



Bundesministerium  
für Arbeit und Soziales

# Pension Projections Exercise 2018

Country Fiche

Germany

**Peer review process on national pension systems and pension projection results**

For the attention of the Economic Policy Committees'  
Working Group on Ageing Populations and Sustainability

November, 2017

# Index of Contents

- 1. Overview of the pension system..... 1
  - 1.1 Description..... 1
  - 1.2 Recent reforms of the pension system included in the projections..... 7
  - 1.3 Description of the actual “constant policy” assumptions used in the projection..... 9
- 2. Overview of the demographic and labour forces projections..... 10
  - 2.1 Demographic development..... 10
  - 2.2 Labour forces..... 12
- 3. Pension projection results..... 14
  - 3.1 Extent of the coverage of pension schemes in the projections..... 14
  - 3.2 Overview of projection results..... 15
  - 3.3 Description of main driving forces behind the projection results and their implication for main items from a pension questionnaire..... 18
  - 3.4 Financing of the pension system..... 28
  - 3.5 Sensitivity analysis..... 29
  - 3.6 Description of the changes in comparison with the 2006, 2009 and 2012 projections..... 32
- 4. Description of the pension model and its base data..... 34
  - 4.1 Institutional context..... 34
  - 4.2 Assumptions and methodologies applied..... 34
  - 4.3 Data used to run the models..... 34
  - 4.4 Reforms incorporated in the models..... 35
  - 4.5 General description of the models..... 35
    - 4.5.1 *The demographic cohort pension model*..... 35
    - 4.5.2 *The financial pension model*..... 36
- Annex – The indexation formula..... 38
- Annex – Further detailed assumptions regarding the projection exercise..... 40

# 1. Overview of the pension system

## 1.1 Description

The pension system in Germany is in general based on three pillars, where the first pillar with the statutory and the civil servant pension system is mandatory for all employees and civil servants. The occupational (2<sup>nd</sup> pillar) and the private pension system (3<sup>rd</sup> pillar) are non-mandatory, but certain elements are of growing importance since future declining public pension benefits shall be compensated by capital formation of the 2<sup>nd</sup> and 3<sup>rd</sup> pillar components. Both systems are tax-promoted and subsidised by the government.<sup>1</sup>

The German projections exercise of future pension expenditures comprises the statutory and the civil servants pension schemes. These schemes provided old-age pension as well as survivors and disability pension claims to (more than) 90 % of the employed population in 2016. Currently, the general pay-as-you-go (PAYG) earnings-related first pillar statutory pension scheme covers about 85 % of the employed German population whereas the public civil servants scheme protects 5 %. Both systems accounted for pension expenditures of about 10.1 % of GDP in 2016. Not covered by this pension projection exercise are specific pension schemes for miners and farmers with pension expenditures of less than 0.4 % of GDP (in 2016).<sup>2</sup>

Means-tested social assistance expenditures for pensioners are projected with a separate model due to the social assistance schemes' substantially different design compared to the public pension systems. Within the concept of minimum income provision, individuals - as of the age of the statutory retirement age - can claim means-tested benefits from social assistance if old-age provision from all income sources is not sufficient.<sup>3</sup> The system of social assistance is completely tax-financed. The respective expenditures amounted to 0.1 % of GDP in 2016.

The statutory pension system is operated by the German Federal Insurance Fund and administrated by the Federal Ministry of Labour and Social Affairs. The civil servants pension scheme is operated by the Federal Ministry of the Interior. If not stated otherwise, following statements refer to the statutory pension scheme.

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<sup>1</sup> Governmental subsidies for the 3<sup>rd</sup> pillar *Riester* pensions - excluding tax savings - amounted e.g. to 2.7 billion Euro in 2013. Tax allowances for a *Riester* pension are of EET concept, which means that contributions are tax-free while pensions are taxed.

<sup>2</sup> For further information concerning the farmers and miners systems see box 3.

<sup>3</sup> Those benefits refer to the individual primary needs. Means-tested provision results from the difference between the individual need and the weighted household equivalence income (including pension benefits). The average of these individual needs amounted to 9,576 EUR per capita in 2016 for all, who received means-tested old-age provision. At the end of the year 2016 roughly 0.53 million persons of statutory retirement age or older received such a provision, which are about 3.0 % of the total population within that age interval. For further details see annex.

## **Statutory Pension System**

The statutory pension scheme - as a *point system* - comprises pensions for old-age, survivors and disability, provides rehabilitation benefits, but no minimum pensions.

The annual budget volume of the statutory pension system is based on two major sources: the contributions by insured persons and the government subsidies. The latter contribute an amount of about 27 % of total receipts. In 2016, insured employees and their employers each contributed 9.35 % of the employees' gross wages to the statutory pension system. In 2016, total revenues amounted to 280.5 billion EUR while total expenditures aggregated to 282.7 billion EUR.

### Old-age pension

The German statutory pension system is oriented towards contribution equivalence, which basically translates the amount of individual pension-related contributions into similar pension entitlements. A minimum of five years of contributions entitles to benefits. For the calculation of old-age pension benefit, see *formula 1* to 3.

Since 1992 numerous pension reforms have reacted on the growing budgetary pressures on the statutory pension schemes due to the demographic development of steadily rising life expectancy and relatively constant fertility rates far below the replacement level. In 2007, a major reform legislated the gradual increase of the statutory retirement age from age 65 to age 67 by the year 2029 (see, *table 1*). Other pension schemes, like the civil servants pension scheme, are also affected by that raise of the retirement age. Simultaneously, several pension types within the statutory pension scheme with retirement ages that were originally lower, such as pensions for women, for unemployed or for people with long insurance records, have expired - fully affecting birth cohorts from 1952 onwards. Hence, since 2011 there is in principle no possibility to retire for old-age pension before the age of 63.<sup>4</sup>

Under current legislation the statutory retirement age for men and women has been age 65 and 6 months in 2017. Nevertheless, as seen in *table 1*, early retirement is possible under certain conditions, but in any case of using such an option, individual benefits will be reduced permanently by 0.3 % for each retired month pensioners fall short of the statutory retirement age. On the other hand, postponement of retirement will yield a higher pension accrual of 0.5 % for each month worked after the statutory retirement age, this to be seen as an incentive to work longer.

As stated in *table 1*, early retirement is possible at the age of 63 for persons with an insurance record of at least 35 years. However, the pension benefit will be reduced by a permanent deduction of 0.3 % for each retired month pensioners fall short of the statutory retirement age. Because the latter is gradually increasing to the age of 67 by 2030, the maximum permanent deduction will increase to 14.4 %.

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<sup>4</sup> Specific exceptions still exist for severely handicapped people.

In addition, there exists a specific exemption for persons with a very long employment (or child care) record of at least 45 years. Those persons can temporarily claim old-age pension without deductions currently at the age of 63. To prevent any kind of early retirement e.g. via planned unemployment at the age of 61 or 62 - the pension law includes the rule that periods of short-time unemployment at the age of 61 and 62 will in general not be accounted for in the 45 years of insurance. Given the raise of the legal retirement age from age 65 to age 67, the age of 63 for an old-age pension without any penalties (under the requirement of 45 contribution years) will also raise gradually up to the age of 65 by the year 2029.

**Table 1 – Qualifying condition for retiring**

		2016	2020	2030	2040	2050	2060	2070	
Qualifying condition for retiring with a full pension	Minimum requirements	Contributory period - men (years)	5	5	5	5	5	5	
		Retirement age - men	(63/2)*	(63/8)*	(65)*	(65)*	(65)*	(65)*	(65)*
		Contributory period - women (years)	5	5	5	5	5	5	5
		Retirement age - women	(63/2)*	(63/8)*	(65)*	(65)*	(65)*	(65)*	(65)*
	Statutory retirement age - men	65/5	65/8	67	67	67	67	67	
	Statutory retirement age - women	65/5	65/8	67	67	67	67	67	
Qualifying condition for retirement WITHOUT a full pension	Early retirement age - men	63	63	63	63	63	63	63	
	Early retirement age - women	63	63	63	63	63	63	63	
	Penalty in case of earliest retirement age	-8,7%	-9,6%	-13,8%	-14,4%	-14,4%	-14,4%	-14,4%	
	Bonus in case of late retirement (per month)	+0,5%	+0,5%	+0,5%	+0,5%	+0,5%	+0,5%	+0,5%	
	Minimum contributory period - men (years)	35	35	35	35	35	35	35	
	Minimum contributory period - women (years)	35	35	35	35	35	35	35	
	Minimum residence period - men	:	:	:	:	:	:	:	
Minimum residence period - women	:	:	:	:	:	:	:		

\* An old-age pension without deductions before the statutory retirement age requires a very long employment (or child care) record of at least 45 years.

**Source:** According to the German statutory pension law, SGB VI.

#### Calculation of old-age pension benefit and indexation of pensions

For each year of contribution an insured person receives *pension points*, which reflect the employees' relative earnings position in year  $t$  (see, *formula 1*). A years' contribution at the level of average earnings of contributors, which are approximately identical to the National Accounts average wages, results in one pension point. Contributions p.a. and therefore entitlements are levied on annual earnings up to a ceiling of approximately 200% of the relevant average earnings.

#### **Box 1: The Contribution Rate**

The *contribution rate* is supposed to be adjusted by mechanism encoded into law. To avoid erratic movements and pro-cyclical adjustments over the economic-cycle, the German statutory pension insurance scheme holds a '*sustainability fund*', which is allowed to fluctuate between the amount of 0.2 and 1.5 of monthly pension expenditures. If the contribution rate is to be projected (in year  $t$ ) to fail to guarantee the amount of the '*sustainability fund*' between the upper or the lower limit for the next year ( $t+1$ ), a new contribution rate is set to meet the corresponding requirements in  $t+1$ .

In the German pure point system where contributory periods make for only a part of the accrued claims for pension benefits, the individual pension benefit in year  $T+n$  (as seen in *formula 2*) results from the sum of individual pension points multiplied by the specific pension type factor (e. g., 1.0 for old-age pension, 0.55 for a widower's pension) and the '*pension point value*' (measured in EUR) in year  $T+n$ . The pension point value is valid for new and stock pensioners. Irrespective of the year of retirement all pensions are adjusted annually with the current pension point value at mid year. Hence, the pension point value is set to be fix for the period July 1<sup>st</sup> in year  $t$  to June 30<sup>th</sup> in year  $t + 1$ .

Formula 1:  $pp_t = e_t / e_t^\emptyset$ , where

$pp_t$  = individual pension points in year  $t$ ,  
 $e_t$  = individual earning in year  $t$ ,  
 $e_t^\emptyset$  = average of nation-wide earnings related to contributors in year  $t$ .

Formula 2:  $P_{T+n} = \sum_{t=1}^T pp_t \times ptf \times ppv_{T+n}$ , where

$P_{T+n}$  = individual pension benefit in year  $T+n$ ,  
 $\sum_{t=1}^T pp_t$  = sum of individual pension points,  
 $ptf$  = pension type factor,  
 $ppv_{T+n}$  = pension point value in year  $T+n$ .

Formula 3:  $ppv_{T+n} = ppv_{T+n-1} \times wf_{T+n-1} \times cf_{T+n-1} \times sf_{T+n-1}$ , where

$ppv_{T+n-1}$  = pension point value in year  $T+n-1$ ,  
 $wf_{T+n-1}$  = wage factor in year  $T+n-1$ ,  
 $cf_{T+n-1}$  = contribution rate factor in year  $T+n-1$ ,  
 $sf_{T+n-1}$  = sustainability factor in year  $T+n-1$ .

The pension point value (see, *formula 3*) is adjusted in relation to the gross wage growth ('*wage factor, wf*') as a starting point. In addition, the '*contribution factor, cf*' accounts for changes of the contribution rate to the statutory pension scheme and to the subsidised (voluntary) private pension schemes. An increase of contribution rates will reduce the adjustment of the pension point value and respectively vice versa. The '*sustainability factor, sf*', that measures the change of the number of standardized contributors in relation to the number of standardized pensioners, links the adjustment of the pension point value to the changes in the statutory pension scheme's dependency ratio, the ratio of pensioners to contributors<sup>5</sup>. The last two factors in the indexation formula 3 can alter the size of adjustment, resulting in lower growth of the pension point value in relation to gross wages per capita in the long run.<sup>6</sup>

<sup>5</sup> Changes of the ratio are reduced by an allocation factor, which is set at 0.25. For more details refer to annex.

