15 February 2018

The Swedish pension system and pension projections until 2070

1 An overview of the pension system

> The Swedish public old-age pension system covers everyone who has worked or lived in Sweden and consists of an earnings-related component based on notional accounts, a private mandatory defined contribution system and a pension-income-tested minimum top-up, the guarantee pension. On top of that, most employees are covered by occupational pension schemes. The possibility to make tax-deductions for private pension savings was abolished in 2016.

1.1 The Swedish public pension system

The reformed Swedish public old-age pension system was fully implemented in 2003. The reformed earnings-related old-age pension system consists of a notionally defined contribution (NDC) PAYG component and a fully funded, defined contribution (DC) pension component.[1] Both are based on lifetime earnings and individual accounts. In addition, there is a pension-income-tested top up, the guarantee pension, which is financed by general taxes from the central government budget. The same pension rules apply to all persons regardless of occupational sector and for employees and self-employed alike. The old-age pension system is independent in the sense that income and expenditure are governed by a fixed set of rules, and not part of the Government budget. The system has a high degree of political independence as its rules are decided in agreement by a six-party working group in Parliament.

The old Swedish pension system consisted of a flat-rate pension provided in full to everyone with at least 40 years of residence in Sweden between the ages of 16 and 65. Further, it included an earnings-related pay-as-you-go (PAYG) component providing a benefit based on 60 per cent of an average of the contributors best 15 years of earnings, with 30 years required to receive a full benefit. This system only affects people born before 1954, and will be phased out around 2020. The reformed system covers individuals born 1938 and later, with transition rules for persons born 1938-1953.

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[1] The latter part is classified as private savings in the National Accounts.

Table 1 – Qualifying conditions for retiring
For all men and women and all years 2016 – 2070
The earliest possible retirement age is **61 years** for earnings related income pension and **65 years** for non-earnings-related guarantee pension.
The yearly pension is calculated on the individual's pension entitlements at retirement and the expected remaining life length. Hence, if a person retires early, at the age of 61, the pension will be correspondingly smaller than if he or she decides to postpone retirement.
The non-earnings-related guarantee pension is reduced in proportion to the time spent in Sweden, with a full pension awarded after 40 years of residence.
Source: Ministry of Finance

Pension rights are credited to the individual accounts for 18.5 percent of the annual pensionable income up to a ceiling amounting to 8.07 income base amounts.[2] 16 percentage points are paid to the NDC PAYG system and 2.5 percentage points to the funded DC system. The insured person pays a pension contribution amounting to 7 percent of the gross pensionable income, and the employer 10.21 per cent.[3] The individual's pension contribution is fully deductible on other income taxes, so in fact very few individuals pay contributions. Contributions over the pension ceiling are transferred to the central government budget as general tax and do not affect the income-based pension system. Contributions are also paid by the central government to cover pension entitlements credited for social insurances, such as benefits for unemployment, sickness, disability or parental leave.

The retirement age is flexible and individuals can claim benefits from the age of 61 without any upper limit. The decision to draw a pension does not mean that the employee must stop working. He or she can continue to work and earn new pension entitlements. Under the Employment Protection Act an employee is entitled to stay in employment until his or her 67th birthday. The exit age from the labour market shows a strong increase, see graph 1. However, in the projections the exit age is unchanged, see table 5 a, 5b. Since it is possible to start drawing a pension and continue to work, the average age for leaving the labour market is disconnected from the average age for first pension. The average age for pension withdrawals has been near 64.6 years since at least 2005, and there is no obvious trend.

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[2] The income base amount was SEK 61 500 or approx. 6 500 € in 2017, so the public pension ceiling was SEK 496 300 or approx. 52 400 €. It is indexed to the change of average earnings.

[3] The contribution is calculated on earnings net of the employee contribution, i.e. $(0.07+0.1021)/(1-0.07) = 0.185$

In the projections the age for pension withdrawal is quite flat; it starts at 64.7 and ends up at 64.8 in 2070. Most people begin to pick up their pension at 65. This is due to a strong 65-year norm, but also that the age limit for disability pension is 65. During the last decade this norm has become weaker and more people retire both before and after 65, but the average is more or less unaffected. There is no attempt to model the increased spread in the projections.

