g* and age *a* in year *t*.

Last, the resulting total public spending on health care is divided by the projected GDP in order to obtain the public health care expenditure as a percentage of GDP:

$$T^{d}_{t} = \frac{\sum S^{d}_{g,a,t}}{Y_t} \qquad \text{II.A6.4}$$

where:

T^{d}_{t} is the ratio of total public spending on health care to GDP in year *t* computed according to the pure demographic scenario.

II. High life expectancy scenario

The "*high life expectancy scenario*" is a sensitivity test to measure the impact of alternative assumptions on mortality rates. It assumes that life expectancy at birth in 2070 exceeds the projected life expectancy used in the "*demographic scenario*" by 2 years. This scenario is methodologically identical to the "*demographic scenario*", but alternative demography and GDP data are used ([124]). Therefore, the mathematical formulation used in the previous scenario still applies, except that the number of individuals in

([124]) Since GDP data also captures the life expectancy change through the impact of the latter on the labour force projections.

each age/sex group up to 2070 is replaced by the new population and macroeconomic assumptions.

III. Constant health scenario

The "*constant health scenario*" is based on the *relative compression of morbidity* hypothesis, meaning that health status is improving in line with declines in mortality rates and increasing life expectancy. It assumes that the number of years spent in bad health during a life time remains constant over the whole projection period. Consequently, the morbidity rate and therefore the age/sex-specific per capita public expenditure profiles are declining with the mortality rate.

This scenario starts with calculating, for each projection year, the change in life expectancy in relation to the base year. The change in life expectancy of a person of sex *g* and age *a* in relation to the base year (say, 2016) for each year of the projections, using the Eurostat population projections 2015 ([125]) is given by:

$$\Delta LE_{g,a,t,2016} = LE_{g,a,t} - LE_{g,a,2016} \qquad \text{II.A6.5}$$

where:

$\Delta LE_{g,a,t,2016}$ is the additional life expectancy of a person of sex *g* and age *a* in year *t* compared to a person of sex *g* and age *a* in 2016;

$LE_{g,a,t}$ is the life expectancy of a person of sex *g* and age *a* in year *t;* and

$LE_{g,a,2016}$ is the life expectancy of a person of sex *g* and age *a* in 2016.

Then, for each year *t*, the projected per capita cost equals:

$$\begin{aligned} c^{ch}_{g,a,0} &= c_{g,a,0} && t = 0 \\ c^{ch}_{g,a,t} &= c^{ch}_{g,a,t-1} \cdot \left(1 + \Delta Ypc_t + \Delta c_{g,0,a-\Delta LE_t}\right) && t > 0 \end{aligned} \qquad \text{II.A6.6}$$

where:

ch stands for constant health scenario;

$c^{ch}_{g,a,t}$ is the cost per capita assigned to a person of sex *g* and age *a* in year *t* of the projection period; and

$\Delta c_{g,0,a-\Delta LEt}$ is the growth rate in costs per capita due to the change in life expectancy between year 0 and projection year t.

$$\Delta c_{g,0,a-\Delta LE_t} = \left(c_{g,0,a-\Delta LE_{g,a,t,2016}} - c_{g,0,a}\right) \Big/ \left(c_{g,0,a}\right) \qquad \text{II.A6.7}$$

where:

$c_{g,0,a-\Delta LE_{g,a,t,2016}}$ is the cost per capita assigned to a person of sex *g* and of age *a* in the base year 2016 minus the years gained in life expectancy by a person of sex *g* and age *a* between year *t* and year 2016, as defined in equation II.A6.5 and specified with a precision to a decimal part of a year in the base year 2016 ([126]). This is done only for those sections of the age-profile where the cost per capita is growing ([127]).

The cost per capita is further adjusted to reflect changes in income per capita over the years using the same indexation system as in the previous

([125]) In the *"constant health scenario"* the total number of years spent in bad health during a person's life time is assumed to remain constant while life expectancy increases, so the morbidity rate must evolve in line with mortality rate for each age cohort. Thus, if between time *t* and *t+1*, total life expectancy increases by *n* years for a cohort of age *a*, healthy life expectancy for that very same age cohort must also increase by *n* years, as assumed by the relative *compression of morbidity hypothesis*. If healthy life expectancy increases by *n* years, then the health status (and consequently health care spending) of this cohort of age *a* at time *t+1* will be the same as the health status (and health care spending) of cohort of age *a-n* at time *t*.

([126]) Changes in life expectancy and therefore shifts in the age profile from one year to another are sometimes very small (in a range of a tenth part of a year). However, the data gathered by the Member States does not provide detailed information on costs per capita by single year of age (the most detailed item available is a 5-year average), so an additional calculation needs to be performed. To solve this problem, the intermediate values can be obtained by simple extrapolation/trend-smoothening method from the existing average figures. In this way it is possible to assign a concrete value of cost per capita to each tenth part of a year of age.

([127]) For the young and the oldest old the reference age remains the same over the whole projection period.

scenario i.e. cost per capita grows in line with GDP per capita growth.

As before, in each year the respective unit cost is multiplied by the projected population in each age group age (using the baseline population projections) to obtain the total public spending for each age/sex group:

$$S^{ch}_{g,a,t} = c^{ch}_{g,a,t} \cdot p_{g,a,t} \qquad \text{II.A6.8}$$

where:

$S^{ch}{}_{g,a,t}$ is public spending on health care for all persons of sex *g* and age *a* in year *t*.

Next, the resulting total public spending on health care is divided by the projected GDP in order to obtain the public health care expenditure as a percentage of GDP:

$$T^{ch}_{t} = \frac{\sum S^{ch}_{g,a,t}}{Y_t} \qquad \text{II.A6.9}$$

where:

$T^{ch}{}_{t}$ is the ratio of total public spending on health care to GDP in year *t*.

IV. Death-related costs scenario

The "*death-related costs scenario*" links per capita public expenditure on health care to the number of remaining years of life. It reflects empirical evidence which suggests that a large share of the total expenditure on health care during a person's life is concentrated in the final years of life ([128]).

In this scenario, the population of each sex-age group is divided into subgroups according to the number of remaining years of life using mortality rate as a weighting factor. In this case the groups are: those supposed to die within a year, the decedents, and those who do not, the survivors.

Each subgroup is assigned a different unit cost, being an adjustment of the "normal" unit cost with the ratio of health care expenditure borne by a person of a given age and sex who is in her terminal phase of life to health care expenditure borne by a survivor. The number of people in each subgroup is thus multiplied by its respective cost per capita to get the total spending of each subgroup. The sum of total spending borne by the two subgroups is the total spending on health care in a given year.

Mathematically, we have the following formulation:

We divide people of the same age and sex into the groups of survivors and those supposed to die within a year. The costs of the decedents-death related costs – are labelled with $\psi^{DR}_{g,a,t}$, and the costs for the survivors – normal costs – are labelled with $\psi^{NC}_{g,a,t}$, where *g*, *a* and *t* refer, respectively, to sex, age and year. With $\mu_{g,a,t}$ being the probability of death within a year in year t, we get:

$$\begin{aligned}\psi_{g,a,t} &= \psi^{NC}_{g,a,t} \cdot \left(1-\mu_{g,a,t}\right) + \psi^{DR}_{g,a,t} \cdot \mu_{g,a,t} \\ &= \psi^{NC}_{g,a,t} \cdot \left(1-\mu_{g,a,t} + k_{g,a,t} \cdot \mu_{g,a,t}\right)\end{aligned} \qquad \text{II.A6.10}$$

where: $k_{g,a,t} = \psi^{DR}_{g,a,t} / \psi^{NC}_{g,a,t}$ is the k-ratio. It estimates, for a given sex and age, how many times the health care costs of decedents exceed those of a survivor. If $k_{g,a,t}$=1, then death-related costs do not matter, while with k going toward infinity means that total health care costs are spent in the last life year.

If one assumes a constant k-ratio over time (*t = 0*), the health care costs would vary along with changes in the probabilities of death:

$$\psi_{g,a,t} = \psi^{NC}_{g,a,0} \cdot \left(1-\mu_{g,a,t} + k_{g,a,0} \cdot \mu_{g,a,t}\right) \qquad \text{II.A6.11}$$

Taking into account that costs of survivors can be derived from the total one, according to the following equation:

$$\psi^{NC}_{g,a,t} = \psi^{NC}_{g,a,0} = \frac{\psi_{g,a,0}}{1-\mu_{g,a,0} + k_{g,a,0} \cdot \mu_{g,a,0}} \qquad \text{II.A6.12}$$

([128]) For an overview of empirical studies, see Raitano (2006).

equation II.A6.10 becomes:

$$\psi_{g,a,t} = \psi_{g,a,0} \frac{1-\mu_{g,a,t}+k_{g,a,0}\cdot\mu_{g,a,t}}{1-\mu_{g,a,0}+k_{g,a,0}\cdot\mu_{g,a,0}} \quad \text{II.A6.13}$$

Equation II.A6.13 shows how the age-sex specific health care cost profile evolves, keeping the k-ratio unchanged with respect to the base year.

However, as shown by Aprile (2013), the empirical evidence strongly suggests a changing *k-ratio* as a function of changes in life expectancy.

As stated in the above mentioned paper, the following potential function approximates well the empirical observations:

$$k = 1+\lambda\cdot LE^{\phi} \quad \text{II.A6.14}$$

according to which *k* is positively correlated with life expectancy and is 1 when life expectancy is nil ([129]). Then, assuming the constant coefficients of the function over time, one may derive the relation between the *k-ratio* and age conditional on life expectancy as follows:

$$k_{g,a,t} = k_{g,a,0}\cdot\frac{f(g,a,t,LE_t)}{f(g,a,0,LE_0)} \quad \text{II.A6.15}$$

where $k_{g,a,0}$ is the value of *k-ratio* in the base year at the age *a*, and *f(g,a,t,LE)* is the fitted function.

As can be seen, *k-ratio* is projected according to a cohort approach, starting from the base-year value at the age a being positively correlated with changes in life expectancy. If no change occurs in life expectancy, the age profile of *k-ratio* is the same as in the base year.

Combining equations II.A6.13 and II.A6.15, the age profile of health care costs is projected according to the following equation:

$$\psi_{g,a,t} = \psi_{g,a,0}\frac{1+\mu_{g,a,t}\cdot k_{g,a,0}\cdot\frac{f(g,a,t,LE_t)}{f(g,a,0,LE_0)}-\mu_{g,a,t}}{1+\mu_{g,a,0}\cdot k_{g,a,0}-\mu_{g,a,0}} \quad \text{II.A6.16}$$

As previously, the age-sex specific costs are adjusted to the GDP per capita growth and summed up over the entire population for each respective year to arrive at total costs.

V. Income elasticity scenario

The *"income elasticity scenario"* captures the effect of changes in national income on demand for health care goods and services. More specifically, this scenario shows the effect of an income elasticity of demand higher than 1, i.e. ε = 1.1, on the evolution of public expenditure on health care. It assumes that economic growth and process of real convergence between countries over the long run will drive elasticity down towards common unity level, by 2070 ([130]).

This scenario is identical to the "*demographic scenario"* except that the income elasticity of demand is set equal to 1.1 in the base year (rather than 1 in the case of the *"demographic scenario"*), converging in a linear manner to 1 by the end of projection horizon in 2070.

The methodology used to project health care spending is the same as for the "*demographic scenario*", except in the way per capita public expenditure on health care is evolving over the projection period. Income elasticity is taken into account by replacing equation II.A6.1 by the following equation II.A6.17, so that the per capita cost of a person of sex *g* and age *a* in year *t* of the projection period, $c^{ie}_{g,a,t}$, is adjusted to the GDP per capita growth with an elasticity that goes from 1.1 to 1 in 2070:

$$\begin{aligned} c^{ie}_{g,a,0} &= c_{g,a,0} && t = 0 \\ c^{ie}_{g,a,t} &= c^{ie}_{g,a,t-1}\cdot\left(1+\Delta Ypc_t\cdot\varepsilon_t\right) && t > 0 \end{aligned} \quad \text{II.A6.17}$$

where:

ie stands for "*income elasticity*" scenario;

([129]) With this function the death-related cost profile is also smoothened, thereby decreasing spurious volatility especially in young age cohorts.

([130]) This is also a common technical assumption in many long-run projection models, to avoid "explosive" path of some of the variables used in the exercise.

$c^{ie}_{g,a,t-1}$ is the cost per capita of a person of sex *g* and age *a* in year *t-1* in scenario *"income elasticity"*;

ΔYpc_t is GDP per capita growth rate in year *t*;

ε_t is income elasticity of demand, assumed to converge from ε_{2016} to ε_{2070} in 2070 according to the following equation:

$$\varepsilon_t = \varepsilon_{2016} - (t-2016)\cdot\frac{\varepsilon_{2016}-\varepsilon_{2070}}{2070-2016} \qquad \text{II.A6.18}$$

In the specific case where the income elasticity of demand converges from 1.1 in 2016 to 1 in 2070, the value will be the following:

$$\varepsilon_t = 1.1-(t-2016)\cdot\frac{0.1}{54} \qquad \text{II.A6.19}$$

The other steps of the projections are the same as in equations II.A6.3 and II.A6.4.

VI. EU28 cost convergence scenario

The "*EU28 cost convergence scenario*" captures the possible effect of an upward convergence in real living standards on health care spending, resulting from a convergence of citizens' expectations towards a similar basket of (health) goods. It considers the convergence by 2070 of all countries that, in the base year, are below the EU28 average in terms of percent of GDP per capita health expenditure to that average.

To project public spending on health care, we build on the methodology used for the "*demographic scenario*". Indeed, for those countries whose age/sex per capita public expenditure as a share of GDP per capita (relative per capita spending) is equal to or above the EU28 average (relative per capita spending), equations II.A6.1 to II.A6.4 from the demographic scenario to project public spending on health care are used.

For those countries whose age/sex per capita public expenditure as a share of GDP per capita is below the EU28 average in the baseline year of 2016, we assume a different evolution path for this variable. We assume it evolves over the projection period so as to reach the EU28 average in 2070.

The real convergence to EU28 average is assumed to follow the following path, based on an adjustment of equation II.A6.1 of the demographic scenario:

$$\begin{aligned} c^{cc}_{g,a,0,i} &= c_{g,a,0,i} && t = 0 \\ c^{cc}_{g,a,t,i} &= c^{cc}_{g,a,t-1,i}\cdot\left(1+\Delta Ypc_{t,i}+m_{g,a,i}\right) && t > 0 \end{aligned} \qquad \text{II.A6.20}$$

where:

cc stands for cost convergence;

$C^{CC}_{g,a,t,i}$ is cost per capita of a person of sex *g* and age *a* in year *t* of the projection period, in country *i*, adjusted to the GDP per capita growth and a catch-up effect if country *i* is below the EU28 average;

$\Delta Ypc_{t,i}$ is GDP per capita rate growth in year *t* of country *i;* and

$m_{g,a,i}$ is a hypothetical rate of growth of per capita costs, which is higher than zero for those countries below the EU28 average, and equal to zero for those countries at or above the EU28 average. To close the gap, $m_{g,a,i}$ is assumed to be constant in time and equal to ([131]):

$$m_{g,a,i} = \left[\left(\frac{\overline{rc}_{g,a,EU\,28,2016}}{rc_{g,a,i,2016}}\right)^{\frac{1}{2070-2016}}\right]-1 \qquad \text{II.A6.21}$$

if $\overline{rc}_{g,a,EU\,28,2016} \geq rc_{g,a,i,2016}$

where:

$\overline{rc}_{g,a,EU\,28,2016}$ is the weighted EU28 average relative cost per capita of sex *g* and age *a* calculated in the baseline year of 2016; and $\overline{rc}_{g,a,i,2016}$ is the relative cost per capita of sex *g* and age *a* for country *i* (if below the EU28 average cost per capita) calculated in the baseline year of 2016 defined as:

([131]) Assumptions for different convergence paths according to the initial country-specific situation - comparing to the EU28 average age profile - will be explored further as soon as data is made available to calculate the new age profiles.

$$rc_{g,a,i,2016} = \left(\frac{c_{g,a,i,2016}}{Ypc_{g,a,i,2016}} \right)$$ and

$$\overline{rc}_{g,a,EU28,2016} = \left(\frac{\bar{c}_{g,a,EU28,2016}}{\overline{Ypc}_{g,a,EU28,2016}} \right)$$

where $\bar{c}_{g,a,EU28,2016}$ is the weighted EU28 average cost per capita of sex *g* and age *a* calculated in the baseline year of 2016; and $\overline{Ypc}_{g,a,EU28,2016}$ is the average GDP per capita in the EU28 calculated in the baseline year of 2016.

After country-specific per capita cost has been calculated, corresponding equations II.A6.3 and II.A6.4 are used to obtain total age/sex group expenditure and total public expenditure on health care in each projection year.

VII. Labour intensity scenario

The "*labour intensity scenario*" estimates the evolution of public expenditure on health care taking into account that health care is and will remain a highly labour-intensive sector. In practical terms, this scenario is similar to the "*demographic scenario*" except that unit costs are assumed to evolve in line with the evolution of GDP per hours worked. Therefore, the growth in GDP per capita is replaced by the growth in GDP per hours worked, so that equation II.A6.1 becomes:

$$\begin{aligned} c^{li}_{g,a,0} &= c_{g,a,0} && t = 0 \\ c^{li}_{g,a,t} &= c^{li}_{g,a,t-1} \cdot \left(1 + \Delta Yphw_t\right) && t > 0 \end{aligned} \qquad \text{II.A6.22}$$

where:

li stands for "*labour intensity*" scenario;

$\Delta Yphw_t$ is the rate of growth of GDP per hours worked in year *t*

$$\Delta Yphw_t = \left(\frac{Y_t}{HW_t} - \frac{Y_{t-1}}{HW_{t-1}} \right) \Big/ \left(\frac{Y_{t-1}}{HW_{t-1}} \right) \qquad \text{II.A6.23}$$

where *HW* stands for total hours worked.

Corresponding equations II.A6.3 and II.A6.4 are then used to calculate total age/sex group expenditure and total public expenditure on health care in each projection year.

VIII. Sector-specific composite indexation scenario

The *"sector-specific composite indexation scenario"* presents the special character of the health care sector (high level of government regulation, investment in new technologies, high labour intensity), and uses sector-specific elements as unit costs determinants in the model.

This scenario considers that expenditure on health care can be disaggregated in its different components, broadly reflecting the different sectors of the health system: 1) inpatient care, 2) outpatient care and ancillary services, 3) pharmaceuticals and therapeutic appliances, 4) preventive care, 5) capital investment, and 6) other factors. The different components are treated separately and indexed in a separate/different way, creating a sort of composite indexation for "unit cost development".

In mathematical terms, the different steps of this scenario are as follows: The share of each of the six components in total public expenditure on health care in each year *t* of available data, up to the baseline year of 2016 is calculated as follows:

$$s_{i,t} = \frac{PE_{i,t}}{\sum_{i=1}^{6} PE_{i,t}} \qquad \text{II.A6.24}$$

where $S_{i,t}$ is the share of public expenditure on component or input *i* at each time *t* to total public expenditure on health care,

$PE_{i,t}$ is total public expenditure on component *i* at each time *t* and

$\sum_{i=1}^{6} PE_{i,t}$ is total public expenditure on health care expressed as the sum of the public expenditure on each of the six components.

The average share of the ten past observations, up to the latest available data, $\bar{s}_i$ of each component is calculated as

$$\bar{s}_i = \frac{\sum_{t=0}^{-9} s_{i,t}}{10} \qquad \text{II.A6.25}$$

These average shares are combined with the age/sex-specific per capita expenditure in 2016 so that this is the sum of the expenditure on the above six components

$$c_{g,a,2016} = \sum_{i=1}^{6} \bar{s}_i \cdot c_{g,a,2016} \qquad \text{II.A6.26}$$

We can define the cost per capita in each subsector as

$$c_{g,a,i,2016} = \bar{s}_i \cdot c_{g,a,2016} \qquad \text{II.A6.27}$$

To calculate the annual growth rate of public expenditure for each of the six components, the growth rate of public expenditure for component *i* at time *t* of available data up to the baseline year of 2016 included is:

$$\Delta PE_{i,t} = \left(\frac{PE_{i,t} - PE_{i,t-1}}{PE_{i,t-1}} \right) \qquad \text{II.A6.28}$$

and the average annual growth rate of public expenditure for component *i* for the last past 10 years where available, which is:

$$\overline{\Delta PE}_i = \frac{\sum_{t=0}^{-9} \Delta PE_{i,t}}{10} \qquad \text{II.A6.29}$$

Now, recall that the annual growth rate of GDP per capita is ΔYpc_t as defined in equation II.A6.2. We then calculate the average annual growth rate of GDP per capita for the ten years (2006-2015) as

$$\overline{\Delta Ypc} = \frac{\sum_{t=0}^{-9} \Delta Ypc_t}{10} \qquad \text{II.A6.30}$$

The ratio of average annual grow rate of expenditure on each component to the average annual growth rate of GDP per capita is calculated by dividing equation II.A6.29 by equation II.A6.30.

Following these calculations the per capita cost is assumed to evolve in the following manner in equation II.A6.31:

$$\begin{aligned} c^{di}_{g,a,i,0} &= \bar{s}_i \cdot c_{g,a,0} && t = 0 \\ c^{di}_{g,a,i,t} &= c^{di}_{g,a,i,t-1} \cdot \left(1 + \frac{\overline{\Delta PE}_i}{\overline{\Delta Ypc}} \cdot \Delta Ypc_t \right) && t > 0 \\ c^{di}_{g,a,t} &= \sum_{i=1}^{6} \left(c^{di}_{g,a,i,t} \right) \end{aligned} \qquad \text{II.A6.31}$$

where:

di stands for decomposed indexation scenario; and

ΔYpc_t is the GDP per capita rate of growth in year *t* for each country.

Each of the six ratios of growth rates (the ratio of $\overline{\Delta PE}_i$ to $\overline{\Delta Ypc}$) converges to 1 by a specified date, 2070. Again, corresponding equations II.A6.3 and II.A6.4 are then used to calculate total age/sex group expenditure and total public expenditure on health care in each projection year.

IX. Non-demographic determinants scenario

The *"non-demographic determinants scenario"* shows the effect of other health care spending drivers next to population's ageing, such as income, technology, relative prices and institutional settings. These factors have been identified as the main drivers of healthcare

expenditure growth by several econometric studies ([132]).

This scenario uses panel regression techniques to estimate country-specific non-demographic cost (NDC) of healthcare. NDC is defined as the excess of growth in real per-capita healthcare expenditure over the growth in real per-capita GDP after controlling for demographic composition effects. Alternatively, results can also be expressed in terms of "average" country specific income elasticities of healthcare expenditure.

This scenario is similar to the "income elasticity scenario" with the two exceptions being that the elasticity of demand is set equal to 1.4 in the base year (rather than 1.1 in the case of the "income elasticity scenario") and that its convergence to 1 by the end of projection horizon in 2070 follows a non-linear path.

X. AWG reference scenario

The *"AWG reference scenario"* is the central scenario used when calculating the overall budgetary impact of ageing. Formally, it builds on the "*income elasticity scenario*", combining it with age/sex specific expenditure profiles intermediate between the "*demographic scenario*" and the "*constant health scenario*", driven by the assumption that half of the future gains in life expectancy are spent in good health.

XI. AWG risk scenario

The "*AWG risk scenario*", follows the same approach as described in the "*non-demographic determinants scenario*" in combination with the assumption that half of the future gains in life expectancy are spent in good health, an intermediate approach to the age/sex specific expenditure profiles between the "*demographic scenario*" and the "*constant health scenario*".

XII. AWG total factor productivity (TFP) risk scenario

The *"Total factor productivity risk scenario"* explores the risk that Total Factor Productivity growth may decline in the future below the assumptions of the "*AWG reference scenario*". It assumes that TFP converges to a growth rate of 0.8% vs 1% for the "*AWG reference scenario*". In both cases, allowance for higher TFP growth for countries with below average GDP per capita is factored in for a period of time, as in the previous projection exercise, to reflect the potential that these countries have for a catching-up with the rest.

([132]) Maisonneuve and Martins (2013), "A projection method of public health and long-term care expenditures", OECD Economic Department WP No. 1048.

ANNEX 7
Mathematical illustration of the long-term care scenarios

General definitions

Let us define $N_{g,a,t}$ the population of a given sex *g* and age *a* in year *t*. Following the main steps of the general methodology process presented in the chapter on long-term care, the following definitions are derived.

STEP 1: dependent / non-dependent population

The ratio of dependent (resp. non-dependent) persons in the base year *t=b* (e.g. 2016) is derived from the EU-SILC data, for each age – actually, 5-year age groups (15+) – and sex group: $d_{g,a,b}$ (resp. *1-* $d_{g,a,b}$). The average dependency rates for the last 5 years are being used, based on data availability. Therefore, the projected dependent population of a given sex *g* and age *a* in a projected year *t* is:

$$D_{g,a,t} = d_{g,a,b} \cdot N_{g,a,t} \qquad \text{II.A7.1}$$

STEP 2: split into types of care

To be able to differentiate the impact of different scenarios according to the respective behaviour of the different types of care, one needs to split the projected dependent population into three groups: those receiving formal care at home, those receiving formal care in institutions, and those receiving only informal care. The category of those receiving cash benefits will be considered at a later stage, given that age profiles for this category of long-term care benefits are not available.

Therefore, one defines $DFh_{g,a,t}$, $DFi_{g,a,t}$, $DI_{g,a,t}$ the projected dependent population of a given sex *g* and age *a* in a projected year *t* receiving respectively formal care at home (*DFh*), formal care in institutions (*DFi*), and informal care (*DI*), as follows:

$$DFh_{g,a,t} = D_{g,a,t} \cdot p^{Fh}_{g,a,0} \qquad \text{II.A7.2}$$

$$DFi_{g,a,t} = D_{g,a,t} \cdot p^{Fi}_{g,a,0} \qquad \text{II.A7.3}$$

$$DI_{g,a,t} = D_{g,a,t} \cdot (1 - p^{Fh}_{g,a,0} - p^{Fi}_{g,a,0}) \qquad \text{II.A7.4}$$

Where $p^{Fh}_{g,a,0}$ is the probability for a dependent person of sex *g* and age *a* to receive formal care at home, in the base year *0* (e.g. 2016). Similarly, $p^{Fi}_{g,a,0}$ is the correspondent probability of being taken care of formally in institutions, while $p^{I}_{g,a,0}$ – the probability of being take care of informally – is defined as not receiving any formal care service.

STEP 3: age-sex profiles of expenditure

Average expenditure is calculated for a base year *0*, to define the long-run unit costs of services. If the data is available (through the SHA joint questionnaire and/or provided by Member States), unit costs for formal care at home and formal care in institutions are calculated separately([133]):

$$c^{Fh}_{g,a,0} = \frac{S^{Fh}_0}{N^{Fh}_{g,a,0}} \qquad \text{II.A7.5}$$

where: S^{Fh}_0 is public spending on formal care at home in the base year (e.g. 2016); and $N^{Fh}_{g,a,0}$ is the number of recipients of a given sex *g* and age *a* of formal care at home, for the same year.

Similarly, the unit cost per beneficiary of a given sex *g* and age *a* of formal care in institution is:

$$c^{Fi}_{g,a,0} = \frac{S^{Fi}_0}{N^{Fi}_{g,a,0}} \qquad \text{II.A7.6}$$

Note that two adjustments are made to the derived unit costs. The first one applies when age profiles are not provided separately for the two types of formal care. The age profiles provided by Member States for public expenditure on formal care services are then used in order to "re-calibrate" the unit costs. In other words, the relative size of the amounts provided for each sex/age group is

([133]) Otherwise, an average is used.

applied to respective "total" public expenditure aggregates of formal care at home (S^{Fh}_0) and formal care in institutions (S^{Fi}_0).

In other words, adjusted unit costs follow the actual sex-age structure of unit costs, as provided by Member States in country-specific age-profiles. For a country *i*, age profiles provide the relative size of unit cost per beneficiary of a given sex *g* and age *a* of formal care as a proportion x^{PF} – where *P* stands for "profiles" and *F* for "formal" – such as:

$$x^{PF}_{g,a,0} = \frac{c^{PF}_{g,a,0}}{S^{PF}_0 / N_0}$$

and

$$\sum_{g,a} x^{PF}_{g,a,0} = 1$$

The unit costs adjusted to the age profiles are therefore calculated as:

$$c^{AFh}_{g,a,0} = x^{PF}_{g,a,0} \cdot \frac{S^{Fh}_0}{N^{Fh}_{g,a,0}}, \text{ and:}$$

$$c^{AFi}_{g,a,0} = x^{PF}_{g,a,0} \cdot \frac{S^{Fi}_0}{N^{Fi}_{g,a,0}}$$

Second, the unit costs evolve in time with the GDP growth, as will be explained in the next section of this annex (see equation II.A7.10).

STEP 4: total public expenditure on long-term care services

For a projected year *t*, public spending on both types of formal care is then computed as:

$$TS^{Fh}_{g,a,t} = c^{AFh}_{g,a,t} \cdot DFh_{g,a,t} \qquad \text{II.A7.7}$$

where: $TS^{Fh}_{g,a,t}$ (resp. $TS^{Fi}_{g,a,t}$) is public spending on formal care at home (resp. in institution) for all persons of sex *g* and age *a* in year *t*.

Hence, for all age and sex groups:

$$TS^{Fh}_t = \sum TS^{Fh}_{g,a,t}$$

and

$$TS^{Fi}_t = \sum TS^{Fi}_{g,a,t} \qquad \text{II.A7.8}$$

STEP 5: total public expenditure on long-term care (services and cash)

Therefore, total public expenditure on both types of formal long-term care services are added to long-term care related cash benefit expenditure, so as to obtain TS^{LTC}_t for a projected year *t*:

$$TS^{LTC}_t = TS^{Fh}_t + TS^{Fi}_t + TS^{C}_t \qquad \text{II.A7.9}$$

Where TS^{C}_t is projected in a similar manner to expenditure on in-kind benefits([134]).

These general definitions apply to the general, "basic" model structure. In order to run more accurate scenarios, general and scenario-specific assumptions are being applied. These assumptions are illustrated in the following section.

Assumptions for the different scenarios

I. Demographic scenario

As mentioned above, the first assumption added to the general model is the following: for the time horizon of the projection exercise, the age-sex specific public expenditure profiles (showing the average public spending on long-term care per beneficiary for each year of age – or 5-year age group, from 15 to 85+ or more, according to data

([134]) The projection of cash benefit expenditure is illustrated in less detail than that for in-kind benefits due to the fact that the data on recipients is less readily available and therefore the profile is often assumed to be the same as that for in-kind care.

availability) are assumed to grow in line with income, i.e. with GDP per capita ([135]).

Therefore, the adjusted per beneficiary cost (expenditure) in a projected year *t* is:

$$\begin{aligned} c'^{F}_{g,a,0} &= c^{AF}_{g,a,0} \qquad t=0 \\ c'^{F}_{g,a,t} &= c'^{F}_{g,a,t-1} \cdot (1+\Delta Ypc_t) \qquad t>0 \end{aligned} \qquad \text{II.A7.10}$$

where:

$c'^{F}_{g,a,t}$ is the cost per beneficiary of a given sex *g* and age group *a* in period *t* of formal care *F – Fh* for formal care at home, *Fi* for formal care in institution;

ΔYpc_t is GDP per capita growth rate in year *t*, i.e.:

$$\Delta Ypc_t = \left(\frac{Y_t}{P_t} - \frac{Y_{t-1}}{P_{t-1}}\right) \Big/ \left(\frac{Y_{t-1}}{P_{t-1}}\right) \qquad \text{II.A7.11}$$

with Y_t *and* P_t representing GDP and total population in projection year *t*;

Hence, the adjusted per beneficiary cost, $c'^{F}_{g,a,t}$, is the formal care cost per beneficiary of a person of sex *g* and age *a* in year *t* of the projection period, following the adjustment to GDP per capita growth.

Equation II.A7.7 above becomes II.A7.7' as the adjusted unit cost *c'* is considered, i.e.:

$$TS^{Fh}_{g,a,t} = c'^{Fh}_{g,a,t} \cdot DFh_{g,a,t} \qquad \text{II.A7.7'}$$

And of course, for formal care in institution:

$$TS^{Fi}_{g,a,t} = c'^{Fi}_{g,a,t} \cdot DFi_{g,a,t} \qquad \text{II.A7.7'b}$$

Similarly for cash benefits, total public spending becomes TS'^{C}_{t}, and an adapted equation II.A7.9 gives adjusted total public spending on long-term care, i.e.:

$$TS'^{LTC}_{t} = TS'^{Fh}_{t} + TS'^{Fi}_{t} + TS'^{C}_{t} \qquad \text{II.A7.9'}$$

II. Base case scenario

For the "*base case scenario*", the assumption on unit cost development is slightly different from the "*demographic scenario*". Indeed, it has been agreed to differentiate two kinds of unit costs. The projections will link unit cost to GDP per hours worked ([136]) for in-kind benefits (services), while unit cost of cash benefits will evolve in line with GDP per capita growth. Therefore, the age-sex specific public expenditure profiles are assumed to grow in line with:

1) GDP per capita for cash benefits;

2) GDP per hours worked for benefits in kind.

The situation is unchanged for cash benefits, i.e. TS'^{C}_{t}, whereas GDP per hours worked will be used to adjust total public spending on formal care services. Equation II.A7.10 becomes:

$$\begin{aligned} c''^{Fc}_{g,a,0} &= c^{Fc}_{g,a,0} \\ c''^{Fc}_{g,a,t} &= c''^{Fc}_{g,a,t-1} \cdot (1+\Delta Yphw_t) \end{aligned} \qquad \text{II.A7.10'}$$

where:

$\Delta Yphw_t$ is the rate of growth of GDP per hours worked in year *t*,

$$\Delta Yphw_t = \left(\frac{Y_t}{HW_t} - \frac{Y_{t-1}}{HW_{t-1}}\right) \Big/ \left(\frac{Y_{t-1}}{HW_{t-1}}\right) \qquad \text{II.A7.12}$$

where *HW* stands for total hours worked.