<sup>6</sup> However, it is enacted in law, that up to the year 2030 the pre-tax replacement rate must not fall below 43 %. This level is not to be understood as target figure, but as the lowest limit for the replacement rate. Whenever there is a risk that this limit cannot be upheld, the legislator is required to act.

Additionally, *formula 3* is linked to specific pension assurance laws, which guarantee that none of the three incorporated factors (*wf*, *cf*, *sf*) translate the indexation of the pension point value in year  $T+n$  into a lower value compared to the previous year  $T+n-1$ . The theoretically possible decrease of the nominal pension point value e.g., due to a declining wage development (observed in 2009 for Germany), is kept virtually and is counterbalanced with future increases of the pension point. Respectively, future increases of the pension point value (based on *formula 3*) will be reduced by 50 % until the original trajectory of the pension point value is reached.

Due to existing differences in per capita income between the Western and the Eastern part of Germany, the pension-related contributory average income levels differ. E.g., the (preliminary) average income in 2017 amounts to 37,103 EUR for Germany (west) and 33,148 EUR for Germany (east). Hence, the calculation of the pension point value distinguishes between both German regions by considering the respective average wages.<sup>7</sup> Consequently, the pension point values are currently<sup>8</sup> set at 31.03 EUR (west) and at 29.69 EUR (east) - regarding pension benefits per month. In 2017 a stepwise harmonization of pension point values was legislated so that there will be a uniform pension legislation for Germany in 2025. From 1 January 2025 onwards there will not be different calculation parameters for calculating pensions.

**Box 2: Example for Calculation of Old-age Pension Benefit**

In December 2017 a man/woman wishes to retire exactly two years before the current statutory retirement age of 65 years and 6 month. He/she has a contribution record of 40 years just based on average income p.a., which results into 40 pension points. This sum of pension points is multiplied by the pension-type factor of 1.0 for old-age pensions and the current pension point value. Because of the two years' earlier retirement, a permanent deduction of 7.2 % results into a gross pension amount of 1,151.83 € per month ( $40 \times 1.0 \times 31.03 \text{ €} \times 0.928$ ) at least until the next pension indexation on 1<sup>th</sup> July 2018.

**Disability pension**

Persons with more than five years' pension contributions are entitled to receive a disability pension. Disability pensions are a replacement income for people below the statutory retirement age, who are partially or completely, temporarily or permanently unable to work. Work capability of less than three hours a day qualifies for a full disability pension with a pension type factor of 1.0, whereas work capability of three to six hours per day results in a partial disability pension with a pension type factor of 0.5.

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<sup>7</sup> This transitional treatment of eastern German pension entitlements is based in regulations legislated during the reunification negotiations. It was implemented to ensure that lower income levels in Germany (east) will not result in permanently lower pension entitlements. The system has been adjusted so that converging income levels will automatically result into converging pension point values. Thus, both - stock and new - pensioners in Germany (east) profit from a declining income gap.

<sup>8</sup> Period from 1<sup>st</sup> July 2017 to 30<sup>th</sup> June 2018.

The disability pension benefit is based on the assumption that the respective person would have worked virtually up to the age of 65 with an earned income p.a. which relates to the individual average wage p.a. based on the working period prior to disability status. Additionally, an examination takes place whether the last four years of earned income p.a. before the disability status will decrease the virtually assumed earned income for the period from the occurrence of disability up to the age of 65. In case of negative influence these respective years will be discounted. In total, disability pension entitlements are an aggregate of already accrued pension points before disability and additional pension points based on a virtual record of contribution.

Individuals will be faced with a maximum deduction of 10.8 % in case of applying for a disability pension before the age of 65. (After that age, pension penalty is reduced by 0.3 % per month.) In general, the disability pension will be converted into an old-age pension (just for statistical reasons) once the respective person has reached the statutory retirement age.

### Survivor's pension

Spouses are entitled to a survivor's pension if the deceased fulfilled the minimum condition of five years of contributions to the statutory pension system. A valid entitlement to a "high-rate" widow's pension exists if the surviving spouse is unable to work or is raising an underage child or is at least 45 years old<sup>9</sup>. Otherwise, a "small" widow's pension is paid. While the "high-rate" widow's pension amounts to 55 % of the full pension benefit of the deceased, the "small" widow's pension is only 25 % of that pension and is additionally restricted to two years.

Orphan's pension is generally paid until the age of 18. Exemptions exist up to the age of 27, but own income is taken into account. The amount of an orphan's pension is also related to the full pension benefit of the deceased, with one-tenth for half-orphans and one-fifth for double orphans.

Receiving an old-age or disability pension plus a survivor's pension results in a reduction of the latter by a specific relative value which is related to the difference between the amount of the old-age or disability pension and an individualized (income-related) exemption.

### New Pensions

Tables 2a - 2c show administrative data on pension take-up in 2015. The major number of new pensions occurs within the age-group 60-64. Overall, old-age pensions reflect about 72% of all new pensions.

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<sup>9</sup> This age is parallelly increasing to age 47 in line with the increasing statutory retirement age.



**Table 2a – Number of new pensioners by age group - administrative data (MEN, year 2015)**

Age group	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	27,769	0	25,722	2,047	0
50 - 54	22,280	0	20,358	1,922	0
55 - 59	29,634	0	26,620	3,014	0
60 - 64	261,470	241,453	14,676	5,341	0
65 - 69	186,640	179,597	42	7,001	0
70 - 74	12,383	1,222	0	11,161	0

**Source:** Commission services.

**Table 2b – Number of new pensioners by age group - administrative data (WOMEN, year 2015)**

Age group	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	41,222	0	30,349	10,873	0
50 - 54	29,651	0	19,532	10,119	0
55 - 59	40,331	0	24,668	15,663	0
60 - 64	261,457	224,720	12,340	24,397	0
65 - 69	237,941	207,330	21	30,590	0
70 - 74	58,218	14,442	0	43,776	0

**Source:** Commission services.

**Table 2c – Number of new pensioners by age group - administrative data (TOTAL, year 2015)**

Age group	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	68,991	0	56,071	12,920	0
50 - 54	51,931	0	39,890	12,041	0
55 - 59	69,965	0	51,288	18,677	0
60 - 64	522,927	466,173	27,016	29,738	0
65 - 69	424,581	386,927	63	37,591	0
70 - 74	70,601	15,664	0	54,937	0

**Source:** Commission services.

## 1.2 Recent reforms of the pension system included in the projections

Pension reforms since the last AWG projection exercise are incorporated into the 2017 exercise. Please find below a detailed description of all components of the latest pension reforms in year 2017.

- **Pension benefit calculation:**

In 2017 a stepwise harmonization of pension point values was legislated. The adjustment of the pension value of the East to the West in 7 annual steps will start in 2018. Simultaneously, the higher valuation of East German earnings from work will be gradual removed. From 1 January 2025 onwards there will not be different calculation parameters for calculating pensions.

- **Old-age pension**

The Flexible Pension Act (Flexirentengesetz) which has been passed in December 2016 will provide new incentives for employees to work beyond the statutory retirement age and will facilitate a flexible transition from working life to retirement. It offers an improved way of supplementing part-time work with a partial pension before reaching the statutory retirement age.

From July 2017, it will be possible to combine a partial pension and supplementary earnings with each other in a more flexible and individual way. The supplementary earnings will be taken into account for the pension progressively during an annual assessment. In order to counterbalance pension deductions resulting from early retirement, it will be possible to pay additional contributions into the pension scheme from the age of 50 years onwards.

Since January 2017, full pensioners continue to be subject to contributions to the statutory pension scheme until they reach the statutory retirement age. As a result, those who receive an early full old-age pension and continue to work will generally increase their pension entitlement. Employees who continue to work after they have reached the statutory retirement age can waive the existing insurance exemption, thereby acquiring further earnings points and, consequently, a higher entitlement under the statutory pension scheme. As the special employer contribution to unemployment insurance that used to apply with respect to employees who are past the statutory retirement age has been dropped until the end of December 2021, it has become even more attractive to employ older workers. The new legislation is expected to further increase the future participation rates in older ages.

- **Disability pension:**

In total, disability pension entitlements are an aggregate of already accrued pension points before and additional pension points after the occurrence of disability. Latter pension points are based on a virtual record of contribution. Before the latest pension reform the virtual employment record (please see section 1.1) lasted up to the age of 62. Under the new legislation, this period is extended to age 65.

### **1.3 Description of the “constant policy” assumptions used in the projection**

As commonly agreed, all recently enacted pension reforms have been taken into account in the German 2017 pension projection exercise. In addition, all AWG assumptions regarding the demographic and macro-economic context have been completely considered.

It is worthwhile to note that alternative assumptions for the demographic and labour market scenarios influence the projection results on pension expenditures.

## 2. Overview of the demographic and labour forces projections

### 2.1 Demographic development

Eurostat's latest population projection (2017) shows a temporary increasing population in Germany over the coming decades. In the long run population growth will nevertheless remain negative. Migration assumptions for Germany are the main driver for the observed increase in population numbers. However, for Germany the natural population growth has been negative for almost 40 years. Since the mid-1970s, the total fertility rate of 1.4 has been relatively stable over time and increased only lately to 1.5 which is still well below the replacement level of approx. 2.1. Hence, the quantity of every new birth cohort is just two-thirds of its parental cohort. Due to the population momentum and the future assumption of fertility being below replacement level, fertility is the main reason for a decreasing population number in the more distant future, as seen in *table 3*.

**Table 3 – Main demographic variables evolution**

	2016	2020	2030	2040	2050	2060	2070	Peak year*
Population (thousand)	82,454	83,838	84,618	84,077	82,596	80,742	79,223	2031
Population growth rate	1.0	0.2	0.0	-0.1	-0.2	-0.2	-0.2	2016
Old-age dependency ratio (pop65/pop15-64)	32.2	34.0	43.5	49.4	51.3	55.1	55.9	2066
Ageing of the aged (pop80+/pop65+)	27.8	32.0	29.0	33.3	42.8	38.9	43.1	2070
Men - Life expectancy at birth	78.7	79.4	80.9	82.3	83.6	84.9	86.1	2070
Men - Life expectancy at 65	18.1	18.5	19.6	20.6	21.5	22.4	23.3	2070
Women - Life expectancy at birth	83.6	84.2	85.5	86.7	87.9	89.0	90.1	2070
Women - Life expectancy at 65	21.3	21.8	22.8	23.7	24.7	25.6	26.4	2070
Men - Survivor rate at 65+	85.9	86.8	88.8	90.4	91.8	93.0	94.1	2070
Men - Survivor rate at 80+	57.2	59.4	64.4	68.9	73.0	76.6	79.7	2070
Women - Survivor rate at 65+	92.1	92.6	93.7	94.6	95.4	96.1	96.6	2070
Women - Survivor rate at 80+	73.4	75.0	78.6	81.7	84.4	86.7	88.7	2070
Net migration	750.0	327.3	268.1	206.0	199.0	175.0	143.5	2016
Net migration over population change	1.0	1.6	16.4	-1.9	-1.1	-1.0	-1.0	2031

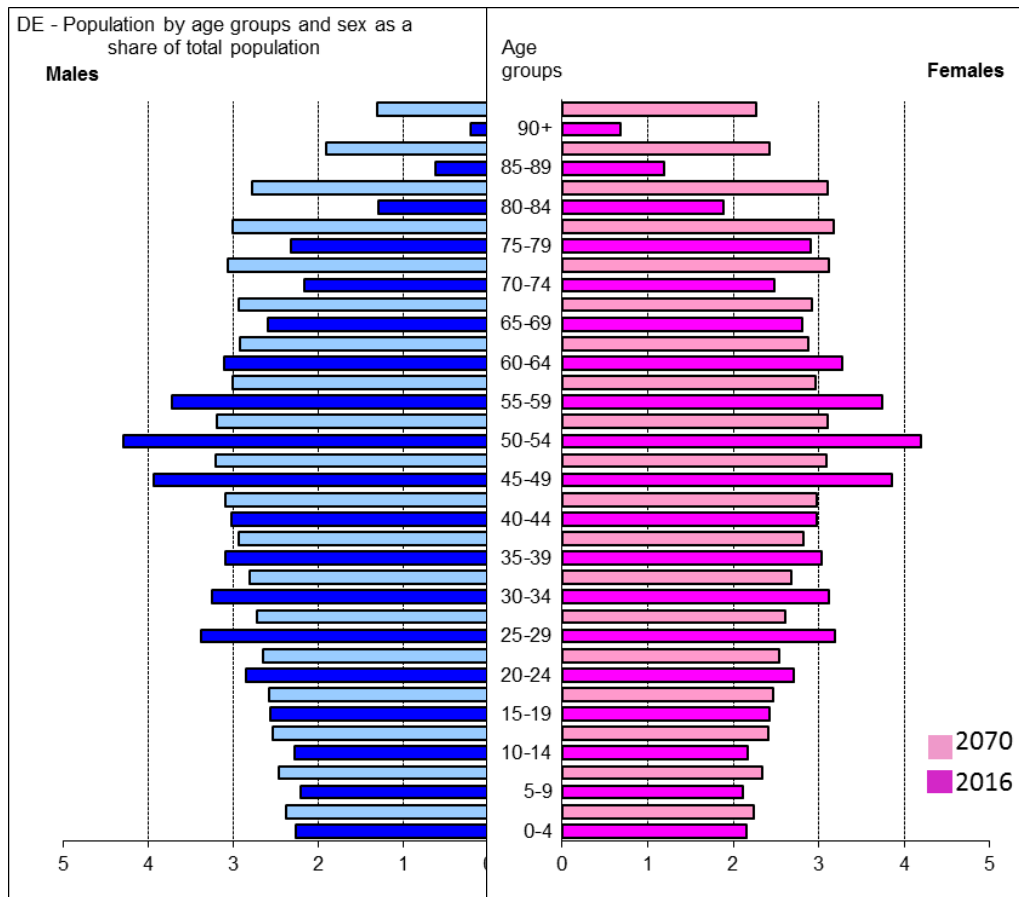
\* This column represents the peak year, in which the respective variable reaches its max. over the period 2016-2070.