Tables 2 a-c show the age and sex distribution of new entrants into the different schemes. There are no "other" pension schemes in Sweden and the survivors' pension scheme has been closed to new entrants, so that pension payment from this scheme will be phased out gradually. At ages above 50 years more women than men receive a disability pension, which is in line with how the public sector health insurance is used.

Table 2a – Number of new pensioners by age group administrative data (MEN)					
Age group	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	3 197	0	3 197	:	:
50 - 54	550	0	550	:	:
55 - 59	756	0	756	:	:
60 - 64	19 064	18 074	990	:	:
65 - 69	32 050	32 035	15	:	:
70 - 74	614	614	0	:	:

Table 2b – Number of new pensioners by age group administrative data (WOMEN)					
Age group	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	3 169	0	3 169	:	:
50 - 54	811	0	811	:	:
55 - 59	954	0	954	:	:
60 - 64	17 270	16 091	1 179	:	:
65 - 69	32 741	32 715	26	:	:
70 - 74	329	329	0	:	:

Table 2c – Number of new pensioners by age group administrative data (TOTAL)					
Age group	All	Old age	Disability	Survivor	Other (including minimum)
15 - 49	6 366	0	6 366	:	:
50 - 54	1 361	0	1 361	:	:
55 - 59	1 710	0	1 710	:	:
60 - 64	36 334	34 165	2 169	:	:
65 - 69	64 791	64 750	41	:	:
70 - 74	943	943	0	:	:

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The NDC PAYG system
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The NDC PAYG pension system works on an actuarial basis. At the time of retirement an annuity is calculated by dividing the individual's cumulated account assets by a divisor reflecting unisex life expectancy

at the specific date of retirement.[4] The individual can counteract the negative effect on the annuity caused by increasing life expectancy by postponing the date of retirement. Hence, incentives are strong to prolong the working career. If for example an individual born in 1946 delayed the retirement from 65 to 67 the annuity divisor decreased from 16.31 to 15.16 and the NDC pension consequently increased with 7.6 % for an unchanged level of cumulated account assets.

The PAYG-pensions are on average indexed by wages, but are front-loaded so that pensioners receive a share of the real economic growth in advance. This makes the fall in income after leaving employment smaller, and gives a pensioner a relatively higher income at the beginning of retirement than towards the end. The NDC savings is as a primary rule indexed by the average rate of growth of earnings per contributor. In case of financial sustainability problems though, the automatic balancing mechanism is activated and the indexation will be reduced until stability is restored. The automatic balancing mechanism guarantees that the system will be able to finance its obligations with a fixed contribution rate and fixed rules regardless of the demographic or economic development. The balancing indexation was activated for the first time in 2010 because of the financial crisis in 2008. The current balancing period will stop in 2017 and normal indexing rules will be applied from 2018.[5] The balancing indexation is not activated again in the projection period.

Information of pension entitlements and expected benefit

The Pension Agency sends a yearly statement of account to every insured person in which the fees which were payed into the system and the size of the accumulated assets are reported, together with an assessment of the expected monthly benefit at different pension ages. It is also possible for an insured person to log on to a web page at any time and obtain personal information of accumulated pension assets and estimated benefit levels, including data for occupational pensions. In this way, the individual can make an informed decision whether to retire at a specific time or not.

Non-earnings-related minimum pensions and basic security

The non-earnings related *Guarantee pension* is financed by general tax revenues. The benefit is proportionally reduced if the number of residence years in Sweden falls short of 40. The guarantee pension, together with the means-tested housing supplement for pensioners (BTP), is higher than the minimum income standard in the system for general social assistance. All forms of basic security benefits for the

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[4] The gender-neutral annuity divisors in the NDC system result in about 8% higher pension for women (at age 65) compared to a system based on sex specific life expectancies.
[5] More details about the automatic balancing can be found in annex 2.

elderly can only be received from the age of 65. The guarantee pension is price indexed and fully taxed.[6] Unlike the earnings-related pension, the guarantee pension is normally paid only to pensioners living in Sweden.