([135]) Alternative indexation assumptions in order to reflect the institutional set-up of specific EU Member States are discussed in Chapter 3 of Section II.

([136]) GDP per hours worked is used, similar to the previous ageing report, to stay in line with the macroeconomic assumptions and the other parts of the projections.

Corresponding equations II.A7.7 and II.A7.7'b are then used and coupled with TS'^{C}_{t} as calculated in the "*demographic scenario*" to calculate total age/sex group expenditure and total public expenditure on long term care in each projection year.

$$TS''^{LTC}_{t} = TS''^{Fh}_{t} + TS''^{Fi}_{t} + TS'^{C}_{t} \qquad \text{II.A7.9''}$$

III. High life expectancy scenario

The "*high life expectancy scenario*" presents the budgetary effects of an alternative demographic scenario which assumes life expectancy to be higher for all ages than in the *demographic* and in the *base case* scenarios. In terms of methodology, the scenario does not differ from the "*base case scenario*", apart from the fact that the baseline demographic projections used as input data are replaced with the alternative, high life expectancy, variant (the same used to assess the sensitivity of pension spending). Therefore, the mathematical illustration of the previous scenario only changes in $N_{g,a,t}$, i.e. the number of individuals in each age/sex group up to 2070 (replaced by the new population assumptions in equation II.A7.1 and II.A7.11).

IV. Constant disability scenario

This scenario reflects an alternative assumption about trends in age-specific ADL-dependency rates. The profile of age-specific disability rates shifts in line with changes in life expectancy (disability rate in the future is equal to that of a younger - by the same number of years as the change in age-specific life expectancy - age cohort today), resulting in a gradual decrease over time in disability prevalence for each age cohort, i.e. affecting the variable $D_{g,a,t}$.

In practical terms, it follows the same reasoning as for the similar health care "*constant health scenario*". One starts by calculating, for each projection year, the change in life expectancy in relation to the base year. For example, life expectancy for a 50-year-old man is expected to increase by, say, 4 years: from 30 years in year *t* to 34 years in year *t+20* in a specific Member State. Then, the scenario assumes that in *t+20*, in that same Member State, a 50-year-old man will have a disability prevalence of a (50-4) = 46-year old man in year *t*.

Hence, the change in life expectancy of a person of sex *g* and age *a* in relation to the base year (say, 2016) is first calculated for each year of the projections, using the Eurostat population projections ([137]):

$$\Delta LE_{g,a,t,0} = LE_{g,a,t} - LE_{g,a,0} \qquad \text{II.A7.13}$$

where:

$\Delta LE_{g,a,t,0}$ is the additional life expectancy of a person of sex *g* and age *a* in year *t* compared to a person of sex *g* and age *a* in the base year,

$LE_{g,a,t}$ is the life expectancy of a person of sex *g* and age *a* in year *t* and

$LE_{g,a,0}$ is life expectancy of an average person of sex *g* and age *a* in the base year.

For year *t* of the projections, the "adjusted" disability prevalence for the cohort of sex *g* and age *a* is then based on equation II.A7.1 adjusted such as:

$$D'_{g,a,t} = d_{g,a-\Delta LE_{g,a,t,b}} \cdot N_{g,a,t} \qquad \text{II.A7.1'}$$

And the adjusted projected dependent population $D'_{g,a,t}$ will therefore replace former $D_{g,a,t}$ in the subsequent equations II.A7.2 to II.A7.4 and then II.A7.10' and II.A7.9', to follow the subsequent steps of the "*base case scenario*".

([137]) In the "*constant disability scenario*" the total number of years spent with disability during a person's life time is assumed to remain the same while life expectancy increases. Thus, if between time *t* and *t+1*, total life expectancy increases by *n* years for a cohort of age *a*, "disability-free" life expectancy for that very same age cohort must also increase by *n* years in order for the *relative compression of morbidity* hypothesis to be valid. If "disability-free" life expectancy increases by *n* years, then the disability prevalence of this cohort of age *a* at time *t+1* will be the same as the disability prevalence of cohort of age *a-n* at time *t*.

V. Scenario assessing the effect of a shift from informal to formal care

Building on the "*base case scenario*", this policy-change scenario is a sensitivity test that examines the budgetary impact of a progressive shift into the formal sector of care of 1% per year of disabled elderly who have so far received only informal care. This extra shift takes place during the first ten years of the projection period, thus it sums up to about 10.5% shift from informal to formal care. This shift will not have an impact on the relative shares of home and institutional formal care. The shift will thus not be 50% of the "new" beneficiaries to move into institutional care, while the other 50% will be assumed to receive formal care at home but a shift in line with the existing shares of home and institutional care. The variables $DFh_{g,a,t}$, $DFi_{g,a,t}$, and $DI_{g,a,t}$ will be adjusted to the new assumptions.

The projected dependent population of a given sex *g* and age *a* in a projected year *t* receiving respectively formal care at home (*DFh*), formal care in institutions (*DFi*), and informal care (*DI*), calculated in equations II.A7.2 to II.A7.4, will be changed as follows. For $t \in [0+1, 0+10]$ – let us say, for the first ten years of the projection period:

$$DI'_{g,a,t} = DI_{g,a,t-1} - 0.1 \cdot DI_{g,a,t-1} = 0.9 \cdot DI_{g,a,t-1}$$
$$DFh'_{g,a,t} = DFh_{g,a,t-1} + (DFh_{g,a,t-1} / D_{g,a,t-1}) \cdot 0.1 \cdot DI_{g,a,t-1}$$
$$DFi'_{g,a,t} = DFi_{g,a,t-1} + (DFi_{g,a,t-1} / D_{g,a,t-1}) \cdot 0.1 \cdot DI_{g,a,t-1}$$

These adapted projected numbers of dependents / recipients of formal care are then injected in equations II.A7.7', II.A7.7b' and II.A7.9' to calculate the total public spending on long-term care, as it was done in the "*base case scenario*". For the rest of the projection period until its end in 2070 the baseline equations are used as above.

VI. Coverage convergence scenario

This policy-change scenario assumes an expansion of publicly financed formal care provision into the groups of population that have not been covered by the public programmes so far. "Formal coverage" covers any of the three types of formal long-term care: institutional care, formal home care, and cash benefits. In order to illustrate this scenario, a "new" probability of being "formally taken care of" through cash benefits, i.e. $p^C_{g,a,0}$, has to be introduced. Alternatively, the number of persons receiving long-term care related cash benefits is available ([138]). The assumption is that all recipients of long-term care are dependent. It means that the equations II.A7.2 to II.A7.4 become four equations, with probabilities now changing over time, i.e. depending on *t*, but also country-specific (for a country *i*). Further, $DI_{g,a,t,i}$ the projected dependent population of a given sex *g* and age group *a* in a projected year *t* receiving informal care (*DI*) is simply "converted" into $DN^F_{g,a,t,i}$:, i.e. the probability of not being covered by formal long-term care coverage.

$$DFh_{g,a,t,i} = D_{g,a,t,i} \cdot p^{Fh}_{g,a,t,i} \qquad \text{II.A7.14}$$

$$DFi_{g,a,t,i} = D_{g,a,t,i} \cdot p^{Fi}_{g,a,t,i}$$

$$DC_{g,a,t,i} = D_{g,a,t,i} \cdot p^{C}_{g,a,t,i}$$

$$DN^F_{g,a,t,i} = D_{g,a,t,i} \cdot (1 - p^F_{g,a,t,i})$$

where:

$DC_{g,a,t,i}$ is the projected dependent population of a given sex *g* and age group *a* in a projected year *t* receiving cash benefits;

$p^F_{g,a,t,i}$ is the probability of receiving any type of formal care, defined as:

$$p^F_{g,a,t,i} = p^{Fh}_{g,a,t,i} + p^{Fi}_{g,a,t,i} + p^C_{g,a,t,i}$$

- The scenario envisaged is a coverage convergence to the EU28 average. It is meant to take into account the high diversity of country-specific current care-mix. The Member States where the formal coverage rate is below the EU28 average in the starting year are assumed to converge to this average by 2070. For countries with coverage above the EU average, this scenario is the same as the base case scenario.

([138]) Hopefully provided by Member States. The issue of double counting is taken care of as much as possible given the availability of detailed data.

- The "*base case scenario*" steps are used for the countries whose formal coverage (i.e. $p^{F}_{g,a,t,i}$) is the same or greater than the EU28 average $\overline{p}^{F}_{g,a,2016,EU28}$ in the base year (2016). For those countries whose formal coverage is below the EU28 average, $p^{F}_{g,a,t,i}$ is assumed to converge to $\overline{p}^{F}_{g,a,2070,EU28}$. It therefore implies that each type of formal care converges at a different pace, making up for the respective relative gaps to the EU28 average. This scenario allows a country to grow faster the relatively less-developed type of formal care.

VII. Cost convergence to EU28 average scenario

This policy-change scenario is run in parallel with the analogous scenario on health care expenditure projections. The "*cost convergence scenario*" is meant to capture the possible effect of a convergence in real living standards on long-term care spending. It assumes an upward convergence of the relative age-sex specific per beneficiary expenditure profiles (as percent of GDP per capita) of all countries below the corresponding EU28 average to the EU28 average. This is done for each type of formal care coverage (i.e. formal care in institutions, formal care at home, cash benefits). For countries with costs above the EU average, this scenario is the same as the base case scenario.

To run this scenario, one builds on the methodology used for the "*base case scenario*". For those countries whose per beneficiary costs are equal to or above the EU28 average the steps illustrated above are followed.

For those countries below the EU28 average per beneficiary costs in the base year (2016) a further change in the way cost per beneficiary is evolving over the projection period is assumed, so as to reach the EU28 average of per beneficiary costs. Building on the equations II.A7.10 – for cash benefits – and II.A7.10' – for in-kind benefits – the real convergence to EU28 average is assumed to follow the adjusted equations:

$$\begin{aligned} c'^{C}_{g,a,0,i} &= c^{C}_{g,a,0,i} && t=0 \\ c'^{C}_{g,a,t,i} &= c'^{C}_{g,a,t-1,i} \cdot \left(1+\Delta Ypc_{t,i}+m_{g,a,i}\right) && t>0 \end{aligned} \quad \text{II.A7.10}$$

$$\begin{aligned} c''^{F}_{g,a,0,i} &= c^{AF}_{g,a,0,i} && t=0 \\ c''^{F}_{g,a,t,i} &= c''^{F}_{g,a,t-1,i} \cdot \left(1+\Delta Yphw_{t,i}+g_{g,a,i}\right) && t>0 \end{aligned} \quad \text{II.A7.10}$$

where:

$c''^{F}_{g,a,t,i}$ is the country *i*-specific cost of in-kind benefits per beneficiary of a given sex *g* and age *a* in period *t* – *Fh* for formal care at home, *Fi* for formal care in institution – adjusted to the GDP per hours worked growth and a catch-up effect if country *i* is below the EU28 average;

$\Delta Yphw_{t,i}$ is GDP per hours worked growth rate in year *t*, for country *i*, and

$m_{g,a,i}$ is a hypothetical rate of growth of per beneficiary costs. It is higher than zero for countries whose per beneficiary costs are below the EU28 average, and equal to zero for those countries whose per beneficiary costs are equal or above the EU28 average. To close the gap, $m_{g,a,i}$ is assumed to be constant in time and equal to ([139]):

$$m_{g,a,i} = \left[\left(\frac{\overline{rc}_{g,a,EU28,2016}}{rc_{g,a,i,2016}}\right)^{\frac{1}{2070-2016}}\right]-1 \quad \text{II.A7.15}$$

$$if\ \overline{rc}_{g,a,EU28,2016} \geq rc_{g,a,i,2016}$$

where:

$\overline{rc}_{g,a,EU28,2016}$ is the weighted EU28 average relative cost per beneficiary of sex *g* and age *a* calculated in the base year of 2016 and

$rc_{g,a,i,2016}$ is the relative cost per beneficiary of sex *g* and age *a* for country *i* calculated in the base year of 2016 defined as:

([139]) Assumptions for different convergence paths according to the initial country-specific situation - comparing to the EU28-average age profile - could be explored further when data is made available.

$$rc_{g,a,i,2016} = \left(\frac{c''_{g,a,i,2016}}{Yphw_{g,a,i,2016}} \right)$$

and

$$\overline{rc}_{g,a,EU\,28,2016} = \left(\frac{\bar{c}_{g,a,EU\,28,2016}}{\overline{Yphw}_{g,a,EU\,28,2016}} \right)$$

where:

$\bar{c}_{g,a,EU\,28,2016}$ is the weighted EU28 average cost per beneficiary of sex *g* and age *a* calculated in the base year (2016); and

$\overline{Yphw}_{g,a,EU\,28,2016}$ is the average GDP per hours worked in the EU28 calculated in the base year (2016).

The same type of reasoning can be run with the corresponding equations for cash benefits, adjusted to GDP per capita growth instead of GDP per hours worked growth.

Then after country-specific per beneficiary cost has been calculated, subsequent corresponding equations are used to obtain total age-sex group expenditure and then total public expenditure on long-term care in each projection year, as in equation II.A7.9".

VIII. Cost and coverage convergence scenario

This policy-change scenario combines the two previous scenarios, the "*coverage convergence scenario*" and the "*cost convergence scenario*" to the EU 28 average. For countries with cost and coverage above the EU average, this scenario is the same as the "*base case scenario*".

IX. AWG reference scenario

The "*AWG reference scenario*" combines the assumptions of the "*base case scenario*" and the "*constant disability scenario*". It assumes that half of the projected longevity gains up to the end of the projection period will be spent in good health and free of disability/dependency. Accordingly, age-specific disability rates shift along the age profile by half of the projected increase in life expectancy. Furthermore, the unit costs are linked to GDP per hour worked in case of LTC services and to GDP per capita in case of cash benefits (subject to the relevant exceptions in order to reflect country-specific assumptions).

For Member States in the highest quartile of LTC expenditure as a proportion of GDP in the base year, income elasticity of LTC expenditure is assumed to remain 1 over the projection period. For the rest, income elasticity is assumed to start at 1.1 in the base year of 2016, falling to 1 by the end of the projection period.

X. AWG risk scenario

The "*AWG risk scenario*" keeps the assumption that half of the future gains in life expectancy are spent without care-demanding disability, as in the "*AWG reference scenario*". In addition, it combines this scenario 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.

ANNEX 8
Organisational structure of secondary education

Three different organisational models can be distinguished: i) a single structure; ii) a compulsory integrated secondary education corresponding to a 'common core'; and iii) distinct types of education. In some new Member States (the Czech Republic, Latvia, Lithuania, Hungary and Slovakia), combinations of these three models coexist. ([140])

In all countries where the single structure is the only type (Denmark, Estonia, Portugal, Slovenia, Finland, Sweden, Iceland, Norway and Bulgaria), the end of secondary education coincides with the end of compulsory education, except in Bulgaria where compulsory education ends one year later.

In almost half of all European countries, all pupils follow the same general curriculum "common core" during lower secondary education. In seven of these countries, the end of lower secondary education coincides with the end of full-time compulsory education.

In Belgium, France, Ireland, Italy, Hungary, Austria, Slovakia, the United Kingdom (England, Wales and Northern Ireland) and Bulgaria, the end of full-time compulsory education does not coincide with the end of lower secondary education. Instead, one or more final years of compulsory education are part of upper secondary education. Thus, pupils in these countries - with the exception of Ireland and the United Kingdom (England, Wales and Northern Ireland) - have to choose between general, technical or vocational education of one or two years (or four in Hungary) before the end of full-time compulsory education.

In the French and German-speaking Belgian Communities, Germany, Latvia, Lithuania, Luxembourg, the Netherlands, Austria and Liechtenstein, pupils may select or be streamed into different types of provision or school from the beginning or before the end of lower secondary education. Even though pupils in Germany attend different schools, they follow entirely compatible curricula for the first two years so that selection of an appropriate study branch can be deferred. In the Netherlands, pupils follow a common core curriculum usually for the first two years at VMBO and three years at HAVO and VWO. While its level varies depending on the type of school concerned, it specifies minimum skills that should be acquired by all pupils. The three types of lower secondary school in Liechtenstein offer the same basic common curriculum, which is supplemented by certain kinds of provision in the Realschule or Gymnasium.

([140]) Source: Key data on education in Europe 2005, European Commission, Eurydice, Eurostat, 2005.

Part III

Statistical Annex

1. BELGIUM

Table III.1.1:

Belgium	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.1	1.73	1.73	1.75	1.76	1.78	1.80	1.82
Life expectancy at birth								
males	7.4	78.8	79.5	81.0	82.4	83.8	85.0	86.2
females	6.5	83.7	84.3	85.7	86.9	88.1	89.2	90.2
Life expectancy at 65								
males	5.1	18.3	18.8	19.8	20.7	21.7	22.6	23.4
females	4.9	21.7	22.1	23.1	24.0	24.9	25.8	26.6
Net migration (thousand)	-29.0	55.2	53.2	48.3	41.5	32.8	29.5	26.2
Net migration as % of population	-0.3	0.5	0.5	0.4	0.3	0.2	0.2	0.2
Population (million)	2.6	11.3	11.6	12.3	12.9	13.3	13.6	13.9
Children population (0-14) as % of total population	-1.1	17.0	17.0	16.5	16.2	16.2	16.0	15.9
Prime age population (25-54) as % of total population	-4.9	40.2	39.2	37.5	37.1	36.3	36.0	35.3
Working age population (15-64) as % of total population	-6.7	64.6	63.7	61.3	59.9	59.2	58.5	58.0
Elderly population (65 and over) as % of total population	7.8	18.4	19.3	22.2	23.9	24.6	25.5	26.2
Very elderly population (80 and over) as % of total population	5.1	5.5	5.7	6.5	8.2	9.6	9.9	10.6
Very elderly population (80 and over) as % of elderly population	10.7	30.0	29.6	29.3	34.3	39.0	38.8	40.7
Very elderly population (80 and over) as % of working age population	9.8	8.5	8.9	10.6	13.7	16.2	16.9	18.4
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.5	1.3	1.4	1.4	1.6	1.7	1.6	1.6
Employment (growth rate)	0.3	0.8	0.7	0.5	0.2	0.2	0.1	0.1
Labour input : hours worked (growth rate)	0.3	0.7	0.7	0.5	0.2	0.2	0.1	0.1
Labour productivity per hour (growth rate)	1.3	0.6	0.7	1.0	1.4	1.5	1.5	1.5
TFP (growth rate)	0.8	0.3	0.5	0.7	0.9	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.4	0.2	0.2	0.3	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.1	0.6	0.7	0.9	1.2	1.4	1.4	1.4
Potential GDP per worker (growth rate)	1.2	0.5	0.7	0.9	1.4	1.5	1.5	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	739	7,320	7,401	7,539	7,705	7,871	7,952	8,059
Population growth (working age:15-64)	-0.3	0.4	0.3	0.1	0.3	0.2	0.1	0.1
Population (20-64) (in thousands)	619	6,689	6,764	6,844	6,991	7,148	7,204	7,307
Population growth (20-64)	-0.3	0.4	0.2	0.1	0.3	0.2	0.1	0.1
Labour force 15-64 (thousands)	747	4,957	5,130	5,339	5,473	5,590	5,633	5,705
Labour force 20-64 (thousands)	739	4,912	5,084	5,288	5,422	5,538	5,579	5,651
Participation rate (20-64)	3.9	73.4	75.2	77.3	77.6	77.5	77.5	77.3
Participation rate (15-64)	3.1	67.7	69.3	70.8	71.0	71.0	70.8	70.8
young (15-24)	0.6	29.0	29.7	29.6	29.4	29.6	29.3	29.5
prime-age (25-54)	0.2	85.1	85.3	85.2	85.2	85.3	85.3	85.3
older (55-64)	17.6	48.2	55.6	65.8	66.0	66.0	65.8	65.8
Participation rate (20-64) - FEMALES	5.3	68.2	70.5	73.2	73.7	73.7	73.7	73.5
Participation rate (15-64) - FEMALES	4.4	63.0	65.1	67.1	67.6	67.6	67.4	67.3
young (15-24)	0.4	26.8	27.5	27.3	27.1	27.2	27.0	27.2
prime-age (25-54)	1.5	79.8	80.6	81.2	81.3	81.4	81.4	81.4
older (55-64)	19.7	42.8	50.9	61.2	62.3	62.7	62.5	62.5
Participation rate (20-64) - MALES	2.4	78.6	79.8	81.4	81.4	81.2	81.2	81.0
Participation rate (15-64) - MALES	1.7	72.4	73.5	74.5	74.4	74.3	74.2	74.1
young (15-24)	0.7	31.1	31.9	31.8	31.6	31.8	31.6	31.8
prime-age (25-54)	-1.2	90.3	90.0	89.3	89.1	89.2	89.1	89.1
older (55-64)	15.4	53.7	60.3	70.3	69.7	69.4	69.2	69.1
Average effective exit age (TOTAL) (1)	2.5	61.8	63.4	64.3	64.3	64.3	64.3	64.3
Men	2.5	61.8	63.3	64.3	64.3	64.3	64.3	64.3
Women	2.5	61.8	63.5	64.3	64.3	64.3	64.3	64.3
Employment rate (15-64)	2.8	62.4	64.0	65.0	65.3	65.4	65.2	65.2
Employment rate (20-64)	3.6	67.8	69.5	71.1	71.5	71.5	71.5	71.4
Employment rate (15-74)	2.0	54.9	55.6	56.5	57.1	57.3	56.8	56.9
Unemployment rate (15-64)	0.0	7.9	7.7	8.2	8.0	7.9	7.9	7.9
Unemployment rate (20-64)	0.0	7.7	7.6	8.0	7.9	7.7	7.7	7.7
Unemployment rate (15-74)	-0.1	7.8	7.7	8.0	7.8	7.7	7.7	7.7
Employment (20-64) (in millions)	0.7	4.5	4.7	4.9	5.0	5.1	5.1	5.2
Employment (15-64) (in millions)	0.7	4.6	4.7	4.9	5.0	5.1	5.2	5.3
share of young (15-24)	0.2	7%	7%	7%	7%	7%	7%	7%
share of prime-age (25-54)	-5.0	79%	76%	74%	75%	74%	75%	74%
share of older (55-64)	4.8	14%	17%	19%	18%	19%	19%	19%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	0.3	19.8	20.7	19.9	19.2	19.9	19.4	20.1
Old-age dependency ratio 15-64 (3)	16.7	28.4	30.2	36.2	39.9	41.5	43.5	45.2
Old-age dependency ratio 20-64 (3)	18.7	31.1	33.1	39.8	44.0	45.7	48.1	49.8
Total dependency ratio (4)	17.8	54.7	57.0	63.1	67.0	68.9	71.0	72.5
Total economic dependency ratio (5)	10.8	145.9	143.3	143.7	148.2	150.7	154.0	156.7
Economic old-age dependency ratio (15-64) (6)	21.4	44.7	46.4	52.7	58.1	60.4	63.6	66.2
Economic old-age dependency ratio (15-74) (7)	19.8	44.3	46.0	51.2	56.4	58.7	61.6	64.2

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

2. BULGARIA

Table III.2.1:

Bulgaria	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.3	1.51	1.62	1.69	1.73	1.76	1.78	1.80
Life expectancy at birth								
males	11.5	71.8	72.6	75.1	77.4	79.5	81.5	83.3
females	9.3	78.5	79.2	81.2	83.0	84.7	86.3	87.8
Life expectancy at 65								
males	7.0	14.5	14.9	16.3	17.7	19.0	20.3	21.5
females	6.8	17.9	18.3	19.7	21.0	22.3	23.5	24.7
Net migration (thousand)	5.6	-4.3	-11.9	-9.1	0.5	3.9	0.7	1.3
Net migration as % of population	0.1	-0.1	-0.2	-0.1	0.0	0.1	0.0	0.0
Population (million)	-2.3	7.1	6.9	6.4	5.9	5.5	5.2	4.9
Children population (0-14) as % of total population	0.0	14.0	14.4	13.6	13.2	13.8	13.9	14.0
Prime age population (25-54) as % of total population	-9.6	42.1	41.2	36.6	33.3	31.5	32.7	32.5
Working age population (15-64) as % of total population	-10.3	65.4	63.7	61.6	58.6	54.5	52.8	55.1
Elderly population (65 and over) as % of total population	10.3	20.6	21.9	24.8	28.2	31.7	33.3	30.9
Very elderly population (80 and over) as % of total population	10.0	4.7	4.9	6.9	8.7	10.1	13.0	14.7
Very elderly population (80 and over) as % of elderly population	24.8	22.9	22.5	27.9	30.9	31.9	39.1	47.7
Very elderly population (80 and over) as % of working age population	19.6	7.2	7.7	11.2	14.9	18.6	24.6	26.8
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.4	2.9	2.2	1.5	1.1	0.9	1.2	1.1
Employment (growth rate)	-1.0	0.9	-0.9	-1.2	-1.3	-1.3	-0.6	-0.5
Labour input : hours worked (growth rate)	-0.9	0.9	-0.8	-1.2	-1.3	-1.3	-0.6	-0.5
Labour productivity per hour (growth rate)	2.3	2.0	3.0	2.7	2.4	2.2	1.9	1.5
TFP (growth rate)	1.4	1.5	1.7	1.7	1.6	1.4	1.2	1.0
Capital deepening (contribution to labour productivity growth)	0.9	0.5	1.3	1.1	0.9	0.8	0.7	0.5
Potential GDP per capita (growth rate)	2.1	3.6	3.0	2.4	1.8	1.5	1.9	1.8
Potential GDP per worker (growth rate)	2.4	2.0	3.1	2.8	2.4	2.2	1.9	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-1,990	4,663	4,412	3,929	3,466	3,023	2,751	2,673
Population growth (working age:15-64)	0.9	-1.4	-1.4	-1.0	-1.6	-1.2	-0.4	-0.4
Population (20-64) (in thousands)	-1,920	4,351	4,098	3,598	3,179	2,764	2,491	2,431
Population growth (20-64)	1.0	-1.4	-1.4	-1.0	-1.5	-1.3	-0.4	-0.4
Labour force 15-64 (thousands)	-1,429	3,205	3,045	2,652	2,305	2,004	1,840	1,776
Labour force 20-64 (thousands)	-1,426	3,189	3,028	2,634	2,289	1,991	1,826	1,763
Participation rate (20-64)	-0.8	73.3	73.9	73.2	72.0	72.0	73.3	72.5
Participation rate (15-64)	-2.3	68.7	69.0	67.5	66.5	66.3	66.9	66.4
young (15-24)	0.3	24.3	23.8	24.0	25.0	24.4	24.1	24.6
prime-age (25-54)	-1.2	82.0	82.2	81.6	80.6	80.9	81.0	80.8
older (55-64)	4.4	58.9	58.6	63.1	63.2	61.6	63.4	63.3
Participation rate (20-64) - FEMALES	-1.6	68.8	69.2	68.4	67.0	66.7	68.1	67.3
Participation rate (15-64) - FEMALES	-3.0	64.6	64.7	63.0	61.9	61.4	62.0	61.5
young (15-24)	-0.3	19.7	18.8	19.0	19.8	19.3	19.1	19.5
prime-age (25-54)	-2.6	78.1	78.1	77.0	75.5	75.5	75.8	75.5
older (55-64)	5.1	54.7	54.4	59.3	59.9	58.0	59.9	59.8
Participation rate (20-64) - MALES	-0.2	77.7	78.5	77.9	76.8	77.1	78.3	77.5
Participation rate (15-64) - MALES	-1.7	72.8	73.2	71.8	70.9	71.0	71.5	71.1
young (15-24)	0.8	28.6	28.4	28.7	29.9	29.1	28.8	29.4
prime-age (25-54)	0.1	85.6	86.1	85.9	85.5	85.9	85.8	85.7
older (55-64)	3.1	63.6	63.2	67.0	66.5	65.1	66.8	66.7
Average effective exit age (TOTAL) (1)	1.2	63.2	63.4	64.1	64.4	64.4	64.4	64.4
Men	0.9	63.8	64.0	64.7	64.7	64.7	64.7	64.7
Women	1.5	62.6	62.8	63.6	64.1	64.1	64.1	64.1
Employment rate (15-64)	-1.5	63.5	65.1	63.0	62.0	61.9	62.4	62.0
Employment rate (20-64)	0.0	67.8	69.7	68.4	67.3	67.3	68.5	67.8
Employment rate (15-74)	-0.2	54.7	55.8	54.5	52.8	51.7	52.5	54.5
Unemployment rate (15-64)	-0.9	7.6	5.7	6.7	6.7	6.7	6.7	6.7
Unemployment rate (20-64)	-1.0	7.5	5.6	6.6	6.6	6.6	6.6	6.6
Unemployment rate (15-74)	-1.1	7.5	5.6	6.5	6.5	6.4	6.4	6.5
Employment (20-64) (in millions)	-1.3	2.9	2.9	2.5	2.1	1.9	1.7	1.6
Employment (15-64) (in millions)	-1.3	3.0	2.9	2.5	2.2	1.9	1.7	1.7
share of young (15-24)	1.7	5%	4%	5%	6%	6%	6%	6%
share of prime-age (25-54)	-5.0	77%	77%	72%	69%	71%	76%	72%
share of older (55-64)	3.3	18%	18%	22%	25%	23%	18%	22%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	1.3	21.1	21.2	23.7	26.0	24.9	19.2	22.5
Old-age dependency ratio 15-64 (3)	24.7	31.5	34.4	40.3	48.1	58.1	63.0	56.2
Old-age dependency ratio 20-64 (3)	28.1	33.8	37.0	44.0	52.4	63.6	69.5	61.8
Total dependency ratio (4)	28.7	52.9	57.0	62.4	70.6	83.5	89.3	81.6
Total economic dependency ratio (5)	44.5	136.0	134.5	147.9	160.7	179.0	187.2	180.6
Economic old-age dependency ratio (15-64) (6)	38.7	47.5	49.9	59.9	72.0	87.5	95.2	86.1
Economic old-age dependency ratio (15-74) (7)	36.0	46.5	48.5	57.5	68.2	82.3	90.2	82.5

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

3. THE CZECH REPUBLIC

Table III.3.1:

Czech Republic	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.62	1.68	1.74	1.76	1.78	1.80	1.82
Life expectancy at birth								
males	8.7	76.2	76.8	78.6	80.3	82.0	83.5	84.9
females	7.2	82.1	82.6	84.1	85.5	86.8	88.1	89.3
Life expectancy at 65								
males	6.1	16.3	16.7	17.9	19.1	20.3	21.3	22.4
females	5.8	19.9	20.3	21.4	22.6	23.6	24.7	25.7
Net migration (thousand)	-10.1	18.6	21.5	17.5	20.5	14.0	8.8	8.5
Net migration as % of population	-0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1
Population (million)	-0.6	10.6	10.7	10.7	10.5	10.5	10.3	10.0
Children population (0-14) as % of total population	-0.8	15.5	16.0	14.9	14.0	15.2	15.2	14.7
Prime age population (25-54) as % of total population	-9.6	43.4	42.6	37.8	34.7	33.5	34.1	33.8
Working age population (15-64) as % of total population	-9.0	65.9	63.7	62.5	60.3	55.7	54.5	57.0
Elderly population (65 and over) as % of total population	9.7	18.6	20.3	22.6	25.7	29.1	30.4	28.3
Very elderly population (80 and over) as % of total population	9.3	4.0	4.2	6.8	8.3	9.0	12.5	13.3
Very elderly population (80 and over) as % of elderly population	25.3	21.6	20.9	30.1	32.3	31.0	41.0	46.8
Very elderly population (80 and over) as % of working age population	17.2	6.1	6.7	10.9	13.7	16.2	22.9	23.3
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.5	2.2	1.9	1.8	1.1	1.1	1.5	1.4
Employment (growth rate)	-0.4	0.9	-0.3	-0.2	-0.7	-0.7	-0.1	-0.1
Labour input : hours worked (growth rate)	-0.3	1.1	-0.1	-0.2	-0.7	-0.7	-0.1	-0.1
Labour productivity per hour (growth rate)	1.8	1.1	2.0	2.0	1.9	1.7	1.6	1.5
TFP (growth rate)	1.2	1.0	1.3	1.3	1.2	1.1	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.6	0.0	0.7	0.7	0.7	0.6	0.6	0.5
Potential GDP per capita (growth rate)	1.6	2.0	1.7	1.9	1.2	1.1	1.8	1.7
Potential GDP per worker (growth rate)	1.8	1.3	2.2	2.0	1.9	1.7	1.6	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-1,291	6,968	6,789	6,675	6,362	5,833	5,607	5,677
Population growth (working age:15-64)	0.8	-0.8	-0.5	-0.3	-1.1	-0.7	0.0	-0.1
Population (20-64) (in thousands)	-1,365	6,511	6,308	6,106	5,817	5,345	5,056	5,147
Population growth (20-64)	0.9	-0.8	-0.8	-0.2	-1.0	-0.8	0.0	0.0
Labour force 15-64 (thousands)	-1,094	5,235	5,110	4,946	4,620	4,297	4,131	4,141
Labour force 20-64 (thousands)	-1,099	5,207	5,081	4,910	4,585	4,267	4,097	4,107
Participation rate (20-64)	-0.2	80.0	80.5	80.4	78.8	79.8	81.0	79.8
Participation rate (15-64)	-2.2	75.1	75.3	74.1	72.6	73.7	73.7	72.9
young (15-24)	-2.1	32.4	29.3	30.0	30.6	30.2	29.0	30.2
prime-age (25-54)	-0.1	88.9	89.2	89.3	88.7	88.6	89.1	88.7
older (55-64)	6.2	61.1	60.3	67.3	65.6	66.7	67.9	67.3
Participation rate (20-64) - FEMALES	1.0	72.0	72.9	73.7	71.8	72.7	74.3	73.0
Participation rate (15-64) - FEMALES	-1.0	67.7	68.2	67.9	66.2	67.1	67.6	66.7
young (15-24)	-1.4	26.5	24.4	24.9	25.4	25.1	24.1	25.1
prime-age (25-54)	0.1	82.0	82.6	83.2	82.1	81.8	82.7	82.1
older (55-64)	9.8	51.4	50.7	60.1	58.7	60.0	61.5	61.2
Participation rate (20-64) - MALES	-1.3	87.7	87.9	87.0	85.6	86.8	87.5	86.4
Participation rate (15-64) - MALES	-3.4	82.3	82.1	80.1	78.8	80.0	79.5	78.9
young (15-24)	-2.7	37.9	34.1	35.0	35.7	35.1	33.8	35.2
prime-age (25-54)	-0.3	95.4	95.5	95.2	95.0	95.3	95.2	95.1
older (55-64)	2.1	71.3	70.0	74.5	72.2	73.4	74.2	73.4
Average effective exit age (TOTAL) (1)	1.1	62.4	62.3	63.3	63.4	63.5	63.5	63.5
Men	0.3	63.5	63.5	63.6	63.8	64.0	63.9	63.8
Women	1.9	61.3	61.2	63.0	63.0	63.1	63.1	63.2
Employment rate (15-64)	-2.2	72.1	72.9	71.0	69.6	70.6	70.6	69.9
Employment rate (20-64)	-0.2	76.8	78.1	77.2	75.7	76.6	77.8	76.6
Employment rate (15-74)	-1.3	62.9	62.9	61.8	59.6	58.7	59.9	61.5
Unemployment rate (15-64)	0.1	4.0	3.2	4.2	4.2	4.2	4.2	4.2
Unemployment rate (20-64)	0.1	3.9	3.1	4.0	4.0	4.0	4.0	4.0
Unemployment rate (15-74)	0.1	4.0	3.1	4.1	4.0	4.0	4.0	4.1
Employment (20-64) (in millions)	-1.1	5.0	4.9	4.7	4.4	4.1	3.9	3.9
Employment (15-64) (in millions)	-1.1	5.0	4.9	4.7	4.4	4.1	4.0	4.0
share of young (15-24)	1.5	6%	5%	7%	7%	7%	7%	7%
share of prime-age (25-54)	-5.6	78%	80%	73%	71%	73%	76%	73%
share of older (55-64)	4.1	16%	15%	20%	22%	21%	17%	20%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	2.1	19.5	19.1	22.0	24.7	22.8	18.1	21.5
Old-age dependency ratio 15-64 (3)	21.6	28.1	31.9	36.2	42.6	52.2	55.7	49.7
Old-age dependency ratio 20-64 (3)	24.7	30.1	34.3	39.6	46.6	57.0	61.8	54.8
Total dependency ratio (4)	23.9	51.6	57.0	60.1	65.8	79.5	83.6	75.6
Total economic dependency ratio (5)	38.5	105.7	109.9	120.8	129.9	144.8	151.1	144.2
Economic old-age dependency ratio (15-64) (6)	31.5	36.7	41.0	48.9	57.5	70.1	75.4	68.2
Economic old-age dependency ratio (15-74) (7)	30.4	35.9	40.0	47.9	55.5	67.5	72.8	66.3