**Source:** Eurostat (2017) and Commission Services.

In addition to low fertility, decreasing mortality rates - with the consequence of increasing life expectancy - accelerate the demographic ageing of the German society being the main driving force for the pension expenditure evolution in Germany. Since 1960 the life

expectancy at birth has increased from 66.5 to 78.7 years for males and from 71.7 to 83.6 years for females according to the latest national life table. That implies an increase of more than 12 years within approx. 57 years for both sexes. Even the remaining life expectancy at age 65 has been increasing during that period to 18.1 years for males and 21.3 years for females. *Table 2* displays a further - almost steady - increase for both indicators in future.

**Figure 1: Age pyramid comparison: 2016 vs. 2070**



**Source:** Eurostat (2017) and Commission Services.

Migration flows - as the third component which affects population growth - are however, extremely difficult to predict. Decisions to migrate depend primarily on current political, economic and demographical developments in the sending and destination countries. Eurostat models a steadily decreasing net migration starting from a level of 750,000 in 2016.

As a consequence of the past fertility and mortality conditions and assumptions on migration, the old-age dependency ratio (number of people age 65 and above in relation to the number of people aged 15 to 64) will rise from 32% (2016) to 56 % in 2070.

## 2.2 Labour forces

In the near future Germany will be faced with a radical societal change based on demographic development. There will be a strong increase in the absolute number of people at age 65 or older and simultaneously the overall population number is decreasing in the long run. In the future, the working age population is shrinking. That will result in a situation where the so called baby-boomers will leave the labour market and will become pension-beneficiaries (in technical terms) whereas the number of contributors will decrease accordingly.

To counterbalance this development partially, the statutory retirement age is increasing from age 65 (in year 2011) to age 67 by the year 2029. The relatively long transition period ensures the adjustment of working conditions to an older work-force in demographical terms. This task has to be accomplished by companies, social partners and policymakers together.

**Table 4 – Participation rate, employment rate and share of workers for the age groups 55-64 and 65-74**

	2016	2020	2030	2040	2050	2060	2070	Peak year*
Labour force participation rate 55-64	71.4	71.4	72.6	74.2	73.7	73.5	74.1	2038
Employment rate for workers aged 55-64	68.6	69.0	69.4	70.9	70.5	70.3	70.9	2038
Share of workers aged 55-64 on the labour force 55-64	96.1	96.6	95.5	95.6	95.6	95.6	95.7	2019
Labour force participation rate 65-74	11.5	13.8	16.4	16.8	18.7	17.8	17.7	2048
Employment rate for workers aged 65-74	11.4	13.7	16.2	16.7	18.6	17.7	17.6	2048
Share of workers aged 65-74 on the labour force 65-74	99.5	99.5	99.2	99.4	99.3	99.3	99.3	2018
Median age of the labour force	43.0	42.0	42.0	43.0	43.0	42.0	42.0	2016

\* This column represents the peak year, in which the respective variable reaches its max. over the period 2016-2070.

**Source:** Commission services.

Apart from demography, labour force development is strongly affected by age-specific participation rates. For more than a decade Germany experienced substantial progress in raising the employment and participation rates, especially of the age groups 55-64 and 65-74. Important experiences have been made and essential priorities have been identified for transforming workplaces progressively in line with changing demography patterns.

Since 2000, the employment rate for age group 55-64 almost doubled from 37.4 % to 70.2 %. While the employment rate for the age group 60-64 was at just 19.6 % in the year 2000 the value tripled to 58.6 % in 2017. Hence, more and more older employees experience the fact that there is an increasing demand by employers for the practical, technical and theoretical expertise of older people.

Table 4 displays the participation and employment rates projected by the European Commission Service. The future results from the underlying cohort simulation model depend crucially on the used assumptions on the effects of legislated policy reforms - e.g. the increase of statutory retirement ages. Overall, the employment rate for workers aged 55-64 is projected to increase from 68.6% in 2016 to 70.9% in 2070. Given the observed labour market trends this development seems to be rather pessimistic.

Due to the definition of the constant policy scenario no meaningful further increase of labour market age-specific participation rates is expected after 2031, the year the statutory retirement age will finally converge to age 67 based on current law. Hence, in combination with steadily decreasing mortality rates, the duration of retirement will increase as can be seen for both sexes in tables 5a, 5b.

**Table 5a – Labour market effective exit age and expected duration of life spent at retirement - MEN**

	2017	2020	2030	2040	2050	2060	2070	Peak year*
Average effective exit age (CSM) (II)	64,6	64,7	65,6	65,7	65,7	65,7	65,7	2031
Contributory period	:	:	:	:	:	:	:	:
Duration of retirement	18,2	18,5	18,8	19,7	20,7	21,6	22,4	2070
Duration of retirement/contributory period	:	:	:	:	:	:	:	:
Percentage of adult life spent at retirement	28,1	28,4	28,3	29,2	30,3	31,2	32,0	2070
Early/late exit	4,1	3,0	1,5	0,9	1,0	0,8	1,1	2016

\* This column represents the peak year, in which the respective variable reaches its max. over the period 2016-2070.

**Source:** Commission Services.

**Table 5b – Labour market effective exit age and expected duration of life spent at retirement - WOMEN**

	2017	2020	2030	2040	2050	2060	2070	Peak year*
Average effective exit age (CSM) (II)	64,0	64,3	65,2	65,3	65,3	65,3	65,3	2035
Contributory period	:	:	:	:	:	:	:	:
Duration of retirement	22,3	22,6	22,8	23,7	24,7	25,6	26,4	2070
Duration of retirement/contributory period	:	:	:	:	:	:	:	:
Percentage of adult life spent at retirement	32,7	32,8	32,6	33,4	34,3	35,1	35,8	2070
Early/late exit	5,7	3,3	1,6	1,0	1,2	1,0	1,3	2016

\* This column represents the peak year, in which the respective variable reaches its max. over the period 2016-2070.

**Source:** Commission Services.

## 3. Pension projection results

### 3.1 Extent of the coverage of pension schemes in the projections

The German projections exercise comprises the statutory and the civil servants pension scheme. Both systems are projected separately. Furthermore, projections are separated into the three components of 'old-age and early pensions', 'disability pensions' and 'survivor's pensions'.

Occupational and private pension schemes have gained widespread acceptance in the recent past as a consequence of governmental promotion and tax treatment. At present, the number of occupational pension entitlements (of active employees) increased from 14.6 million in 2001 to about 20,4 million and the number of "Riester"-contracts in place reached a level of 16,5 million by the end of June 2017. It can be assumed that about 70 % of all employees between ages 25 to 65 with compulsory social insurance coverage are entitled to a supplementary occupational pension or a "Riester"-pension. But at present, no reliable data is available in order to provide extended projections including these non-mandatory pension schemes into this projection exercise.

#### **Box 3: Pension Schemes for Miners and Farmers**

As mentioned earlier, pension schemes for miners and farmers are not part of the pension expenditure projection exercise. Currently, pension expenditures related to miners amount to about 0.3 % of GDP while farmers' pension expenditures account for 0.1 % of GDP. Within the concept of a collective of assured people, the share of pensioners has substantially increased during the last decades for both systems while the share of contributors decreased due to structural changes of these economic sectors. Beside individual pension contributions the main part of expenditures is currently financed by state-subsidies.

At present, no sophisticated projection models exist for projecting the expenditure development of these two systems. Since, it is expected that the future number of pensioners within these two schemes will continue to decline significantly, the respective pension expenditures will decrease also substantially. Against that background, no demographic pressure will be posed on these systems.

As a general information concerning the farmers' pension system in the year 2016, this scheme was responsible for 596,000 pensions compared to 210,000 contributors and an overall budget of 2.8 billion Euro. The miners system covers about 54,500 contributors and 1.0 million pensions in 2016 while the overall expenditures amounts to approx. 8.5 billion Euro.



Table 6 provides an overview of the pension expenditures between 2007 and 2014 with an additional comparison of ESSPROS and AWG data. Table 6 illustrates that the scope of the German EPC-AWG public pension projections differs of Eurostat figures (ESSPROS). Differences are primarily due to the fact that the current German projection exercise does not include pension schemes for miners and farmers as well as specific non-cash benefits. Occupational and private pensions explain the marginal difference between Eurostat's total and public pension expenditures which are expected to level out in the future.

**Table 6 – Eurostat (ESSPROS) vs. Ageing Working Group definition of pension expenditure (% GDP)**

	2007	2008	2009	2010	2011	2012	2013	2014
1 Eurostat total pension expenditure	12,0	12,0	12,8	12,4	11,9	11,9	11,9	11,8
2 Eurostat public pension expenditure	10,8	10,8	11,5	11,1	10,7	10,7	10,6	10,6
3 Public pension expenditure (AWG)	10,4	10,4	11,1	10,7	10,4	10,3	10,3	10,2
4 Difference (2) - (3)	0,4	0,4	0,4	0,4	0,3	0,4	0,3	0,4

**Source:** Commission Services.

### 3.2 Overview of projection results

As can be seen from table 7, in the baseline scenario overall public pension expenditures are projected to increase - as a share of GDP - by 2.4 percentage points from 10.1 % in 2017 to 12.5 % in 2070. Due to currently favourable economic and demographic conditions - with regard to the relative age distribution - and past pension reforms, the 2016 rate is the lowest value over the projection horizon. In the coming years, the larger post-war baby boomer cohorts will reach retirement age and the expenditure ratio will increase steeply until the mid-2030s. Given the decline of demographic pressure starting from the mid-2030s, the further increase of pension expenditure (as share of GDP) will be decelerated until the temporary peak is reached in the year 2061. During the remaining projection horizon the pension expenditure (as share of GDP) will slightly decrease.

**Table 7 - Projected gross and net pension spending and contributions  
(% of GDP)**

<b>Expenditure</b>	2016	2020	2030	2040	2050	2060	2070	Peak year*
Gross public pension expenditure	10.1	10.3	11.5	12.0	12.2	12.5	12.5	2061
Private occupational pensions	:	:	:	:	:	:	:	:
Private individual pensions	:	:	:	:	:	:	:	:
<i>Mandatory private</i>	:	:	:	:	:	:	:	:
<i>Non-mandatory private</i>	:	:	:	:	:	:	:	:
Gross total pension expenditure	10.1	10.3	11.5	12.0	12.2	12.5	12.5	2061
Net public pension expenditure	8.3	8.5	9.3	9.6	9.7	10.0	9.9	2060
Net total pension expenditure	8.3	8.5	9.3	9.6	9.7	10.0	9.9	2060
<b>Contributions</b>	2016	2020	2030	2040	2050	2060	:	Peak year*
Public pension contributions	10.4	10.4	11.7	12.2	12.5	12.9	12.9	2066
Total pension contributions	10.4	10.4	11.7	12.2	12.5	12.9	12.9	2066

\* This column represents the peak year, in which the respective variable reaches its max. over the period 2016-2070.