The guarantee pension is means-tested against public pension income and survivor benefits, from Sweden and other countries, but not against work income, etc. For low incomes, the benefit is reduced krona by krona, and for higher incomes, the benefit is reduced by 48 per cent, so that it is fully phased out when the income pension reaches 3.07 price base amounts (PBA) for single households and 2.72 PBA's for cohabitants. The annual benefit amounts to a maximum of 2.13 PBA's for single households (some 10 075 € in 2017), and 1.90 PBA's per person for cohabitants (some 9 000 € in 2017).[7]

The tax-free means tested *Housing supplement for pensioners* (BTP) is formally outside the old-age pension system, but de facto closely interlinked.[8] There is also a *Special housing supplement* (SBTP) for pensioners with low income and high housing costs. Finally, there is a tax-free means-tested program, *Maintenance support for the elderly (ÄFS)*, which ensure that pensioners with very low income, usually immigrants with few years of residence in Sweden, do not become dependent on social assistance. The size depends on household income and housing costs, but is by design always higher than the social assistance benefit.

Early retirement, survivor's and disability pension

It is possible to retire at the age of 61 but the loss is twofold for the individual. First, the benefit is based on lifetime contributions, which implies that all years with earnings will increase the benefit. Second, the level of the benefit is calculated using the cohort-specific life expectancy at the date of retirement. Hence, leaving early implies both a lower acquired pension capital and a longer period of payment, a higher annuity divisor, and therefore the annual benefit will be lower compared with a later retirement age. Regardless of the flexibility in the reformed pension system there is a strong tendency to claim public pension at age 65, which was the statutory retirement age in the old system. However, as has been pointed out earlier, to claim a pension is not the same as leaving the labour force. In 2016 the average age for the first public pension payment was 64.5 years, which is unchanged since

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[6] Income indexation is assumed from the end of the medium-term projection period 2020 for all transfers and taxes regardless if legislation states otherwise.

[7] The price base amount 2017 is SEK 44 800 or some 4 730 €. It is indexed to the change of the consumer price index.

[8] BTP amounts to a maximum of 93% of housing costs up to SEK 5 090 a month (540 €) in 2017. The average payment was SEK 2 400 a month (255 €).

2013 and has varied very little the last 15 years.[9] On the other hand, the average age for withdrawal from the labour market, which shows a clearly increasing trend since the mid-1990s, was estimated at 63.9 years in 2016 (see graph1).

Graph 1 – Average exit age from the labour market
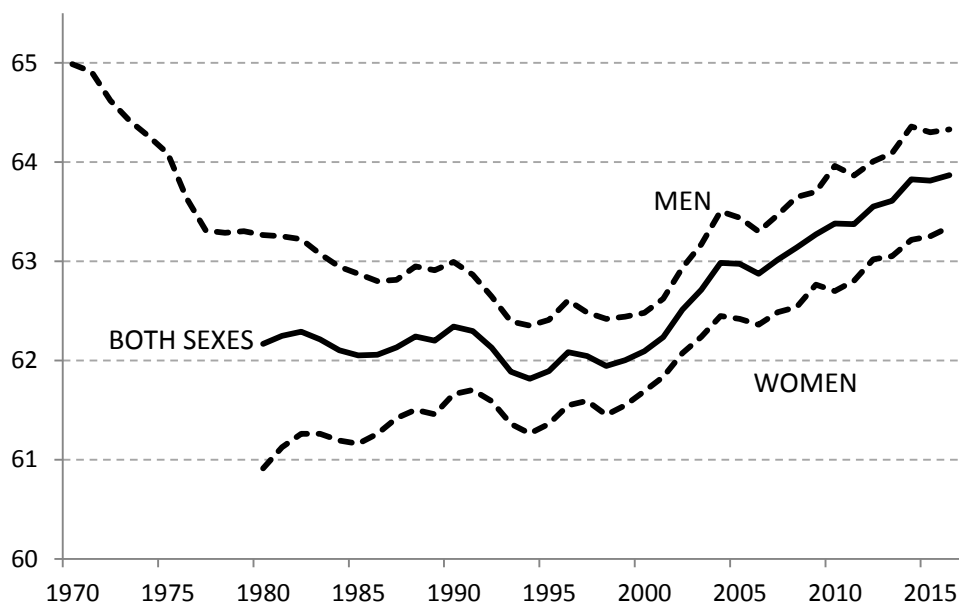
Source: Calculations made from the labour market survey by the National Pension Authority

The reformed pension system is individual-based. The previous widow's pension (women only) has been replaced by a new, temporary and gender-neutral, so-called adjustment allowance. However, due to the long phase out period, widow's pensions will continue to be paid out for several decades. In the reformed system, a survivor will receive an adjustment allowance for 12 months as a standard, but the payments continue if the survivor has children younger than 12 years. The size of the adjustment allowance, as well as the widow's pension, is based on the deceased's earnings.