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

4. DENMARK

Table III.4.1:

Denmark	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.0	1.79	1.71	1.73	1.75	1.77	1.79	1.82
Life expectancy at birth								
males	7.3	78.8	79.5	81.0	82.4	83.7	84.9	86.1
females	7.1	82.9	83.6	85.0	86.4	87.7	88.9	90.0
Life expectancy at 65								
males	5.2	18.1	18.5	19.5	20.5	21.5	22.4	23.3
females	5.6	20.8	21.3	22.4	23.5	24.5	25.5	26.4
Net migration (thousand)	-27.4	36.7	33.4	26.8	18.9	10.7	11.4	9.3
Net migration as % of population	-0.5	0.6	0.6	0.4	0.3	0.2	0.2	0.1
Population (million)	1.1	5.7	5.9	6.3	6.6	6.7	6.8	6.8
Children population (0-14) as % of total population	-1.3	16.8	16.3	16.6	16.5	15.5	15.3	15.5
Prime age population (25-54) as % of total population	-4.8	39.3	39.1	38.0	38.0	36.3	35.2	34.5
Working age population (15-64) as % of total population	-8.0	64.3	63.8	61.4	59.8	60.4	58.4	56.3
Elderly population (65 and over) as % of total population	9.3	18.9	19.8	22.0	23.8	24.1	26.3	28.3
Very elderly population (80 and over) as % of total population	6.3	4.3	4.8	7.0	7.9	9.4	10.0	10.6
Very elderly population (80 and over) as % of elderly population	14.7	22.8	24.0	31.8	33.2	39.0	38.1	37.6
Very elderly population (80 and over) as % of working age population	12.1	6.7	7.5	11.4	13.2	15.5	17.1	18.9
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.6	1.2	1.6	1.6	1.6	1.8	1.5	1.3
Employment (growth rate)	0.2	0.7	0.6	0.3	0.2	0.2	-0.1	-0.2
Labour input : hours worked (growth rate)	0.2	0.5	0.6	0.3	0.2	0.2	0.0	-0.2
Labour productivity per hour (growth rate)	1.4	0.7	0.9	1.3	1.5	1.5	1.5	1.5
TFP (growth rate)	0.9	0.4	0.7	0.9	1.0	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.3	0.3	0.4	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.3	0.4	0.8	1.1	1.4	1.7	1.4	1.2
Potential GDP per worker (growth rate)	1.4	0.5	0.9	1.4	1.4	1.5	1.6	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	158	3,686	3,771	3,876	3,928	4,041	3,948	3,844
Population growth (working age:15-64)	-0.9	0.7	0.5	-0.1	0.2	0.2	-0.4	-0.2
Population (20-64) (in thousands)	152	3,336	3,428	3,552	3,559	3,666	3,595	3,489
Population growth (20-64)	-1.1	0.9	0.6	0.1	0.1	0.2	-0.4	-0.2
Labour force 15-64 (thousands)	168	2,951	3,057	3,145	3,182	3,270	3,202	3,120
Labour force 20-64 (thousands)	166	2,744	2,853	2,952	2,963	3,047	2,992	2,909
Participation rate (20-64)	1.2	82.2	83.2	83.1	83.3	83.1	83.2	83.4
Participation rate (15-64)	1.1	80.1	81.0	81.1	81.0	80.9	81.1	81.2
young (15-24)	0.5	66.3	67.2	67.4	66.7	67.0	67.0	66.8
prime-age (25-54)	-0.5	87.3	87.2	86.8	86.8	86.8	86.8	86.9
older (55-64)	5.9	71.1	75.3	76.0	75.3	76.6	77.0	77.0
Participation rate (20-64) - FEMALES	1.5	79.1	80.5	80.1	80.2	80.2	80.4	80.5
Participation rate (15-64) - FEMALES	1.3	77.3	78.7	78.5	78.3	78.4	78.6	78.7
young (15-24)	0.7	67.5	68.5	68.7	67.9	68.3	68.3	68.1
prime-age (25-54)	-0.5	83.8	83.7	83.1	83.1	83.2	83.2	83.3
older (55-64)	7.6	66.9	73.0	73.1	71.8	73.6	74.4	74.5
Participation rate (20-64) - MALES	0.8	85.4	85.9	86.1	86.3	85.9	86.0	86.1
Participation rate (15-64) - MALES	0.8	82.8	83.4	83.7	83.6	83.4	83.5	83.6
young (15-24)	0.3	65.3	66.0	66.1	65.4	65.8	65.8	65.6
prime-age (25-54)	-0.5	90.8	90.7	90.4	90.3	90.2	90.3	90.3
older (55-64)	4.1	75.4	77.7	78.9	78.8	79.6	79.6	79.6
Average effective exit age (TOTAL) (1)	3.3	64.7	65.6	66.3	66.6	67.1	67.9	68.0
Men	2.7	65.2	65.8	66.9	67.1	67.5	67.9	68.0
Women	3.8	64.2	65.4	65.7	66.1	66.8	67.9	68.0
Employment rate (15-64)	2.4	75.0	76.8	77.4	77.3	77.2	77.4	77.4
Employment rate (20-64)	2.4	77.5	79.2	79.6	79.8	79.7	79.8	79.9
Employment rate (15-74)	3.8	66.0	67.6	69.1	68.9	70.1	69.9	69.8
Unemployment rate (15-64)	-1.7	6.4	5.3	4.6	4.6	4.6	4.6	4.6
Unemployment rate (20-64)	-1.6	5.7	4.8	4.2	4.1	4.2	4.2	4.2
Unemployment rate (15-74)	-1.9	6.2	5.1	4.4	4.4	4.4	4.3	4.2
Employment (20-64) (in millions)	0.2	2.6	2.7	2.8	2.8	2.9	2.9	2.8
Employment (15-64) (in millions)	0.2	2.8	2.9	3.0	3.0	3.1	3.1	3.0
share of young (15-24)	-0.9	15%	15%	14%	14%	15%	14%	15%
share of prime-age (25-54)	-1.3	67%	66%	67%	69%	65%	65%	66%
share of older (55-64)	2.3	17%	19%	19%	17%	20%	21%	20%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	1.2	19.0	19.7	20.2	17.9	21.0	21.5	20.2
Old-age dependency ratio 15-64 (3)	20.8	29.5	31.1	35.9	39.8	39.9	45.0	50.2
Old-age dependency ratio 20-64 (3)	22.8	32.5	34.2	39.2	43.9	44.0	49.4	55.3
Total dependency ratio (4)	22.2	55.5	56.7	62.9	67.4	65.5	71.2	77.7
Total economic dependency ratio (5)	9.5	100.8	98.0	100.7	104.8	103.1	103.4	110.2
Economic old-age dependency ratio (15-64) (6)	19.7	36.0	37.4	41.4	45.7	46.1	49.3	55.7
Economic old-age dependency ratio (15-74) (7)	16.2	34.8	36.3	39.5	43.2	43.7	45.3	51.0

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

5. GERMANY

Table III.5.1:

Germany	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.49	1.50	1.53	1.57	1.60	1.64	1.68
Life expectancy at birth								
males	7.4	78.7	79.4	80.9	82.3	83.6	84.9	86.1
females	6.5	83.6	84.2	85.5	86.7	87.9	89.0	90.1
Life expectancy at 65								
males	5.2	18.1	18.5	19.6	20.6	21.5	22.4	23.3
females	5.1	21.3	21.8	22.8	23.7	24.7	25.6	26.4
Net migration (thousand)	-606.5	750.0	327.3	268.1	206.0	199.0	175.0	143.5
Net migration as % of population	-0.7	0.9	0.4	0.3	0.2	0.2	0.2	0.2
Population (million)	-3.2	82.5	83.8	84.6	84.1	82.6	80.7	79.2
Children population (0-14) as % of total population	0.7	13.2	13.4	14.0	13.3	13.1	13.8	13.9
Prime age population (25-54) as % of total population	-7.3	41.3	39.6	37.0	35.6	34.2	34.1	34.0
Working age population (15-64) as % of total population	-10.4	65.7	64.6	59.9	58.0	57.4	55.6	55.3
Elderly population (65 and over) as % of total population	9.7	21.1	21.9	26.1	28.7	29.5	30.6	30.9
Very elderly population (80 and over) as % of total population	7.4	5.9	7.0	7.6	9.6	12.6	11.9	13.3
Very elderly population (80 and over) as % of elderly population	15.3	27.8	32.0	29.0	33.3	42.8	38.9	43.1
Very elderly population (80 and over) as % of working age population	15.1	8.9	10.9	12.6	16.5	22.0	21.4	24.1
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.2	1.8	1.4	1.0	1.2	1.1	1.1	1.3
Employment (growth rate)	-0.3	1.5	0.5	-0.5	-0.2	-0.4	-0.5	-0.2
Labour input : hours worked (growth rate)	-0.3	1.1	0.1	-0.5	-0.3	-0.4	-0.5	-0.2
Labour productivity per hour (growth rate)	1.5	0.7	1.3	1.4	1.5	1.5	1.5	1.5
TFP (growth rate)	1.0	0.8	0.9	0.9	1.0	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	-0.1	0.4	0.5	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.2	0.9	1.2	0.9	1.4	1.4	1.3	1.5
Potential GDP per worker (growth rate)	1.4	0.3	0.9	1.4	1.5	1.5	1.6	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-10,376	54,149	54,172	50,709	48,792	47,413	44,876	43,773
Population growth (working age:15-64)	-0.9	0.8	-0.3	-0.8	0.0	-0.4	-0.4	-0.1
Population (20-64) (in thousands)	-10,129	50,046	50,326	46,823	44,637	43,571	41,151	39,917
Population growth (20-64)	-1.0	0.8	-0.1	-1.0	0.0	-0.4	-0.4	-0.1
Labour force 15-64 (thousands)	-8,153	42,242	42,260	39,573	38,049	36,894	34,991	34,089
Labour force 20-64 (thousands)	-8,056	41,039	41,136	38,473	36,850	35,780	33,923	32,982
Participation rate (20-64)	0.6	82.0	81.7	82.2	82.6	82.1	82.4	82.6
Participation rate (15-64)	-0.1	78.0	78.0	78.0	78.0	77.8	78.0	77.9
young (15-24)	-0.6	49.9	50.9	49.1	49.5	50.1	49.5	49.3
prime-age (25-54)	0.0	87.4	87.4	87.3	87.4	87.3	87.4	87.4
older (55-64)	2.7	71.4	71.4	72.6	74.2	73.7	73.5	74.1
Participation rate (20-64) - FEMALES	3.4	77.3	77.6	79.2	80.3	80.2	80.4	80.7
Participation rate (15-64) - FEMALES	2.4	73.6	74.0	75.2	75.8	75.9	76.0	75.9
young (15-24)	-0.5	48.0	49.2	47.3	47.8	48.4	47.8	47.5
prime-age (25-54)	2.3	82.7	83.1	84.2	84.9	84.8	84.8	84.9
older (55-64)	7.9	65.9	66.6	69.9	72.6	73.2	73.1	73.8
Participation rate (20-64) - MALES	-2.1	86.6	85.8	85.0	84.7	84.0	84.4	84.5
Participation rate (15-64) - MALES	-2.6	82.4	81.9	80.8	80.1	79.7	79.9	79.7
young (15-24)	-0.7	51.6	52.6	50.8	51.2	51.8	51.2	50.9
prime-age (25-54)	-2.1	92.0	91.4	90.4	89.8	89.8	90.0	89.9
older (55-64)	-2.6	77.1	76.3	75.3	75.7	74.1	73.9	74.5
Average effective exit age (TOTAL) (1)	1.2	64.3	64.5	65.4	65.5	65.5	65.5	65.5
Men	1.0	64.6	64.7	65.6	65.7	65.7	65.7	65.7
Women	1.3	64.0	64.3	65.2	65.3	65.3	65.3	65.3
Employment rate (15-64)	-0.6	74.7	75.1	74.3	74.3	74.1	74.3	74.2
Employment rate (20-64)	0.2	78.6	78.7	78.3	78.7	78.3	78.6	78.8
Employment rate (15-74)	-2.0	66.3	66.5	63.6	64.0	64.7	63.6	64.3
Unemployment rate (15-64)	0.6	4.2	3.8	4.8	4.8	4.8	4.8	4.8
Unemployment rate (20-64)	0.5	4.1	3.7	4.6	4.6	4.6	4.6	4.6
Unemployment rate (15-74)	0.5	4.1	3.7	4.6	4.6	4.6	4.6	4.6
Employment (20-64) (in millions)	-7.9	39.4	39.6	36.7	35.1	34.1	32.3	31.5
Employment (15-64) (in millions)	-8.0	40.5	40.7	37.7	36.2	35.1	33.3	32.5
share of young (15-24)	1.0	10%	10%	9%	11%	11%	10%	11%
share of prime-age (25-54)	-1.3	71%	69%	69%	69%	67%	69%	69%
share of older (55-64)	0.3	19%	21%	21%	20%	22%	20%	20%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	-0.5	21.1	23.3	22.7	21.2	23.4	21.5	20.6
Old-age dependency ratio 15-64 (3)	23.7	32.2	34.0	43.5	49.4	51.3	55.1	55.9
Old-age dependency ratio 20-64 (3)	26.4	34.8	36.6	47.1	54.0	55.8	60.1	61.3
Total dependency ratio (4)	28.7	52.3	54.8	66.9	72.3	74.2	79.9	81.0
Total economic dependency ratio (5)	33.3	99.1	100.2	113.9	121.3	123.6	129.5	132.5
Economic old-age dependency ratio (15-64) (6)	29.7	40.6	42.3	53.5	61.6	64.1	68.6	70.3
Economic old-age dependency ratio (15-74) (7)	27.3	39.7	41.0	51.0	58.8	61.0	65.0	67.0

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

6. ESTONIA

Table III.6.1:

Estonia	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.58	1.67	1.75	1.77	1.78	1.80	1.81
Life expectancy at birth								
males	11.1	72.8	73.8	76.1	78.3	80.3	82.2	83.9
females	7.6	81.9	82.5	84.1	85.6	87.0	88.3	89.5
Life expectancy at 65								
males	6.8	15.4	16.0	17.3	18.6	19.9	21.1	22.2
females	5.6	20.4	20.9	22.0	23.1	24.1	25.1	26.0
Net migration (thousand)	-2.7	2.9	2.3	1.4	1.2	0.7	0.1	0.3
Net migration as % of population	-0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0
Population (million)	-0.1	1.3	1.3	1.3	1.3	1.3	1.2	1.2
Children population (0-14) as % of total population	-1.4	16.1	16.5	15.4	14.7	15.2	15.0	14.7
Prime age population (25-54) as % of total population	-8.4	41.6	40.8	37.6	35.7	33.4	34.0	33.2
Working age population (15-64) as % of total population	-8.8	64.7	63.2	61.4	59.8	56.8	54.6	55.9
Elderly population (65 and over) as % of total population	10.2	19.2	20.3	23.2	25.5	28.0	30.4	29.4
Very elderly population (80 and over) as % of total population	8.7	5.2	6.0	6.8	8.8	9.9	11.4	13.9
Very elderly population (80 and over) as % of elderly population	20.2	27.2	29.4	29.4	34.4	35.4	37.4	47.4
Very elderly population (80 and over) as % of working age population	16.9	8.1	9.4	11.1	14.6	17.4	20.9	24.9
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.5	2.3	2.4	1.7	1.4	1.1	1.3	1.3
Employment (growth rate)	-0.4	1.3	0.5	-0.3	-0.5	-0.8	-0.4	-0.3
Labour input : hours worked (growth rate)	-0.4	1.2	0.4	-0.3	-0.5	-0.8	-0.4	-0.3
Labour productivity per hour (growth rate)	1.9	1.1	1.9	2.1	1.9	1.9	1.7	1.5
TFP (growth rate)	1.2	0.8	1.1	1.3	1.3	1.2	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.7	0.3	0.8	0.8	0.7	0.7	0.6	0.5
Potential GDP per capita (growth rate)	1.7	2.2	2.4	1.9	1.6	1.4	1.6	1.6
Potential GDP per worker (growth rate)	1.9	1.0	1.9	2.1	1.9	1.9	1.7	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-193	851	833	802	767	713	665	657
Population growth (working age:15-64)	0.2	-0.5	-0.5	-0.3	-0.6	-0.9	-0.2	-0.3
Population (20-64) (in thousands)	-194	791	770	732	701	652	602	597
Population growth (20-64)	0.3	-0.5	-0.7	-0.2	-0.5	-1.0	-0.2	-0.3
Labour force 15-64 (thousands)	-163	659	644	613	582	539	505	497
Labour force 20-64 (thousands)	-163	652	636	604	573	531	497	489
Participation rate (20-64)	-0.5	82.4	82.6	82.5	81.7	81.4	82.6	81.9
Participation rate (15-64)	-1.9	77.5	77.2	76.5	75.8	75.5	75.9	75.6
young (15-24)	0.3	42.3	41.1	43.0	42.8	42.3	41.8	42.6
prime-age (25-54)	-0.2	87.9	87.7	87.5	87.4	87.7	87.7	87.7
older (55-64)	-0.2	71.2	70.6	73.1	71.2	69.8	71.4	71.0
Participation rate (20-64) - FEMALES	-0.7	77.5	77.6	77.7	76.7	76.2	77.4	76.8
Participation rate (15-64) - FEMALES	-2.2	73.3	72.8	72.1	71.3	70.9	71.4	71.1
young (15-24)	0.7	38.9	38.2	39.8	39.8	39.3	38.9	39.6
prime-age (25-54)	-0.3	82.0	81.6	81.7	81.4	81.4	81.8	81.6
older (55-64)	-2.0	71.4	70.4	72.2	69.6	68.0	69.7	69.3
Participation rate (20-64) - MALES	-0.4	87.3	87.6	87.2	86.7	86.5	87.6	86.9
Participation rate (15-64) - MALES	-1.8	81.8	81.7	80.7	80.2	80.1	80.3	80.0
young (15-24)	-0.1	45.5	44.0	46.1	45.7	45.1	44.6	45.5
prime-age (25-54)	0.0	93.7	93.6	93.0	93.3	93.9	93.6	93.6
older (55-64)	1.7	70.9	70.8	74.1	72.8	71.6	73.1	72.6
Average effective exit age (TOTAL) (1)	0.0	65.1	64.6	65.0	65.0	65.0	65.0	65.0
Men	0.2	65.2	64.8	65.3	65.3	65.3	65.3	65.3
Women	-0.2	65.0	64.5	64.8	64.8	64.8	64.8	64.8
Employment rate (15-64)	-2.6	72.2	71.4	70.0	69.6	69.6	69.9	69.6
Employment rate (20-64)	-1.2	76.9	76.5	75.8	75.3	75.2	76.3	75.7
Employment rate (15-74)	-4.3	66.2	64.4	61.7	61.4	60.3	59.8	61.9
Unemployment rate (15-64)	1.1	6.8	7.5	8.4	8.1	7.9	7.9	7.9
Unemployment rate (20-64)	1.0	6.6	7.3	8.1	7.9	7.6	7.6	7.6
Unemployment rate (15-74)	1.1	6.5	7.1	8.0	7.8	7.5	7.5	7.6
Employment (20-64) (in millions)	-0.2	0.6	0.6	0.6	0.5	0.5	0.5	0.5
Employment (15-64) (in millions)	-0.2	0.6	0.6	0.6	0.5	0.5	0.5	0.5
share of young (15-24)	2.0	8%	7%	9%	9%	9%	10%	10%
share of prime-age (25-54)	-3.8	74%	74%	71%	70%	69%	73%	70%
share of older (55-64)	1.8	19%	19%	20%	21%	22%	17%	20%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	1.4	20.4	20.7	20.7	22.5	23.9	18.7	21.8
Old-age dependency ratio 15-64 (3)	23.0	29.7	32.2	37.8	42.6	49.2	55.7	52.7
Old-age dependency ratio 20-64 (3)	26.1	31.9	34.8	41.4	46.7	53.9	61.6	58.0
Total dependency ratio (4)	24.4	54.6	58.2	62.8	67.2	76.0	83.2	79.0
Total economic dependency ratio (5)	42.1	103.1	110.1	121.6	127.7	138.6	147.4	145.2
Economic old-age dependency ratio (15-64) (6)	35.1	35.7	39.6	49.1	55.8	64.7	73.8	70.8
Economic old-age dependency ratio (15-74) (7)	33.7	33.8	37.6	46.8	52.9	61.1	69.7	67.5

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

7. IRELAND

Table III.7.1:

Ireland	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.1	1.89	1.96	1.96	1.96	1.96	1.96	1.97
Life expectancy at birth								
males	6.9	79.5	80.1	81.5	82.9	84.1	85.3	86.4
females	6.8	83.5	84.2	85.5	86.9	88.1	89.2	90.3
Life expectancy at 65								
males	5.0	18.5	18.9	19.9	20.9	21.8	22.7	23.5
females	5.5	21.1	21.6	22.7	23.8	24.8	25.7	26.6
Net migration (thousand)	-4.0	14.8	9.9	7.5	11.4	13.7	12.2	10.8
Net migration as % of population	-0.1	0.3	0.2	0.1	0.2	0.2	0.2	0.2
Population (million)	1.4	4.7	4.9	5.2	5.4	5.7	5.9	6.0
Children population (0-14) as % of total population	-5.2	22.2	22.1	18.5	17.2	18.4	17.8	17.0
Prime age population (25-54) as % of total population	-8.0	42.6	40.6	36.6	35.0	35.4	35.5	34.6
Working age population (15-64) as % of total population	-5.6	64.4	63.3	63.1	60.4	56.0	57.0	58.7
Elderly population (65 and over) as % of total population	10.8	13.4	14.6	18.4	22.4	25.6	25.2	24.2
Very elderly population (80 and over) as % of total population	8.0	3.1	3.4	4.9	6.6	8.5	10.6	11.2
Very elderly population (80 and over) as % of elderly population	22.6	23.5	23.4	26.9	29.7	33.1	42.2	46.0
Very elderly population (80 and over) as % of working age population	14.1	4.9	5.4	7.8	11.0	15.1	18.7	19.0
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	2.1	5.0	3.3	1.8	1.6	1.5	2.0	1.9
Employment (growth rate)	0.5	2.8	0.9	0.6	0.1	-0.1	0.5	0.4
Labour input : hours worked (growth rate)	0.5	3.1	0.8	0.5	0.1	0.0	0.5	0.4
Labour productivity per hour (growth rate)	1.6	1.8	2.4	1.3	1.5	1.5	1.5	1.5
TFP (growth rate)	1.1	1.9	1.8	0.9	1.0	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	-0.1	0.6	0.4	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.6	4.1	2.4	1.4	1.0	1.0	1.8	1.7
Potential GDP per worker (growth rate)	1.6	2.2	2.4	1.2	1.5	1.6	1.5	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	532	3,018	3,085	3,255	3,268	3,196	3,366	3,550
Population growth (working age:15-64)	-0.1	0.4	0.5	0.3	-0.2	0.0	0.8	0.3
Population (20-64) (in thousands)	462	2,725	2,774	2,874	2,944	2,880	2,998	3,187
Population growth (20-64)	0.3	0.2	0.4	0.5	0.0	-0.1	0.8	0.5
Labour force 15-64 (thousands)	363	2,128	2,166	2,251	2,297	2,262	2,365	2,491
Labour force 20-64 (thousands)	347	2,076	2,111	2,180	2,237	2,206	2,298	2,424
Participation rate (20-64)	-0.1	76.2	76.1	75.8	76.0	76.6	76.7	76.0
Participation rate (15-64)	-0.3	70.5	70.2	69.2	70.3	70.8	70.2	70.2
young (15-24)	4.0	38.6	39.3	40.5	42.7	41.0	40.8	42.6
prime-age (25-54)	0.1	81.2	81.2	81.4	81.3	81.4	81.2	81.3
older (55-64)	4.8	61.0	61.9	64.8	66.2	64.3	65.8	65.8
Participation rate (20-64) - FEMALES	3.0	68.5	69.1	70.5	71.2	71.5	71.9	71.4
Participation rate (15-64) - FEMALES	2.3	63.7	64.1	64.5	66.0	66.2	66.0	66.0
young (15-24)	3.8	36.9	37.3	38.7	40.8	39.2	39.0	40.8
prime-age (25-54)	2.3	73.4	74.1	75.8	75.6	75.7	75.6	75.8
older (55-64)	12.1	51.0	53.7	59.4	63.4	61.4	63.1	63.1
Participation rate (20-64) - MALES	-3.7	84.1	83.2	81.2	80.7	81.4	81.2	80.5
Participation rate (15-64) - MALES	-3.3	77.5	76.4	73.8	74.5	75.2	74.3	74.2
young (15-24)	4.3	40.1	41.2	42.3	44.6	42.8	42.5	44.3
prime-age (25-54)	-2.8	89.3	88.6	87.0	86.7	86.9	86.5	86.5
older (55-64)	-2.8	71.1	70.4	70.6	69.3	67.4	68.4	68.4
Average effective exit age (TOTAL) (1)	1.5	64.6	65.2	66.0	66.0	66.0	66.0	66.0
Men	1.0	65.0	65.3	66.0	66.0	66.0	66.0	66.0
Women	1.9	64.1	65.1	66.1	66.1	66.1	66.1	66.1
Employment rate (15-64)	0.8	64.8	66.3	64.6	65.7	66.2	65.7	65.6
Employment rate (20-64)	1.0	70.3	72.1	71.2	71.3	71.8	71.9	71.3
Employment rate (15-74)	0.4	59.5	60.5	58.8	58.9	58.4	59.4	59.8
Unemployment rate (15-64)	-1.5	8.1	5.5	6.5	6.5	6.5	6.5	6.5
Unemployment rate (20-64)	-1.5	7.7	5.3	6.2	6.2	6.2	6.2	6.2
Unemployment rate (15-74)	-1.7	7.9	5.4	6.3	6.2	6.1	6.2	6.2
Employment (20-64) (in millions)	0.4	1.9	2.0	2.0	2.1	2.1	2.2	2.3
Employment (15-64) (in millions)	0.4	2.0	2.0	2.1	2.1	2.1	2.2	2.3
share of young (15-24)	3.0	8%	9%	12%	11%	10%	11%	11%
share of prime-age (25-54)	-8.2	77%	75%	69%	67%	73%	72%	69%
share of older (55-64)	5.2	15%	16%	19%	21%	17%	16%	20%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	4.2	16.7	17.7	20.2	22.2	18.1	17.2	20.9
Old-age dependency ratio 15-64 (3)	20.4	20.9	23.1	29.1	37.1	45.7	44.2	41.2
Old-age dependency ratio 20-64 (3)	22.8	23.1	25.7	32.9	41.2	50.7	49.6	45.9
Total dependency ratio (4)	14.9	55.4	57.9	58.5	65.6	78.5	75.4	70.2
Total economic dependency ratio (5)	13.2	132.9	130.5	133.2	136.5	151.8	154.0	146.1
Economic old-age dependency ratio (15-64) (6)	28.2	29.2	31.5	39.8	49.9	61.9	62.1	57.4
Economic old-age dependency ratio (15-74) (7)	26.1	28.3	30.5	37.9	46.8	57.7	59.1	54.4

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

8. GREECE

Table III.8.1:

Greece	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.3	1.39	1.33	1.40	1.46	1.52	1.58	1.64
Life expectancy at birth								
males	7.7	78.8	79.6	81.2	82.6	84.0	85.3	86.5
females	6.4	83.9	84.5	85.8	87.0	88.2	89.3	90.3
Life expectancy at 65								
males	5.1	18.7	19.2	20.2	21.2	22.1	23.0	23.8
females	5.2	21.4	21.9	22.9	23.9	24.8	25.7	26.6
Net migration (thousand)	34.9	-23.9	-16.8	-4.1	7.9	13.3	10.5	11.0
Net migration as % of population	0.4	-0.2	-0.2	0.0	0.1	0.1	0.1	0.1
Population (million)	-3.1	10.8	10.5	9.9	9.4	8.9	8.3	7.7
Children population (0-14) as % of total population	-2.1	14.4	13.9	11.6	11.4	12.1	11.8	12.3
Prime age population (25-54) as % of total population	-9.7	41.4	39.8	35.2	32.2	32.1	32.1	31.6
Working age population (15-64) as % of total population	-10.4	64.2	63.3	61.0	55.6	51.4	52.7	53.8
Elderly population (65 and over) as % of total population	12.5	21.4	22.8	27.4	32.9	36.5	35.4	33.9
Very elderly population (80 and over) as % of total population	10.1	6.6	7.4	8.8	11.3	14.4	17.2	16.6
Very elderly population (80 and over) as % of elderly population	18.3	30.8	32.2	32.1	34.2	39.4	48.6	49.1
Very elderly population (80 and over) as % of working age population	20.7	10.3	11.6	14.4	20.2	28.0	32.7	31.0
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	0.8	-1.4	-0.3	0.5	0.8	1.1	1.3	1.2
Employment (growth rate)	-0.4	-0.4	-0.2	-0.3	-0.8	-0.8	-0.4	-0.4
Labour input : hours worked (growth rate)	-0.4	-0.2	0.1	-0.3	-0.8	-0.8	-0.4	-0.4
Labour productivity per hour (growth rate)	1.1	-1.2	-0.4	0.8	1.6	1.9	1.7	1.5
TFP (growth rate)	0.8	-0.6	0.0	0.5	1.0	1.2	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.4	-0.6	-0.3	0.3	0.5	0.7	0.6	0.5
Potential GDP per capita (growth rate)	1.4	-0.8	0.3	1.1	1.3	1.7	2.1	1.9
Potential GDP per worker (growth rate)	1.2	-0.9	-0.1	0.8	1.6	1.9	1.7	1.6
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-2,785	6,904	6,667	6,050	5,228	4,569	4,357	4,118
Population growth (working age:15-64)	0.3	-1.0	-0.9	-1.1	-1.5	-0.8	-0.4	-0.7
Population (20-64) (in thousands)	-2,588	6,369	6,137	5,559	4,847	4,198	3,976	3,781
Population growth (20-64)	0.4	-1.0	-1.0	-0.9	-1.5	-0.9	-0.4	-0.7
Labour force 15-64 (thousands)	-1,627	4,698	4,594	4,320	3,878	3,437	3,241	3,071
Labour force 20-64 (thousands)	-1,616	4,666	4,562	4,289	3,855	3,414	3,218	3,050
Participation rate (20-64)	7.4	73.3	74.3	77.1	79.5	81.3	80.9	80.7
Participation rate (15-64)	6.5	68.0	68.9	71.4	74.2	75.2	74.4	74.6
young (15-24)	2.2	25.7	26.3	27.6	28.5	26.9	27.0	27.9
prime-age (25-54)	2.8	85.4	86.5	87.4	88.1	88.4	88.1	88.2
older (55-64)	30.2	45.2	48.8	65.0	71.3	74.6	75.3	75.3
Participation rate (20-64) - FEMALES	10.5	65.1	67.0	71.5	74.2	76.2	75.9	75.6
Participation rate (15-64) - FEMALES	9.2	60.7	62.4	66.5	69.4	70.6	69.7	69.9
young (15-24)	1.6	24.3	24.5	25.7	26.5	24.9	24.9	25.8
prime-age (25-54)	4.9	77.8	80.1	82.2	82.7	82.9	82.7	82.7
older (55-64)	37.0	34.0	38.3	58.2	65.7	70.3	70.9	71.0
Participation rate (20-64) - MALES	3.6	81.7	81.9	82.9	84.8	86.2	85.6	85.3
Participation rate (15-64) - MALES	3.2	75.6	75.7	76.4	78.8	79.6	78.7	78.9
young (15-24)	2.6	27.1	28.1	29.4	30.3	28.7	28.8	29.7
prime-age (25-54)	-0.2	93.3	93.0	92.6	93.2	93.4	93.0	93.1
older (55-64)	22.0	57.6	60.8	72.6	77.4	79.3	79.8	79.6
Average effective exit age (TOTAL) (1)	6.2	61.9	62.9	64.9	66.1	67.0	67.4	68.1
Men	5.6	62.3	63.0	65.0	66.3	67.0	67.2	67.8
Women	6.8	61.6	62.8	64.7	66.0	66.9	67.6	68.3
Employment rate (15-64)	16.8	51.8	57.4	63.3	67.0	69.3	68.5	68.7
Employment rate (20-64)	18.4	56.0	62.0	68.5	71.9	75.0	74.6	74.4
Employment rate (15-74)	17.0	45.4	49.5	53.7	56.3	58.8	61.3	62.4
Unemployment rate (15-64)	-15.9	23.8	16.7	11.4	9.6	7.9	7.9	7.9
Unemployment rate (20-64)	-15.8	23.6	16.5	11.2	9.5	7.8	7.8	7.8
Unemployment rate (15-74)	-16.2	23.6	16.6	11.2	9.3	7.5	7.6	7.5
Employment (20-64) (in millions)	-0.8	3.6	3.8	3.8	3.5	3.1	3.0	2.8
Employment (15-64) (in millions)	-0.8	3.6	3.8	3.8	3.5	3.2	3.0	2.8
share of young (15-24)	1.9	4%	5%	6%	6%	5%	6%	6%
share of prime-age (25-54)	-12.3	82%	80%	71%	69%	73%	72%	70%
share of older (55-64)	10.4	14%	15%	23%	26%	21%	22%	24%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	3.9	19.7	21.1	25.0	26.1	20.9	21.1	23.6
Old-age dependency ratio 15-64 (3)	29.7	33.4	36.1	44.9	59.2	71.0	67.2	63.1
Old-age dependency ratio 20-64 (3)	32.6	36.2	39.2	48.9	63.8	77.3	73.6	68.7
Total dependency ratio (4)	30.2	55.8	58.0	63.9	79.7	94.6	89.6	86.0
Total economic dependency ratio (5)	-50.9	195.6	170.7	150.7	150.5	156.9	154.8	144.6
Economic old-age dependency ratio (15-64) (6)	18.4	62.4	61.0	67.4	80.9	92.8	89.1	80.8
Economic old-age dependency ratio (15-74) (7)	11.7	61.3	60.0	65.3	75.6	84.9	82.0	73.0

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

9. SPAIN

Table III.9.1:

Spain	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.6	1.31	1.57	1.80	1.87	1.88	1.88	1.88
Life expectancy at birth								
males	6.4	80.5	81.0	82.3	83.6	84.8	85.9	86.9
females	5.2	86.0	86.3	87.4	88.4	89.4	90.3	91.2
Life expectancy at 65								
males	4.6	19.3	19.6	20.6	21.5	22.3	23.2	23.9
females	4.1	23.2	23.4	24.3	25.1	25.9	26.6	27.3
Net migration (thousand)	123.8	12.9	51.2	119.4	163.4	170.9	153.8	136.8
Net migration as % of population	0.2	0.0	0.1	0.3	0.3	0.3	0.3	0.3
Population (million)	3.4	46.4	46.6	47.2	48.3	49.3	49.6	49.9
Children population (0-14) as % of total population	1.3	15.1	14.7	13.8	14.7	15.7	15.7	16.3
Prime age population (25-54) as % of total population	-9.5	44.0	41.4	35.0	31.6	32.4	33.7	34.6
Working age population (15-64) as % of total population	-9.0	66.0	65.1	61.2	55.1	52.1	55.0	57.1
Elderly population (65 and over) as % of total population	7.7	18.9	20.2	25.0	30.2	32.2	29.3	26.6
Very elderly population (80 and over) as % of total population	6.7	6.1	6.3	7.7	9.8	12.6	14.8	12.8
Very elderly population (80 and over) as % of elderly population	15.7	32.3	31.1	30.6	32.3	39.2	50.5	48.0
Very elderly population (80 and over) as % of working age population	13.1	9.2	9.6	12.5	17.7	24.3	26.9	22.4
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.5	0.4	0.8	1.3	1.0	1.8	2.2	1.9
Employment (growth rate)	0.1	-0.3	-0.3	0.2	-0.4	0.2	0.6	0.4
Labour input : hours worked (growth rate)	0.1	-0.3	-0.2	0.2	-0.4	0.2	0.6	0.4
Labour productivity per hour (growth rate)	1.3	0.7	1.0	1.1	1.5	1.6	1.6	1.5
TFP (growth rate)	0.9	0.4	0.5	0.7	0.9	1.1	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.4	0.5	0.4	0.5	0.6	0.5	0.5
Potential GDP per capita (growth rate)	1.3	0.4	0.7	1.1	0.8	1.7	2.2	1.8
Potential GDP per worker (growth rate)	1.3	0.7	1.1	1.0	1.4	1.6	1.6	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-2,212	30,659	30,314	28,875	26,627	25,684	27,260	28,447
Population growth (working age:15-64)	0.5	-0.3	-0.2	-0.8	-0.9	0.3	0.7	0.2
Population (20-64) (in thousands)	-2,733	28,451	27,928	26,511	24,326	23,154	24,501	25,718
Population growth (20-64)	0.7	-0.5	-0.4	-0.6	-1.0	0.2	0.7	0.2
Labour force 15-64 (thousands)	-840	22,766	22,861	22,307	20,679	19,807	20,928	21,926
Labour force 20-64 (thousands)	-905	22,526	22,603	22,033	20,421	19,528	20,620	21,621
Participation rate (20-64)	4.9	79.2	80.9	83.1	84.0	84.3	84.2	84.1
Participation rate (15-64)	2.8	74.3	75.4	77.3	77.7	77.1	76.8	77.1
young (15-24)	0.7	33.3	32.5	35.0	33.9	33.3	33.6	34.0
prime-age (25-54)	2.2	87.4	88.7	89.8	89.7	89.8	89.7	89.7
older (55-64)	22.6	59.2	66.8	78.5	81.5	81.8	82.4	81.8
Participation rate (20-64) - FEMALES	9.5	73.7	76.8	81.2	83.0	83.4	83.2	83.2
Participation rate (15-64) - FEMALES	7.1	69.2	71.7	75.6	77.0	76.4	76.0	76.2
young (15-24)	0.5	31.4	30.5	33.0	31.9	31.2	31.5	31.9
prime-age (25-54)	5.7	82.3	84.9	88.0	88.1	88.2	88.2	88.1
older (55-64)	32.2	51.7	61.2	76.4	82.5	83.7	84.3	83.9
Participation rate (20-64) - MALES	0.3	84.6	85.0	85.0	84.9	85.3	85.0	84.9
Participation rate (15-64) - MALES	-1.4	79.3	79.1	78.8	78.4	77.9	77.6	77.9
young (15-24)	0.8	35.2	34.3	36.9	35.8	35.2	35.6	35.9
prime-age (25-54)	-1.3	92.5	92.3	91.6	91.2	91.3	91.1	91.2
older (55-64)	12.8	67.0	72.6	80.6	80.4	79.7	80.4	79.7
Average effective exit age (TOTAL) (1)	2.5	64.0	65.3	66.3	66.3	66.3	66.4	66.4
Men	2.8	63.4	64.8	66.0	66.1	66.1	66.1	66.2
Women	2.2	64.5	65.8	66.5	66.6	66.6	66.6	66.7
Employment rate (15-64)	11.4	59.6	63.0	66.3	69.1	71.0	70.7	71.0
Employment rate (20-64)	13.7	63.9	68.0	71.6	74.9	77.9	77.7	77.6
Employment rate (15-74)	11.4	52.6	55.6	57.9	59.0	60.6	63.6	63.9
Unemployment rate (15-64)	-11.9	19.7	16.4	14.2	11.0	7.9	7.9	7.9
Unemployment rate (20-64)	-11.6	19.3	16.0	13.8	10.8	7.7	7.7	7.7
Unemployment rate (15-74)	-12.0	19.6	16.2	13.7	10.5	7.5	7.6	7.6
Employment (20-64) (in millions)	1.8	18.2	19.0	19.0	18.2	18.0	19.0	20.0
Employment (15-64) (in millions)	1.9	18.3	19.1	19.1	18.4	18.2	19.3	20.2
share of young (15-24)	3.3	5%	5%	6%	7%	8%	8%	8%
share of prime-age (25-54)	-9.0	80%	76%	67%	67%	73%	72%	71%
share of older (55-64)	5.7	15%	19%	26%	27%	19%	20%	21%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	0.9	18.7	20.9	25.2	24.7	17.9	18.1	19.5
Old-age dependency ratio 15-64 (3)	18.0	28.6	31.0	40.8	54.7	61.9	53.2	46.6
Old-age dependency ratio 20-64 (3)	20.7	30.9	33.7	44.4	59.9	68.6	59.2	51.6
Total dependency ratio (4)	23.8	51.5	53.7	63.3	81.4	91.9	81.8	75.3
Total economic dependency ratio (5)	-17.8	152.1	139.3	133.6	143.9	153.7	145.4	134.3
Economic old-age dependency ratio (15-64) (6)	13.1	47.2	47.3	55.9	71.4	80.5	70.4	60.2
Economic old-age dependency ratio (15-74) (7)	10.4	46.8	46.4	53.0	66.3	75.6	67.2	57.2

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

10. FRANCE

Table III.10.1:

France	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.0	2.01	2.01	2.00	1.99	1.99	1.99	1.99
Life expectancy at birth								
males	7.1	79.5	80.2	81.7	83.1	84.3	85.5	86.6
females	5.5	85.6	86.1	87.3	88.4	89.4	90.3	91.1
Life expectancy at 65								
males	4.5	19.5	19.9	20.8	21.7	22.5	23.3	24.0
females	4.0	23.5	23.8	24.6	25.4	26.1	26.8	27.5
Net migration (thousand)	1.7	53.6	77.0	85.9	77.3	69.2	62.2	55.3
Net migration as % of population	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Population (million)	10.2	66.8	68.0	70.7	73.0	74.4	75.6	77.0
Children population (0-14) as % of total population	-1.3	18.4	18.1	17.6	17.6	17.4	17.1	17.1
Prime age population (25-54) as % of total population	-3.4	38.2	36.7	34.8	34.5	35.1	34.9	34.8
Working age population (15-64) as % of total population	-5.3	62.6	61.5	58.9	56.8	56.9	57.8	57.3
Elderly population (65 and over) as % of total population	6.6	19.0	20.4	23.6	25.6	25.6	25.1	25.6
Very elderly population (80 and over) as % of total population	4.9	5.9	6.1	7.7	9.6	10.7	11.0	10.8
Very elderly population (80 and over) as % of elderly population	11.1	31.1	30.0	32.5	37.6	41.9	43.8	42.2
Very elderly population (80 and over) as % of working age population	9.5	9.4	10.0	13.0	16.9	18.9	19.0	18.9
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.6	1.1	1.1	1.2	1.7	1.9	1.8	1.6
Employment (growth rate)	0.3	0.7	0.4	0.2	0.3	0.3	0.3	0.1
Labour input : hours worked (growth rate)	0.3	0.4	0.2	0.2	0.3	0.3	0.3	0.1
Labour productivity per hour (growth rate)	1.3	0.7	0.9	1.0	1.4	1.5	1.5	1.5
TFP (growth rate)	0.8	0.4	0.5	0.7	0.9	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.3	0.4	0.4	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.3	0.7	0.7	0.8	1.4	1.7	1.6	1.4
Potential GDP per worker (growth rate)	1.3	0.4	0.7	1.0	1.4	1.5	1.5	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	2,299	41,809	41,775	41,593	41,457	42,375	43,694	44,108
Population growth (working age:15-64)	0.1	0.0	0.0	-0.1	0.1	0.3	0.3	0.1
Population (20-64) (in thousands)	2,057	37,688	37,587	37,510	37,282	38,011	39,303	39,744
Population growth (20-64)	0.3	-0.2	0.0	-0.1	0.1	0.3	0.3	0.1
Labour force 15-64 (thousands)	3,046	29,763	29,955	30,329	30,619	31,481	32,462	32,810
Labour force 20-64 (thousands)	3,000	29,179	29,345	29,733	30,015	30,852	31,825	32,179
Participation rate (20-64)	3.5	77.4	78.1	79.3	80.5	81.2	81.0	81.0
Participation rate (15-64)	3.2	71.2	71.7	72.9	73.9	74.3	74.3	74.4
young (15-24)	1.7	37.5	38.7	39.8	39.3	38.8	39.2	39.2
prime-age (25-54)	0.5	87.5	87.7	87.6	87.9	87.9	87.9	88.0
older (55-64)	14.6	53.5	57.2	63.5	66.2	68.1	68.6	68.1
Participation rate (20-64) - FEMALES	4.2	73.2	74.0	75.6	77.0	77.7	77.5	77.5
Participation rate (15-64) - FEMALES	3.7	67.4	68.0	69.6	70.7	71.1	71.0	71.1
young (15-24)	1.6	34.3	35.6	36.5	36.0	35.6	35.9	35.9
prime-age (25-54)	1.6	82.7	83.3	83.8	84.3	84.4	84.4	84.4
older (55-64)	14.1	51.3	54.2	60.4	63.6	65.3	65.8	65.4
Participation rate (20-64) - MALES	2.6	81.8	82.3	83.0	84.0	84.6	84.4	84.3
Participation rate (15-64) - MALES	2.5	75.1	75.5	76.3	77.0	77.5	77.5	77.6
young (15-24)	1.7	40.6	41.7	42.8	42.3	41.9	42.3	42.2
prime-age (25-54)	-1.0	92.4	92.2	91.5	91.5	91.4	91.4	91.4
older (55-64)	14.9	56.0	60.5	66.8	69.1	71.1	71.3	70.9
Average effective exit age (TOTAL) (1)	2.6	61.9	62.6	63.5	64.3	64.5	64.5	64.5
Men	2.8	61.9	62.8	63.6	64.5	64.7	64.7	64.7
Women	2.5	61.8	62.5	63.3	64.1	64.3	64.3	64.3
Employment rate (15-64)	4.6	63.9	65.1	66.7	67.8	68.4	68.4	68.5
Employment rate (20-64)	5.0	69.8	71.2	72.8	74.2	75.0	74.9	74.8
Employment rate (15-74)	4.3	55.9	56.0	57.5	58.7	60.4	60.8	60.2
Unemployment rate (15-64)	-2.4	10.2	9.3	8.5	8.2	7.9	7.9	7.9
Unemployment rate (20-64)	-2.2	9.8	8.9	8.2	7.9	7.6	7.6	7.6
Unemployment rate (15-74)	-2.5	10.2	9.2	8.4	8.0	7.7	7.7	7.7
Employment (20-64) (in millions)	3.4	26.3	26.7	27.3	27.7	28.5	29.4	29.7
Employment (15-64) (in millions)	3.5	26.7	27.2	27.7	28.1	29.0	29.9	30.2
share of young (15-24)	0.9	8%	9%	10%	10%	10%	10%	9%
share of prime-age (25-54)	-3.5	76%	74%	72%	73%	74%	72%	73%
share of older (55-64)	2.6	15%	17%	19%	17%	17%	18%	18%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	-0.7	19.9	20.3	20.6	18.8	17.8	19.2	19.2
Old-age dependency ratio 15-64 (3)	14.4	30.4	33.2	40.0	45.1	45.0	43.3	44.8
Old-age dependency ratio 20-64 (3)	16.0	33.7	36.9	44.4	50.2	50.2	48.2	49.7
Total dependency ratio (4)	14.8	59.8	62.7	69.9	76.1	75.7	73.0	74.6
Total economic dependency ratio (5)	-1.7	147.1	146.5	148.4	151.4	147.8	144.3	145.4
Economic old-age dependency ratio (15-64) (6)	15.1	46.3	49.6	57.4	63.1	62.1	59.8	61.4
Economic old-age dependency ratio (15-74) (7)	13.4	45.7	48.9	56.0	61.1	60.0	57.8	59.1

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

11. CROATIA

Table III.11.1:

Croatia	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.41	1.47	1.51	1.54	1.58	1.61	1.65
Life expectancy at birth								
males	9.4	75.0	75.8	77.8	79.6	81.3	82.9	84.4
females	7.8	81.1	81.8	83.4	84.9	86.3	87.6	88.9
Life expectancy at 65								
males	6.4	15.6	16.1	17.4	18.6	19.8	21.0	22.0
females	6.2	19.1	19.6	20.8	22.0	23.2	24.3	25.3
Net migration (thousand)	26.1	-21.5	-1.7	4.2	5.0	6.0	5.2	4.6
Net migration as % of population	0.6	-0.5	0.0	0.1	0.1	0.2	0.1	0.1
Population (million)	-0.8	4.2	4.1	3.9	3.8	3.7	3.5	3.4
Children population (0-14) as % of total population	-1.4	14.6	14.5	13.6	13.2	13.2	13.1	13.2
Prime age population (25-54) as % of total population	-6.8	40.3	39.4	38.1	36.3	35.3	34.5	33.5
Working age population (15-64) as % of total population	-10.5	66.0	64.4	61.6	59.9	57.7	56.5	55.6
Elderly population (65 and over) as % of total population	11.9	19.4	21.1	24.8	26.9	29.1	30.3	31.2
Very elderly population (80 and over) as % of total population	8.0	4.9	5.5	6.4	9.0	10.3	11.5	13.0
Very elderly population (80 and over) as % of elderly population	16.1	25.4	26.2	26.0	33.4	35.4	37.9	41.5
Very elderly population (80 and over) as % of working age population	15.9	7.5	8.6	10.5	15.0	17.8	20.3	23.3
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.2	1.1	1.0	1.0	1.6	1.6	1.2	1.0
Employment (growth rate)	-0.4	0.4	-0.3	-0.1	-0.2	-0.4	-0.6	-0.5
Labour input : hours worked (growth rate)	-0.4	0.2	-0.5	-0.1	-0.2	-0.4	-0.6	-0.5
Labour productivity per hour (growth rate)	1.7	0.9	1.5	1.1	1.8	2.1	1.8	1.5
TFP (growth rate)	1.0	0.3	0.5	0.7	1.2	1.3	1.2	1.0
Capital deepening (contribution to labour productivity growth)	0.7	0.6	1.0	0.4	0.6	0.7	0.6	0.5
Potential GDP per capita (growth rate)	1.3	1.9	1.5	0.6	0.9	1.7	1.6	1.5
Potential GDP per worker (growth rate)	1.3	0.7	1.3	0.4	0.7	1.7	1.8	1.7
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-869	2,755	2,628	2,432	2,282	2,118	1,993	1,887
Population growth (working age:15-64)	0.8	-1.3	-1.1	-0.7	-0.6	-0.8	-0.6	-0.5
Population (20-64) (in thousands)	-794	2,524	2,427	2,233	2,103	1,949	1,830	1,731
Population growth (20-64)	0.6	-1.1	-1.0	-0.6	-0.6	-0.8	-0.6	-0.5
Labour force 15-64 (thousands)	-478	1,809	1,767	1,672	1,602	1,497	1,407	1,331
Labour force 20-64 (thousands)	-465	1,773	1,737	1,642	1,576	1,472	1,383	1,308
Participation rate (20-64)	5.3	70.2	71.6	73.5	74.9	75.5	75.6	75.6
Participation rate (15-64)	4.9	65.7	67.2	68.8	70.2	70.7	70.6	70.6
young (15-24)	2.6	37.3	41.3	40.0	39.9	40.0	39.7	39.9
prime-age (25-54)	3.1	82.0	82.9	84.0	84.8	85.1	85.1	85.2
older (55-64)	12.5	42.3	43.5	47.3	53.3	54.0	54.2	54.7
Participation rate (20-64) - FEMALES	7.4	65.3	67.0	70.2	72.0	72.6	72.7	72.7
Participation rate (15-64) - FEMALES	6.8	61.1	63.0	65.6	67.4	67.9	67.9	67.8
young (15-24)	2.8	33.0	37.1	35.9	35.8	35.9	35.6	35.7
prime-age (25-54)	3.8	78.7	80.0	81.2	82.2	82.5	82.5	82.6
older (55-64)	18.3	34.4	36.3	44.5	50.8	52.0	52.2	52.7
Participation rate (20-64) - MALES	3.1	75.2	76.1	76.8	77.8	78.3	78.3	78.3
Participation rate (15-64) - MALES	2.9	70.3	71.5	71.8	73.0	73.4	73.2	73.2
young (15-24)	2.4	41.4	45.2	43.9	43.8	43.9	43.6	43.8
prime-age (25-54)	2.4	85.3	85.7	86.7	87.2	87.6	87.6	87.6
older (55-64)	6.1	50.7	51.3	50.3	55.8	56.1	56.3	56.8
Average effective exit age (TOTAL) (1)	2.4	61.5	61.8	62.7	63.9	63.9	63.9	63.9
Men	1.6	62.4	62.5	62.9	64.0	64.0	64.0	64.0
Women	3.0	60.7	61.1	62.5	63.7	63.7	63.7	63.7
Employment rate (15-64)	8.0	57.0	59.4	60.7	63.3	65.1	65.0	65.0
Employment rate (20-64)	8.4	61.6	63.7	65.4	68.0	69.9	70.0	69.9
Employment rate (15-74)	5.8	50.0	51.2	51.5	54.5	55.6	55.8	55.8
Unemployment rate (15-64)	-5.3	13.2	11.6	11.7	9.8	7.9	7.9	7.9
Unemployment rate (20-64)	-4.9	12.4	11.0	11.1	9.3	7.5	7.5	7.5
Unemployment rate (15-74)	-5.5	13.0	11.4	11.5	9.5	7.5	7.5	7.5
Employment (20-64) (in millions)	-0.3	1.6	1.5	1.5	1.4	1.4	1.3	1.2
Employment (15-64) (in millions)	-0.3	1.6	1.6	1.5	1.4	1.4	1.3	1.2
share of young (15-24)	0.8	8%	9%	8%	8%	8%	8%	9%
share of prime-age (25-54)	-4.2	78%	77%	77%	74%	74%	74%	73%
share of older (55-64)	3.4	15%	15%	15%	18%	18%	18%	18%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	0.9	21.8	22.1	21.2	23.0	22.4	22.2	22.6
Old-age dependency ratio 15-64 (3)	26.9	29.3	32.8	40.3	45.0	50.4	53.7	56.2
Old-age dependency ratio 20-64 (3)	29.3	32.0	35.5	43.9	48.8	54.8	58.5	61.3
Total dependency ratio (4)	28.5	51.5	55.4	62.4	67.0	73.2	77.0	80.0
Total economic dependency ratio (5)	1.7	162.2	156.8	160.5	154.2	153.1	159.1	163.9
Economic old-age dependency ratio (15-64) (6)	31.4	50.1	53.3	63.7	67.2	72.3	77.5	81.5
Economic old-age dependency ratio (15-74) (7)	28.2	49.5	52.4	62.0	64.8	68.8	73.8	77.7

LEGENDA:

*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**

(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.

(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64

(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64

(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64

(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74

(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64

(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74

NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

12. ITALY

Table III.12.1:

Italy	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.3	1.33	1.36	1.42	1.48	1.54	1.60	1.66
Life expectancy at birth								
males	6.2	80.7	81.2	82.5	83.7	84.8	85.9	86.9
females	5.6	85.3	85.8	86.9	88.0	89.0	90.0	90.9
Life expectancy at 65								
males	4.6	19.1	19.5	20.4	21.3	22.1	23.0	23.7
females	4.5	22.5	22.9	23.8	24.7	25.5	26.3	27.0
Net migration (thousand)	29.3	134.5	161.2	209.7	217.7	197.4	176.7	163.8
Net migration as % of population	0.1	0.2	0.3	0.3	0.4	0.3	0.3	0.3
Population (million)	-5.9	60.8	60.7	60.3	60.0	58.9	56.8	54.9
Children population (0-14) as % of total population	-1.0	13.6	13.0	11.6	11.8	12.1	12.1	12.6
Prime age population (25-54) as % of total population	-9.0	41.6	39.9	35.5	34.3	33.5	33.1	32.7
Working age population (15-64) as % of total population	-9.8	64.3	63.8	61.0	55.9	54.1	54.6	54.5
Elderly population (65 and over) as % of total population	10.7	22.1	23.2	27.4	32.3	33.8	33.3	32.9
Very elderly population (80 and over) as % of total population	7.9	6.7	7.5	8.9	10.6	14.0	15.5	14.6
Very elderly population (80 and over) as % of elderly population	14.0	30.5	32.3	32.6	32.9	41.3	46.5	44.5
Very elderly population (80 and over) as % of working age population	16.3	10.5	11.8	14.6	19.0	25.8	28.4	26.8
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	0.8	-0.3	0.5	0.3	0.5	1.3	1.2	1.1
Employment (growth rate)	-0.2	-0.1	0.6	-0.3	-0.7	-0.3	-0.3	-0.4
Labour input : hours worked (growth rate)	-0.2	0.0	0.6	-0.3	-0.8	-0.3	-0.3	-0.4
Labour productivity per hour (growth rate)	1.0	-0.3	-0.1	0.6	1.2	1.6	1.6	1.5
TFP (growth rate)	0.7	-0.2	0.0	0.3	0.8	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.4	-0.1	0.0	0.2	0.4	0.6	0.5	0.5
Potential GDP per capita (growth rate)	1.0	-0.3	0.6	0.3	0.6	1.5	1.6	1.4
Potential GDP per worker (growth rate)	1.1	-0.3	-0.1	0.6	1.2	1.6	1.6	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-9,145	39,049	38,719	36,796	33,493	31,842	31,008	29,904
Population growth (working age:15-64)	-0.2	-0.2	-0.3	-0.9	-0.9	-0.3	-0.2	-0.5
Population (20-64) (in thousands)	-8,644	36,165	35,812	34,057	31,071	29,372	28,500	27,521
Population growth (20-64)	-0.2	-0.3	-0.3	-0.8	-1.0	-0.4	-0.2	-0.5
Labour force 15-64 (thousands)	-5,160	25,374	25,604	24,784	22,726	21,565	20,920	20,214
Labour force 20-64 (thousands)	-5,129	25,178	25,405	24,589	22,559	21,397	20,747	20,050
Participation rate (20-64)	3.2	69.6	70.9	72.2	72.6	72.8	72.8	72.9
Participation rate (15-64)	2.6	65.0	66.1	67.4	67.9	67.7	67.5	67.6
young (15-24)	0.3	26.8	26.5	27.6	27.2	26.7	26.8	27.1
prime-age (25-54)	-0.9	77.5	77.8	76.9	76.6	76.7	76.7	76.6
older (55-64)	19.7	53.4	60.5	70.2	71.1	71.8	72.6	73.1
Participation rate (20-64) - FEMALES	5.8	59.0	61.0	63.8	64.5	64.7	64.7	64.8
Participation rate (15-64) - FEMALES	4.9	55.2	57.0	59.6	60.4	60.1	59.9	60.1
young (15-24)	0.2	22.8	22.5	23.4	23.1	22.7	22.8	23.0
prime-age (25-54)	0.6	66.8	67.7	67.7	67.4	67.5	67.4	67.4
older (55-64)	25.7	41.7	49.8	62.9	65.5	65.9	66.7	67.5
Participation rate (20-64) - MALES	0.1	80.4	80.9	80.5	80.4	80.7	80.5	80.5
Participation rate (15-64) - MALES	-0.1	74.8	75.3	75.0	75.1	75.0	74.6	74.7
young (15-24)	0.4	30.5	30.2	31.4	31.0	30.4	30.6	30.9
prime-age (25-54)	-3.0	88.2	87.7	85.9	85.4	85.4	85.3	85.3
older (55-64)	12.7	65.9	71.9	77.8	77.0	77.7	78.4	78.6
Average effective exit age (TOTAL) (1)	4.6	63.8	66.2	66.5	67.0	67.6	68.1	68.4
Men	3.9	63.9	65.9	66.1	66.3	66.9	67.6	67.8
Women	5.4	63.7	66.6	66.8	67.7	68.2	68.6	69.1
Employment rate (15-64)	5.0	57.3	59.0	61.4	62.2	62.4	62.1	62.3
Employment rate (20-64)	5.7	61.6	63.5	66.0	66.7	67.3	67.2	67.3
Employment rate (15-74)	6.4	50.0	51.5	53.7	53.5	54.9	56.0	56.4
Unemployment rate (15-64)	-4.0	11.9	10.8	8.9	8.4	7.9	7.9	7.9
Unemployment rate (20-64)	-3.9	11.5	10.5	8.6	8.1	7.7	7.6	7.6
Unemployment rate (15-74)	-4.4	11.7	10.6	8.5	7.8	7.4	7.3	7.3
Employment (20-64) (in millions)	-3.8	22.3	22.7	22.5	20.7	19.8	19.2	18.5
Employment (15-64) (in millions)	-3.7	22.4	22.8	22.6	20.8	19.9	19.3	18.6
share of young (15-24)	1.0	4%	4%	5%	5%	5%	5%	5%
share of prime-age (25-54)	-9.9	78%	74%	66%	69%	70%	69%	68%
share of older (55-64)	9.0	18%	22%	29%	26%	25%	26%	27%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	3.4	20.1	22.3	26.1	23.5	22.2	22.7	23.5
Old-age dependency ratio 15-64 (3)	25.8	34.5	36.4	45.0	57.9	62.5	61.0	60.3
Old-age dependency ratio 20-64 (3)	28.3	37.2	39.4	48.6	62.4	67.7	66.4	65.5
Total dependency ratio (4)	27.8	55.6	56.8	64.0	79.0	84.9	83.3	83.5
Total economic dependency ratio (5)	-1.7	166.5	158.0	150.3	163.2	172.3	168.1	164.7
Economic old-age dependency ratio (15-64) (6)	27.3	58.1	58.7	66.4	83.5	91.2	88.1	85.4
Economic old-age dependency ratio (15-74) (7)	19.7	57.0	56.9	62.2	76.4	83.7	80.1	76.7

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

13. CYPRUS

Table III.13.1:

Cyprus	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.3	1.31	1.35	1.40	1.45	1.51	1.56	1.62
Life expectancy at birth								
males	6.4	80.6	81.4	82.7	83.8	84.9	86.0	87.0
females	5.9	84.3	85.0	86.2	87.2	88.3	89.3	90.2
Life expectancy at 65								
males	4.8	19.0	19.6	20.5	21.4	22.2	23.0	23.8
females	5.0	21.3	21.9	22.8	23.7	24.6	25.4	26.3
Net migration (thousand)	2.7	1.0	1.7	2.9	3.9	4.9	4.4	3.7
Net migration as % of population	0.3	0.1	0.2	0.3	0.4	0.5	0.4	0.4
Population (million)	0.2	0.9	0.9	0.9	1.0	1.0	1.0	1.0
Children population (0-14) as % of total population	-4.7	16.1	15.4	13.8	11.9	11.2	11.5	11.4
Prime age population (25-54) as % of total population	-9.5	43.9	44.8	44.6	42.2	38.0	36.1	34.4
Working age population (15-64) as % of total population	-13.6	68.7	67.9	65.9	65.3	62.2	56.9	55.1
Elderly population (65 and over) as % of total population	18.3	15.3	16.7	20.3	22.8	26.6	31.7	33.6
Very elderly population (80 and over) as % of total population	10.6	3.4	3.9	5.7	7.5	8.8	10.3	14.0
Very elderly population (80 and over) as % of elderly population	19.7	22.0	23.5	28.1	32.7	33.2	32.6	41.7
Very elderly population (80 and over) as % of working age population	20.5	4.9	5.8	8.7	11.4	14.2	18.2	25.4
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.4	0.3	1.1	1.1	1.6	1.7	1.3	1.4
Employment (growth rate)	0.3	0.4	0.7	0.5	0.3	0.0	-0.4	-0.1
Labour input : hours worked (growth rate)	0.2	0.1	0.6	0.5	0.3	0.0	-0.4	-0.1
Labour productivity per hour (growth rate)	1.2	0.2	0.5	0.6	1.3	1.7	1.6	1.5
TFP (growth rate)	0.7	-0.2	0.0	0.3	0.9	1.1	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.4	0.5	0.3	0.5	0.6	0.6	0.5
Potential GDP per capita (growth rate)	1.1	-0.1	0.5	0.7	1.3	1.3	1.1	1.5
Potential GDP per worker (growth rate)	1.2	-0.1	0.4	0.6	1.3	1.7	1.6	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-23	584	592	607	624	614	576	561
Population growth (working age:15-64)	-0.3	0.1	0.4	0.2	0.3	-0.5	-0.5	-0.2
Population (20-64) (in thousands)	-13	535	548	565	582	577	539	522
Population growth (20-64)	-0.7	0.5	0.5	0.4	0.4	-0.4	-0.6	-0.2
Labour force 15-64 (thousands)	15	426	445	467	481	478	453	440
Labour force 20-64 (thousands)	16	420	441	463	477	474	449	436
Participation rate (20-64)	5.0	78.6	80.4	81.9	82.0	82.2	83.3	83.6
Participation rate (15-64)	5.6	72.9	75.2	77.0	77.1	77.9	78.6	78.5
young (15-24)	-0.8	38.7	40.2	38.2	37.7	39.8	38.3	37.9
prime-age (25-54)	1.7	86.8	87.5	87.9	88.0	88.4	88.5	88.5
older (55-64)	17.8	59.0	61.7	66.9	69.8	72.5	74.6	76.8
Participation rate (20-64) - FEMALES	7.3	73.5	75.8	78.0	78.5	79.0	80.4	80.8
Participation rate (15-64) - FEMALES	7.7	68.4	71.3	74.0	74.4	75.4	76.3	76.1
young (15-24)	-1.4	39.7	41.1	39.0	38.1	40.5	38.8	38.3
prime-age (25-54)	4.2	81.8	83.5	85.0	85.5	86.0	86.2	86.1
older (55-64)	24.3	47.3	50.6	57.6	63.0	66.8	69.6	71.6
Participation rate (20-64) - MALES	2.2	84.1	85.4	86.2	85.7	85.4	86.1	86.4
Participation rate (15-64) - MALES	3.2	77.6	79.4	80.2	80.0	80.5	80.9	80.7
young (15-24)	-0.1	37.6	39.3	37.6	37.4	39.2	37.9	37.5
prime-age (25-54)	-1.5	92.3	92.0	91.1	90.6	90.7	90.8	90.7
older (55-64)	11.2	70.9	73.1	77.9	78.5	78.9	80.2	82.1
Average effective exit age (TOTAL) (1)	3.5	64.3	64.1	64.6	65.2	65.9	66.9	67.7
Men	3.9	64.5	64.9	65.7	66.1	66.6	67.5	68.4
Women	3.1	64.0	63.3	63.7	64.4	65.2	66.2	67.1
Employment rate (15-64)	10.7	63.0	66.7	72.2	72.5	73.2	73.9	73.7
Employment rate (20-64)	10.4	68.3	71.5	76.9	77.1	77.3	78.3	78.6
Employment rate (15-74)	8.2	57.0	59.8	64.0	64.4	63.8	63.1	65.2
Unemployment rate (15-64)	-7.4	13.5	11.3	6.2	6.1	6.1	6.1	6.1
Unemployment rate (20-64)	-7.2	13.2	11.1	6.1	5.9	6.0	6.0	5.9
Unemployment rate (15-74)	-7.6	13.2	11.1	6.1	5.9	5.8	5.7	5.6
Employment (20-64) (in millions)	0.0	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Employment (15-64) (in millions)	0.0	0.4	0.4	0.4	0.5	0.4	0.4	0.4
share of young (15-24)	-2.0	8%	7%	7%	6%	6%	6%	6%
share of prime-age (25-54)	-6.9	78%	78%	78%	74%	70%	72%	71%
share of older (55-64)	8.9	14%	15%	16%	20%	24%	22%	23%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	6.3	16.8	17.6	17.7	21.5	26.0	23.2	23.1
Old-age dependency ratio 15-64 (3)	38.7	22.2	24.6	30.8	34.9	42.7	55.7	61.0
Old-age dependency ratio 20-64 (3)	41.3	24.3	26.6	33.1	37.4	45.4	59.5	65.5
Total dependency ratio (4)	36.1	45.6	47.3	51.8	53.1	60.7	75.9	81.7
Total economic dependency ratio (5)	0.9	125.9	115.8	104.4	104.7	108.6	120.2	126.8
Economic old-age dependency ratio (15-64) (6)	41.2	32.8	34.5	39.8	44.9	53.1	67.3	74.0
Economic old-age dependency ratio (15-74) (7)	36.0	32.1	33.8	38.7	43.5	50.4	62.2	68.1

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

14. LATVIA

Table III.14.1:

Latvia	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.1	1.74	1.83	1.85	1.85	1.85	1.86	1.87
Life expectancy at birth								
males	13.3	69.4	70.7	73.5	76.1	78.5	80.7	82.7
females	9.1	79.5	80.4	82.3	84.1	85.7	87.2	88.6
Life expectancy at 65								
males	7.6	14.0	14.7	16.2	17.7	19.0	20.4	21.6
females	6.4	19.0	19.6	20.9	22.1	23.3	24.4	25.4
Net migration (thousand)	9.5	-9.4	-8.0	-6.1	-1.5	1.2	0.0	0.1
Net migration as % of population	0.5	-0.5	-0.4	-0.4	-0.1	0.1	0.0	0.0
Population (million)	-0.6	2.0	1.9	1.7	1.6	1.5	1.4	1.3
Children population (0-14) as % of total population	0.1	15.4	16.3	16.1	14.0	15.5	16.2	15.4
Prime age population (25-54) as % of total population	-9.3	41.3	39.7	34.0	30.9	29.7	31.8	32.0
Working age population (15-64) as % of total population	-9.9	64.9	62.8	58.5	56.8	52.9	50.7	55.0
Elderly population (65 and over) as % of total population	9.8	19.8	20.8	25.4	29.2	31.6	33.1	29.6
Very elderly population (80 and over) as % of total population	9.9	5.1	6.0	7.1	9.5	11.5	12.7	15.0
Very elderly population (80 and over) as % of elderly population	25.0	25.8	28.8	27.8	32.6	36.4	38.4	50.8
Very elderly population (80 and over) as % of working age population	19.5	7.9	9.5	12.1	16.8	21.8	25.0	27.3
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.9	1.4	4.2	2.7	1.7	0.9	1.2	1.5
Employment (growth rate)	-0.8	0.1	-0.5	-1.2	-0.7	-1.1	-0.5	0.0
Labour input : hours worked (growth rate)	-0.8	-0.2	-0.6	-1.2	-0.7	-1.1	-0.5	0.0
Labour productivity per hour (growth rate)	2.7	1.6	4.8	3.9	2.4	2.0	1.8	1.5
TFP (growth rate)	1.8	3.3	3.2	2.5	1.6	1.3	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.9	-1.7	1.5	1.4	0.9	0.7	0.6	0.5
Potential GDP per capita (growth rate)	2.6	2.2	5.0	3.7	2.5	1.4	1.9	2.1
Potential GDP per worker (growth rate)	2.7	1.3	4.7	3.9	2.5	2.0	1.8	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-535	1,272	1,197	1,015	905	794	721	736
Population growth (working age:15-64)	1.6	-1.6	-1.6	-1.3	-1.2	-1.4	0.0	0.0
Population (20-64) (in thousands)	-526	1,186	1,108	922	817	726	645	660
Population growth (20-64)	1.7	-1.6	-1.8	-1.7	-1.0	-1.5	-0.2	0.1
Labour force 15-64 (thousands)	-408	970	905	766	682	610	558	562
Labour force 20-64 (thousands)	-407	963	897	759	674	604	552	556
Participation rate (20-64)	3.0	81.2	81.0	82.2	82.6	83.3	85.5	84.2
Participation rate (15-64)	0.1	76.3	75.6	75.5	75.4	76.8	77.3	76.4
young (15-24)	-2.6	39.6	35.0	36.0	38.3	37.3	35.1	37.0
prime-age (25-54)	4.0	87.9	88.7	91.0	91.4	92.3	92.2	91.9
older (55-64)	4.9	67.5	64.5	67.5	70.9	70.0	72.7	72.4
Participation rate (20-64) - FEMALES	4.7	78.6	79.2	81.2	81.4	82.3	84.7	83.3
Participation rate (15-64) - FEMALES	1.4	74.0	74.1	74.5	74.1	75.7	76.3	75.4
young (15-24)	-3.3	36.1	30.9	31.9	34.0	33.2	31.2	32.8
prime-age (25-54)	5.7	85.6	87.3	90.2	90.9	91.5	91.7	91.3
older (55-64)	7.1	66.0	64.1	68.6	70.6	70.7	73.4	73.1
Participation rate (20-64) - MALES	1.1	83.8	82.9	83.3	83.8	84.2	86.3	85.0
Participation rate (15-64) - MALES	-1.4	78.7	77.2	76.4	76.6	77.9	78.3	77.3
young (15-24)	-1.9	42.9	38.9	39.9	42.5	41.4	39.0	41.0
prime-age (25-54)	2.2	90.2	90.0	91.7	92.0	93.1	92.7	92.4
older (55-64)	2.2	69.4	64.9	66.2	71.3	69.4	72.0	71.7
Average effective exit age (TOTAL) (1)	2.6	62.7	63.6	65.2	65.2	65.2	65.2	65.2
Men	3.4	61.7	62.9	65.2	65.2	65.2	65.2	65.2
Women	1.8	63.5	64.2	65.3	65.3	65.3	65.3	65.3
Employment rate (15-64)	1.6	68.8	68.8	68.1	68.7	70.7	71.2	70.3
Employment rate (20-64)	4.3	73.2	73.7	74.3	75.3	76.7	78.8	77.5
Employment rate (15-74)	1.9	61.7	61.1	58.8	59.3	60.3	60.2	63.5
Unemployment rate (15-64)	-1.9	9.8	9.1	9.7	8.8	7.9	7.9	7.9
Unemployment rate (20-64)	-1.9	9.8	9.0	9.7	8.8	7.9	7.9	7.9
Unemployment rate (15-74)	-2.0	9.5	8.7	9.2	8.3	7.4	7.4	7.6
Employment (20-64) (in millions)	-0.4	0.9	0.8	0.7	0.6	0.6	0.5	0.5
Employment (15-64) (in millions)	-0.4	0.9	0.8	0.7	0.6	0.6	0.5	0.5
share of young (15-24)	2.2	7%	6%	8%	10%	8%	9%	10%
share of prime-age (25-54)	-3.4	74%	74%	70%	66%	68%	75%	70%
share of older (55-64)	1.2	19%	20%	22%	24%	24%	16%	20%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	-0.2	21.1	22.8	23.9	25.1	26.2	17.1	20.9
Old-age dependency ratio 15-64 (3)	23.3	30.5	33.1	43.5	51.4	59.8	65.2	53.8
Old-age dependency ratio 20-64 (3)	27.3	32.7	35.8	47.9	57.0	65.5	72.9	59.9
Total dependency ratio (4)	27.7	54.2	59.1	70.9	76.1	89.2	97.1	81.8
Total economic dependency ratio (5)	30.4	116.4	122.4	136.2	139.7	148.5	157.9	146.8
Economic old-age dependency ratio (15-64) (6)	31.0	40.7	44.1	57.6	68.0	76.9	84.2	71.7
Economic old-age dependency ratio (15-74) (7)	29.1	39.3	42.4	54.2	63.6	71.5	78.5	68.4

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

15. LITHUANIA

Table III.15.1:

Lithuania	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.66	1.71	1.76	1.79	1.81	1.82	1.84
Life expectancy at birth								
males	13.5	69.3	70.8	73.6	76.2	78.6	80.8	82.8
females	8.9	79.9	81.0	82.8	84.5	86.0	87.4	88.8
Life expectancy at 65								
males	7.5	14.3	15.1	16.6	18.0	19.3	20.6	21.8
females	6.3	19.3	20.0	21.2	22.4	23.5	24.6	25.6
Net migration (thousand)	28.2	-28.2	-23.8	-17.0	-6.3	1.3	0.2	0.0
Net migration as % of population	1.0	-1.0	-0.9	-0.7	-0.3	0.1	0.0	0.0
Population (million)	-1.1	2.9	2.7	2.4	2.1	2.0	1.8	1.7
Children population (0-14) as % of total population	-0.1	14.7	15.4	15.2	12.6	14.2	15.7	14.7
Prime age population (25-54) as % of total population	-6.8	40.4	39.2	33.7	32.0	31.1	33.3	33.6
Working age population (15-64) as % of total population	-10.4	66.1	64.1	57.9	55.6	53.6	51.4	55.8
Elderly population (65 and over) as % of total population	10.4	19.2	20.5	26.9	31.8	32.3	32.9	29.6
Very elderly population (80 and over) as % of total population	8.5	5.4	6.1	7.3	10.5	13.3	13.2	13.9
Very elderly population (80 and over) as % of elderly population	18.9	28.0	29.7	27.1	33.1	41.4	40.1	46.9
Very elderly population (80 and over) as % of working age population	16.8	8.1	9.5	12.6	18.9	24.9	25.7	24.9
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.1	2.1	1.7	0.5	1.0	0.9	1.0	1.7
Employment (growth rate)	-1.0	0.8	-0.6	-2.0	-1.1	-0.9	-0.7	0.2
Labour input : hours worked (growth rate)	-0.9	1.2	-0.6	-2.1	-1.1	-0.9	-0.7	0.1
Labour productivity per hour (growth rate)	2.0	0.8	2.3	2.5	2.1	1.9	1.7	1.5
TFP (growth rate)	1.2	0.2	1.1	1.5	1.3	1.2	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.8	0.6	1.2	1.0	0.7	0.7	0.6	0.5
Potential GDP per capita (growth rate)	2.0	3.3	2.9	1.9	2.1	1.6	1.7	2.2
Potential GDP per worker (growth rate)	2.1	1.2	2.3	2.5	2.1	1.9	1.7	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-938	1,897	1,752	1,387	1,177	1,046	942	959
Population growth (working age:15-64)	2.1	-1.8	-2.1	-2.0	-1.3	-1.2	-0.4	0.3
Population (20-64) (in thousands)	-875	1,740	1,625	1,259	1,063	969	854	865
Population growth (20-64)	1.9	-1.5	-1.9	-2.2	-1.1	-1.1	-0.7	0.4
Labour force 15-64 (thousands)	-693	1,434	1,325	1,052	895	819	736	741
Labour force 20-64 (thousands)	-688	1,423	1,316	1,044	887	814	731	735
Participation rate (20-64)	3.2	81.8	81.0	82.9	83.4	84.0	85.6	85.0
Participation rate (15-64)	1.7	75.6	75.6	75.9	76.1	78.4	78.2	77.3
young (15-24)	-2.3	36.2	36.4	30.9	34.6	36.1	31.3	33.9
prime-age (25-54)	3.2	89.3	90.2	91.9	92.3	92.6	92.8	92.5
older (55-64)	3.8	69.9	63.4	68.8	70.6	71.7	70.7	73.7
Participation rate (20-64) - FEMALES	4.6	79.7	78.5	82.1	82.6	83.0	84.9	84.3
Participation rate (15-64) - FEMALES	2.7	74.0	73.5	75.3	75.4	77.4	77.4	76.7
young (15-24)	-2.0	32.3	32.4	27.3	30.8	32.3	28.0	30.3
prime-age (25-54)	3.7	88.4	89.6	91.8	92.0	91.8	92.3	92.1
older (55-64)	7.6	66.9	58.9	69.0	71.4	72.3	71.2	74.5
Participation rate (20-64) - MALES	1.6	84.0	83.6	83.8	84.3	85.0	86.3	85.7
Participation rate (15-64) - MALES	0.6	77.3	77.9	76.5	76.8	79.3	78.9	77.9
young (15-24)	-2.5	39.8	40.1	34.3	38.2	39.9	34.5	37.4
prime-age (25-54)	2.7	90.2	90.9	92.0	92.7	93.4	93.2	92.9
older (55-64)	-0.8	73.7	69.0	68.5	69.6	71.1	70.2	72.9
Average effective exit age (TOTAL) (1)	1.0	63.0	62.5	64.0	64.0	64.0	64.0	64.0
Men	-0.1	64.3	63.2	64.3	64.3	64.3	64.3	64.3
Women	2.0	61.8	61.8	63.8	63.8	63.8	63.8	63.8
Employment rate (15-64)	1.7	69.5	70.3	69.7	70.0	72.2	72.0	71.2
Employment rate (20-64)	3.1	75.3	75.2	76.3	76.9	77.4	78.9	78.3
Employment rate (15-74)	0.2	62.4	62.1	57.5	57.7	60.5	58.9	62.6
Unemployment rate (15-64)	-0.1	8.0	7.1	8.1	8.0	7.9	7.9	7.9
Unemployment rate (20-64)	-0.2	8.0	7.1	8.0	7.9	7.8	7.8	7.8
Unemployment rate (15-74)	-0.1	7.9	7.0	7.9	7.8	7.7	7.7	7.8
Employment (20-64) (in millions)	-0.6	1.3	1.2	1.0	0.8	0.8	0.7	0.7
Employment (15-64) (in millions)	-0.6	1.3	1.2	1.0	0.8	0.8	0.7	0.7
share of young (15-24)	-0.2	8%	7%	6%	8%	7%	6%	8%
share of prime-age (25-54)	0.0	73%	73%	71%	70%	69%	77%	73%
share of older (55-64)	0.2	19%	20%	23%	22%	24%	16%	19%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	-0.4	20.7	23.5	24.9	23.0	26.5	18.1	20.3
Old-age dependency ratio 15-64 (3)	24.1	29.0	31.9	46.4	57.2	60.2	63.9	53.1
Old-age dependency ratio 20-64 (3)	27.2	31.6	34.4	51.1	63.3	65.0	70.6	58.8
Total dependency ratio (4)	28.1	51.2	56.0	72.7	79.9	86.6	94.4	79.3
Total economic dependency ratio (5)	34.6	111.5	116.3	140.0	148.1	150.2	160.0	146.2
Economic old-age dependency ratio (15-64) (6)	33.5	38.7	42.8	63.3	78.1	80.0	84.9	72.2
Economic old-age dependency ratio (15-74) (7)	32.9	37.6	41.7	61.4	75.3	77.4	81.7	70.5

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

16. LUXEMBOURG

Table III.16.1:

Luxembourg	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.3	1.40	1.54	1.57	1.60	1.63	1.66	1.69
Life expectancy at birth								
males	7.2	79.2	80.0	81.5	82.8	84.1	85.3	86.4
females	6.3	84.6	85.3	86.6	87.8	88.9	89.9	90.9
Life expectancy at 65								
males	5.0	18.5	19.0	20.0	20.9	21.8	22.7	23.5
females	4.7	22.4	22.9	23.8	24.7	25.6	26.4	27.1
Net migration (thousand)	-6.8	10.8	10.2	8.7	7.0	5.0	4.5	4.0
Net migration as % of population	-1.5	1.9	1.6	1.1	0.8	0.5	0.4	0.4
Population (million)	0.5	0.6	0.6	0.8	0.9	0.9	1.0	1.0
Children population (0-14) as % of total population	-1.5	16.4	16.2	16.4	15.8	15.0	14.9	14.9
Prime age population (25-54) as % of total population	-10.2	45.7	45.0	42.9	40.2	37.7	36.2	35.5
Working age population (15-64) as % of total population	-12.1	69.3	68.9	65.9	63.3	61.4	58.8	57.2
Elderly population (65 and over) as % of total population	13.6	14.3	14.9	17.7	20.9	23.6	26.3	27.9
Very elderly population (80 and over) as % of total population	7.1	4.0	4.1	4.6	6.1	8.2	9.5	11.1
Very elderly population (80 and over) as % of elderly population	11.9	28.0	27.8	26.0	29.0	34.7	36.3	39.9
Very elderly population (80 and over) as % of working age population	13.7	5.8	6.0	7.0	9.6	13.4	16.2	19.5
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	2.3	3.0	3.8	2.5	2.1	1.8	1.7	1.7
Employment (growth rate)	0.8	2.2	2.9	1.0	0.6	0.2	0.1	0.2
Labour input : hours worked (growth rate)	0.8	2.5	2.9	1.0	0.6	0.2	0.1	0.2
Labour productivity per hour (growth rate)	1.4	0.5	0.8	1.5	1.5	1.5	1.5	1.5
TFP (growth rate)	0.9	0.4	0.7	0.9	1.0	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.1	0.1	0.6	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.1	0.7	1.6	0.9	1.0	1.1	1.2	1.4
Potential GDP per worker (growth rate)	1.4	0.8	0.9	1.5	1.5	1.5	1.5	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	189	404	438	501	548	578	586	593
Population growth (working age:15-64)	-2.2	2.4	1.9	1.0	0.8	0.3	0.1	0.2
Population (20-64) (in thousands)	171	371	404	463	503	529	536	541
Population growth (20-64)	-2.4	2.6	2.0	1.0	0.8	0.3	0.0	0.2
Labour force 15-64 (thousands)	128	283	310	354	384	399	404	411
Labour force 20-64 (thousands)	125	279	306	349	377	393	398	404
Participation rate (20-64)	-0.5	75.1	75.6	75.4	75.1	74.2	74.2	74.6
Participation rate (15-64)	-0.8	70.1	70.9	70.7	70.0	69.1	69.1	69.3
young (15-24)	0.4	32.0	33.6	32.6	32.0	32.6	32.6	32.3
prime-age (25-54)	1.5	87.1	87.6	88.3	88.5	88.5	88.6	88.6
older (55-64)	0.1	42.4	44.2	42.4	42.9	43.0	42.1	42.5
Participation rate (20-64) - FEMALES	2.2	69.5	70.7	72.1	72.2	71.5	71.2	71.6
Participation rate (15-64) - FEMALES	1.8	64.8	66.3	67.6	67.3	66.6	66.4	66.5
young (15-24)	-0.2	32.0	33.3	32.3	31.6	32.1	32.1	31.8
prime-age (25-54)	4.1	81.0	82.7	84.5	84.9	85.0	85.1	85.1
older (55-64)	5.3	34.7	36.8	38.5	40.0	40.6	39.5	39.9
Participation rate (20-64) - MALES	-3.0	80.6	80.2	78.6	78.0	77.0	77.1	77.6
Participation rate (15-64) - MALES	-3.2	75.2	75.3	73.8	72.7	71.7	71.8	72.1
young (15-24)	0.9	31.9	33.9	33.0	32.4	33.0	33.0	32.8
prime-age (25-54)	-0.8	93.0	92.5	92.0	92.1	92.1	92.2	92.2
older (55-64)	-4.7	49.8	51.2	46.1	45.7	45.4	44.7	45.2
Average effective exit age (TOTAL) (1)	0.1	60.2	60.3	60.3	60.3	60.3	60.3	60.3
Men	0.1	60.4	60.4	60.4	60.4	60.4	60.4	60.4
Women	0.1	60.0	60.1	60.1	60.1	60.1	60.1	60.1
Employment rate (15-64)	0.1	65.7	66.8	67.2	66.5	65.7	65.6	65.9
Employment rate (20-64)	0.4	70.8	71.5	71.9	71.6	70.8	70.7	71.2
Employment rate (15-74)	-3.9	59.5	60.1	59.0	57.6	56.4	55.4	55.5
Unemployment rate (15-64)	-1.2	6.2	5.7	5.0	5.0	5.0	5.0	5.0
Unemployment rate (20-64)	-1.2	5.8	5.4	4.7	4.7	4.6	4.6	4.6
Unemployment rate (15-74)	-1.3	6.2	5.7	4.9	4.9	4.9	4.9	4.9
Employment (20-64) (in millions)	0.1	0.3	0.3	0.3	0.4	0.4	0.4	0.4
Employment (15-64) (in millions)	0.1	0.3	0.3	0.3	0.4	0.4	0.4	0.4
share of young (15-24)	0.7	7%	7%	6%	7%	7%	7%	7%
share of prime-age (25-54)	-2.8	83%	82%	82%	81%	79%	79%	80%
share of older (55-64)	2.2	10%	12%	12%	12%	14%	13%	13%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	3.2	16.9	18.2	19.3	19.8	21.2	21.1	20.1
Old-age dependency ratio 15-64 (3)	28.2	20.6	21.7	26.9	32.9	38.5	44.6	48.9
Old-age dependency ratio 20-64 (3)	31.0	22.5	23.4	29.1	35.9	42.0	48.7	53.5
Total dependency ratio (4)	30.6	44.3	45.2	51.8	57.9	63.0	69.9	74.9
Total economic dependency ratio (5)	43.7	118.7	116.1	123.8	135.0	145.3	155.8	162.4
Economic old-age dependency ratio (15-64) (6)	42.0	31.0	31.9	39.1	48.5	57.5	66.8	73.0
Economic old-age dependency ratio (15-74) (7)	41.2	30.9	31.7	38.7	48.0	56.8	66.0	72.1

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

17. HUNGARY

Table III.17.1:

Hungary	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.3	1.48	1.61	1.68	1.72	1.75	1.77	1.80
Life expectancy at birth								
males	11.1	72.8	73.7	76.0	78.2	80.3	82.1	83.9
females	9.0	79.6	80.4	82.3	84.0	85.7	87.2	88.6
Life expectancy at 65								
males	7.1	14.9	15.4	16.8	18.2	19.5	20.8	22.0
females	6.7	18.7	19.2	20.6	21.9	23.1	24.3	25.4
Net migration (thousand)	-7.0	18.2	19.9	16.2	20.8	15.3	13.8	11.2
Net migration as % of population	-0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1
Population (million)	-1.0	9.8	9.8	9.7	9.5	9.3	9.1	8.9
Children population (0-14) as % of total population	0.4	14.5	14.6	14.8	14.4	14.4	14.8	14.9
Prime age population (25-54) as % of total population	-7.9	41.9	42.3	38.8	35.4	34.1	34.0	34.0
Working age population (15-64) as % of total population	-11.1	67.1	65.0	63.0	60.4	57.4	55.6	56.0
Elderly population (65 and over) as % of total population	10.7	18.5	20.3	22.2	25.2	28.2	29.6	29.1
Very elderly population (80 and over) as % of total population	8.0	4.3	4.6	6.2	8.2	8.9	12.0	12.3
Very elderly population (80 and over) as % of elderly population	18.9	23.4	22.8	27.9	32.7	31.7	40.5	42.2
Very elderly population (80 and over) as % of working age population	15.5	6.4	7.1	9.8	13.7	15.6	21.6	22.0
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.6	1.9	1.9	2.1	1.2	1.5	1.3	1.3
Employment (growth rate)	-0.3	1.7	0.1	-0.2	-0.9	-0.5	-0.5	-0.2
Labour input : hours worked (growth rate)	-0.3	1.6	0.1	-0.2	-0.9	-0.5	-0.5	-0.2
Labour productivity per hour (growth rate)	1.9	0.2	1.8	2.4	2.1	1.9	1.7	1.5
TFP (growth rate)	1.3	0.7	1.1	1.5	1.4	1.3	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.7	-0.5	0.7	0.8	0.8	0.7	0.6	0.5
Potential GDP per capita (growth rate)	1.8	2.1	1.9	2.3	1.4	1.7	1.5	1.6
Potential GDP per worker (growth rate)	1.9	0.1	1.8	2.3	2.2	1.9	1.7	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-1,620	6,588	6,364	6,081	5,711	5,325	5,065	4,968
Population growth (working age:15-64)	0.6	-0.7	-1.0	-0.3	-1.1	-0.4	-0.5	-0.2
Population (20-64) (in thousands)	-1,582	6,089	5,876	5,612	5,217	4,863	4,608	4,506
Population growth (20-64)	0.4	-0.6	-1.1	-0.4	-1.2	-0.4	-0.5	-0.2
Labour force 15-64 (thousands)	-831	4,623	4,616	4,710	4,367	4,086	3,879	3,793
Labour force 20-64 (thousands)	-827	4,587	4,581	4,677	4,332	4,053	3,846	3,760
Participation rate (20-64)	8.1	75.3	78.0	83.3	83.0	83.3	83.5	83.4
Participation rate (15-64)	6.2	70.2	72.5	77.5	76.5	76.7	76.6	76.3
young (15-24)	-2.1	33.2	32.3	32.1	31.2	31.8	31.2	31.1
prime-age (25-54)	2.6	86.1	87.4	88.4	88.7	88.6	88.6	88.7
older (55-64)	29.1	52.2	55.6	80.2	79.8	81.5	81.2	81.3
Participation rate (20-64) - FEMALES	10.6	68.0	71.8	78.5	78.1	78.5	78.6	78.6
Participation rate (15-64) - FEMALES	8.4	63.5	66.9	73.0	71.9	72.2	72.0	71.8
young (15-24)	-1.9	29.0	28.3	28.1	27.2	27.8	27.2	27.1
prime-age (25-54)	3.5	79.8	81.6	82.9	83.4	83.1	83.1	83.3
older (55-64)	35.2	43.5	50.1	77.7	76.4	78.8	78.6	78.7
Participation rate (20-64) - MALES	5.3	82.8	84.1	88.1	87.9	88.1	88.2	88.1
Participation rate (15-64) - MALES	3.7	77.0	78.2	81.9	80.9	81.1	81.0	80.7
young (15-24)	-2.2	37.1	36.1	36.0	35.0	35.7	35.0	34.9
prime-age (25-54)	1.5	92.3	93.1	93.8	93.8	93.8	93.9	93.8
older (55-64)	21.4	62.5	61.8	82.8	83.3	84.2	83.9	83.9
Average effective exit age (TOTAL) (1)	3.3	61.7	62.8	65.1	65.1	65.1	65.1	65.1
Men	2.8	62.5	63.2	65.3	65.3	65.3	65.3	65.3
Women	3.8	61.0	62.4	64.8	64.8	64.8	64.8	64.8
Employment rate (15-64)	6.0	66.6	69.6	73.6	72.7	72.9	72.8	72.5
Employment rate (20-64)	7.9	71.6	74.9	79.3	79.0	79.3	79.4	79.4
Employment rate (15-74)	4.4	58.0	59.4	64.2	62.2	61.1	61.7	62.4
Unemployment rate (15-64)	-0.2	5.2	4.0	5.0	5.0	5.0	5.0	5.0
Unemployment rate (20-64)	-0.2	5.0	3.9	4.8	4.8	4.8	4.8	4.8
Unemployment rate (15-74)	-0.2	5.1	4.0	4.9	4.9	4.9	4.9	4.9
Employment (20-64) (in millions)	-0.8	4.4	4.4	4.5	4.1	3.9	3.7	3.6
Employment (15-64) (in millions)	-0.8	4.4	4.4	4.5	4.1	3.9	3.7	3.6
share of young (15-24)	-0.3	7%	7%	6%	7%	7%	7%	7%
share of prime-age (25-54)	-6.2	77%	79%	71%	68%	69%	71%	71%
share of older (55-64)	6.4	16%	15%	23%	25%	24%	22%	22%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	-0.3	20.7	18.9	22.2	23.7	22.5	20.5	20.5
Old-age dependency ratio 15-64 (3)	24.5	27.5	31.3	35.2	41.8	49.1	53.2	52.0
Old-age dependency ratio 20-64 (3)	27.6	29.8	33.9	38.2	45.8	53.7	58.5	57.3
Total dependency ratio (4)	29.5	49.1	53.8	58.8	65.7	74.3	79.8	78.6
Total economic dependency ratio (5)	17.2	121.9	118.9	111.2	120.3	131.7	139.0	139.1
Economic old-age dependency ratio (15-64) (6)	28.3	40.4	44.0	45.7	54.0	64.1	69.7	68.7
Economic old-age dependency ratio (15-74) (7)	26.7	40.0	43.6	44.7	52.1	62.1	67.3	66.7

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

18. MALTA

Table III.18.1:

Malta	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.3	1.41	1.54	1.62	1.67	1.70	1.72	1.75
Life expectancy at birth								
males	6.8	80.0	80.5	82.0	83.4	84.7	85.8	86.8
females	6.3	84.3	84.8	86.1	87.4	88.5	89.6	90.6
Life expectancy at 65								
males	4.6	19.3	19.6	20.6	21.5	22.3	23.1	23.9
females	4.7	22.2	22.5	23.5	24.4	25.3	26.1	26.9
Net migration (thousand)	-2.5	3.5	3.2	2.6	2.0	1.4	1.3	1.0
Net migration as % of population	-0.6	0.8	0.7	0.5	0.4	0.3	0.2	0.2
Population (million)	0.1	0.4	0.5	0.5	0.5	0.5	0.5	0.5
Children population (0-14) as % of total population	0.3	14.3	14.6	15.2	14.3	14.2	14.7	14.5
Prime age population (25-54) as % of total population	-7.1	40.7	40.7	39.7	37.1	34.8	33.9	33.7
Working age population (15-64) as % of total population	-11.5	66.4	64.2	60.4	60.6	58.7	55.4	54.9
Elderly population (65 and over) as % of total population	11.2	19.3	21.2	24.4	25.1	27.0	29.9	30.6
Very elderly population (80 and over) as % of total population	9.1	4.2	4.9	7.9	9.9	10.0	11.1	13.3
Very elderly population (80 and over) as % of elderly population	21.6	22.0	23.3	32.2	39.4	36.8	37.2	43.6
Very elderly population (80 and over) as % of working age population	17.9	6.4	7.7	13.0	16.3	16.9	20.1	24.3
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	2.3	6.1	4.2	3.2	2.0	1.2	1.2	1.6
Employment (growth rate)	0.4	3.8	1.8	0.8	0.2	-0.4	-0.4	0.1
Labour input : hours worked (growth rate)	0.4	3.5	1.6	0.7	0.2	-0.4	-0.3	0.0
Labour productivity per hour (growth rate)	1.9	2.5	2.6	2.4	1.8	1.6	1.6	1.5
TFP (growth rate)	1.2	1.7	1.6	1.5	1.2	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.7	0.7	0.9	0.9	0.6	0.6	0.5	0.5
Potential GDP per capita (growth rate)	2.0	4.9	3.2	2.6	1.8	1.1	1.1	1.6
Potential GDP per worker (growth rate)	1.9	2.1	2.3	2.3	1.8	1.6	1.6	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-4	290	292	296	307	302	288	286
Population growth (working age:15-64)	-0.2	0.3	0.1	0.4	0.1	-0.4	-0.4	0.1
Population (20-64) (in thousands)	-7	267	271	273	280	277	263	259
Population growth (20-64)	-0.5	0.6	0.3	0.2	0.1	-0.3	-0.5	0.1
Labour force 15-64 (thousands)	27	201	211	232	243	240	229	227
Labour force 20-64 (thousands)	26	194	205	226	236	233	222	220
Participation rate (20-64)	12.2	72.9	75.7	83.0	84.2	84.3	84.6	85.0
Participation rate (15-64)	10.3	69.2	72.2	78.5	79.2	79.5	79.4	79.5
young (15-24)	-1.5	52.3	54.1	50.8	50.8	52.0	50.9	50.8
prime-age (25-54)	9.3	82.0	85.7	90.0	91.3	91.4	91.4	91.4
older (55-64)	24.5	45.6	44.4	61.7	67.7	69.8	68.6	70.1
Participation rate (20-64) - FEMALES	21.9	58.3	63.8	75.2	78.7	79.3	79.5	80.2
Participation rate (15-64) - FEMALES	19.4	55.6	61.0	71.2	74.0	74.8	74.7	75.0
young (15-24)	-1.2	49.7	51.3	48.1	48.4	49.6	48.5	48.5
prime-age (25-54)	19.0	67.3	74.6	83.3	86.2	86.3	86.2	86.3
older (55-64)	38.1	26.9	27.6	48.4	60.3	64.6	63.4	65.0
Participation rate (20-64) - MALES	2.9	86.8	87.0	90.4	89.4	89.1	89.4	89.7
Participation rate (15-64) - MALES	1.8	82.1	82.7	85.4	84.1	84.0	83.9	83.8
young (15-24)	-1.7	54.8	56.8	53.2	53.1	54.3	53.2	53.1
prime-age (25-54)	0.3	96.0	96.2	96.2	96.1	96.3	96.4	96.3
older (55-64)	10.6	64.3	61.1	74.6	74.9	74.8	73.5	74.9
Average effective exit age (TOTAL) (1)	1.4	62.0	61.8	63.3	63.3	63.3	63.3	63.3
Men	1.5	62.5	62.1	64.0	64.0	64.0	64.0	64.0
Women	1.2	61.5	61.5	62.6	62.6	62.6	62.6	62.6
Employment rate (15-64)	8.8	66.2	68.8	74.1	74.7	75.0	75.0	75.1
Employment rate (20-64)	10.7	70.1	72.5	78.8	80.0	80.0	80.3	80.8
Employment rate (15-74)	6.2	57.1	58.5	62.8	64.7	63.1	61.7	63.3
Unemployment rate (15-64)	1.4	4.2	4.6	5.6	5.6	5.6	5.6	5.6
Unemployment rate (20-64)	1.2	3.8	4.2	5.1	5.1	5.1	5.0	5.0
Unemployment rate (15-74)	1.3	4.2	4.5	5.5	5.5	5.5	5.5	5.5
Employment (20-64) (in millions)	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Employment (15-64) (in millions)	0.0	0.2	0.2	0.2	0.2	0.2	0.2	0.2
share of young (15-24)	-1.9	13%	11%	9%	10%	10%	10%	11%
share of prime-age (25-54)	-2.2	73%	76%	76%	71%	69%	71%	71%
share of older (55-64)	4.1	14%	13%	15%	19%	21%	19%	18%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	-0.9	20.5	20.3	18.3	21.2	23.3	20.9	19.7
Old-age dependency ratio 15-64 (3)	26.6	29.1	33.0	40.4	41.4	46.0	53.9	55.8
Old-age dependency ratio 20-64 (3)	29.8	31.7	35.5	43.9	45.3	50.2	59.1	61.5
Total dependency ratio (4)	31.7	50.6	55.7	65.6	65.0	70.2	80.5	82.3
Total economic dependency ratio (5)	15.4	124.1	123.1	121.2	118.1	123.4	136.7	139.5
Economic old-age dependency ratio (15-64) (6)	30.4	42.5	46.5	53.6	54.2	59.8	70.2	72.9
Economic old-age dependency ratio (15-74) (7)	30.0	41.9	45.9	53.1	53.5	58.9	69.0	71.9

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

19. THE NETHERLANDS

Table III.19.1:

Netherlands	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.66	1.73	1.74	1.76	1.77	1.79	1.81
Life expectancy at birth								
males	6.7	79.8	80.7	82.0	83.2	84.4	85.5	86.5
females	6.8	83.3	84.1	85.5	86.7	87.9	89.0	90.1
Life expectancy at 65								
males	5.0	18.4	19.0	20.0	20.9	21.8	22.6	23.4
females	5.2	21.2	21.8	22.8	23.8	24.7	25.6	26.4
Net migration (thousand)	-61.0	85.5	66.9	59.5	43.7	29.6	28.6	24.5
Net migration as % of population	-0.4	0.5	0.4	0.3	0.2	0.2	0.1	0.1
Population (million)	2.5	17.0	17.5	18.4	19.1	19.2	19.3	19.6
Children population (0-14) as % of total population	-0.7	16.4	15.8	16.1	16.2	15.5	15.4	15.7
Prime age population (25-54) as % of total population	-4.8	39.8	38.6	36.8	36.8	36.0	35.4	35.0
Working age population (15-64) as % of total population	-8.5	65.3	64.4	60.4	58.2	59.3	58.6	56.8
Elderly population (65 and over) as % of total population	9.2	18.3	19.8	23.5	25.5	25.2	26.0	27.5
Very elderly population (80 and over) as % of total population	6.1	4.5	4.9	7.0	8.7	10.5	10.3	10.6
Very elderly population (80 and over) as % of elderly population	14.3	24.3	24.6	29.7	34.1	41.8	39.5	38.5
Very elderly population (80 and over) as % of working age population	11.8	6.8	7.5	11.5	15.0	17.8	17.5	18.7
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.5	1.3	1.4	1.1	1.5	1.8	1.6	1.5
Employment (growth rate)	0.2	0.6	0.6	0.0	0.2	0.3	0.0	-0.1
Labour input : hours worked (growth rate)	0.2	0.9	0.7	0.0	0.2	0.3	0.0	-0.1
Labour productivity per hour (growth rate)	1.3	0.4	0.7	1.0	1.4	1.5	1.5	1.5
TFP (growth rate)	0.8	0.2	0.4	0.6	0.9	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.1	0.3	0.4	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.2	0.7	0.8	0.6	1.3	1.8	1.5	1.3
Potential GDP per worker (growth rate)	1.3	0.7	0.8	1.0	1.3	1.5	1.6	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-20	11,122	11,247	11,141	11,091	11,407	11,324	11,102
Population growth (working age:15-64)	-0.5	0.4	0.2	-0.3	0.3	0.2	-0.2	-0.1
Population (20-64) (in thousands)	-15	10,098	10,218	10,198	10,055	10,335	10,309	10,082
Population growth (20-64)	-0.4	0.3	0.3	-0.2	0.2	0.2	-0.1	-0.2
Labour force 15-64 (thousands)	292	8,863	8,982	9,022	9,040	9,325	9,309	9,156
Labour force 20-64 (thousands)	279	8,238	8,335	8,430	8,392	8,653	8,672	8,518
Participation rate (20-64)	2.9	81.6	81.6	82.7	83.5	83.7	84.1	84.5
Participation rate (15-64)	2.8	79.7	79.9	81.0	81.5	81.7	82.2	82.5
young (15-24)	2.2	68.2	70.3	70.8	70.2	70.5	70.6	70.4
prime-age (25-54)	0.3	87.0	87.1	87.1	87.2	87.2	87.3	87.3
older (55-64)	10.4	68.4	68.0	72.0	73.3	76.1	77.9	78.8
Participation rate (20-64) - FEMALES	5.6	76.2	76.8	78.8	80.3	80.9	81.3	81.7
Participation rate (15-64) - FEMALES	5.2	75.0	75.7	77.6	78.8	79.4	79.8	80.1
young (15-24)	2.3	69.2	71.5	71.9	71.4	71.6	71.7	71.5
prime-age (25-54)	2.4	82.2	82.8	83.8	84.4	84.5	84.5	84.5
older (55-64)	16.1	58.6	59.4	64.8	67.0	71.4	73.6	74.7
Participation rate (20-64) - MALES	0.1	87.0	86.3	86.5	86.6	86.5	86.8	87.1
Participation rate (15-64) - MALES	0.3	84.4	84.0	84.3	84.1	84.0	84.5	84.7
young (15-24)	2.1	67.3	69.2	69.7	69.2	69.4	69.6	69.3
prime-age (25-54)	-1.8	91.7	91.3	90.3	89.9	89.8	89.9	89.9
older (55-64)	4.6	78.3	76.7	79.4	79.7	80.7	82.1	82.8
Average effective exit age (TOTAL) (1)	3.7	64.6	65.2	66.2	66.7	67.3	68.0	68.3
Men	3.6	65.4	66.1	67.1	67.6	68.2	68.8	69.0
Women	3.8	63.7	64.3	65.3	65.8	66.5	67.1	67.5
Employment rate (15-64)	3.9	74.9	75.8	77.3	77.8	78.0	78.5	78.7
Employment rate (20-64)	3.9	77.1	77.9	79.3	80.1	80.3	80.7	81.0
Employment rate (15-74)	5.0	65.8	66.8	68.1	68.8	70.7	70.7	70.8
Unemployment rate (15-64)	-1.5	6.1	5.0	4.5	4.5	4.5	4.5	4.5
Unemployment rate (20-64)	-1.4	5.4	4.5	4.1	4.1	4.1	4.1	4.1
Unemployment rate (15-74)	-1.6	6.0	5.0	4.4	4.4	4.4	4.4	4.4
Employment (20-64) (in millions)	0.4	7.8	8.0	8.1	8.1	8.3	8.3	8.2
Employment (15-64) (in millions)	0.4	8.3	8.5	8.6	8.6	8.9	8.9	8.7
share of young (15-24)	0.1	15%	16%	15%	16%	16%	15%	15%
share of prime-age (25-54)	-1.5	68%	66%	66%	68%	66%	65%	66%
share of older (55-64)	1.5	17%	18%	19%	16%	18%	20%	19%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	-0.5	20.2	21.2	21.1	18.1	20.0	21.0	19.6
Old-age dependency ratio 15-64 (3)	20.3	28.1	30.7	38.9	43.9	42.5	44.3	48.4
Old-age dependency ratio 20-64 (3)	22.4	31.0	33.8	42.5	48.4	46.9	48.7	53.3
Total dependency ratio (4)	22.9	53.2	55.3	65.5	71.8	68.7	70.7	76.1
Total economic dependency ratio (5)	6.3	100.2	98.0	103.2	108.6	104.7	102.9	106.5
Economic old-age dependency ratio (15-64) (6)	17.8	35.2	37.0	44.8	50.4	48.8	49.1	53.0
Economic old-age dependency ratio (15-74) (7)	14.5	34.4	35.8	42.5	47.6	46.2	45.8	48.9

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

20. AUSTRIA

Table III.20.1:

Austria	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.47	1.49	1.53	1.56	1.59	1.62	1.66
Life expectancy at birth								
males	7.3	79.0	79.8	81.3	82.7	84.0	85.2	86.3
females	6.4	83.8	84.5	85.8	87.0	88.2	89.2	90.2
Life expectancy at 65								
males	5.2	18.3	18.9	19.9	20.8	21.7	22.6	23.5
females	4.9	21.6	22.1	23.1	24.0	24.9	25.7	26.5
Net migration (thousand)	-53.2	73.8	67.8	55.4	40.3	26.3	24.8	20.6
Net migration as % of population	-0.6	0.8	0.7	0.6	0.4	0.3	0.2	0.2
Population (million)	1.4	8.7	9.0	9.7	10.1	10.2	10.2	10.2
Children population (0-14) as % of total population	-0.5	14.3	14.3	14.7	14.1	13.6	13.8	13.8
Prime age population (25-54) as % of total population	-8.6	43.0	42.0	39.4	37.9	35.8	34.9	34.4
Working age population (15-64) as % of total population	-11.4	67.2	66.6	62.6	60.4	59.4	57.0	55.8
Elderly population (65 and over) as % of total population	11.9	18.5	19.0	22.6	25.5	27.0	29.2	30.4
Very elderly population (80 and over) as % of total population	7.5	5.0	5.5	6.6	8.1	10.8	11.0	12.4
Very elderly population (80 and over) as % of elderly population	14.2	26.7	28.8	29.2	31.6	40.0	37.7	40.9
Very elderly population (80 and over) as % of working age population	14.9	7.4	8.2	10.5	13.3	18.2	19.3	22.3
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.5	1.4	1.7	1.5	1.7	1.3	1.2	1.3
Employment (growth rate)	0.1	1.3	1.2	0.2	0.2	-0.2	-0.3	-0.2
Labour input : hours worked (growth rate)	0.1	0.7	0.7	0.2	0.2	-0.2	-0.3	-0.2
Labour productivity per hour (growth rate)	1.4	0.7	1.0	1.4	1.5	1.5	1.5	1.5
TFP (growth rate)	0.9	0.5	0.7	0.9	1.0	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.2	0.3	0.5	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.2	0.3	0.9	1.0	1.4	1.3	1.3	1.4
Potential GDP per worker (growth rate)	1.3	0.1	0.5	1.4	1.4	1.5	1.5	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-191	5,866	6,024	6,077	6,101	6,084	5,826	5,675
Population growth (working age:15-64)	-1.2	1.0	0.6	-0.1	0.2	-0.3	-0.5	-0.2
Population (20-64) (in thousands)	-232	5,417	5,587	5,617	5,590	5,591	5,345	5,185
Population growth (20-64)	-1.5	1.3	0.6	-0.2	0.2	-0.2	-0.5	-0.2
Labour force 15-64 (thousands)	-16	4,475	4,638	4,684	4,811	4,768	4,568	4,458
Labour force 20-64 (thousands)	-29	4,300	4,471	4,509	4,616	4,579	4,385	4,271
Participation rate (20-64)	3.0	79.4	80.0	80.3	82.6	81.9	82.0	82.4
Participation rate (15-64)	2.3	76.3	77.0	77.1	78.9	78.4	78.4	78.6
young (15-24)	-1.3	58.1	58.3	57.1	56.9	57.4	57.1	56.9
prime-age (25-54)	2.2	88.4	89.0	90.0	90.6	90.5	90.6	90.6
older (55-64)	9.5	51.8	55.1	53.6	61.0	61.7	60.8	61.3
Participation rate (20-64) - FEMALES	6.2	74.8	75.6	76.9	81.1	80.6	80.7	81.0
Participation rate (15-64) - FEMALES	5.2	71.7	72.5	73.7	77.2	76.8	76.8	76.9
young (15-24)	-0.9	55.0	55.8	54.5	54.2	54.8	54.4	54.1
prime-age (25-54)	4.6	84.9	86.3	88.5	89.5	89.4	89.5	89.5
older (55-64)	16.4	42.7	44.5	44.8	58.2	59.6	58.6	59.1
Participation rate (20-64) - MALES	-0.3	84.0	84.5	83.6	84.0	83.2	83.4	83.7
Participation rate (15-64) - MALES	-0.7	80.8	81.4	80.4	80.5	79.9	80.0	80.1
young (15-24)	-1.6	61.1	60.7	59.6	59.5	60.0	59.7	59.5
prime-age (25-54)	-0.1	91.8	91.7	91.6	91.6	91.6	91.7	91.6
older (55-64)	2.3	61.2	66.0	62.6	63.8	63.8	62.9	63.5
Average effective exit age (TOTAL) (1)	0.7	63.0	62.6	62.8	63.7	63.7	63.7	63.7
Men	0.2	64.0	64.0	64.2	64.2	64.2	64.2	64.2
Women	1.2	62.0	61.2	61.4	63.2	63.2	63.2	63.2
Employment rate (15-64)	3.1	71.6	72.7	73.3	75.0	74.6	74.6	74.7
Employment rate (20-64)	3.8	74.8	75.8	76.6	78.8	78.1	78.3	78.6
Employment rate (15-74)	1.1	63.7	64.7	63.8	65.2	65.6	64.3	64.8
Unemployment rate (15-64)	-1.3	6.1	5.6	4.9	4.9	4.9	4.9	4.9
Unemployment rate (20-64)	-1.2	5.8	5.3	4.6	4.6	4.6	4.6	4.6
Unemployment rate (15-74)	-1.4	6.0	5.5	4.7	4.7	4.7	4.6	4.6
Employment (20-64) (in millions)	0.0	4.1	4.2	4.3	4.4	4.4	4.2	4.1
Employment (15-64) (in millions)	0.0	4.2	4.4	4.5	4.6	4.5	4.3	4.2
share of young (15-24)	-0.1	12%	11%	11%	12%	12%	12%	12%
share of prime-age (25-54)	-3.3	75%	73%	74%	72%	70%	71%	71%
share of older (55-64)	3.5	13%	15%	15%	16%	18%	17%	16%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	1.9	18.9	21.1	21.4	20.1	22.7	21.7	20.8
Old-age dependency ratio 15-64 (3)	26.9	27.6	28.6	36.1	42.3	45.5	51.3	54.4
Old-age dependency ratio 20-64 (3)	29.7	29.9	30.8	39.1	46.1	49.5	55.9	59.6
Total dependency ratio (4)	30.4	48.8	50.1	59.7	65.6	68.4	75.6	79.2
Total economic dependency ratio (5)	23.5	104.8	102.8	109.9	112.1	116.0	123.1	128.3
Economic old-age dependency ratio (15-64) (6)	30.9	36.9	37.5	45.5	52.3	56.5	63.3	67.8
Economic old-age dependency ratio (15-74) (7)	28.2	36.4	36.8	43.9	50.3	54.0	60.0	64.6

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

21. POLAND

Table III.21.1:

Poland	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.3	1.37	1.45	1.56	1.61	1.65	1.68	1.71
Life expectancy at birth								
males	10.5	73.9	74.9	77.1	79.2	81.1	82.8	84.4
females	7.9	81.6	82.4	84.0	85.6	87.0	88.3	89.5
Life expectancy at 65								
males	6.6	16.0	16.6	17.9	19.1	20.3	21.5	22.6
females	5.9	20.2	20.7	21.9	23.0	24.1	25.1	26.1
Net migration (thousand)	2.4	4.9	0.0	-2.4	16.2	29.7	11.6	7.3
Net migration as % of population	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Population (million)	-7.1	38.0	37.9	37.2	35.8	34.3	32.8	30.9
Children population (0-14) as % of total population	-1.9	15.0	15.3	14.0	12.8	13.3	13.4	13.1
Prime age population (25-54) as % of total population	-11.1	43.0	42.8	40.1	35.4	32.7	32.6	31.9
Working age population (15-64) as % of total population	-15.1	68.7	66.0	62.6	61.1	55.9	52.5	53.6
Elderly population (65 and over) as % of total population	17.1	16.3	18.7	23.3	26.1	30.9	34.1	33.3
Very elderly population (80 and over) as % of total population	12.0	4.2	4.5	6.0	9.7	10.1	12.8	16.2
Very elderly population (80 and over) as % of elderly population	23.0	25.7	24.1	25.9	37.3	32.8	37.6	48.7
Very elderly population (80 and over) as % of working age population	24.2	6.1	6.8	9.6	15.9	18.1	24.4	30.3
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.4	2.7	2.6	1.9	1.2	0.7	1.0	1.0
Employment (growth rate)	-0.8	0.4	-0.3	-0.7	-1.0	-1.2	-0.8	-0.6
Labour input : hours worked (growth rate)	-0.8	0.5	-0.3	-0.7	-1.0	-1.2	-0.8	-0.6
Labour productivity per hour (growth rate)	2.2	2.1	2.9	2.7	2.2	1.9	1.7	1.5
TFP (growth rate)	1.3	1.1	1.5	1.7	1.4	1.2	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.8	1.1	1.4	1.0	0.8	0.7	0.6	0.5
Potential GDP per capita (growth rate)	1.8	2.7	2.7	2.3	1.6	1.2	1.5	1.6
Potential GDP per worker (growth rate)	2.2	2.2	2.9	2.7	2.2	1.9	1.7	1.6
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-9,543	26,075	25,017	23,271	21,868	19,160	17,214	16,533
Population growth (working age:15-64)	0.5	-0.9	-1.1	-0.5	-1.0	-1.5	-0.7	-0.4
Population (20-64) (in thousands)	-9,078	24,146	23,250	21,397	20,131	17,671	15,683	15,068
Population growth (20-64)	0.4	-0.7	-1.1	-0.3	-0.9	-1.5	-0.8	-0.3
Labour force 15-64 (thousands)	-6,637	18,019	17,693	16,377	14,974	13,191	11,972	11,382
Labour force 20-64 (thousands)	-6,603	17,891	17,579	16,254	14,860	13,096	11,875	11,288
Participation rate (20-64)	0.8	74.1	75.6	76.0	73.8	74.1	75.7	74.9
Participation rate (15-64)	-0.3	69.1	70.7	70.4	68.5	68.8	69.5	68.8
young (15-24)	-2.1	34.9	34.1	32.8	33.2	33.2	32.0	32.9
prime-age (25-54)	0.8	85.0	85.4	85.2	85.5	86.0	85.9	85.8
older (55-64)	4.4	48.5	50.6	53.6	52.5	52.0	52.4	53.0
Participation rate (20-64) - FEMALES	0.3	66.6	68.0	68.3	65.6	65.8	67.9	66.9
Participation rate (15-64) - FEMALES	-0.8	62.2	63.7	63.3	60.8	61.0	62.3	61.4
young (15-24)	-2.0	29.4	28.4	27.2	27.7	27.7	26.7	27.4
prime-age (25-54)	1.0	78.9	79.5	79.6	79.8	80.1	80.1	80.0
older (55-64)	1.1	39.2	40.3	41.8	40.4	39.2	39.6	40.3
Participation rate (20-64) - MALES	1.1	81.6	83.2	83.5	81.9	82.2	83.3	82.6
Participation rate (15-64) - MALES	0.0	76.0	77.7	77.3	76.0	76.4	76.6	76.0
young (15-24)	-2.0	40.2	39.5	38.2	38.5	38.6	37.2	38.2
prime-age (25-54)	0.4	90.8	91.2	90.7	91.0	91.6	91.4	91.3
older (55-64)	6.6	58.9	61.8	66.1	65.1	64.7	64.9	65.5
Average effective exit age (TOTAL) (1)	0.3	62.6	62.9	62.9	62.9	62.9	62.9	62.9
Men	0.5	64.0	64.5	64.5	64.5	64.5	64.5	64.5
Women	0.0	61.3	61.3	61.3	61.3	61.3	61.3	61.3
Employment rate (15-64)	0.1	64.8	67.3	66.3	64.5	64.8	65.5	64.8
Employment rate (20-64)	1.1	69.6	72.1	71.7	69.7	69.9	71.5	70.7
Employment rate (15-74)	-1.9	58.1	58.7	57.7	56.5	53.9	54.5	56.2
Unemployment rate (15-64)	-0.4	6.3	4.8	5.8	5.8	5.8	5.8	5.8
Unemployment rate (20-64)	-0.4	6.1	4.7	5.6	5.6	5.7	5.6	5.6
Unemployment rate (15-74)	-0.5	6.2	4.7	5.7	5.6	5.6	5.6	5.6
Employment (20-64) (in millions)	-6.2	16.8	16.8	15.3	14.0	12.4	11.2	10.7
Employment (15-64) (in millions)	-6.2	16.9	16.8	15.4	14.1	12.4	11.3	10.7
share of young (15-24)	0.3	7%	6%	7%	7%	7%	7%	8%
share of prime-age (25-54)	-2.8	78%	79%	78%	73%	74%	77%	75%
share of older (55-64)	2.5	15%	15%	15%	20%	20%	16%	18%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	1.4	21.0	20.2	19.5	25.7	25.5	20.4	22.4
Old-age dependency ratio 15-64 (3)	38.5	23.7	28.4	37.3	42.6	55.3	64.9	62.2
Old-age dependency ratio 20-64 (3)	42.7	25.6	30.6	40.5	46.3	59.9	71.2	68.3
Total dependency ratio (4)	41.1	45.6	51.6	59.7	63.6	79.0	90.3	86.7
Total economic dependency ratio (5)	55.6	121.2	119.8	132.5	143.8	161.4	176.1	176.8
Economic old-age dependency ratio (15-64) (6)	57.0	34.9	39.8	52.6	62.0	79.6	93.8	91.9
Economic old-age dependency ratio (15-74) (7)	54.0	34.3	38.8	50.8	59.6	75.4	89.1	88.3

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

22. PORTUGAL

Table III.22.1:

Portugal	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.34	1.28	1.34	1.40	1.47	1.53	1.59
Life expectancy at birth								
males	7.7	78.2	78.9	80.5	82.0	83.4	84.7	85.9
females	6.1	84.3	84.9	86.1	87.3	88.4	89.4	90.4
Life expectancy at 65								
males	5.2	18.1	18.6	19.6	20.6	21.5	22.4	23.3
females	4.9	21.8	22.2	23.2	24.1	25.0	25.9	26.7
Net migration (thousand)	24.6	-10.5	2.4	12.8	18.2	15.8	14.6	14.2
Net migration as % of population	0.3	-0.1	0.0	0.1	0.2	0.2	0.2	0.2
Population (million)	-2.3	10.3	10.2	9.9	9.5	9.1	8.5	8.0
Children population (0-14) as % of total population	-2.1	14.0	13.0	11.3	11.5	11.5	11.3	11.9
Prime age population (25-54) as % of total population	-9.7	41.2	39.8	36.8	34.0	33.2	31.8	31.5
Working age population (15-64) as % of total population	-12.4	65.1	64.5	61.5	56.6	53.5	53.8	52.7
Elderly population (65 and over) as % of total population	14.5	20.9	22.5	27.2	31.9	35.0	34.9	35.4
Very elderly population (80 and over) as % of total population	9.7	6.0	6.7	8.3	10.7	13.4	16.2	15.7
Very elderly population (80 and over) as % of elderly population	15.4	28.9	29.7	30.7	33.6	38.4	46.5	44.4
Very elderly population (80 and over) as % of working age population	20.5	9.3	10.4	13.6	19.0	25.1	30.2	29.8
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	0.9	0.4	0.8	1.0	0.8	0.9	1.0	0.8
Employment (growth rate)	-0.6	0.3	-0.3	-0.4	-0.9	-0.9	-0.7	-0.8
Labour input : hours worked (growth rate)	-0.6	0.1	-0.2	-0.4	-0.9	-0.9	-0.7	-0.8
Labour productivity per hour (growth rate)	1.5	0.3	1.0	1.4	1.7	1.8	1.7	1.5
TFP (growth rate)	1.0	0.5	0.7	0.9	1.1	1.2	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.5	-0.3	0.2	0.5	0.6	0.6	0.6	0.5
Potential GDP per capita (growth rate)	1.4	0.7	1.1	1.3	1.2	1.5	1.7	1.4
Potential GDP per worker (growth rate)	1.5	0.1	1.0	1.4	1.8	1.9	1.7	1.6
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-2,515	6,724	6,572	6,065	5,395	4,862	4,587	4,208
Population growth (working age:15-64)	-0.3	-0.6	-0.6	-1.0	-1.4	-0.7	-0.6	-0.9
Population (20-64) (in thousands)	-2,283	6,163	6,035	5,623	5,021	4,483	4,226	3,881
Population growth (20-64)	-0.2	-0.7	-0.5	-0.9	-1.4	-0.7	-0.6	-0.9
Labour force 15-64 (thousands)	-1,740	4,962	4,933	4,644	4,164	3,748	3,506	3,221
Labour force 20-64 (thousands)	-1,718	4,906	4,877	4,596	4,125	3,709	3,468	3,188
Participation rate (20-64)	2.5	79.6	80.8	81.7	82.2	82.7	82.1	82.1
Participation rate (15-64)	2.8	73.8	75.1	76.6	77.2	77.1	76.4	76.6
young (15-24)	2.1	33.6	34.9	36.6	36.1	34.8	35.6	35.7
prime-age (25-54)	1.4	89.2	89.9	90.4	90.5	90.6	90.5	90.6
older (55-64)	11.0	58.4	63.8	68.5	69.1	69.5	69.8	69.4
Participation rate (20-64) - FEMALES	6.1	75.8	78.0	80.4	81.5	82.4	81.8	81.9
Participation rate (15-64) - FEMALES	5.8	70.5	72.6	75.4	76.6	76.9	76.2	76.3
young (15-24)	2.4	31.8	33.3	35.1	34.6	33.3	34.1	34.2
prime-age (25-54)	4.3	86.6	88.2	90.1	90.8	90.9	90.8	90.9
older (55-64)	17.7	50.8	57.4	65.0	67.2	68.4	68.9	68.5
Participation rate (20-64) - MALES	-1.2	83.6	83.9	83.2	82.9	83.1	82.3	82.4
Participation rate (15-64) - MALES	-0.5	77.2	77.6	77.8	77.7	77.3	76.6	76.8
young (15-24)	1.8	35.3	36.3	38.1	37.5	36.2	37.0	37.2
prime-age (25-54)	-1.7	91.9	91.6	90.7	90.3	90.3	90.2	90.3
older (55-64)	3.3	67.0	71.0	72.3	71.2	70.7	70.7	70.3
Average effective exit age (TOTAL) (1)	2.0	64.4	65.4	66.1	66.3	66.4	66.4	66.4
Men	1.8	64.8	65.3	66.3	66.5	66.6	66.6	66.6
Women	2.2	64.1	65.4	65.9	66.1	66.2	66.2	66.3
Employment rate (15-64)	5.2	65.3	67.6	69.7	70.7	71.0	70.4	70.5
Employment rate (20-64)	5.1	70.7	73.0	74.6	75.4	76.4	75.8	75.8
Employment rate (15-74)	4.3	58.3	59.7	61.9	62.3	62.4	63.3	62.6
Unemployment rate (15-64)	-3.6	11.5	9.9	8.9	8.4	7.9	7.9	7.9
Unemployment rate (20-64)	-3.5	11.2	9.7	8.7	8.2	7.7	7.7	7.7
Unemployment rate (15-74)	-4.0	11.2	9.6	8.4	7.8	7.3	7.3	7.2
Employment (20-64) (in millions)	-1.4	4.4	4.4	4.2	3.8	3.4	3.2	2.9
Employment (15-64) (in millions)	-1.4	4.4	4.4	4.2	3.8	3.5	3.2	3.0
share of young (15-24)	0.6	6%	7%	7%	6%	6%	7%	7%
share of prime-age (25-54)	-6.4	78%	75%	71%	71%	74%	71%	71%
share of older (55-64)	5.8	16%	18%	22%	23%	20%	22%	22%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	3.8	20.2	21.6	24.5	25.2	22.2	24.4	24.0
Old-age dependency ratio 15-64 (3)	35.1	32.1	34.9	44.2	56.4	65.4	64.9	67.2
Old-age dependency ratio 20-64 (3)	37.8	35.0	38.1	47.7	60.6	70.9	70.4	72.8
Total dependency ratio (4)	36.2	53.6	55.1	62.6	76.7	87.0	85.8	89.7
Total economic dependency ratio (5)	14.5	126.3	120.3	115.7	125.0	136.5	139.5	140.8
Economic old-age dependency ratio (15-64) (6)	38.4	44.9	47.5	55.1	68.5	80.6	81.8	83.4
Economic old-age dependency ratio (15-74) (7)	31.4	43.2	45.6	50.9	61.6	72.4	74.2	74.6

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

23. ROMANIA

Table III.23.1:

Romania	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.4	1.54	1.72	1.81	1.85	1.87	1.88	1.89
Life expectancy at birth								
males	11.8	71.8	72.9	75.4	77.8	79.9	81.8	83.6
females	9.4	78.9	79.9	81.8	83.6	85.3	86.9	88.3
Life expectancy at 65								
males	7.2	14.8	15.4	16.8	18.2	19.5	20.8	22.0
females	6.9	18.2	18.8	20.2	21.5	22.8	24.0	25.1
Net migration (thousand)	66.4	-63.8	-65.1	-51.1	-8.9	7.7	1.6	2.6
Net migration as % of population	0.3	-0.3	-0.3	-0.3	-0.1	0.0	0.0	0.0
Population (million)	-4.7	19.7	19.2	18.0	17.0	16.3	15.7	15.0
Children population (0-14) as % of total population	0.1	15.3	15.2	14.9	14.6	14.8	15.2	15.5
Prime age population (25-54) as % of total population	-9.4	42.7	42.7	37.6	33.8	32.5	32.9	33.3
Working age population (15-64) as % of total population	-11.8	67.1	65.4	63.2	58.6	55.2	54.1	55.3
Elderly population (65 and over) as % of total population	11.6	17.6	19.4	21.9	26.8	29.9	30.7	29.2
Very elderly population (80 and over) as % of total population	9.2	4.3	4.8	5.9	8.4	9.9	12.6	13.5
Very elderly population (80 and over) as % of elderly population	21.8	24.4	24.9	26.8	31.2	33.2	41.2	46.2
Very elderly population (80 and over) as % of working age population	18.0	6.4	7.4	9.3	14.3	18.0	23.3	24.4
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.8	3.5	3.4	2.1	1.3	1.3	1.3	1.3
Employment (growth rate)	-0.8	0.1	-0.2	-1.4	-1.1	-0.8	-0.4	-0.3
Labour input : hours worked (growth rate)	-0.8	-0.1	-0.4	-1.4	-1.1	-0.8	-0.4	-0.3
Labour productivity per hour (growth rate)	2.6	3.6	3.8	3.5	2.4	2.1	1.8	1.5
TFP (growth rate)	1.7	2.8	2.6	2.2	1.6	1.3	1.2	1.0
Capital deepening (contribution to labour productivity growth)	0.9	0.8	1.1	1.3	0.9	0.7	0.6	0.5
Potential GDP per capita (growth rate)	2.3	4.2	4.1	2.8	1.8	1.7	1.8	1.7
Potential GDP per worker (growth rate)	2.6	3.4	3.7	3.5	2.5	2.1	1.8	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-4,906	13,193	12,563	11,356	9,983	9,003	8,480	8,287
Population growth (working age:15-64)	0.8	-1.1	-1.3	-0.8	-1.3	-0.8	-0.3	-0.3
Population (20-64) (in thousands)	-4,620	12,116	11,537	10,473	9,112	8,191	7,680	7,496
Population growth (20-64)	0.9	-1.2	-1.3	-0.6	-1.3	-0.8	-0.3	-0.3
Labour force 15-64 (thousands)	-3,262	8,650	8,377	7,439	6,412	5,824	5,547	5,387
Labour force 20-64 (thousands)	-3,229	8,523	8,255	7,334	6,308	5,728	5,453	5,294
Participation rate (20-64)	0.3	70.3	71.6	70.0	69.2	69.9	71.0	70.6
Participation rate (15-64)	-0.6	65.6	66.7	65.5	64.2	64.7	65.4	65.0
young (15-24)	0.9	28.2	29.1	30.0	29.0	29.2	29.1	29.1
prime-age (25-54)	-0.6	81.9	81.5	81.0	81.1	81.5	81.4	81.3
older (55-64)	6.7	44.0	47.5	51.5	49.9	49.7	51.4	50.7
Participation rate (20-64) - FEMALES	-1.1	60.3	60.8	58.8	57.5	58.4	59.5	59.2
Participation rate (15-64) - FEMALES	-1.8	56.1	56.6	54.9	53.2	53.9	54.7	54.4
young (15-24)	1.1	21.9	22.9	23.6	23.0	23.1	23.0	23.1
prime-age (25-54)	-2.5	72.3	71.3	69.5	69.2	69.9	69.8	69.8
older (55-64)	3.9	34.2	36.0	40.8	37.9	36.9	38.6	38.1
Participation rate (20-64) - MALES	1.8	80.2	82.0	80.9	80.6	81.2	82.4	82.0
Participation rate (15-64) - MALES	0.8	74.8	76.5	75.8	75.0	75.3	76.0	75.6
young (15-24)	1.1	34.1	35.1	36.2	35.1	35.3	35.1	35.2
prime-age (25-54)	1.9	91.0	91.2	91.9	92.5	92.9	92.9	92.9
older (55-64)	8.2	54.9	59.9	62.2	61.8	61.9	63.8	63.1
Average effective exit age (TOTAL) (1)	0.1	63.2	63.2	63.3	63.3	63.3	63.3	63.3
Men	0.0	64.0	64.0	64.0	64.0	64.0	64.0	64.0
Women	0.2	62.4	62.4	62.6	62.6	62.6	62.6	62.6
Employment rate (15-64)	-0.6	61.6	63.3	61.5	60.3	60.7	61.4	61.0
Employment rate (20-64)	0.3	66.3	68.1	66.0	65.2	65.9	66.9	66.6
Employment rate (15-74)	-2.0	55.7	55.9	54.6	51.7	51.7	52.9	53.7
Unemployment rate (15-64)	0.1	6.1	5.1	6.2	6.2	6.2	6.2	6.2
Unemployment rate (20-64)	0.0	5.7	4.8	5.8	5.8	5.8	5.8	5.7
Unemployment rate (15-74)	0.0	5.9	4.9	5.9	5.8	5.8	5.9	5.9
Employment (20-64) (in millions)	-3.0	8.0	7.9	6.9	5.9	5.4	5.1	5.0
Employment (15-64) (in millions)	-3.1	8.1	7.9	7.0	6.0	5.5	5.2	5.1
share of young (15-24)	1.4	6%	6%	6%	7%	7%	7%	7%
share of prime-age (25-54)	-4.2	80%	80%	74%	73%	75%	76%	76%
share of older (55-64)	2.8	14%	13%	20%	20%	18%	16%	17%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	0.6	20.0	18.4	24.2	24.8	23.1	20.3	20.6
Old-age dependency ratio 15-64 (3)	26.6	26.3	29.6	34.7	45.7	54.2	56.7	52.8
Old-age dependency ratio 20-64 (3)	29.8	28.6	32.2	37.6	50.1	59.6	62.6	58.4
Total dependency ratio (4)	31.7	49.1	52.8	58.2	70.6	81.1	84.7	80.8
Total economic dependency ratio (5)	48.0	134.0	133.4	147.2	165.6	180.6	184.9	182.0
Economic old-age dependency ratio (15-64) (6)	42.4	39.1	43.3	52.3	69.3	83.0	86.7	81.5
Economic old-age dependency ratio (15-74) (7)	39.8	37.8	41.8	50.3	65.0	78.0	82.1	77.6

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

24. SLOVENIA

Table III.24.1:

Slovenia	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.58	1.62	1.66	1.70	1.74	1.78	1.81
Life expectancy at birth								
males	7.6	78.2	78.9	80.4	81.9	83.3	84.6	85.8
females	6.3	83.8	84.4	85.7	86.9	88.0	89.1	90.1
Life expectancy at 65								
males	5.4	17.7	18.1	19.2	20.3	21.3	22.2	23.1
females	5.0	21.4	21.8	22.8	23.8	24.7	25.6	26.4
Net migration (thousand)	2.4	0.2	4.2	4.1	4.3	3.8	2.8	2.5
Net migration as % of population	0.1	0.0	0.2	0.2	0.2	0.2	0.1	0.1
Population (million)	-0.1	2.1	2.1	2.1	2.1	2.0	2.0	2.0
Children population (0-14) as % of total population	0.0	14.9	15.3	13.9	13.6	14.8	14.8	14.9
Prime age population (25-54) as % of total population	-8.9	42.6	40.6	36.4	33.8	33.4	34.0	33.7
Working age population (15-64) as % of total population	-9.8	66.4	64.0	61.0	58.2	54.6	54.9	56.7
Elderly population (65 and over) as % of total population	9.8	18.7	20.7	25.2	28.3	30.6	30.2	28.5
Very elderly population (80 and over) as % of total population	8.5	5.0	5.6	6.9	9.8	11.4	12.9	13.5
Very elderly population (80 and over) as % of elderly population	20.5	27.0	26.9	27.6	34.6	37.3	42.6	47.5
Very elderly population (80 and over) as % of working age population	16.3	7.6	8.7	11.4	16.8	20.9	23.4	23.8
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.5	1.0	2.1	1.6	1.3	1.2	1.6	1.4
Employment (growth rate)	-0.2	0.5	0.5	-0.5	-0.7	-0.5	0.0	-0.1
Labour input : hours worked (growth rate)	-0.2	0.7	0.5	-0.6	-0.6	-0.5	0.0	-0.1
Labour productivity per hour (growth rate)	1.8	0.3	1.6	2.1	1.9	1.8	1.7	1.5
TFP (growth rate)	1.2	0.9	1.3	1.4	1.2	1.1	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.6	-0.6	0.3	0.8	0.7	0.6	0.6	0.5
Potential GDP per capita (growth rate)	1.6	1.0	2.0	1.6	1.3	1.4	1.9	1.6
Potential GDP per worker (growth rate)	1.8	0.6	1.6	2.1	1.9	1.8	1.6	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-264	1,372	1,330	1,268	1,201	1,116	1,098	1,108
Population growth (working age:15-64)	0.8	-0.8	-0.7	-0.5	-0.7	-0.5	0.1	0.0
Population (20-64) (in thousands)	-271	1,278	1,237	1,155	1,103	1,021	992	1,007
Population growth (20-64)	0.9	-0.8	-0.8	-0.5	-0.6	-0.7	0.1	0.1
Labour force 15-64 (thousands)	-175	985	980	930	877	822	806	810
Labour force 20-64 (thousands)	-176	975	971	918	867	812	796	799
Participation rate (20-64)	3.1	76.3	78.5	79.5	78.6	79.6	80.2	79.4
Participation rate (15-64)	1.3	71.8	73.7	73.3	73.0	73.6	73.5	73.1
young (15-24)	0.3	34.1	34.2	33.2	34.9	33.8	33.3	34.3
prime-age (25-54)	-0.6	90.5	90.7	90.0	89.8	90.2	90.0	89.9
older (55-64)	19.7	41.1	50.7	60.8	60.1	58.8	60.1	60.9
Participation rate (20-64) - FEMALES	4.3	73.1	75.5	77.5	76.7	77.7	78.2	77.4
Participation rate (15-64) - FEMALES	2.5	68.8	70.9	71.4	71.2	71.8	71.6	71.2
young (15-24)	0.3	30.3	30.4	29.5	31.1	30.1	29.6	30.6
prime-age (25-54)	-0.9	89.0	89.1	88.4	88.0	88.4	88.2	88.1
older (55-64)	24.7	35.5	46.1	60.2	59.4	58.3	59.5	60.2
Participation rate (20-64) - MALES	2.1	79.3	81.3	81.3	80.4	81.4	82.1	81.4
Participation rate (15-64) - MALES	0.3	74.7	76.4	75.1	74.8	75.4	75.3	74.9
young (15-24)	0.3	37.7	37.8	36.7	38.6	37.3	36.8	38.0
prime-age (25-54)	-0.3	91.9	92.2	91.6	91.6	92.0	91.7	91.7
older (55-64)	14.8	46.7	55.3	61.4	60.7	59.3	60.7	61.5
Average effective exit age (TOTAL) (1)	2.1	60.5	62.6	62.6	62.6	62.6	62.6	62.6
Men	1.8	60.9	62.7	62.7	62.7	62.7	62.7	62.7
Women	2.3	60.2	62.5	62.5	62.5	62.5	62.5	62.5
Employment rate (15-64)	2.8	66.0	68.7	69.0	68.7	69.3	69.1	68.8
Employment rate (20-64)	4.6	70.2	73.2	74.8	74.0	74.9	75.5	74.8
Employment rate (15-74)	1.6	58.0	59.0	58.2	57.8	57.2	58.6	59.6
Unemployment rate (15-64)	-2.2	8.1	6.8	5.9	5.9	5.9	5.9	5.9
Unemployment rate (20-64)	-2.2	8.1	6.7	5.9	5.9	5.9	5.9	5.9
Unemployment rate (15-74)	-2.2	8.0	6.7	5.8	5.8	5.7	5.8	5.8
Employment (20-64) (in millions)	-0.1	0.9	0.9	0.9	0.8	0.8	0.7	0.8
Employment (15-64) (in millions)	-0.1	0.9	0.9	0.9	0.8	0.8	0.8	0.8
share of young (15-24)	2.1	6%	6%	8%	8%	8%	8%	8%
share of prime-age (25-54)	-7.9	81%	78%	73%	72%	75%	76%	73%
share of older (55-64)	5.8	13%	15%	19%	20%	17%	16%	18%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	0.2	21.4	22.1	22.6	24.5	21.5	18.9	21.6
Old-age dependency ratio 15-64 (3)	22.1	28.1	32.3	41.3	48.6	55.9	55.0	50.2
Old-age dependency ratio 20-64 (3)	25.1	30.1	34.8	45.3	52.9	61.2	60.9	55.3
Total dependency ratio (4)	26.0	50.5	56.2	64.0	71.9	83.0	82.0	76.5
Total economic dependency ratio (5)	26.0	125.6	124.8	132.9	144.2	157.2	157.7	151.6
Economic old-age dependency ratio (15-64) (6)	29.6	41.4	46.0	57.8	68.2	78.0	77.4	71.0
Economic old-age dependency ratio (15-74) (7)	28.7	41.0	45.5	56.6	66.6	76.0	75.8	69.7

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

25. SLOVAKIA

Table III.25.1:

Slovakia	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.4	1.40	1.47	1.60	1.68	1.74	1.79	1.82
Life expectancy at birth								
males	10.5	73.7	74.6	76.8	78.9	80.8	82.6	84.2
females	8.4	80.7	81.4	83.2	84.8	86.3	87.8	89.1
Life expectancy at 65								
males	6.8	15.3	15.8	17.2	18.5	19.8	21.0	22.1
females	6.5	19.1	19.7	21.0	22.2	23.4	24.6	25.6
Net migration (thousand)	-2.7	6.0	5.9	5.0	6.8	6.5	3.8	3.2
Net migration as % of population	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Population (million)	-0.5	5.4	5.5	5.5	5.4	5.3	5.1	4.9
Children population (0-14) as % of total population	-1.2	15.3	15.4	14.3	13.5	14.0	14.1	14.2
Prime age population (25-54) as % of total population	-12.3	44.9	44.4	40.8	36.2	33.3	33.1	32.7
Working age population (15-64) as % of total population	-15.2	70.0	67.7	64.5	61.9	56.8	53.9	54.7
Elderly population (65 and over) as % of total population	16.4	14.7	16.9	21.2	24.6	29.3	32.0	31.1
Very elderly population (80 and over) as % of total population	11.2	3.2	3.4	5.0	7.8	9.0	12.0	14.3
Very elderly population (80 and over) as % of elderly population	24.5	21.5	20.2	23.7	31.7	30.6	37.5	46.1
Very elderly population (80 and over) as % of working age population	21.7	4.5	5.0	7.8	12.6	15.8	22.3	26.2
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.9	2.4	2.8	2.8	1.8	1.2	1.2	1.5
Employment (growth rate)	-0.3	1.0	-0.1	-0.3	-0.5	-0.6	-0.4	0.0
Labour input : hours worked (growth rate)	-0.4	0.6	-0.3	-0.3	-0.6	-0.6	-0.4	0.0
Labour productivity per hour (growth rate)	2.2	1.7	3.0	3.1	2.3	1.8	1.7	1.5
TFP (growth rate)	1.5	2.0	2.3	2.1	1.5	1.1	1.1	1.0
Capital deepening (contribution to labour productivity growth)	0.7	-0.3	0.8	1.1	0.8	0.6	0.6	0.5
Potential GDP per capita (growth rate)	2.1	2.2	2.6	2.9	2.0	1.4	1.6	1.9
Potential GDP per worker (growth rate)	2.2	1.4	2.9	3.1	2.3	1.8	1.7	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-1,118	3,799	3,696	3,521	3,325	2,983	2,750	2,681
Population growth (working age:15-64)	0.4	-0.6	-0.7	-0.5	-1.0	-1.1	-0.4	-0.3
Population (20-64) (in thousands)	-1,079	3,517	3,431	3,230	3,060	2,741	2,500	2,438
Population growth (20-64)	0.2	-0.5	-0.7	-0.4	-0.9	-1.2	-0.5	-0.3
Labour force 15-64 (thousands)	-726	2,739	2,708	2,586	2,437	2,222	2,062	2,014
Labour force 20-64 (thousands)	-722	2,719	2,689	2,566	2,419	2,205	2,045	1,997
Participation rate (20-64)	4.6	77.3	78.4	79.4	79.0	80.5	81.8	81.9
Participation rate (15-64)	3.0	72.1	73.3	73.5	73.3	74.5	75.0	75.1
young (15-24)	-1.1	32.4	32.3	30.8	31.7	31.6	30.8	31.3
prime-age (25-54)	0.6	87.6	87.9	87.8	88.0	88.1	88.2	88.2
older (55-64)	21.9	54.4	55.7	63.3	66.5	71.1	74.5	76.3
Participation rate (20-64) - FEMALES	6.5	70.4	72.2	74.2	73.9	75.4	76.8	76.8
Participation rate (15-64) - FEMALES	4.8	65.6	67.5	68.6	68.5	69.7	70.3	70.4
young (15-24)	-1.3	24.8	24.2	23.1	23.9	23.7	23.1	23.6
prime-age (25-54)	1.4	81.5	82.1	82.8	82.9	82.7	83.0	82.9
older (55-64)	27.0	48.5	52.2	61.2	64.2	69.9	73.7	75.5
Participation rate (20-64) - MALES	2.6	84.2	84.5	84.5	84.1	85.4	86.7	86.8
Participation rate (15-64) - MALES	1.1	78.5	79.0	78.2	78.0	79.1	79.5	79.7
young (15-24)	-0.9	39.7	39.9	38.2	39.3	39.1	38.1	38.8
prime-age (25-54)	-0.2	93.5	93.4	92.6	92.9	93.3	93.2	93.3
older (55-64)	16.2	60.9	59.6	65.4	68.8	72.4	75.3	77.1
Average effective exit age (TOTAL) (1)	5.8	61.4	61.8	62.5	63.7	64.9	66.1	67.2
Men	5.4	61.9	62.0	62.7	63.9	65.0	66.2	67.3
Women	6.1	61.0	61.5	62.4	63.6	64.9	66.1	67.1
Employment rate (15-64)	4.0	65.1	67.1	66.7	67.1	68.6	69.1	69.2
Employment rate (20-64)	5.6	70.1	72.0	72.4	72.5	74.3	75.5	75.6
Employment rate (15-74)	4.3	58.3	58.7	57.5	57.7	57.6	59.5	62.6
Unemployment rate (15-64)	-1.8	9.7	8.4	9.1	8.5	7.9	7.9	7.9
Unemployment rate (20-64)	-1.7	9.4	8.2	8.9	8.3	7.7	7.6	7.6
Unemployment rate (15-74)	-2.2	9.6	8.3	9.0	8.3	7.6	7.4	7.4
Employment (20-64) (in millions)	-0.6	2.5	2.5	2.3	2.2	2.0	1.9	1.8
Employment (15-64) (in millions)	-0.6	2.5	2.5	2.3	2.2	2.0	1.9	1.9
share of young (15-24)	0.4	6%	6%	6%	6%	6%	7%	7%
share of prime-age (25-54)	-8.2	79%	79%	76%	71%	70%	73%	71%
share of older (55-64)	7.8	15%	15%	18%	23%	24%	20%	22%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	2.5	19.3	19.3	20.3	25.1	24.6	20.3	21.8
Old-age dependency ratio 15-64 (3)	35.8	21.0	24.9	32.9	39.7	51.5	59.4	56.8
Old-age dependency ratio 20-64 (3)	39.8	22.7	26.9	35.9	43.1	56.1	65.3	62.5
Total dependency ratio (4)	39.7	42.9	47.8	55.1	61.5	76.2	85.6	82.7
Total economic dependency ratio (5)	26.4	117.7	117.8	129.2	134.5	143.6	149.8	144.1
Economic old-age dependency ratio (15-64) (6)	42.5	31.4	36.1	47.9	56.4	69.6	78.3	73.9
Economic old-age dependency ratio (15-74) (7)	37.1	31.2	35.7	47.2	55.0	66.1	72.7	68.3

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

26. FINLAND

Table III.26.1:

Finland	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.60	1.71	1.72	1.74	1.76	1.78	1.80
Life expectancy at birth								
males	7.4	78.5	79.1	80.6	82.1	83.4	84.7	85.9
females	6.1	84.1	84.6	85.8	87.0	88.1	89.2	90.2
Life expectancy at 65								
males	5.1	18.2	18.6	19.6	20.6	21.5	22.4	23.3
females	4.8	21.7	22.0	23.0	23.9	24.8	25.7	26.5
Net migration (thousand)	-9.1	15.9	15.8	13.7	10.7	8.5	7.8	6.8
Net migration as % of population	-0.2	0.3	0.3	0.2	0.2	0.1	0.1	0.1
Population (million)	0.1	5.5	5.6	5.7	5.7	5.7	5.7	5.6
Children population (0-14) as % of total population	-1.5	16.3	16.2	15.5	15.2	15.1	14.9	14.7
Prime age population (25-54) as % of total population	-4.2	38.0	37.5	36.8	36.2	35.1	34.7	33.8
Working age population (15-64) as % of total population	-6.9	63.0	61.5	59.3	59.1	58.3	56.8	56.1
Elderly population (65 and over) as % of total population	8.5	20.7	22.3	25.2	25.7	26.6	28.2	29.2
Very elderly population (80 and over) as % of total population	7.0	5.2	5.6	8.2	9.9	10.5	10.7	12.2
Very elderly population (80 and over) as % of elderly population	16.7	25.2	25.2	32.4	38.4	39.3	37.9	41.8
Very elderly population (80 and over) as % of working age population	13.5	8.3	9.1	13.7	16.7	17.9	18.8	21.7
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.3	0.4	0.7	1.1	1.5	1.5	1.5	1.5
Employment (growth rate)	0.0	0.1	-0.2	0.0	0.1	0.0	0.0	-0.1
Labour input : hours worked (growth rate)	0.0	0.4	-0.1	0.0	0.1	0.0	0.0	-0.1
Labour productivity per hour (growth rate)	1.3	0.1	0.8	1.0	1.4	1.5	1.5	1.5
TFP (growth rate)	0.8	-0.1	0.3	0.7	0.9	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.2	0.6	0.3	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.2	0.2	0.4	0.9	1.5	1.6	1.5	1.6
Potential GDP per worker (growth rate)	1.3	0.4	0.9	1.0	1.4	1.5	1.5	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-307	3,463	3,425	3,382	3,383	3,314	3,213	3,155
Population growth (working age:15-64)	0.2	-0.4	-0.2	-0.2	0.0	-0.3	-0.3	-0.2
Population (20-64) (in thousands)	-295	3,164	3,128	3,071	3,077	3,020	2,920	2,869
Population growth (20-64)	0.1	-0.3	-0.3	-0.1	0.0	-0.3	-0.3	-0.2
Labour force 15-64 (thousands)	-153	2,628	2,606	2,575	2,592	2,561	2,504	2,474
Labour force 20-64 (thousands)	-148	2,526	2,506	2,469	2,489	2,461	2,405	2,378
Participation rate (20-64)	3.0	79.8	80.1	80.4	80.9	81.5	82.4	82.9
Participation rate (15-64)	2.5	75.9	76.1	76.1	76.6	77.3	77.9	78.4
young (15-24)	-0.2	52.9	52.8	52.9	52.5	52.8	52.6	52.7
prime-age (25-54)	-0.5	86.3	85.9	85.6	85.7	85.8	85.9	85.8
older (55-64)	13.4	66.2	67.3	68.3	71.0	74.0	77.1	79.6
Participation rate (20-64) - FEMALES	3.5	77.6	77.8	78.4	79.2	79.9	80.7	81.1
Participation rate (15-64) - FEMALES	3.0	74.1	74.2	74.6	75.4	76.1	76.7	77.1
young (15-24)	0.0	54.2	54.3	54.4	54.0	54.3	54.2	54.2
prime-age (25-54)	0.3	82.7	82.5	82.7	83.0	83.0	83.1	83.1
older (55-64)	12.7	67.2	67.4	68.3	71.9	74.9	77.7	79.9
Participation rate (20-64) - MALES	2.5	82.1	82.4	82.4	82.5	83.1	84.0	84.6
Participation rate (15-64) - MALES	2.1	77.6	77.9	77.6	77.8	78.4	79.1	79.7
young (15-24)	-0.4	51.7	51.4	51.4	51.0	51.4	51.2	51.3
prime-age (25-54)	-1.3	89.7	89.2	88.4	88.3	88.4	88.5	88.5
older (55-64)	14.2	65.2	67.2	68.3	70.2	73.1	76.4	79.4
Average effective exit age (TOTAL) (1)	4.2	63.6	63.6	64.3	65.1	66.0	67.1	67.8
Men	4.0	63.9	63.9	64.4	65.2	66.1	67.2	67.9
Women	4.4	63.2	63.4	64.1	65.0	65.9	67.1	67.6
Employment rate (15-64)	3.5	69.0	70.5	70.4	70.8	71.4	72.0	72.5
Employment rate (20-64)	3.9	73.3	74.8	74.9	75.4	75.9	76.7	77.2
Employment rate (15-74)	5.2	59.8	60.1	60.6	62.2	62.7	63.6	65.1
Unemployment rate (15-64)	-1.5	9.1	7.4	7.6	7.6	7.6	7.6	7.6
Unemployment rate (20-64)	-1.4	8.2	6.7	6.8	6.8	6.8	6.8	6.8
Unemployment rate (15-74)	-1.8	8.9	7.2	7.4	7.4	7.3	7.2	7.1
Employment (20-64) (in millions)	-0.1	2.3	2.3	2.3	2.3	2.3	2.2	2.2
Employment (15-64) (in millions)	-0.1	2.4	2.4	2.4	2.4	2.4	2.3	2.3
share of young (15-24)	-0.2	11%	11%	12%	11%	11%	11%	11%
share of prime-age (25-54)	-2.9	70%	70%	71%	70%	68%	68%	67%
share of older (55-64)	3.0	19%	19%	18%	19%	21%	21%	22%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	0.0	21.3	21.3	19.3	20.6	21.6	20.5	21.3
Old-age dependency ratio 15-64 (3)	19.1	32.8	36.3	42.4	43.5	45.7	49.7	52.0
Old-age dependency ratio 20-64 (3)	21.2	35.9	39.8	46.7	47.8	50.1	54.7	57.2
Total dependency ratio (4)	19.5	58.7	62.6	68.6	69.1	71.6	75.9	78.3
Total economic dependency ratio (5)	4.8	123.6	124.2	132.1	130.6	128.4	128.2	128.4
Economic old-age dependency ratio (15-64) (6)	19.2	44.7	48.6	57.1	57.8	58.7	61.8	63.9
Economic old-age dependency ratio (15-74) (7)	15.9	43.4	47.2	55.3	55.8	55.8	57.8	59.4

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

27. SWEDEN

Table III.27.1:

Sweden	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.86	1.87	1.91	1.95	1.98	2.01	2.03
Life expectancy at birth								
males	6.1	80.6	81.1	82.3	83.5	84.6	85.7	86.7
females	6.0	84.3	84.8	86.1	87.2	88.3	89.4	90.3
Life expectancy at 65								
males	4.6	19.0	19.4	20.3	21.2	22.0	22.8	23.6
females	4.9	21.7	22.1	23.1	24.0	24.9	25.8	26.6
Net migration (thousand)	-79.1	103.5	67.9	57.2	44.7	30.5	27.4	24.4
Net migration as % of population	-0.9	1.0	0.7	0.5	0.4	0.2	0.2	0.2
Population (million)	4.0	9.9	10.3	11.3	12.0	12.7	13.3	13.9
Children population (0-14) as % of total population	-0.3	17.5	17.9	17.8	17.3	17.6	17.5	17.2
Prime age population (25-54) as % of total population	-4.5	39.4	39.3	37.2	37.3	35.9	35.6	34.9
Working age population (15-64) as % of total population	-4.9	62.7	61.9	61.0	60.4	59.7	57.8	57.8
Elderly population (65 and over) as % of total population	5.1	19.8	20.2	21.3	22.3	22.7	24.7	25.0
Very elderly population (80 and over) as % of total population	5.0	5.1	5.3	7.2	7.6	8.5	9.1	10.1
Very elderly population (80 and over) as % of elderly population	14.8	25.7	26.1	33.9	34.1	37.5	36.8	40.5
Very elderly population (80 and over) as % of working age population	9.4	8.1	8.5	11.8	12.6	14.3	15.7	17.5
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.9	2.7	1.9	1.9	2.0	1.8	1.8	1.9
Employment (growth rate)	0.5	1.4	0.5	0.6	0.6	0.3	0.3	0.3
Labour input : hours worked (growth rate)	0.5	1.5	0.5	0.6	0.5	0.3	0.2	0.3
Labour productivity per hour (growth rate)	1.5	1.1	1.4	1.4	1.5	1.5	1.5	1.5
TFP (growth rate)	1.0	0.9	0.9	0.9	1.0	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.3	0.5	0.5	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.3	1.5	0.9	1.2	1.4	1.3	1.4	1.5
Potential GDP per worker (growth rate)	1.4	1.2	1.4	1.3	1.5	1.5	1.5	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	1,802	6,218	6,405	6,875	7,261	7,589	7,694	8,019
Population growth (working age:15-64)	-0.4	0.8	0.7	0.5	0.5	0.3	0.3	0.3
Population (20-64) (in thousands)	1,515	5,694	5,832	6,200	6,535	6,862	6,916	7,209
Population growth (20-64)	-0.5	0.9	0.5	0.5	0.6	0.3	0.2	0.3
Labour force 15-64 (thousands)	1,400	5,113	5,257	5,595	5,918	6,183	6,264	6,513
Labour force 20-64 (thousands)	1,303	4,933	5,064	5,362	5,668	5,933	5,998	6,235
Participation rate (20-64)	-0.1	86.6	86.8	86.5	86.7	86.5	86.7	86.5
Participation rate (15-64)	-1.0	82.2	82.1	81.4	81.5	81.5	81.4	81.2
young (15-24)	-1.4	55.5	53.6	54.0	54.1	54.1	53.8	54.0
prime-age (25-54)	0.6	90.9	91.1	91.6	91.5	91.5	91.5	91.5
older (55-64)	-2.2	79.9	78.5	77.2	77.8	78.0	77.7	77.7
Participation rate (20-64) - FEMALES	0.5	84.1	84.3	84.4	84.8	84.5	84.9	84.6
Participation rate (15-64) - FEMALES	-0.4	80.4	80.2	79.9	80.2	80.2	80.2	80.0
young (15-24)	-0.8	56.3	55.1	55.5	55.5	55.6	55.2	55.5
prime-age (25-54)	1.5	88.4	89.0	89.8	90.0	89.9	90.0	89.9
older (55-64)	-2.6	77.1	73.9	73.4	74.2	74.9	74.5	74.6
Participation rate (20-64) - MALES	-0.8	89.1	89.3	88.6	88.6	88.3	88.5	88.3
Participation rate (15-64) - MALES	-1.6	84.0	83.9	82.8	82.7	82.7	82.6	82.4
young (15-24)	-2.0	54.7	52.3	52.7	52.7	52.8	52.4	52.7
prime-age (25-54)	-0.3	93.3	93.2	93.2	93.0	93.0	93.0	93.0
older (55-64)	-1.8	82.7	83.0	80.9	81.3	81.1	80.8	80.9
Average effective exit age (TOTAL) (1)	-0.3	65.3	65.0	65.0	65.0	65.0	65.0	65.0
Men	-0.3	65.9	65.6	65.6	65.6	65.6	65.6	65.6
Women	-0.3	64.7	64.4	64.4	64.4	64.4	64.4	64.4
Employment rate (15-64)	0.2	76.4	77.2	76.7	76.8	76.8	76.7	76.6
Employment rate (20-64)	1.0	81.2	82.4	82.2	82.5	82.2	82.5	82.3
Employment rate (15-74)	0.8	67.2	68.2	68.3	68.0	68.4	67.0	67.9
Unemployment rate (15-64)	-1.4	7.1	5.9	5.8	5.7	5.7	5.7	5.7
Unemployment rate (20-64)	-1.4	6.2	5.2	4.9	4.9	4.9	4.9	4.9
Unemployment rate (15-74)	-1.4	7.0	5.8	5.6	5.6	5.6	5.6	5.6
Employment (20-64) (in millions)	1.3	4.6	4.8	5.1	5.4	5.6	5.7	5.9
Employment (15-64) (in millions)	1.4	4.7	4.9	5.3	5.6	5.8	5.9	6.1
share of young (15-24)	1.1	11%	10%	12%	12%	12%	12%	12%
share of prime-age (25-54)	-1.6	71%	71%	70%	71%	68%	70%	69%
share of older (55-64)	0.6	18%	18%	19%	17%	20%	18%	19%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	0.9	18.4	18.7	19.2	18.0	20.5	18.2	19.3
Old-age dependency ratio 15-64 (3)	11.6	31.6	32.6	34.9	37.0	38.1	42.7	43.2
Old-age dependency ratio 20-64 (3)	13.5	34.5	35.8	38.7	41.1	42.1	47.5	48.0
Total dependency ratio (4)	13.5	59.5	61.5	64.0	65.7	67.5	73.0	73.0
Total economic dependency ratio (5)	16.5	101.5	102.1	106.4	108.1	110.6	116.4	118.0
Economic old-age dependency ratio (15-64) (6)	15.0	37.6	38.7	41.8	44.4	46.0	51.3	52.7
Economic old-age dependency ratio (15-74) (7)	14.5	36.3	37.3	40.3	42.9	44.4	49.3	50.8

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

28. UNITED KINGDOM

Table III.28.1:

United-Kingdom	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.1	1.80	1.80	1.81	1.83	1.84	1.86	1.87
Life expectancy at birth								
males	6.9	79.6	80.2	81.6	83.0	84.2	85.4	86.5
females	6.8	83.3	83.9	85.3	86.7	87.9	89.0	90.1
Life expectancy at 65								
males	4.8	18.8	19.2	20.1	21.1	22.0	22.8	23.6
females	5.2	21.3	21.7	22.8	23.8	24.8	25.7	26.5
Net migration (thousand)	-136.7	244.0	251.5	220.1	181.0	134.2	121.1	107.3
Net migration as % of population	-0.2	0.4	0.4	0.3	0.2	0.2	0.2	0.1
Population (million)	15.4	65.6	67.5	71.8	75.2	77.7	79.4	81.0
Children population (0-14) as % of total population	-1.7	17.7	17.7	17.0	16.7	16.4	16.2	15.9
Prime age population (25-54) as % of total population	-5.5	40.4	39.6	37.8	37.7	36.4	35.8	34.9
Working age population (15-64) as % of total population	-6.8	64.4	63.7	61.8	60.2	59.6	58.4	57.6
Elderly population (65 and over) as % of total population	8.5	18.0	18.6	21.3	23.2	23.9	25.4	26.5
Very elderly population (80 and over) as % of total population	5.8	4.8	5.1	6.6	7.7	9.4	9.6	10.7
Very elderly population (80 and over) as % of elderly population	13.4	26.9	27.4	31.1	33.1	39.2	37.9	40.3
Very elderly population (80 and over) as % of working age population	11.0	7.5	8.0	10.7	12.7	15.8	16.5	18.5
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.7	1.5	1.6	1.8	1.8	1.8	1.6	1.6
Employment (growth rate)	0.3	0.9	0.5	0.4	0.3	0.3	0.0	0.0
Labour input : hours worked (growth rate)	0.3	1.1	0.6	0.4	0.3	0.3	0.0	0.0
Labour productivity per hour (growth rate)	1.4	0.5	1.0	1.4	1.5	1.5	1.5	1.5
TFP (growth rate)	0.9	0.3	0.6	0.9	1.0	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.2	0.4	0.5	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.3	0.8	0.9	1.2	1.4	1.5	1.4	1.4
Potential GDP per worker (growth rate)	1.4	0.6	1.0	1.3	1.5	1.5	1.5	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	4,440	42,225	42,959	44,314	45,214	46,314	46,390	46,665
Population growth (working age:15-64)	-0.4	0.5	0.5	0.1	0.4	0.1	0.0	0.1
Population (20-64) (in thousands)	3,861	38,451	39,322	40,191	41,038	42,064	42,044	42,312
Population growth (20-64)	-0.6	0.7	0.5	0.1	0.4	0.1	0.0	0.1
Labour force 15-64 (thousands)	4,774	32,599	33,389	34,828	36,026	37,092	37,161	37,373
Labour force 20-64 (thousands)	4,589	31,160	32,040	33,267	34,470	35,507	35,541	35,749
Participation rate (20-64)	3.5	81.0	81.5	82.8	84.0	84.4	84.5	84.5
Participation rate (15-64)	2.9	77.2	77.7	78.6	79.7	80.1	80.1	80.1
young (15-24)	-1.2	58.6	58.5	57.8	57.4	57.5	57.3	57.4
prime-age (25-54)	3.1	86.1	86.9	88.2	88.9	89.2	89.2	89.2
older (55-64)	8.3	66.0	66.7	68.9	71.1	73.7	73.9	74.2
Participation rate (20-64) - FEMALES	5.9	75.3	76.2	78.5	80.4	81.1	81.2	81.2
Participation rate (15-64) - FEMALES	5.1	72.1	73.0	74.9	76.6	77.2	77.3	77.2
young (15-24)	-1.1	57.6	57.5	57.1	56.6	56.6	56.4	56.5
prime-age (25-54)	5.3	80.1	81.3	83.6	85.0	85.4	85.5	85.5
older (55-64)	12.7	59.4	61.2	65.4	68.3	71.4	71.8	72.1
Participation rate (20-64) - MALES	0.9	86.9	86.8	87.0	87.6	87.7	87.8	87.7
Participation rate (15-64) - MALES	0.6	82.3	82.4	82.2	82.7	82.9	82.9	82.9
young (15-24)	-1.3	59.5	59.4	58.6	58.2	58.3	58.1	58.2
prime-age (25-54)	0.7	92.2	92.5	92.8	92.8	92.9	92.8	92.8
older (55-64)	3.6	72.8	72.4	72.6	74.0	76.1	76.0	76.4
Average effective exit age (TOTAL) (1)	1.4	64.4	64.7	65.1	65.1	65.8	65.8	65.8
Men	0.8	65.0	64.8	65.1	65.1	65.8	65.8	65.8
Women	2.0	63.8	64.5	65.1	65.1	65.8	65.8	65.8
Employment rate (15-64)	1.8	73.3	73.3	73.7	74.7	75.1	75.1	75.1
Employment rate (20-64)	2.4	77.5	77.5	78.4	79.5	79.9	80.0	80.0
Employment rate (15-74)	0.9	65.8	65.4	65.2	65.9	67.2	66.6	66.7
Unemployment rate (15-64)	1.2	5.0	5.6	6.2	6.2	6.2	6.2	6.2
Unemployment rate (20-64)	1.0	4.3	4.9	5.3	5.4	5.4	5.3	5.3
Unemployment rate (15-74)	1.1	4.9	5.5	6.1	6.1	6.1	6.0	6.0
Employment (20-64) (in millions)	4.0	29.8	30.5	31.5	32.6	33.6	33.6	33.8
Employment (15-64) (in millions)	4.1	31.0	31.5	32.7	33.8	34.8	34.8	35.0
share of young (15-24)	-1.1	13%	13%	13%	12%	12%	12%	12%
share of prime-age (25-54)	-2.3	71%	71%	70%	71%	69%	70%	69%
share of older (55-64)	3.5	16%	17%	17%	17%	19%	18%	19%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	2.2	18.0	19.4	19.4	18.3	20.0	19.4	20.2
Old-age dependency ratio 15-64 (3)	18.0	27.9	29.3	34.4	38.5	40.2	43.5	46.0
Old-age dependency ratio 20-64 (3)	20.0	30.7	32.0	38.0	42.5	44.2	48.0	50.7
Total dependency ratio (4)	18.3	55.4	57.0	61.9	66.2	67.7	71.2	73.7
Total economic dependency ratio (5)	14.9	104.8	107.7	111.8	114.2	113.5	116.0	119.7
Economic old-age dependency ratio (15-64) (6)	21.3	34.5	36.8	42.9	47.6	48.8	52.3	55.8
Economic old-age dependency ratio (15-74) (7)	19.7	33.4	35.7	41.3	45.8	46.6	49.6	53.0

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

29. NORWAY

Table III.29.1:

Norway	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.1	1.70	1.74	1.76	1.77	1.79	1.81	1.83
Life expectancy at birth								
males	6.4	80.2	80.8	82.1	83.3	84.4	85.5	86.6
females	6.1	84.3	84.8	86.1	87.2	88.3	89.4	90.4
Life expectancy at 65								
males	4.7	18.8	19.2	20.1	21.0	21.9	22.7	23.5
females	4.9	21.7	22.1	23.1	24.1	25.0	25.8	26.6
Net migration (thousand)	-11.3	27.4	27.3	26.0	23.7	20.2	18.1	16.1
Net migration as % of population	-0.3	0.5	0.5	0.4	0.4	0.3	0.3	0.2
Population (million)	1.8	5.2	5.4	5.9	6.3	6.6	6.8	7.0
Children population (0-14) as % of total population	-2.1	17.8	17.5	16.9	16.5	16.0	15.8	15.7
Prime age population (25-54) as % of total population	-6.2	41.2	41.0	39.1	38.4	36.7	35.8	35.1
Working age population (15-64) as % of total population	-8.4	65.7	64.9	62.9	60.9	60.2	58.4	57.3
Elderly population (65 and over) as % of total population	10.5	16.5	17.5	20.2	22.7	23.8	25.8	27.0
Very elderly population (80 and over) as % of total population	6.5	4.2	4.3	6.1	7.4	8.8	9.7	10.7
Very elderly population (80 and over) as % of elderly population	14.2	25.5	24.5	30.0	32.6	37.0	37.4	39.7
Very elderly population (80 and over) as % of working age population	12.3	6.4	6.6	9.6	12.2	14.7	16.5	18.7
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.8	2.1	2.0	1.7	1.8	1.8	1.6	1.6
Employment (growth rate)	0.3	0.2	1.2	0.4	0.4	0.2	0.0	0.1
Labour input : hours worked (growth rate)	0.3	0.5	2.0	0.4	0.3	0.2	0.0	0.1
Labour productivity per hour (growth rate)	1.5	0.5	0.6	1.3	1.4	1.5	1.5	1.5
TFP (growth rate)	0.9	-0.2	0.4	0.8	0.9	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.6	0.3	0.5	0.5	0.5	0.5	0.5
Potential GDP per capita (growth rate)	1.2	1.2	1.1	1.0	1.2	1.4	1.3	1.3
Potential GDP per worker (growth rate)	1.4	1.9	0.8	1.3	1.4	1.5	1.5	1.5
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	579	3,439	3,524	3,712	3,826	3,962	3,985	4,018
Population growth (working age:15-64)	-0.6	0.7	0.6	0.3	0.4	0.2	0.0	0.1
Population (20-64) (in thousands)	533	3,115	3,209	3,383	3,475	3,604	3,623	3,648
Population growth (20-64)	-0.8	0.9	0.7	0.4	0.4	0.2	0.0	0.1
Labour force 15-64 (thousands)	480	2,683	2,763	2,917	3,014	3,122	3,138	3,163
Labour force 20-64 (thousands)	463	2,556	2,641	2,788	2,878	2,983	2,997	3,019
Participation rate (20-64)	0.7	82.1	82.3	82.4	82.8	82.8	82.7	82.8
Participation rate (15-64)	0.7	78.0	78.4	78.6	78.8	78.8	78.8	78.7
young (15-24)	0.0	54.9	55.4	55.3	54.6	55.0	54.9	54.8
prime-age (25-54)	1.6	86.4	86.9	87.5	87.9	87.9	87.9	88.0
older (55-64)	-1.1	73.9	72.5	72.1	71.7	73.1	72.6	72.8
Participation rate (20-64) - FEMALES	1.7	79.4	79.7	80.3	81.1	81.2	81.1	81.1
Participation rate (15-64) - FEMALES	1.7	75.8	76.2	76.8	77.4	77.5	77.5	77.4
young (15-24)	-0.3	55.1	55.3	55.2	54.6	55.0	54.9	54.8
prime-age (25-54)	2.6	83.8	84.4	85.6	86.3	86.3	86.3	86.4
older (55-64)	1.1	70.1	69.1	69.3	69.4	71.4	71.0	71.1
Participation rate (20-64) - MALES	-0.3	84.6	84.7	84.4	84.5	84.3	84.3	84.3
Participation rate (15-64) - MALES	-0.2	80.2	80.5	80.3	80.2	80.1	80.0	80.0
young (15-24)	0.2	54.6	55.5	55.3	54.5	55.0	54.9	54.8
prime-age (25-54)	0.7	88.8	89.2	89.3	89.5	89.4	89.5	89.5
older (55-64)	-3.2	77.7	75.8	74.8	73.9	74.7	74.2	74.4
Average effective exit age (TOTAL) (1)	0.0	65.5	65.5	65.5	65.5	65.5	65.5	65.5
Men	0.0	65.9	65.9	65.9	65.9	65.9	65.9	65.9
Women	0.0	65.1	65.1	65.1	65.1	65.1	65.1	65.1
Employment rate (15-64)	1.8	74.3	75.8	76.0	76.2	76.2	76.1	76.1
Employment rate (20-64)	1.7	78.6	79.9	80.0	80.4	80.3	80.3	80.3
Employment rate (15-74)	-0.4	67.3	68.4	68.2	67.5	67.9	66.9	66.9
Unemployment rate (15-64)	-1.5	4.8	3.3	3.3	3.3	3.3	3.3	3.3
Unemployment rate (20-64)	-1.3	4.2	3.0	3.0	2.9	2.9	2.9	2.9
Unemployment rate (15-74)	-1.5	4.7	3.2	3.2	3.2	3.2	3.2	3.2
Employment (20-64) (in millions)	0.5	2.4	2.6	2.7	2.8	2.9	2.9	2.9
Employment (15-64) (in millions)	0.5	2.6	2.7	2.8	2.9	3.0	3.0	3.1
share of young (15-24)	-0.4	13%	13%	12%	12%	12%	12%	12%
share of prime-age (25-54)	-1.3	70%	70%	69%	71%	68%	69%	69%
share of older (55-64)	1.7	17%	17%	18%	17%	19%	19%	19%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	2.4	17.8	18.3	19.7	18.7	20.6	20.2	20.2
Old-age dependency ratio 15-64 (3)	22.1	25.2	27.0	32.1	37.3	39.6	44.1	47.2
Old-age dependency ratio 20-64 (3)	24.2	27.8	29.7	35.2	41.0	43.5	48.5	52.0
Total dependency ratio (4)	22.3	52.3	54.0	59.0	64.3	66.1	71.1	74.6
Total economic dependency ratio (5)	21.1	97.8	95.4	100.9	106.5	109.0	114.1	118.9
Economic old-age dependency ratio (15-64) (6)	27.0	30.2	31.7	38.0	44.4	47.7	53.0	57.2
Economic old-age dependency ratio (15-74) (7)	25.5	29.1	30.5	36.5	42.6	45.7	50.5	54.6

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

30. EURO AREA

Table III.30.1:

Euro-Area	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.56	1.61	1.67	1.71	1.74	1.76	1.79
Life expectancy at birth								
males	7.1	79.3	80.0	81.4	82.8	84.1	85.3	86.4
females	6.1	84.6	85.1	86.3	87.5	88.6	89.6	90.6
Life expectancy at 65								
males	4.9	18.7	19.1	20.1	21.1	21.9	22.8	23.6
females	4.7	22.2	22.6	23.5	24.4	25.3	26.1	26.9
Net migration (thousand)	-520.3	1148.6	811.8	877.8	855.6	801.2	712.9	628.2
Net migration as % of population	-0.2	0.3	0.2	0.3	0.2	0.2	0.2	0.2
Population (million)	5.2	340.3	343.8	349.0	352.2	351.8	348.3	345.6
Children population (0-14) as % of total population	-0.2	15.2	15.0	14.5	14.4	14.6	14.7	14.9
Prime age population (25-54) as % of total population	-7.1	41.1	39.4	36.1	34.6	34.2	34.2	34.0
Working age population (15-64) as % of total population	-8.8	64.8	63.8	60.4	57.2	55.9	56.0	56.0
Elderly population (65 and over) as % of total population	9.0	20.0	21.2	25.1	28.4	29.5	29.3	29.0
Very elderly population (80 and over) as % of total population	6.8	5.9	6.5	7.7	9.6	12.0	12.7	12.7
Very elderly population (80 and over) as % of elderly population	14.4	29.3	30.5	30.7	34.0	40.8	43.4	43.7
Very elderly population (80 and over) as % of working age population	13.6	9.1	10.1	12.7	16.9	21.5	22.7	22.6
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.3	1.0	1.2	1.0	1.2	1.5	1.5	1.5
Employment (growth rate)	0.0	0.7	0.4	-0.1	-0.2	-0.1	-0.1	-0.1
Labour input : hours worked (growth rate)	-0.1	0.5	0.2	-0.1	-0.2	-0.1	-0.1	-0.1
Labour productivity per hour (growth rate)	1.4	0.5	0.9	1.2	1.5	1.6	1.6	1.5
TFP (growth rate)	0.9	0.4	0.6	0.7	0.9	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.1	0.3	0.4	0.5	0.6	0.6	0.5
Potential GDP per capita (growth rate)	1.3	0.7	1.0	0.9	1.2	1.5	1.6	1.5
Potential GDP per worker (growth rate)	1.4	0.4	0.8	1.2	1.5	1.6	1.6	1.6
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-26,869	220,550	219,529	210,879	201,394	196,763	195,087	193,682
Population growth (working age:15-64)	-0.2	0.1	-0.2	-0.6	-0.3	-0.1	0.0	-0.1
Population (20-64) (in thousands)	-26,576	202,658	201,692	193,285	183,949	179,255	177,363	176,082
Population growth (20-64)	-0.1	0.0	-0.2	-0.6	-0.3	-0.2	0.0	-0.1
Labour force 15-64 (thousands)	-15,236	160,553	161,256	156,829	150,909	147,567	146,179	145,316
Labour force 20-64 (thousands)	-15,225	157,172	157,895	153,516	147,491	144,185	142,828	141,947
Participation rate (20-64)	3.1	77.6	78.3	79.4	80.2	80.4	80.5	80.6
Participation rate (15-64)	2.2	72.8	73.5	74.4	74.9	75.0	74.9	75.0
young (15-24)	0.6	39.9	40.4	40.5	41.0	40.8	40.4	40.6
prime-age (25-54)	0.8	85.5	85.8	86.0	86.0	86.1	86.2	86.3
older (55-64)	13.2	59.8	63.5	69.8	71.8	72.2	72.7	73.0
Participation rate (20-64) - FEMALES	5.7	71.6	73.0	75.3	76.7	77.1	77.2	77.3
Participation rate (15-64) - FEMALES	4.6	67.3	68.6	70.6	71.7	71.9	71.8	71.9
young (15-24)	0.6	37.5	38.1	38.1	38.6	38.4	38.0	38.2
prime-age (25-54)	2.9	79.6	80.7	81.8	82.2	82.3	82.4	82.5
older (55-64)	17.9	53.0	57.3	65.6	69.2	70.1	70.6	71.0
Participation rate (20-64) - MALES	0.3	83.5	83.6	83.5	83.6	83.7	83.8	83.8
Participation rate (15-64) - MALES	-0.3	78.3	78.3	78.1	78.1	78.0	77.9	78.0
young (15-24)	0.6	42.2	42.7	42.8	43.3	43.0	42.7	42.9
prime-age (25-54)	-1.5	91.4	91.0	90.0	89.7	89.8	89.8	89.8
older (55-64)	8.0	66.9	70.0	74.1	74.5	74.3	74.8	75.0
Average effective exit age (TOTAL) (1)	2.6	63.4	64.4	65.2	65.5	65.8	65.9	66.0
Men	2.5	63.6	64.4	65.2	65.6	65.8	66.0	66.1
Women	2.8	63.3	64.3	65.1	65.5	65.7	65.9	66.0
Employment rate (15-64)	4.5	65.4	67.0	68.3	69.4	69.9	69.9	69.9
Employment rate (20-64)	5.4	69.9	71.6	73.2	74.4	75.2	75.3	75.3
Employment rate (15-74)	4.3	57.7	58.7	59.2	59.9	61.1	61.6	61.9
Unemployment rate (15-64)	-3.4	10.2	8.8	8.1	7.4	6.7	6.8	6.8
Unemployment rate (20-64)	-3.3	9.9	8.5	7.9	7.2	6.5	6.6	6.6
Unemployment rate (15-74)	-3.5	10.0	8.6	7.8	7.1	6.5	6.5	6.5
Employment (20-64) (in millions)	-9.0	141.6	144.4	141.4	136.9	134.8	133.5	132.6
Employment (15-64) (in millions)	-8.8	144.2	147.1	144.1	139.7	137.6	136.3	135.4
share of young (15-24)	1.2	8%	8%	8%	9%	9%	9%	9%
share of prime-age (25-54)	-4.8	75%	73%	70%	70%	71%	71%	70%
share of older (55-64)	3.6	17%	19%	22%	21%	20%	20%	20%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	0.7	20.0	21.6	23.0	21.6	20.8	20.5	20.7
Old-age dependency ratio 15-64 (3)	20.9	30.9	33.1	41.5	49.7	52.7	52.3	51.8
Old-age dependency ratio 20-64 (3)	23.3	33.6	36.1	45.3	54.4	57.9	57.5	56.9
Total dependency ratio (4)	24.1	54.3	56.6	65.5	74.9	78.8	78.5	78.4
Total economic dependency ratio (5)	8.7	131.7	128.2	131.4	138.4	141.8	141.5	140.4
Economic old-age dependency ratio (15-64) (6)	22.5	45.3	47.0	56.0	65.7	69.6	68.9	67.8
Economic old-age dependency ratio (15-74) (7)	19.4	44.5	45.9	53.5	62.2	65.8	65.1	63.9

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

31. EUROPEAN UNION*

Table III.31.1:

European Union *	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.2	1.58	1.63	1.69	1.73	1.76	1.78	1.81
Life expectancy at birth								
males	7.8	78.3	79.1	80.7	82.2	83.6	84.9	86.1
females	6.6	83.7	84.3	85.6	86.9	88.1	89.2	90.3
Life expectancy at 65								
males	5.3	18.1	18.6	19.7	20.7	21.6	22.6	23.4
females	5.1	21.5	22.0	23.0	24.0	24.9	25.8	26.6
Net migration (thousand)	-680.1	1484.8	1127.1	1157.2	1154.3	1053.3	914.6	804.7
Net migration as % of population	-0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Population (million)	9.3	510.9	516.1	524.1	528.5	528.4	524.4	520.3
Children population (0-14) as % of total population	-0.5	15.5	15.4	14.9	14.7	14.9	14.9	15.0
Prime age population (25-54) as % of total population	-7.2	41.2	39.9	36.8	35.2	34.4	34.3	34.0
Working age population (15-64) as % of total population	-9.0	65.2	64.0	61.0	58.2	56.6	56.1	56.2
Elderly population (65 and over) as % of total population	9.5	19.3	20.5	24.1	27.1	28.5	29.0	28.8
Very elderly population (80 and over) as % of total population	7.1	5.4	5.9	7.3	9.2	11.2	12.1	12.5
Very elderly population (80 and over) as % of elderly population	15.5	28.1	28.9	30.2	33.9	39.2	41.8	43.6
Very elderly population (80 and over) as % of working age population	14.0	8.3	9.3	11.9	15.8	19.8	21.6	22.3
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.4	1.3	1.4	1.3	1.3	1.5	1.5	1.5
Employment (growth rate)	-0.1	0.7	0.3	-0.1	-0.2	-0.1	-0.1	-0.1
Labour input : hours worked (growth rate)	-0.1	0.6	0.2	-0.1	-0.3	-0.2	-0.1	-0.1
Labour productivity per hour (growth rate)	1.5	0.6	1.1	1.4	1.6	1.6	1.6	1.6
TFP (growth rate)	0.9	0.5	0.7	0.9	1.0	1.0	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.1	0.4	0.5	0.6	0.6	0.6	0.6
Potential GDP per capita (growth rate)	1.4	1.0	1.2	1.2	1.3	1.5	1.6	1.5
Potential GDP per worker (growth rate)	1.5	0.6	1.1	1.4	1.6	1.6	1.6	1.6
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-40,687	332,922	330,438	319,688	307,470	299,168	294,231	292,235
Population growth (working age:15-64)	0.0	0.0	-0.2	-0.5	-0.3	-0.2	-0.1	-0.1
Population (20-64) (in thousands)	-40,407	305,877	303,770	292,646	280,640	272,630	267,266	265,470
Population growth (20-64)	0.0	0.0	-0.2	-0.4	-0.3	-0.2	-0.1	-0.1
Labour force 15-64 (thousands)	-22,626	242,758	243,566	238,193	230,313	225,010	221,582	220,133
Labour force 20-64 (thousands)	-22,817	237,178	238,111	232,548	224,542	219,279	215,840	214,361
Participation rate (20-64)	3.2	77.5	78.4	79.5	80.0	80.4	80.8	80.7
Participation rate (15-64)	2.4	72.9	73.7	74.5	74.9	75.2	75.3	75.3
young (15-24)	0.8	42.0	42.3	42.4	42.8	42.9	42.5	42.8
prime-age (25-54)	1.2	85.5	85.9	86.2	86.5	86.6	86.7	86.7
older (55-64)	12.2	59.1	62.4	68.0	69.2	70.1	71.1	71.3
Participation rate (20-64) - FEMALES	5.5	71.4	72.7	74.8	75.8	76.4	76.8	76.9
Participation rate (15-64) - FEMALES	4.5	67.3	68.5	70.3	71.1	71.5	71.7	71.8
young (15-24)	1.0	39.4	39.8	39.9	40.3	40.5	40.1	40.4
prime-age (25-54)	3.1	79.6	80.5	81.7	82.2	82.4	82.6	82.6
older (55-64)	16.2	52.0	55.7	63.2	65.2	66.7	67.9	68.2
Participation rate (20-64) - MALES	0.8	83.7	84.0	84.1	84.1	84.3	84.5	84.5
Participation rate (15-64) - MALES	0.2	78.5	78.9	78.7	78.6	78.8	78.8	78.8
young (15-24)	0.6	44.5	44.6	44.7	45.1	45.2	44.8	45.1
prime-age (25-54)	-0.7	91.4	91.3	90.7	90.6	90.7	90.7	90.7
older (55-64)	7.7	66.7	69.3	73.0	73.2	73.6	74.2	74.4
Average effective exit age (TOTAL) (1)	2.2	63.5	64.2	64.9	65.1	65.4	65.6	65.6
Men	2.0	63.9	64.4	65.1	65.3	65.6	65.7	65.8
Women	2.4	63.1	63.9	64.6	65.0	65.2	65.4	65.5
Employment rate (15-64)	3.9	66.6	68.1	69.0	69.7	70.4	70.4	70.4
Employment rate (20-64)	4.7	71.1	72.7	73.9	74.8	75.5	75.8	75.8
Employment rate (15-74)	3.4	58.9	59.8	60.1	60.5	61.4	61.8	62.3
Unemployment rate (15-64)	-2.2	8.7	7.6	7.4	6.9	6.5	6.5	6.5
Unemployment rate (20-64)	-2.2	8.4	7.3	7.0	6.6	6.1	6.1	6.1
Unemployment rate (15-74)	-2.3	8.5	7.5	7.2	6.6	6.2	6.2	6.2
Employment (20-64) (in millions)	-16.1	217.3	220.7	216.2	209.8	205.9	202.6	201.2
Employment (15-64) (in millions)	-15.8	221.7	225.0	220.6	214.4	210.5	207.2	205.8
share of young (15-24)	1.0	9%	9%	9%	9%	9%	10%	10%
share of prime-age (25-54)	-4.5	75%	73%	70%	70%	71%	71%	70%
share of older (55-64)	3.5	16%	18%	21%	20%	20%	19%	20%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	0.9	19.8	20.9	22.1	21.6	21.1	20.2	20.7
Old-age dependency ratio 15-64 (3)	21.6	29.6	32.1	39.5	46.6	50.4	51.6	51.2
Old-age dependency ratio 20-64 (3)	24.2	32.2	34.9	43.2	51.1	55.3	56.8	56.4
Total dependency ratio (4)	24.6	53.5	56.2	64.0	71.9	76.6	78.2	78.0
Total economic dependency ratio (5)	13.5	125.6	123.6	127.8	134.3	138.2	139.5	139.2
Economic old-age dependency ratio (15-64) (6)	24.7	42.2	44.5	52.9	61.6	66.2	67.5	67.0
Economic old-age dependency ratio (15-74) (7)	22.0	41.4	43.4	50.7	58.5	62.8	63.9	63.4

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

32. EUROPEAN UNION 27

Table III.32.1:

European Union 27	EC-EPC (AWG) 2018 projections							
Main demographic and macroeconomic assumptions								
Demographic projections - Eurostat 2015-based population projections	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Fertility rate	0.3	1.55	1.61	1.67	1.71	1.74	1.77	1.80
Life expectancy at birth								
males	7.9	78.2	78.9	80.6	82.1	83.5	84.8	86.1
females	6.6	83.7	84.3	85.7	87.0	88.2	89.3	90.3
Life expectancy at 65								
males	5.3	18.0	18.5	19.6	20.6	21.6	22.5	23.4
females	5.1	21.6	22.0	23.0	24.0	25.0	25.8	26.7
Net migration (thousand)	-543.4	1240.8	875.6	937.2	973.4	919.1	793.4	697.4
Net migration as % of population	-0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Population (million)	-6.1	445.3	448.7	452.4	453.3	450.8	445.0	439.2
Children population (0-14) as % of total population	-0.3	15.2	15.1	14.6	14.4	14.6	14.7	14.9
Prime age population (25-54) as % of total population	-7.5	41.3	40.0	36.6	34.8	34.0	34.0	33.9
Working age population (15-64) as % of total population	-9.4	65.3	64.1	60.9	57.9	56.1	55.7	55.9
Elderly population (65 and over) as % of total population	9.7	19.5	20.8	24.6	27.8	29.3	29.6	29.2
Very elderly population (80 and over) as % of total population	7.4	5.5	6.1	7.4	9.4	11.5	12.5	12.9
Very elderly population (80 and over) as % of elderly population	15.8	28.3	29.1	30.1	34.0	39.2	42.4	44.1
Very elderly population (80 and over) as % of working age population	14.6	8.4	9.4	12.1	16.3	20.5	22.5	23.0
Macroeconomic assumptions*	AVG 16-70	2016	2020	2030	2040	2050	2060	2070
Potential GDP (growth rate)	1.3	1.3	1.4	1.2	1.2	1.4	1.5	1.4
Employment (growth rate)	-0.1	0.7	0.3	-0.2	-0.3	-0.2	-0.1	-0.1
Labour input : hours worked (growth rate)	-0.2	0.5	0.1	-0.2	-0.4	-0.3	-0.1	-0.1
Labour productivity per hour (growth rate)	1.5	0.7	1.1	1.4	1.6	1.7	1.6	1.6
TFP (growth rate)	0.9	0.5	0.7	0.9	1.0	1.1	1.0	1.0
Capital deepening (contribution to labour productivity growth)	0.5	0.2	0.4	0.5	0.6	0.6	0.6	0.6
Potential GDP per capita (growth rate)	1.4	1.0	1.3	1.2	1.3	1.5	1.6	1.6
Potential GDP per worker (growth rate)	1.5	0.6	1.1	1.4	1.6	1.7	1.6	1.6
Labour force assumptions	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Working age population (15-64) (in thousands)	-45,127	290,697	287,478	275,374	262,255	252,854	247,841	245,570
Population growth (working age:15-64)	0.0	-0.1	-0.3	-0.6	-0.4	-0.3	-0.1	-0.1
Population (20-64) (in thousands)	-44,268	267,426	264,448	252,455	239,602	230,566	225,222	223,158
Population growth (20-64)	0.0	-0.1	-0.4	-0.5	-0.5	-0.3	-0.1	-0.1
Labour force 15-64 (thousands)	-27,399	210,159	210,177	203,364	194,287	187,918	184,421	182,760
Labour force 20-64 (thousands)	-27,406	206,018	206,071	199,282	190,071	183,772	180,299	178,611
Participation rate (20-64)	3.0	77.0	77.9	78.9	79.3	79.7	80.1	80.0
Participation rate (15-64)	2.1	72.3	73.1	73.9	74.1	74.3	74.4	74.4
young (15-24)	0.8	39.2	39.5	39.6	40.1	40.1	39.7	40.0
prime-age (25-54)	0.9	85.4	85.8	85.9	86.0	86.2	86.2	86.3
older (55-64)	12.5	58.2	61.8	67.9	68.9	69.5	70.6	70.8
Participation rate (20-64) - FEMALES	5.2	70.8	72.2	74.2	75.0	75.6	76.0	76.0
Participation rate (15-64) - FEMALES	4.1	66.6	67.8	69.5	70.1	70.5	70.7	70.7
young (15-24)	0.9	36.3	36.7	36.7	37.3	37.4	37.0	37.2
prime-age (25-54)	2.6	79.5	80.4	81.4	81.7	81.9	82.0	82.1
older (55-64)	16.4	51.0	55.0	62.9	64.8	65.9	67.2	67.4
Participation rate (20-64) - MALES	0.6	83.3	83.6	83.6	83.5	83.7	83.9	83.9
Participation rate (15-64) - MALES	0.0	78.0	78.3	78.1	77.9	78.0	78.0	78.0
young (15-24)	0.6	41.9	42.2	42.3	42.7	42.7	42.2	42.5
prime-age (25-54)	-1.0	91.3	91.1	90.4	90.2	90.3	90.3	90.3
older (55-64)	8.2	65.9	68.9	73.1	73.1	73.2	73.9	74.0
Average effective exit age (TOTAL) (1)	2.3	63.3	64.1	64.8	65.2	65.4	65.5	65.6
Men	2.1	63.7	64.4	65.1	65.4	65.6	65.7	65.8
Women	2.5	63.0	63.8	64.6	65.0	65.2	65.3	65.4
Employment rate (15-64)	3.9	65.6	67.3	68.3	68.9	69.5	69.5	69.5
Employment rate (20-64)	4.9	70.1	72.0	73.2	74.0	74.7	75.0	75.0
Employment rate (15-74)	3.5	57.9	58.9	59.3	59.5	60.3	60.9	61.5
Unemployment rate (15-64)	-2.7	9.3	7.9	7.6	7.0	6.5	6.5	6.6
Unemployment rate (20-64)	-2.7	9.0	7.7	7.3	6.8	6.3	6.3	6.3
Unemployment rate (15-74)	-2.8	9.1	7.8	7.3	6.8	6.2	6.3	6.3
Employment (20-64) (in millions)	-20.2	187.5	190.3	184.7	177.2	172.3	169.0	167.4
Employment (15-64) (in millions)	-19.9	190.7	193.5	187.9	180.6	175.7	172.4	170.8
share of young (15-24)	1.2	8%	8%	8%	9%	9%	9%	9%
share of prime-age (25-54)	-4.7	75%	74%	71%	70%	71%	71%	71%
share of older (55-64)	3.5	17%	18%	21%	21%	20%	20%	20%
Dependency ratios	Ch 16-70	2016	2020	2030	2040	2050	2060	2070
Share of older population (55-64) (2)	0.7	20.1	21.1	22.5	22.1	21.4	20.4	20.8
Old-age dependency ratio 15-64 (3)	22.4	29.9	32.5	40.3	48.0	52.3	53.1	52.2
Old-age dependency ratio 20-64 (3)	25.0	32.5	35.3	44.0	52.6	57.3	58.4	57.5
Total dependency ratio (4)	25.7	53.2	56.1	64.3	72.9	78.3	79.5	78.9
Total economic dependency ratio (5)	14.1	129.1	126.2	130.6	138.0	143.1	144.3	143.2
Economic old-age dependency ratio (15-64) (6)	25.8	43.5	45.7	54.6	64.2	69.6	70.6	69.3
Economic old-age dependency ratio (15-74) (7)	22.8	42.7	44.6	52.3	60.9	65.9	66.8	65.5

LEGENDA:
*** The potential GDP and its components are used to estimate the rate of potential output growth, net of normal cyclical variations**
(1) Based on the calculation of the average probability of labour force entry and exit observed. The table reports the value for 2017 instead of 2016.
(2) Share of older population = Population aged 55 to 64 as a % of the population aged 15-64
(3) Old-age dependency ratio = Population aged 65 and over as a % of the population aged 15-64 or 20-64
(4) Total dependency ratio = Population under 15 and over 64 as a % of the population aged 15-64
(5) Total economic dependency ratio = Total population less employed as a % of the employed population 15-74
(6) Economic old-age dependency ratio (15-64) = Inactive population aged 65+ as a % of the employed population 15-64
(7) Economic old-age dependency ratio (15-74) = Inactive population aged 65+ as a % of the employed population 15-74
NB: : = data not provided

Source: Commission Services (DG ECFIN), Eurostat 2015-based population projections, EPC (AWG).

Part IV

Resources

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