**Source:** EPC-AWG projection, baseline scenario.

The net public pension expenditure in *table 7* is increasing sub-proportionally to the total expenditure. However, the respective level is lower, being adjusted by pensioners' social security contributions to health and long term care as well as by the projected average relative tax amount paid by this group. Regarding individual income taxes, Germany is currently undergoing a change in the tax regime relating to contributions and pensions.<sup>10</sup> Therefore, the taxation of pensions from the statutory pension schemes is gradually changing from a system with partial taxation of contributions and practically no taxation of pension benefits into an opposite system. Pension contributions will be completely exempted from tax by the year 2025 and pension benefits will be completely taxed by the year 2040. For this projection, a linear increase up to the final respective year is assumed.<sup>11</sup>

Contributions (in terms of GDP) in *table 7* increase almost proportionally to the total expenditure, but on a higher level. Contributions include without limitation contributions by employers and employees, other social sub-systems, as well as state subsidies. An essential factor for explaining the difference to gross pension expenditures are the contributions for health insurance for pensioners, which are classified as expenditures of the statutory pension fund. During working life, statutory healthcare contributions are almost equally financed by employers and employees. Starting with retirement, the pension fund pays the contributions that were formerly financed by the employer. Contributions of the pension fund to health insurance for pensioners are not

<sup>10</sup> Legislated by the *Old-Age-Income-Act* (Alterseinkünftegesetz) in 2005.

<sup>11</sup> For detailed explanation see annex.

part of the individual gross pension benefits. Nevertheless, those contributions are additional expenditures and hence part of overall pension expenditure of the statutory pension system.

Contributions of the pension fund to the statutory healthcare system account for about 0.6 % of GDP p.a. until 2037 and 0.7 % of GDP p.a. afterwards. That is slightly more than the difference between the relative amount of contributions and total expenditures in *table 7*, but since parts of pension benefits for civil servants are financed from appropriate reserve funds, contributions and expenditures are not necessarily identical, especially in the long run. Nevertheless, the parallel development of contributions and expenditures results from interaction of the contribution rate and the annual pension indexation. Both components ensure automatically the financial sustainability of the public pension systems, as seen in the ratio of public pension expenditure and contributions to GDP in *table 7*.

**Table 8 - Projected gross public pension spending by scheme (% of GDP)**

Pension scheme	2016	2020	2030	2040	2050	2060	2070	Peak year *
Total public pensions	10,1	10,3	11,5	12,0	12,2	12,5	12,5	2061
of which								
Old age and early pensions:	7,8	8,1	9,4	10,1	10,3	10,7	10,8	2068
<i>Flat component</i>	:	:	:	:	:	:	:	:
<i>Earnings related</i>	7,8	8,1	9,4	10,1	10,3	10,7	10,8	2068
<i>Minimum pensions (non-contributory) i.e. minimum income guarantee for people above 65</i>	:	:	:	:	:	:	:	:
Disability pensions	0,68	0,67	0,63	0,60	0,63	0,59	0,57	2017
Survivor pensions	1,55	1,53	1,47	1,31	1,26	1,21	1,11	2017
Other pensions	:	:	:	:	:	:	:	:

\* This column represents the peak year, in which the respective variable reaches its max. over the period 2016-2070.

**Source:** EPC-AWG projection, baseline scenario.

*Table 8* displays how the overall evolution of pension expenditure within the projection horizon 2016-2070 is split among the three components ‘old-age and early pensions’, ‘disability pensions’ and ‘survivor pensions’. Thus, ‘old-age and early pensions’ represent the largest category of total expenditure (as share of GDP) and are projected to increase by about 38 % within the projection horizon. However, in the same time expenditures for survivor and disability pensions respectively will decrease by about 28 % and 16 %. The latter decline results predominantly from a combined situation of an expected future decrease of the labour force (which reduced the potential of individuals that can get disabled) in absolute numbers and in relative terms to the number of pensioners as well as declining probabilities of getting disabled. The future decline of survivor pension expenditures stems from the facts that the probabilities of marriage are significantly lower for younger than for older cohorts and that male death rates are converging to the one’s of females. Hence, the number of pensioners who receive a survivor’s pension is projected to decrease with corresponding consequences for this type of pension expenditure.

**Table 8a - Projected means-tested benefits (% of GDP)**

year	2016	2020	2030	2040	2050	2060	2070	peak year*
Total spending	0.1	0.1	0.1	0.1	0.1	0.1	0.1	2070

\* This column represents the peak year, in which the respective variable reaches its max. over the period 2016-2070.

**Source:** EPC-AWG projection, baseline scenario.

As already stated above, within the concept of minimum income provision for individuals from the age of the statutory retirement age, the German social system provides means-tested benefits from social assistance if old-age provision from all income sources is not sufficient. This system of social assistance is completely tax-financed and not part of the public pension system. Nevertheless, these expenditures are part of the public social system and therefore displayed separately in *table 8a*.

Individual net-benefits provided by the means-tested social system - therefore defined as the expenditures - are calculated as the difference between the individuals' gross needs and individuals' available income from all sources. Empirical data illustrate that on average pension benefits from the public pension scheme are the main source of overall income. Expenditures for means-tested benefits for individuals at the age of the statutory retirement age or older account for an almost constant share of GDP over the projection horizon of 0.1 %, as seen in *table 8a*. This development is mainly explained by different indexation rules regarding social assistance and pension benefits.<sup>12</sup>

### 3.3 Description of main driving forces behind the projection results and their implication for main items from a pension questionnaire

In order to identify more clearly the driving forces behind the above mentioned development of public pension expenditure in the baseline variant, *table 8a* displays the decomposed factors of the pension expenditure to GDP ratio, generated with *formulas 4 to 6*.

Formula 4:

$$\frac{\text{Pension Exp.}}{\text{GDP}} = \frac{\overbrace{\text{Population 65+}}^{\text{Dependency Ratio}}}{\text{Population 20-64}} \times \frac{\overbrace{\text{Number of Pensioners}}^{\text{Coverage Ratio}}}{\text{Population 65+}} \times \frac{\overbrace{\text{Population 20-64}}^{\text{Labour Market/Labour Intensity}}}{\text{Working People 20-74}} \times \frac{\overbrace{\text{Average Pension}}^{\text{Benefit Ratio}}}{\text{GDP}} \times \frac{\text{Hours Worked 20-74}}{\text{GDP}}$$

As agreed in the AWG for the pension projections exercise 2014, the 'coverage ratio' is further decomposed to show up the single effects of early-age pensions and old-age pensions, see *formula 5*.

<sup>12</sup> For further descriptions and model explanations see annex.

Formula 5:

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

Formula 6 decomposes the labour market indicator as following:

Formula 6:

$$\frac{\overbrace{\text{Population 20 - 64}}^{\text{Labour Market/Labour Intensity}}}{\text{WorkingPeople 20 - 74}} = \frac{\overbrace{\text{Population 20 - 64}}^{1/\text{EmploymentRate}}}{\text{WorkingPeople 20 - 64}} \times \frac{\overbrace{\text{WorkingPeople 20 - 64}}^{1/\text{Labour intensity}}}{\text{Hours Worked 20 - 64}} \times \frac{\overbrace{\text{Hours Worked 20 - 64}}^{1/\text{Career shift}}}{\text{Hours Worked 20 - 74}}$$

As highlighted with the *dependency ratio*, the demographic setting remains the main driving force related to the pension expenditure development over time. With the retirement of the baby boomer cohorts the dependency ratio will steeply increase until the mid-2030s. Afterwards, the population’s age distribution is projected to be more balanced between the number of pensioners and contributors. For the last decade of the projection it decreases pension expenditures. The coverage ratio, the inverted employment rate, the benefit ratio as well as the residual factor act as counterbalancing components compared to the demographic-related expenditure.

The increase of the statutory retirement age results in postponing the effective retirement age for future pensioners. This will lower the *coverage ratio*, which contains the population aged 65+ in the denominator. In addition, the further reduction of the gender gap regarding life expectancy, combined with reduced probabilities of marriage in future pensioners’ cohorts, will reduce the number of survivor pensions. Nevertheless, the effect of an increasing retirement age will start to level off in the year 2031, when the standard pension age of 67 will apply to all new pensioners. After 2040, the contribution of the coverage ratio to decelerate the increase of pension expenditures becomes less important.

In the given decomposition, the *employment ratio* reduces its positive impact on decelerating pension expenditure increase until the mid-2030s as the assumed increase of older workers’ labour participation will enlarge the workforce over age 64 as can be seen by the career shift effect. Although the increase of the statutory retirement age will start in the year 2012, it is assumed that the working population will adjust to longer working careers substantially earlier. For the remaining projection horizon the influence of the *inverse employment rate* is marginal.

**Table 9a - Factors behind the change in public pension expenditures between 2016 and 2070 using pension data (in percentage points of GDP) - pensions**

	2016-20	2020-30	2030-40	2040-50	2050-60	2060-70	2016-70	Average annual change
Public pensions to GDP	0.3	1.1	0.5	0.2	0.4	-0.1	2.4	0.045
Dependency ratio effect	0.5	2.9	1.7	0.4	0.9	0.3	6.6	12.0 %
Coverage ratio effect	-0.1	-0.8	-0.5	-0.1	-0.2	-0.1	-1.9	-3.5 %
Coverage ratio old-age*	0.0	-0.5	-0.3	-0.2	-0.1	-0.1	-1.1	-2.1 %
Coverage ratio early-age*	-0.8	0.5	-1.4	0.6	0.4	-0.6	-1.3	-2.5 %
Cohort effect*	-0.1	-3.2	-1.2	-0.1	-1.8	-0.2	-6.5	-13.0 %
Benefit ratio effect	-0.1	-0.7	-0.5	-0.1	-0.2	-0.2	-1.8	-3.4 %
Labour Market/Labour intensity effect	-0.1	-0.1	0.0	0.0	-0.1	0.0	-0.3	-0.5 %
Employment ratio effect	0.0	0.0	-0.1	0.1	0.0	0.0	0.0	-0.1 %
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1 %
Career shift effect	-0.1	-0.2	0.0	0.0	-0.1	0.1	-0.3	-0.5 %
Residual	0.0	-0.2	-0.1	0.0	0.0	0.0	-0.3	-0.1 %

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

**Source:** EPC-AWG projection, baseline scenario.

As a consequence of *formula 3*, the *benefit ratio* mitigates the increase of pension expenditures compared to GDP substantially. Basically, the sustainability factor, which accounts for the ratio of pensioners to contributors, will decelerate the future nominal increase of the pension point value as compared to an adjustment based on wage growth solely. In addition, as the penalty deductions for early retirement - introduced in the late 1990s - will increasingly unfold their full impact, average new pensions will decline compared to stock-pensions. Although, unemployment still generates pension accruals, long periods of unemployment have a negative impact on future pension benefits. On the other hand, there is a partially counterbalancing effect caused by the growing female labour participation rates and the postponement of the effective retirement age, which will result in increased pension entitlements and a favourable ratio of contributors to pensioners (see, *formula 3*). A positive impact of the *benefit ratio* (in the sense of reducing the pension expenditures) will remain over the whole projection horizon but it will be less effective starting in the mid-2040s as a result of a much more favourable ratio of pensioners to labour force population. Due to the “new” demographic situation the negative impact of the sustainability factor in *formula 3* will be reduced. Additionally, the effect of longer contribution records will also have an impact on the reverse impact of the benefit ratio.

As expected, the incorporated *labour intensity effect* has no impact on the pension expenditure/GDP ratio.

**Table 9b - Factors behind the change in public pension expenditures between 2016 and 2070 using pensioners data (in percentage points of GDP) - pensioners**

	2016-20	2020-30	2030-40	2040-50	2050-60	2060-70	2016-70	Average annual change
Public pensions to GDP	0.3	1.1	0.5	0.2	0.4	-0.1	2.4	0.045
Dependency ratio effect	0.5	2.9	1.7	0.4	0.9	0.3	6.6	12.0 %
Coverage ratio effect	-0.1	-0.6	-0.3	-0.1	-0.2	0.0	-1.3	-2.4 %
Coverage ratio old-age*	0.0	-0.3	-0.1	-0.2	-0.1	0.0	-0.5	-1.0 %
Coverage ratio early-age*	-0.6	0.8	-1.3	0.7	0.5	-0.6	-0.5	-1.1 %
Cohort effect*	-0.1	-3.2	-1.2	-0.1	-1.8	-0.2	-6.5	-13.0 %
Benefit ratio effect	-0.1	-0.8	-0.7	-0.2	-0.3	-0.3	-2.4	-4.5 %
Labour Market/Labour intensity effect	-0.1	-0.1	0.0	0.0	-0.1	0.0	-0.3	-0.5 %
Employment ratio effect	0.0	0.0	-0.1	0.1	0.0	0.0	0.0	-0.1 %
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1 %
Career shift effect	-0.1	-0.2	0.0	0.0	-0.1	0.1	-0.3	-0.5 %
Residual	0.0	-0.2	-0.1	0.0	0.0	0.0	-0.3	-0.1 %

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

**Source:** EPC-AWG projection, baseline scenario.

Table 9b presents the decomposition results for pensioners instead of pensions following the same procedure as formulas 4 to 6. Hence, the respective effects of the single components related to the increase of pension expenditures are almost the same as for pension perspective.