Disability benefits, which are equivalent to disability pensions in most European countries, are formally a part of the sickness insurance scheme. Individuals with disability benefits continue to accumulate pension entitlements in the public pension system. The pension contributions are paid by the central government budget. Public old-age pension benefits for disabled persons are based on lifetime earnings, just as for everyone else.[10]

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[9] The average pension age for persons working at age 50 including disability pensioners. Source: The Swedish Pensions Agency.

[10] Disability pensioners receive extra pension rights based on a calculated wage they should have had if they had worked. Survivors and disability pensions are income indexed in the calculations.

Occupational pensions

Most employees in the public and the private sector, some 95 per cent of all female and 93 per cent of all male employees, are covered by semi-mandatory occupational pension schemes based on collective agreements between the unions and the employers' confederations. These occupational pension schemes, financed through employers' contributions, provide a supplement to the public system, and a top-up for incomes above the public pension system ceiling. Thus, these schemes are more important for high-income earners. There are four major occupational plans: blue-collar workers in the private sector, white-collar workers in the private sector, central government employees and local government employees.[11]

Private individual pensions

Mandatory private premium pension
The second part of the public system is a mandatory fully funded defined-contribution part, the *Premium pension*. The system is administered by the state and financed by a contribution rate of 2.5% of pensionable earnings, following the same transition rules as the PAYG system. In the National Accounts, however, this system is a part of household savings.[12] Individuals can choose from several hundred funds when investing their capital. A government run default fund caters for people who do not make an active choice. The individual mutual funds earn a market rate of return. At retirement, at any age from 61 years, individuals can choose a fixed or variable annuity, in part or in full. It is possible to include a survivor's protection component for this part of the public system which will give a partner the right to accumulated funds. In this case the pension will be lowered to reflect the expected longer payment period.

Voluntary private pensions
Until 2016 it was possible to make tax-deductions for private pension saving. The maximum yearly deduction allowed was SEK 12 000 (EUR 1 280). In 2011 approximately 38 per cent of the population in ages 20-64 years made tax-deductions for private pension savings, on average SEK 5 600 (EUR 600) and in total SEK 11 400 billion (EUR 1 120 billion).For self-employed not eligible for occupational pension plans deductions are still allowed. The maximum yearly deduction allowed for self-employed is 12 000 SEK plus 35 percent of business income not exceeding 10 PBAs.

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[11] The occupational systems have been renegotiated to harmonize with the reformed public pension system, towards more defined contribution and less defined benefit. There are long transitional periods. The calculations only cover negotiated pensions paid out as a supplement to public pensions, and no other negotiated cessation compensation, etc. paid out before the age of 65.
[12] The reclassification to the private sector in 2007 reduced general government net lending by approximately 1 percent of GDP.

Tax status

Old-age (including guarantee pension), disability and survivors pension, are subject to income tax (but not payroll taxes). The means-tested basic security allowances (BTP, SBTP and ÄFS) are tax-free. Private tax-deductible pension savings, as well as funded occupational pensions are taxed ETT (contributions Exempt, returns Taxed, benefits Taxed). The mandatory premium pension is taxed EET.

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

Old-age pensions

There have been no major reforms of the old age pension system since 2003, only minor modifications in the formula for the calculation of the balancing index. Triggered by the 2008 financial crisis it was decided to smooth the value of the buffer funds in the formula to make the balancing index fluctuate less. From 2017 the smoothing of the income index has been removed. At the same time the calculation of the balance ratio was simplified.[13] These changes only affect the system in the short run.

Many aspects of the Swedish pension system are currently being considered, but no concrete reforms have been proposed to Parliament so far. A recent government inquiry, The Pension Age Committee, made several proposals on pension-related age limits and ways to promote a longer working life.[14] The committee proposed that the earliest age of retirement, 61 years, and the earliest age for guarantee pension, 65 years, should both be indexed to the expected life length at 65 years. It also proposed a non-binding indicative age for retirement that should increase in the same way.

Another aspect of the pension system that is being discussed is the complexity of the Premium pension system and the number of funds for investment in this system. The last few years there have been examples of aggressive telephone promotion of certain funds with high administrative fees. There have also been cases of financial transactions in funds which have led to a poor result for the fund holders, and even to criminal investigations. Another possible problem is that relatively few people bother to make an active choice of funds.

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[13] For more information about the automatic balancing mechanism, see annex 2.

[14] SOU 2013:25, see http://www.regeringen.se/sb/d/16827/a/214148. The report is in Swedish but contains a summary in English (page 39-56).

Disability pension

The disability pension system has recently been reviewed to control costs. The changes primarily entail stricter eligibility conditions that require a permanent reduction of the ability to work, thus reducing the inflow of retirees. Already granted benefits remain the same, except for the temporary disability pension that has been abolished. For individuals who receive a disability pension the same rules as previously apply.

Private tax-deductible pension savings

The tax-deductibility of private voluntary pension savings was abolished in 2016 for all but the self-employed. In the calculations, there are no new contributions after 2016, but pension payments will be substantial for several decades.

Other reforms affecting pensioners

A number of reforms have been introduced the last few years to improve income and stimulate work among people who are 65 years and older. A special tax deduction for this age-group was introduced in 2009, and then increased in several steps.[15] In addition, the Earned Income Tax Credit (EITC) that was introduced in 2007 makes work pay better for everyone, but especially pensioners. For those who are 65 years and older, the EITC is approximately doubled, giving a strong incentive to prolong working lives. Social contributions (31.42% of earnings in 2013) have been reduced for individuals who are 65 years and older, so that they only pay the old age pension contribution (10.21% of their earnings).

1.3 Description of the "constant policy" assumptions used in the projection

All types of pensions, benefits and thresholds in the pension and tax systems are income indexed from 2021 in the calculations, regardless if legislation states otherwise (e.g. guarantee pension, BTP, SBPT and ÄFS are price indexed by law).[16]

There is a pension group in parliament with representatives from a broad majority of parties which is responsible for the maintenance of the pension reform. Any change in the reformed system requires consensus in this group. This means that it is easier for the government to help low-income pensioners outside the pension system. Hence, the price indexation of the guarantee pension has not been changed since the system was implemented in 2003. Instead, the enhanced basic tax deduction and the BTP, which are outside the pension agreement, have been made more generous to

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[15] The SESIM model has been updated with the tax reforms until 2016.
[16] By law some thresholds in these systems are not indexed at all.

compensate for the indexation only to prices. The income indexation of the minimum pension in the AWG calculations might therefore be too cautious, while a price indexation probably would be too restrictive.

2   An overview of the Demographic and labour forces projections

Demographic development

The Swedish population is expected to increase rapidly from nearly 10 million in 2016 to almost 14 million in 2070 in the latest Eurostat projection, or by a bit more than 40 percent, see graph 2 and table 3. This is a somewhat more rapid increase than in the previous Eurostat population forecast.