Regarding the replacement rate at retirement in the public pension scheme, this value is calculated with the assumption that the average wage at retirement is five percentage points above the nationwide average wage (over all ages) for the entire projection period. For further clarification, please see annex.

As stated in table 10, the replacement rate at retirement is expected to decrease from 42 % to 36 % over the projection horizon.<sup>13</sup> This development is a consequence of the sustainability factor performance in the pension indexation formula 3. This specific component of the pension indexation formula reflects the strong increase in the absolute number of people at age 65 or older while simultaneously the overall population number is decreasing in the transition period. The latter fact relates primarily to the shrinking working age population in future. That results into a situation that the so called baby-boomers will leave the labour market and will become pension-beneficiaries (in technical terms) whereas the number of contributors will decrease accordingly. Furthermore, this development is intensified by the fact, that - in absolute numbers - the very old post-war cohorts are much smaller than the baby-boomer cohorts.<sup>14</sup>

<sup>13</sup> The calculation of benefit ratio and replacement rate includes pensions abroad. When ascribing total pension costs to the number of national pensioners only, the calculated ratios are higher.

<sup>14</sup> See page 27 for further details on the impact of the different factors of the indexation formula.

**Table 10 - Replacement rate at retirement (RR), benefit ratio (BR) and coverage by pension scheme (in %)**

	2016	2020	2030	2040	2050	2060	2070
Public scheme (BR)	42 %	42 %	40 %	38 %	37 %	36 %	36 %
Public scheme (RR)	40 %	40 %	38 %	36 %	35 %	35 %	34 %
Coverage	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Public scheme old-age earnings related (BR)	40 %	40 %	38 %	37 %	36 %	36 %	35 %
Public scheme old-age earnings related (RR)	38 %	38 %	37 %	35 %	35 %	34 %	33 %
Coverage	82.2	82.5	84.6	86.3	86.6	87.5	88.1
Private occupational scheme (BR)	:	:	:	:	:	:	:
Private occupational scheme (RR)	:	:	:	:	:	:	:
Coverage	:	:	:	:	:	:	:
Private individual scheme (BR)	:	:	:	:	:	:	:
Private individual scheme (RR)	:	:	:	:	:	:	:
Coverage	:	:	:	:	:	:	:
Total (BR)	42 %	42 %	40 %	38 %	37 %	36 %	36 %
Total (RR)	40 %	40 %	38 %	36 %	35 %	35 %	34 %

**Source:** EPC-AWG projection, baseline scenario.

As stated above, the demographic ageing of the German population is the main driving force of the future development of pension expenditure in relation to GDP. *Table 11* illustrates that compared to the year 2016 the number of pensioners will increase by 25 % by 2070. The number of people aged 65+ will even increase by 40 % within the same period. Simultaneously, the number of employed individuals will decline by more than 17 % by 2070. The potential workforce population (age 15 to 64) will even decline by almost 20 % by 2070.<sup>15</sup>

The figures display that the increase of the statutory retirement age - combined with the withdrawal of early retirement incentives - will affect the increase of the number of pensioners at a much lower pace than the number of people aged 65+. Additionally, the working age population decreases stronger than the number of employed people. Nevertheless, the ratio from contributors to pensioners will decline strongly when baby boomer cohorts enter retirement ages around the year 2030.

<sup>15</sup> See latest population projection by Eurostat (2017).



**Table 11 - System dependency ratio and old-age dependency ratio**

	2016	2020	2030	2040	2050	2060	2070
Number of pensioners (thousand) (I)	22597.5	23688.2	26863.2	28564.5	28626.3	28678.8	28277.5
Employment (thousand) (II)	41410.2	41872.0	39554.1	38000.6	36934.9	35180.1	34079.7
Pension System Dependency Ratio (SDR) (I)/(II)	54.6	56.6	67.9	75.2	77.5	81.5	83.0
Number of people aged 65+ (thousand) (III)	17435.0	18395.4	22044.3	24113.4	24333.6	24724.1	24462.6
Working age population 15 - 64 (thousand) (IV)	54149.1	54171.8	50708.7	48792.4	47413.2	44875.7	43773.5
Old-age Dependency Ratio (ODR) (III)/(IV)	32.2	34.0	43.5	49.4	51.3	55.1	55.9
System efficiency (SDR/ODR)	1.7	1.7	1.6	1.5	1.5	1.5	1.5

**Source:** EPC-AWG projection, baseline scenario, data concerning people in 1,000.

Tables 12a to 13b show the ratio of pensioners to the overall population, respectively to the inactive population by age groups and gender (overall and female only). The latter is by definition the total population minus labour force (including employees and unemployed).

Ratios above 100 % occur as the current projection also depicts foreign pensions and pensioners (pensions abroad). Additionally, a person can receive pension benefits from both the public civil servants scheme and the statutory pension system simultaneously. Due to model restrictions, it is not possible to match these two benefits to one person.

**Table 12a - Pensioners (public scheme) to inactive population ratio by age group (%)**

	2016	2020	2030	2040	2050	2060	2070
Age group -54*	4.7	4.3	3.9	4.1	3.8	3.6	3.7
Age group 55-59	57.2	54.7	58.5	54.6	57.6	58.2	56.5
Age group 60-64	75.0	67.0	70.9	71.1	72.5	73.8	73.0
Age group 65-69	124.4	127.7	123.1	127.6	126.6	127.5	126.3
Age group 70-74	120.9	118.0	115.6	115.1	115.4	116.2	117.9
Age group 75+	114.0	117.0	118.4	114.3	112.2	111.0	110.2

\*Interval for population in denominator: 20-54.

**Source:** AWG projection, baseline scenario.

**Table 12b - Pensioners (public schemes) to total population ratio by age group (%)**

	2016	2020	2030	2040	2050	2060	2070
Age group -54*	1.7	1.6	1.5	1.6	1.5	1.4	1.5
Age group 55-59	10.1	9.6	9.5	9.4	9.6	9.7	9.4
Age group 60-64	31.0	27.9	25.8	25.2	25.8	26.3	25.9
Age group 65-69	105.0	104.5	93.0	92.5	91.0	92.0	90.9
Age group 70-74	112.9	108.4	108.3	106.0	106.2	106.8	108.6
Age group 75+	114.0	117.0	118.4	114.3	112.2	111.0	110.2

\*Interval for population in denominator: 20-54.

**Source:** AWG projection, baseline scenario.

**Table 13a – Female pensioners (public scheme) to inactive population ratio by age group (%)**

	2016	2020	2030	2040	2050	2060	2070
Age group -54*	4.7	4.4	3.9	4.2	3.9	3.7	3.8
Age group 55-59	46.5	46.6	53.7	53.4	59.2	59.6	57.8
Age group 60-64	68.8	62.3	70.6	72.7	76.4	77.2	76.4
Age group 65-69	116.1	120.6	115.7	121.3	120.3	121.0	119.8
Age group 70-74	116.5	112.4	111.6	111.3	112.2	113.0	113.7
Age group 75+	116.2	119.5	121.2	116.2	114.7	113.9	112.4

\*Interval for population in denominator: 20-54.

**Source:** AWG projection, baseline scenario.

**Table 13b – Female pensioners (public scheme) to total population ratio by age group (%)**

	2016	2020	2030	2040	2050	2060	2070
Age group -54*	1.9	1.7	1.6	1.7	1.6	1.5	1.6
Age group 55-59	10.5	10.2	10.2	9.9	10.1	10.1	9.8
Age group 60-64	32.4	29.2	27.5	27.0	27.5	27.8	27.3
Age group 65-69	102.2	101.6	90.0	90.7	88.8	89.2	88.1
Age group 70-74	111.5	106.2	106.1	104.8	105.3	106.0	106.8
Age group 75+	116.2	119.5	121.2	116.2	114.7	113.9	112.4

\*Interval for population in denominator: 20-54.

**Source:** AWG projection, baseline scenario.

Overall, the ratios in *table 12a* and *table 13a* are strongly influenced by labour market dynamics. A proper description of the ratios' development over time should be able to extract these effects, what is rather complicated. Therefore, a ratio of pensioners to population for the same age groups, as shown in *table 12b* and *table 13b* is calculated. Especially for the age groups 60-64 and 65-69 the declining ratios in the next 20 years reflect quite clearly the effect of postponing the retirement age due to the increase of the statutory retirement until 2029.

The individual pension benefit accrued in the German statutory pension scheme - as a point system - is in principle based on the number of individual pension points accrued during working life. The quantity of pension points *p.a.* depends in general on the proportion of individual gross wage to economy-wide average wage. Furthermore, credits for specific periods raise the individual pension entitlements. Hence, the number of pension points is not necessarily comparable to the length of the working career. In addition, there is no direct link between the cost of pension points and the number of pension points. The absolute costs of a pension point *p.a.* depend on the level of the contribution rate and the individual gross wage in that specific year as limited by the corresponding earnings ceiling.

*Tables 14a to 14c* show the main driving forces behind the future development of expenditure for new pensions by gender. Despite the increase of the statutory retirement age, the number of new old-age and early pensions will increase within the next two decades, as the baby-boomers will reach retirement ages. After baby-boomers have retired in the mid-2030s, the number of new pensions will decrease and reach a lower level in 2070 comparable to that in 2016. The pension point value will increase - according to the pension indexation formula - on a lower level than the wages will increase (see also *formula 7 et seqq.*). A future increase of the average number of individual pension points can mainly be explained by an extended working lifetime and the projected higher labour market participation, especially of women and older people. However, differences between cohorts emerge due to varying pension claims already accrued in the base year.

In *tables 14a to 14c*, the value for the category “sustainability/adjustment factors” is constantly declared to be 1.0. That declaration is necessary to obtain a transparent and consistent correlation between the projected new pension expenditures and the categories “number of new pensions”, “total pension points at retirement” and “point value”. That definition does not mean that the German statutory pension system has no sustainability elements implemented. It just clarifies, that the pension point value in year *t* for new pensioners in year *t* contains already all previous adjustments by the sustainability factor before the year *t*. Furthermore, the pension point value is equal for stock and new pensions. Hence, the current pension point value in year *t* reflects the adjustment by the sustainability factor for stock and new pensions.

**Table 14a - Projected and disaggregated new public pension expenditure (old-age and early earnings-related pensions) - Total**

New pension	2016	2020	2030	2040	2050	2060	2070
I Projected new pension expenditure (millions EUR)	6,008.3	7,452.0	11,340.2	11,793.3	19,357.4	25,585.1	30,911.0
II Number of new pensions (in 1,000)	834.3	954.5	1121.9	840.4	966.9	913.0	793.6
Total pension points at retirement	40.8	40.0	40.4	42.3	43.5	43.9	43.4
III Average pension points accumulated per year or average contributory period	0.8	0.8	0.8	0.8	0.8	0.8	0.8
IV Average accrual rate (=V/K)	:	:	:	:	:	:	:
Point value (V)	352.7	390.3	499.9	662.7	919.7	1276.5	1795.2
Point cost (K)	:	:	:	:	:	:	:
V Sustainability/adjustment factors	1.0	1.0	1.0	1.0	1.0	1.0	1.0
VI Average number of months paid the first year	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Monthly average pensionable earnings / Monthly economy-wide average wage	0.43	0.42	0.39	0.39	0.39	0.38	0.37

**Source:** EPC-AWG projection, baseline scenario.

**Table 14b - Disaggregated new public pension expenditure (old-age and early earnings-related pensions) - MEN**

New pension	2016	2020	2030	2040	2050	2060	2070
I Projected new pension expenditure (millions EUR)	3,516.5	4,410.8	6,811.2	6,946.2	11,581.5	15,248.7	18,262.5
II Number of new pensions (in 1,000)	396.3	447.0	537.6	396.1	465.9	440.6	382.9
Total pension points at retirement	50.3	50.6	50.7	52.9	54.1	54.2	53.1
III Average pension points accumulated per year or average contributory period	0.9	1.0	1.0	1.0	1.0	1.0	1.0
IV Average accrual rate (=V/K)	:	:	:	:	:	:	:
Point value (V)	352.7	390.3	499.9	662.7	919.7	1276.5	1795.2
Point cost (K)	:	:	:	:	:	:	:
V Sustainability/adjustment factors	1.0	1.0	1.0	1.0	1.0	1.0	1.0
VI Average number of months paid the first year	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Monthly average pensionable earnings / Monthly economy-wide average wage	0.53	0.54	0.49	0.48	0.48	0.47	0.46

**Source:** EPC-AWG projection, baseline scenario.

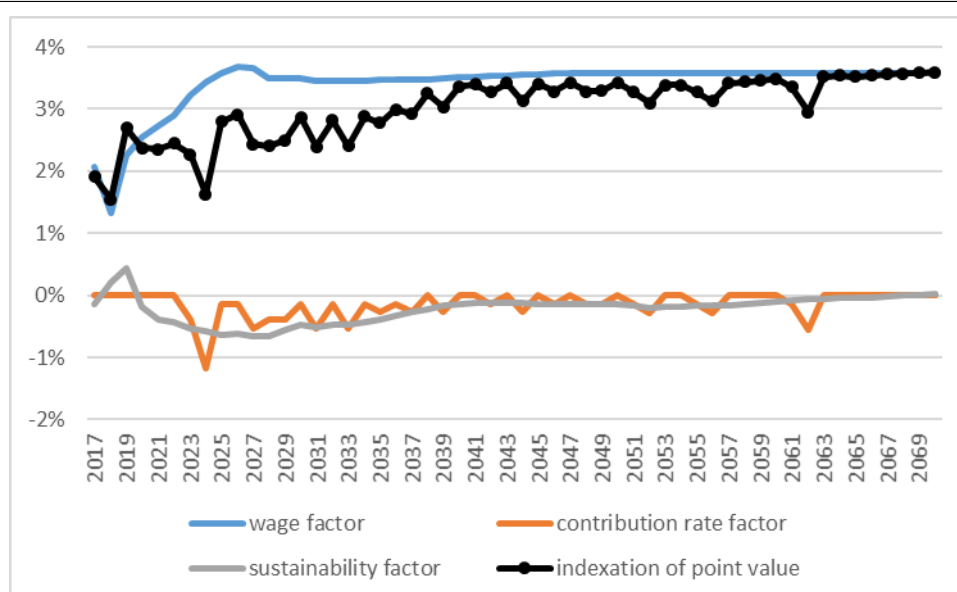
**Table 14c - Disaggregated new public pension expenditure (old-age and early earnings-related pensions) - WOMEN**

New pension	2016	2020	2030	2040	2050	2060	2070
I Projected new pension expenditure (millions EUR)	2,491.8	3,041.2	4,529.1	4,847.1	7,775.8	10,336.3	12,648.6
II Number of new pensions (in 1,000)	438.0	507.5	584.2	444.3	501.1	472.4	410.7
Total pension points at retirement	32.3	30.7	31.0	32.9	33.7	34.3	34.3
III Average pension points accumulated per year or average contributory period	0.6	0.6	0.6	0.6	0.6	0.6	0.6
IV Average accrual rate (=V/K)	:	:	:	:	:	:	:
Point value (V)	352.7	390.3	499.9	662.7	919.7	1276.5	1795.2
Point cost (K)	:	:	:	:	:	:	:
V Sustainability/adjustment factors	1.0	1.0	1.0	1.0	1.0	1.0	1.0
VI Average number of months paid the first year	6.0	6.0	6.0	6.0	6.0	6.0	6.0
Monthly average pensionable earnings / Monthly economy-wide average wage	0.34	0.33	0.30	0.30	0.30	0.30	0.30

**Source:** EPC-AWG projection, baseline scenario.

Figure 2 shows the annual impact of the three indexation factors concerning the pension indexation during the projection horizon. Due to demographic change, by the 2030s, contribution rates increase and therefore, the contribution rate factor lowers the indexation as well as the sustainability factor. Hence, the benefit ratio is decreasing. Since the demographic development is more favourable from the 2040s onwards, the impact of the contribution rate and the sustainability factor on the pension indexation decreases. Pension benefits will therefore go in line with wage growth. Hence, the development of the benefit ratios is stabilizing.

**Figure 2: Impact of the three indexation factors concerning the indexation of the pension point value (in %) - period view**



**Source:** EPC-AWG projection, baseline scenario.

### 3.4 Financing of the pension system

Table 15 gives an overview of the financing of the system.

<b>Table 15 – Financing of the system</b>			
	Public employees	Private employees	Self-employed
Contribution base	36,267	36,267	36,267
Contribution rate/contribution			
<i>Employer</i>	9.4 %	9.4 %	18.7 %
<i>Employee</i>	9.4 %	9.4 %	
<i>State</i>	-	-	-
<i>Other revenues</i>	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.	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.	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.
Maximum contribution	6,956.4	6,956.4	13,912.8
Minimum contribution	0	0	0

**Source:** Commission Services.

Table 16 displays the breakdown of public pension schemes' revenues. Contributions to the statutory pension scheme - except the state contributions - are financed equally by employees and employers as a percentage (the contribution rate) of gross wage up to the respective income ceiling.

State contributions contain contributions to the civil servants pension scheme and the statutory pension scheme. The civil servants pension scheme is completely tax-financed. In contrast, state subsidies to the statutory pension scheme compensate the intra-social policy components of the pension system. These refer to benefits which are not geared to cover the risk of longevity, in particular disability benefits based on the virtual employment career (see explanation in *chapter 1.1*) and survivor benefits. Furthermore, state contribution refers to child-rearing benefits and liabilities related to German reunification and World War II. State subsidies are adjusted annually. The indexation is generally in line with gross wage and contribution rate development. In consequence, an almost constant ratio of state contribution related to GDP is guaranteed.

**Table 16 – Revenue from contribution (million), number of contributors in the public scheme (in 1,000), total employment (in 1,000) and related ratios (%)**

	2016	2020	2030	2040	2050	2060	2070
Public contribution	324239.3	371499.5	564295.8	795427.5	1121046.7	1565135.3	2163550.3
Employer contribution	101736.5	114247.9	172663.7	246780.5	349977.8	485527.9	680319.8
Employee contribution	101736.5	114247.9	172663.7	246780.5	349977.8	485527.9	680319.8
State contribution	120766.3	143003.8	218968.5	301866.6	421091.2	594079.5	802910.8
Other revenues	:	:	:	:	:	:	:
Number of contributors (I)	35496.0	36052.0	33944.0	32639.0	31753.0	30264.0	29320.0
Employment (II)	41410.2	41872.0	39554.1	38000.6	36934.9	35180.1	34079.7
Ratio of (I)/(II)	0.9	0.9	0.9	0.9	0.9	0.9	0.9

**Source:** EPC-AWG projection, baseline scenario.

### 3.5 Sensitivity analysis

In order to analyse the validity of the assumption-setting in the baseline variant, eight additional sensitivity tests were calculated. The respective results are presented in *table 17*. By interpreting each of the following variants it should be kept in mind that, due to the specific impacts of certain components of the pension point value indexation (see, *formula 3*), none of the eight sensitivity tests demonstrates an isolated effect of e.g., higher life expectancy, lower migration, etc. solely. Each variation leads to changes in the development of the pension contribution rate and the pension indexation, which again result in an impact on the statutory pension system's revenues and expenditure.

**Table 17 – Public and total pension expenditure under different scenarios (p.p. deviation from the baseline)**

	2016	2020	2030	2040	2050	2060	2070
<b>Public Pension Expenditure</b>							
Baseline	10,1	10,3	11,5	12,0	12,2	12,5	12,5
Higher life expectancy (2 extra years)	0,0	0,0	0,1	0,1	0,2	0,3	0,3
Higher Total Factor Productivity Growth (+0.4 pp.)	0,0	0,0	0,0	0,0	-0,1	-0,1	-0,1
Lower Total Factor Productivity Growth (-0.4 pp.)	0,0	0,0	0,0	0,1	0,1	0,1	0,1
Higher emp. rate (+2 pp.)	0,0	0,0	-0,2	-0,2	-0,2	-0,2	-0,2
Lower emp. rate (-2 pp.)	0,0	0,0	0,2	0,2	0,2	0,2	0,1
Higher emp. of older workers (+10 pp.)	0,0	-0,1	-0,6	-0,5	-0,5	-0,5	-0,4
Higher migration (+33%)	0,0	-0,1	-0,3	-0,4	-0,5	-0,5	-0,4
Lower migration (-33%)	0,0	0,1	0,3	0,5	0,5	0,5	0,5
Lower fertility	0,0	0,0	0,0	0,2	0,4	0,7	1,2
Risk scenario	0,0	0,0	0,0	0,0	0,0	0,0	0,1
Policy scenario: linking retirement age to increases in life expectancy	0,0	0,0	-0,1	-0,3	-0,5	-0,6	-0,7
<b>Total Pension Expenditure</b>							
Baseline	10,1	10,3	11,5	12,0	12,2	12,5	12,5
Higher life expectancy (2 extra years)	0,0	0,0	0,1	0,1	0,2	0,3	0,3
Higher Total Factor Productivity Growth (+0.4 pp.)	0,0	0,0	0,0	0,0	-0,1	-0,1	-0,1
Lower Total Factor Productivity Growth (-0.4 pp.)	0,0	0,0	0,0	0,1	0,1	0,1	0,1
Higher emp. rate (+2 pp.)	0,0	0,0	-0,2	-0,2	-0,2	-0,2	-0,2
Lower emp. rate (-2 pp.)	0,0	0,0	0,2	0,2	0,2	0,2	0,1
Higher emp. of older workers (+10 pp.)	0,0	-0,1	-0,6	-0,5	-0,5	-0,5	-0,4
Higher migration (+33%)	0,0	-0,1	-0,3	-0,4	-0,5	-0,5	-0,4
Lower migration (-33%)	0,0	0,1	0,3	0,5	0,5	0,5	0,5
Lower fertility	0,0	0,0	0,0	0,2	0,4	0,7	1,2
Risk scenario	0,0	0,0	0,0	0,0	0,0	0,0	0,1
Policy scenario: linking retirement age to increases in life expectancy	0,0	0,0	-0,1	-0,3	-0,5	-0,6	-0,7

**Source:** EPC-AWG projections.

- *Higher life expectancy (2 extra years)*

Because higher life expectancy will alter the number of pensioners when all other variables remain constant, a slight increase of pension expenditure - compared to the baseline scenario - is being observed.

- *Higher/lower labour productivity (+/-0.4 pp.)*

Because pension benefits basically are indexed in line with nominal wages (as a starting point), a change in labour productivity has minor effects on the results of these scenarios compared to the baseline variant.

- *Higher/lower employment rate (+/-2 pp.)/Higher employment of older workers (+10pp.)*

Because higher (lower) employment rates will not only result in a higher (lower) GDP, but also increase the pension entitlements, only a minor positive effect on the expenditure side is observed. The fact, that the increase of additional pension entitlements is weighted by the sustainability factor, promotes that minor effect.



- *Higher/Lower migration (+/- 33 %)*

The different age structure of immigrants and emigrants and the total effect of the population size explain most of the observed results: Higher (lower) migration, due to more (fewer) immigrants, increases (reduces) labour supply and employment and hence GDP, but decreases (increases) the pension entitlements due to more (fewer) emigrants on the other hand, the pension expenditure/GDP ratio will decrease (increase) slightly compared to the baseline scenario.

- *Lower fertility*

In comparison to the baseline scenario a lower fertility will reduce the number of contributors while wages are not affected. Together with a lower GDP the pension expenditures in relation to GDP increase over the projection horizon.

- *TFP risk scenario*

This scenario with its effects on pension expenditures is almost similar to the lower productivity scenario. Changes of TFP from 1 to 0.8 do not have a clearly recognizable effect on the results of this scenario compared to the baseline variant.

- *Linking statutory retirement age to increase in life expectancy*

This scenario was incorporated into the sensitivity test to discuss the question whether a further increase of the statutory retirement age is needed to guarantee financial sustainability of public pension systems. The present approach keeps the current pension payment period constant. A review of the question whether the coming gains in life expectancy will be one to one gains of life in good health and therefore working time - as the assumptions implicate - has been not considered. Furthermore, there is abstraction from adequate reaction of the labour market. Assumptions regarding future employability of older people are not considered. In addition, probabilities for entering into a disability pension are kept as constant. Hence, results of this artificial scenario calculation should be interpreted carefully.

### 3.6 Description of the changes in comparison with the 2006, 2009, 2012 and 2015 projections

Table 18 represents the changing impact of the main items concerning the decomposition of pension expenditures since the 2006 AWG-projection exercise. Before interpreting each variable over time it should be kept in mind that none of these values is comparable over time precisely, due to four different projection horizons and varying assumptions.

However, the pension expenditures as share of GDP are projected to increase in the current exercise by 2.4 percentage points from 2016 to 2070. That is slightly less than in the recent projections. A main explanation for that difference are favourable economic conditions in the base year.

Due to distinct differences between the latest Eurostat population projection (2017) and the previous projection in 2013 for Germany, the dependency ratio declines in the 2018 projection exercises. The coverage ratio is affected by various demographic components (e.g., increasing life expectancy, decreasing probabilities of marriage). Nevertheless, the slightly lower coverage ratio effect (compared to the 2015 exercise) is also influenced by the projected increase of female labour force participation rates and therefore longer contribution periods. The impact of the benefit ratio is unchanged compared to the last projection exercise and will decelerate the increase of the overall pension expenditures. In contrast to that, labour intensity has only a marginal effect.

**Table 18 - Overall change in public pension expenditure to GDP under the 2006, 2009, 2012 and 2015 projection exercises - pensions**

	Public pensions to GDP	Dependency ratio	Coverage ratio	Employment effect	Benefit ratio	Labour intensity	Residual (incl. Interaction effect)
2006 *	1.94	7.53	-0.60	-1.12	-3.46	:	-0.41
2009 **	2.32	7.93	-1.88	-0.75	-2.20	:	-0.77
2012 ***	2.58	7.90	-1.76	-0.47	-2.23	0.04	-0.90
2015****	2.81	7.53	-1.82	-0.38	-1.77	0.03	-0.78
2018*****	2.41	6.60	-1.85	-0.03	-1.77	0.04	-0.57

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

**Source:** Commission Services

As table 19 displays an overview of the decomposition of the difference between the projection exercise in 2015 and 2018.

**Table 19 - Decomposition of the difference between 2015 and the new public pension projection (% of GDP)**

	2016	2020	2030	2040	2050	2060	2070
Ageing report 2015	10,3	10,6	11,9	12,6	12,8	13,1	:
<i>Change in assumptions</i>	-0,2	-0,3	-0,5	-0,7	-0,7	-0,6	:
<i>Improvement in the coverage or in the modelling</i>	:	:	:	:	:	:	:
<i>Change in the interpretation of constant policy</i>	:	:	:	:	:	:	:
<i>Policy related changes</i>	0	0	0,1	0,1	0,1	0,1	:
New projection	10,1	10,3	11,5	12,0	12,2	12,5	:

**Source:** EPC-AWG projections

## 4. Description of the pension model and data

### 4.1 Institutional context

The pension model for the statutory pension scheme is operated jointly by the *Federal Ministry of Labour and Social Affairs* and the German Federal Insurance Fund (*Deutsche Rentenversicherung*). A joint working group with experts of both institutions project the financial development of the statutory pension scheme. Meetings are scheduled at least four times a year. The projected results are used for indexation of the pension point value, the fixation of the contribution rate and the assessment of pension reforms and long-term planning.

### 4.2 Assumptions and methodologies applied

All originally model components with national focus are calibrated in order to fully comply with the *Ageing Working Group (AWG)* assumptions.

### 4.3 Data used to run the models

The models incorporate data from numerous sources. Most data relating to pensions is provided by the official statistics of the *German statutory pension insurance scheme*. Population data is provided by the *Federal Statistical Office (Statistisches Bundesamt)*. The set of long-term demographic and macroeconomic assumptions is set by the governmental committee on "Achieving financial sustainability for the social security system" and supplemented by short and medium term economic forecasts of the government. However, this projection exercise is based on the commonly agreed (AWG) assumptions. Fertility rates, mortality rates and migration assumptions are in line with the assumptions of the latest population projection of Eurostat (2017). For future employment growth as well as for the future participation rates the AWG pre-settings are used. AWG labour productivity assumptions are applied to model real wage growth. The following data sets are included:

- number of pensions (DRV),
- average pension benefit of the persons already retired (DRV),
- new pensions (DRV),
- average pension benefit of new pensions (DRV),
- population projection, mortality and fertility rates (Eurostat scenarios),
- labour market (AWG scenarios),
- gross wages (AWG scenario).

## **4.4 Reforms incorporated in the models**

All legislated pension reforms have been taken into account. In particular, the gradual increase in statutory retirement age - to age 67 by the year 2029 - has been considered.

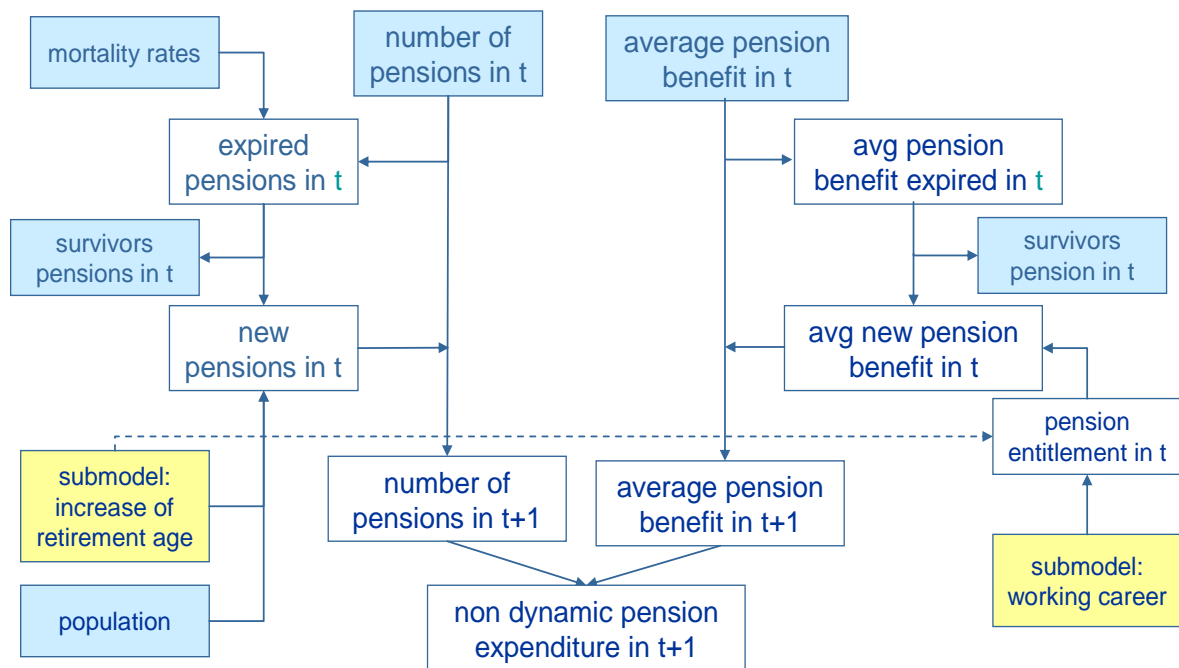
## **4.5 General description of the models**

Basically, the pension model consists of two sub-models: a cohort model for the projection of the demographic components on pension expenditures (demographic cohort pension model) and a model for the calculation of the dynamic financial development regarding the pension adjustment and the contribution rate (financial pension model). Supplementary, two major sub-modules, which capture the future occupational career developments and the interactions between different pension types, affected by individual performances due to early retirement and the rising statutory retirement age, have been incorporated. As already noticed, the model distinguishes between the Western and Eastern part of Germany.

### ***4.5.1 The demographic cohort pension model***

The demographic pension model is based on a cohort approach. In general, the number of stock pensions in year  $t+1$  for a specific cohort  $y$  results from the number of pensions in year  $t, y$  plus new pensions minus pensions expiring due to death. Because of the possibility to receive pensions from more than one pension scheme simultaneously (e. g. old age pension and a survivor's pension), the original model runs with the number of pensions and not with the number of pensioners. The number of expired pensions in each projection year is equal to the number of pensions in year  $t$  multiplied by the mortality rates given the AWG population scenario. Conditional on age and gender-specific marriage probabilities, spouses of the deceased retirees will be granted survivor pensions. Newly granted old-age and disability pensions are calculated with probabilities of pension entry, estimated on the basis of past trends, while also taking into account the legislated increase of the statutory retirement age. *Figure 3* illustrates the main interdependencies of this model for Western Germany.

**Figure 3: The demographic cohort pension model**



The projection of the average pension benefits is similar to the calculation of the number of pensions (see, *figure 3*). In addition, the impacts of changing labour market conditions (e. g. unemployment and participation rates) are taken into account for projecting pension entitlements. Likewise, the deduction on pensions in the case of early retirement is considered.

Multiplying the number of pensions by the average pension benefit yields *non-dynamic* pension expenditures. Up to this stage no pension-indexation is taken into account and *non-dynamic* expenditures capture therefore demographic and labour market trends as well as projected employment biographies of future pensioners solely.

The model is slightly modified for the projection of pension expenditures in the Eastern part of Germany to account for differences in per capita income, probabilities of pension entry and pension benefits. However, it is assumed that the share of insured persons in the statutory pension scheme and average income levels in both parts of Germany will converge.

#### **4.5.2 The financial pension model**

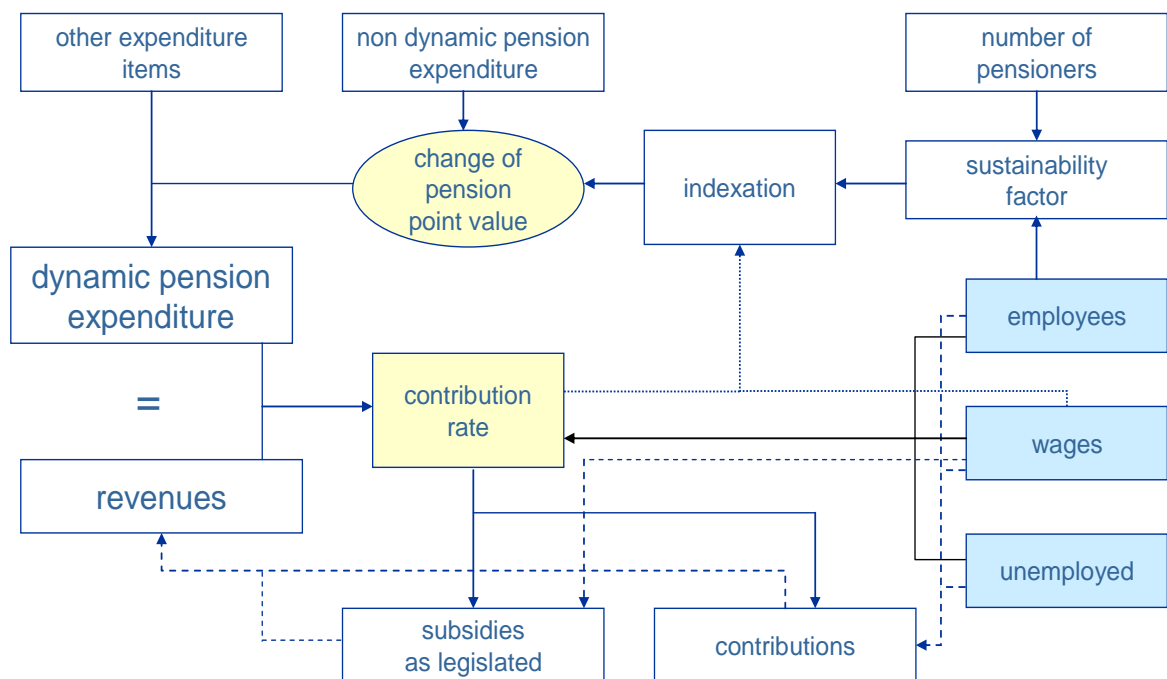
The financial pension model aims to project *dynamic* pension expenditures. The main difference between *non-dynamic* and *dynamic* pension expenditures is the indexation of pension benefits by calculating and applying the pension point value (see *figure 4*). Moreover, within this model the contribution rate for the statutory pension scheme is calculated on the condition that revenues and expenditures have to be in balance in every year. As stated in chapter 1, there is no adjustment of the contribution rate as long

as the 'sustainability fund' of the German statutory pension insurance scheme holds an amount between 0.2 and 1.5 of monthly pension expenditures.

Considering the pension point value, the model demonstrates the evolution of dynamic pension expenditure taking into account other expenditure items (e.g. rehabilitation or administrative costs). As seen in *formula 3*, the indexation of the pension point value depends on the development of gross wages, changes in the contribution rate and the sustainability factor.

The revenues of the pension system stem from pension contributions and governmental subsidies. Revenues from the federal budget are adjusted on wage growth and the change of the contribution rate. The corresponding mechanism follows rules encoded into law. Contributions depend on the number of employees, the number of unemployed - as the *Federal Employment Agency* (Bundesanstalt für Arbeit) is transferring contributions for this group -, the development of wages (AWG scenario) and the level of the contribution rate.

**Figure 4: The financial pension model**



## Annex

### **The indexation formula**

Pensions are adjusted annually on 1<sup>st</sup> of July. *Formula 7* displays the indexation of the pension point value for year  $t$ .

$$\text{Formula 7: } ppv_t = ppv_{t-1} \times \frac{ae_{t-1}}{ae_{t-2}^*} \times \frac{100 - rf_{t-1} - cr_{t-1}}{100 - rf_{t-2} - cr_{t-2}} \times \left( \left( 1 - \frac{pc_{t-1}}{pc_{t-2}} \right)^{\alpha} + 1 \right), \text{ where}$$

$$ppv_t = ppv_{t-1} \times \frac{\text{wage}}{\text{factor}} \times \frac{\text{contribution}}{\text{factor}} \times \frac{\text{sustainability}}{\text{factor}}$$

- $ppv$  = pension point value,
- $ae$  = average wage based on National Accounts,
- $ae^*$  = adjusted average wage,
- $rf$  = contribution rate to subsidised private pension scheme,
- $cr$  = contribution rate to statutory pension scheme,
- $pc$  = equivalent pensioners/contributors ratio,
- $\alpha$  = allocation factor = 0.25.

*Formula 7* is equivalent to the more general *formula 3*. The pension point value is adjusted in line with the growth of average earnings and the change of the contribution and the sustainability factor as well. However, due to specific safeguard laws the adjustment of the pension point value must not be lower than zero.

Regarding the calculation of the *wage-factor*, National Accounts data is used as basis. Taking into account different trends of average wages based on National Accounts and based on contributors to the statutory pension scheme, a correction factor ( $ae_{t-2}^*$ ) is integrated in *formula 7*: Due to statistical specifics the time lag of this factor reaches to  $t - 3$ . A lower increase of contributors' average wages compared to the corresponding National Accounts' data reduces the adjustment and vice versa (see, *formula 8*).

$$\text{Formula 8: } ae_{t-2}^* = ae_{t-2} * \frac{ae_{t-2} / ae_{t-3}}{ae_{t-2}^{ps} / ae_{t-3}^{ps}}, \text{ where}$$

- $ae^*$  = adjusted average wages,
- $ae$  = average wages based on National Accounts,
- $ae^{ps}$  = average wages of contributors to statutory pension scheme.

The *contribution-factor* leads to a reduction of the adjustment if the contribution rate to the statutory pension scheme has increased in the previous year. Up to the year 2013, a further reduction occurred due to the implied increase of the contribution rate to the subsidised private pension scheme. A specific amount (2008 2.0 %, 2009: 2.5 %, ...,



2012 et seqq.: 4.0 %) of the average gross wage is supposed to be used for private old-age pension plans.

In order to maintain the long term financial sustainability of the statutory pension scheme, the *sustainability-factor* is included in the indexation formula. This factor causes a reduction of the adjustment if the number of those financing the pension system (contributors) decreases and/or if the number of pensioners increases. Therefore, the sustainability factor takes account of the fluctuation of the pensioner/contributor ratio. There is the hypothesis that a decrease in mortality rates by 10 % would result in an increase of the number of pensioners by 10 % and respectively to an increase of pension expenditures by 10 %: The mechanism of the sustainability factor would decelerate the originally expected upward-movement of expenditures, explicitly relieving the financial burden of contributors. The same mechanism operates vice versa regarding the number of contributors. Hence, the impact of the sustainability factor depends on the demographic and economic development.

As changes in part-time/full-time work should be eliminated, the number of pensioners and contributors are calculated on the basis of specific equivalent values, which are defined differently for Western and Eastern Germany (see, *formula 9*). The number of equivalent pensioners (*ePen*) is calculated as displayed in *formula 10*. The standard pension is a pension based on 45 pension points multiplied by the current pension point value (e.g. 31.03 € for Western Germany, 2017). By dividing the pension expenditures by the amount of this standard pension the number of equivalent pensioners is obtained. A similar approach is used for calculating the equivalent contributors (*eCon*): Total contributions are divided by a "standard"-contribution, which has to be paid for earning one pension point, to receive the number of equivalent contributors.

Formula 9: 
$$pc = \frac{ePen_W + ePen_E}{eCon_W + eCon_E}, \text{ where}$$

*pc* = pensioner/contributor ratio,  
*ePen* = number of equivalent-pensioners,  
*eCon* = number of equivalent-contributors,  
*W, E* = Western, Eastern Germany.

Formula 10: 
$$ePen = \frac{PE}{sp}, \text{ where}$$

*PE* = total pension expenditure,  
*sp* = standard pension.

Formula 11: 
$$eCon = \frac{CR}{sc}, \text{ where}$$

*CR* = contribution paid by employees and the unemployed,  
*sc* = standard contribution.

### ***Economy-wide average wage at retirement***

A reasonable approach about future age-specific wage development is currently not feasible. At this time, there exist no valid empirical findings about:

- a) the development of productivity at older ages compared to the average,
- b) if the shortage of skilled labour forces leads e.g. to a large upgrading of workplace health management or to a higher payment for older workers to commit those skilled worker to companies.

Hence, for this exercise we focus on the current weak empirical evidence, which documents 5 % higher wages on average for workers at age 60-64 compared to the economy-wide average wage.

### ***Pensioners vs. Pension***

As stated in section 1.3, all AWG assumptions regarding the demographic and macro-economic context have been considered in the national pension projection model. In general, a pensioner in the statutory pension scheme is entitled to just one pension type. Differences between the numbers of pensions and pensioners result by drawing additional retirement benefits on survivor's pensions solely. In addition, it is not possible to isolate pensioners who receive pension benefits from both, the statutory pension scheme and the civil servant scheme. Hence, double counting for this case is observed.

### ***Pension taxation***

Regarding individual income taxes, Germany is currently undergoing a change in the tax regime relating to contributions and pensions.<sup>16</sup> Therefore, the taxation of pensions from the statutory pension schemes is gradually changing from a system with partial taxations of contributions and practically no taxation of pension benefits into an opposite system. Pension contributions will be completely exempted from tax by the year 2025 and pension benefits will be completely taxed by the year 2040.

Beside this, it should be noted that the effective tax rate depends on household income, which includes more than the income source of old-age pensions. Due to the ongoing rearrangement of taxation of public pension benefits, we assumed in linear increase of tax burden from 7 % in 2013 to 10 % in 2070 for this projection round.

### ***Survivors pension***

The projection considers single age-sex specific probabilities to marriage within the age-cohort model in combination with single age-sex specific mortality rates. Furthermore,

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<sup>16</sup> Legislated by the *Old-Age-Income-Act* (Alterseinkünftegesetz) in year 2005.

the model adopt the current age gap between spouses with the assumption of no future change for the projection horizon.

### ***Non-earnings related minimum pension***

The eligibility criteria for means-tested benefits from social assistance for older people is just the fact of reaching the statutory retirement age. There exists no other request e.g., for specific minimum years of contributions.

The amount of means-tested benefit consists of two parts:

- a) *social assistance benefits*, and
- b) *housing allowances*.

**Social assistance** benefits secure the recipients' livelihood (covers e.g., the demand for food, personal care, household goods, etc.). It includes a lump-sum for non-recurring and recurring needs. Regarding the social assistance benefit amount, there exist different social assistance categories. Social assistance benefits are indexed by an aggregate of 70 % CPI for low income group and 30 % of economy-wide average net wage.

**Housing allowances** depend on the local rental market. Reasonable housing costs are determined according to the circumstances of each individual, particularly family size, age, sex and state of health of the family members. Based on these individual information concerning the beneficiary and his/her relatives, the number of living rooms, the local rent level and the conditions of the local housing market is to be evaluated.

Hence, the individual maximum gross amount of means-tested benefits depends on the household structure and the condition of the local rental market. However, individual net-benefits and therefore the gross expenditures for the means-tested benefits from the social assistance system are calculated as the difference between gross individual needs and individual income from all sources.

For this projection round the means-tested social benefit model is based on an age-cohort approach with configurations for the development of demography, wage and inflation. Furthermore, the change p.a. of past stock information is considered. Information regarding in- and outflows are not available and the projection is, thus, based on stock information with a distinction of relevant sex-specific expenditure items and state of housing.

The results - as presented in *table 8a* - are mainly influenced by demographic development, and the specific underlining assumptions regarding the commonly agreed wage and price development, where CPI is assumed to increase at a lower level over the projection horizon than wage. Additionally, gross needs are primarily indexed by CPI whereas pensions - as the main individual income source of older people - are indexed (- due to the sustainability factor -) to a somewhat lower level than wage development. This specific setting results into a more or less parallel development of gross needs and

means-tested incomes (mainly pensions), with an almost constant ratio of expenditures related to GDP.

## Alternative pension spending decomposition

**Table A1 - Factors behind the change in public pension expenditures between 2016 and 2070 using pension data (in percentage points of GDP) - pensions**

	2016-20	2020-30	2030-40	2040-50	2050-60	2060-70	2016-70
Public pensions to GDP	0.3	1.1	0.5	0.2	0.4	-0.1	2.4
Dependency ratio effect	0.5	3.0	2.0	0.5	1.2	0.3	7.6
Coverage ratio effect	-0.1	-0.7	-0.4	-0.1	-0.2	-0.1	-1.6
Coverage ratio old-age*	0.0	-0.4	-0.2	-0.2	-0.1	0.0	-0.9
Coverage ratio early-age*	-0.8	0.4	-1.1	0.5	0.3	-0.5	-1.2
Cohort effect*	-0.1	-2.8	-0.8	0.0	-0.9	-0.1	-4.7
Benefit ratio effect	-0.1	-0.6	-0.4	-0.1	-0.1	-0.2	-1.5
Labour Market/Labour intensity effect	-0.1	-0.1	0.0	0.0	-0.1	0.0	-0.2
Employment ratio effect	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Career shift effect	-0.1	-0.2	0.0	0.0	0.0	0.1	-0.3
Residual	0.0	-0.5	-0.6	-0.2	-0.5	-0.2	-2.0

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

**Source:** EPC-AWG projection, baseline scenario.

**Table A2 - Factors behind the change in public pension expenditures between 2016 and 2070 using pensioners data (in percentage points of GDP) - pensioners**

	2016-20	2020-30	2030-40	2040-50	2050-60	2060-70	2016-70
Public pensions to GDP	0.3	1.1	0.5	0.2	0.4	-0.1	2.4
Dependency ratio effect	0.5	3.0	2.0	0.5	1.2	0.3	7.6
Coverage ratio effect	-0.1	-0.5	-0.3	-0.1	-0.1	0.0	-1.1
Coverage ratio old-age*	0.0	-0.3	-0.1	-0.1	0.0	0.0	-0.5
Coverage ratio early-age*	-0.6	0.7	-1.1	0.5	0.4	-0.5	-0.5
Cohort effect*	-0.1	-2.8	-0.8	0.0	-0.9	-0.1	-4.7
Benefit ratio effect	-0.1	-0.8	-0.5	-0.1	-0.2	-0.2	-1.9
Labour Market/Labour intensity effect	-0.1	-0.1	0.0	0.0	-0.1	0.0	-0.2
Employment ratio effect	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Labour intensity effect	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Career shift effect	-0.1	-0.2	0.0	0.0	0.0	0.1	-0.3
Residual	0.0	-0.5	-0.6	-0.2	-0.5	-0.2	-2.0

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

**Source:** EPC-AWG projection, baseline scenario.