Graph 2 – Total population, Index 2015=100
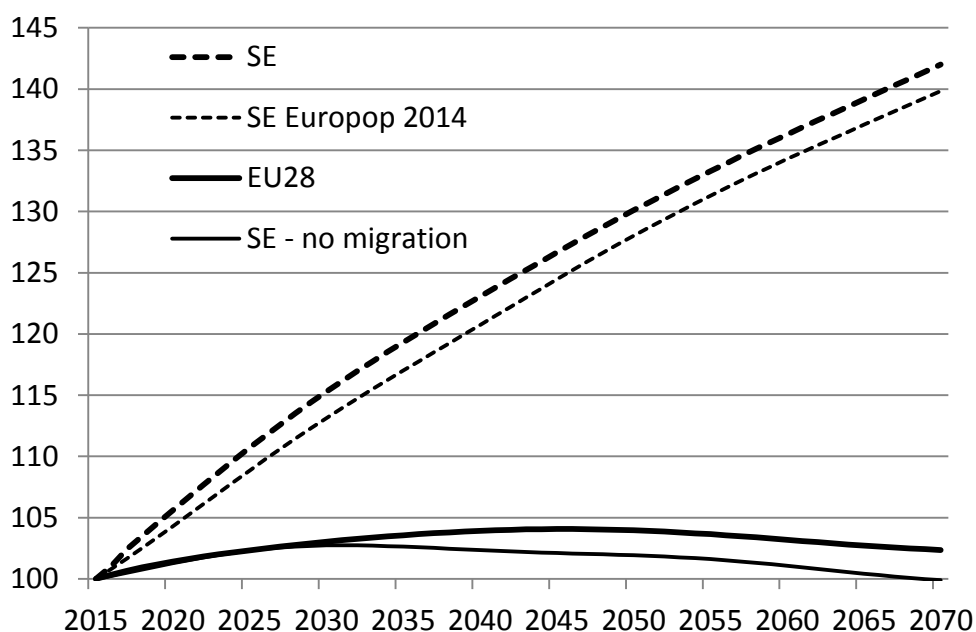
The population increase is mainly driven by a strong positive net migration. In a scenario with zero net migration, Eurostat predicts that the Swedish population would continue to grow until around 2030, but at a much slower rate, and then decline so that the number of people in Sweden would be more or less unchanged in 2070 compared to 2015.

Life expectancy at birth is expected to increase by some 6 years for both sexes from 2016 to 2070, from 80.6 years for men and 84.3 years for women, to 86.7 and 90.3 years respectively. The bulk of the increase in life expectancy occurs above the age of 65. Life expectancy for 65-year-

olds, which determines the pension benefit for people who decides to retire at that age, increases by 4.6 years for men and 4.9 years for women.

Strong immigration and rapid population growth make the old-age dependency ratio increase at a relatively slow rate compared to many other member states. Nevertheless, the number of people 65 years and older per 100 persons in the ages 15 to 64 years old increases from 31.6 in 2016 to 43.2 in 2070.

In table 3, 2070 is the peak year for the old age dependency ratio, but most likely this ratio will continue to rise, indicating continued cost increases in the years after 2070. In comparison with most other member states, however, the development in Sweden is relatively benign (see graph 3). Whereas Sweden has the fourth highest dependency burden in the union in 2015, it is projected to have the second to lightest burden in 2070. This means that Sweden will have the smallest increase in the dependency burden of all member states. The difference between the latest Eurostat population forecast and the previous one is small, with slightly fewer old people in relation to the population in active ages in the near future in the new projection, and a marginally older population in the long run.

Table 3 – Main demographic variables evolution								
	2016	2020	2030	2040	2050	2060	2070	Peak year*
Population (thousand)	9 916	10 344	11 278	12 030	12 713	13 313	13 870	2070
Population growth rate	1,2	1,0	0,7	0,6	0,5	0,4	0,4	2016
Old-age dependency ratio (pop65/pop15-64)	31,6	32,6	34,9	37,0	38,1	42,7	43,2	2070
Ageing of the aged (pop80+/pop65+)	25,7	26,1	33,9	34,1	37,5	36,8	40,5	2070
Life expectancy at birth, Men	80,6	81,1	82,3	83,5	84,6	85,7	86,7	2070
Life expectancy at 65, Men	19,0	19,4	20,3	21,2	22,0	22,8	23,6	2070
Life expectancy at birth, Women	84,3	84,8	86,1	87,2	88,3	89,4	90,3	2070
Life expectancy at 65, Women	21,7	22,1	23,1	24,0	24,9	25,8	26,6	2070
Survivor rate at 65+, Men	89,8	90,3	91,6	92,6	93,6	94,4	95,1	2070
Survivor rate at 80+, Men	63,7	65,4	69,4	73,0	76,3	79,2	81,8	2070
Survivor rate at 65+, Women	93,3	93,6	94,5	95,3	95,9	96,4	96,9	2070
Survivor rate at 80+, Women	74,8	76,2	79,6	82,5	85,0	87,2	89,1	2070
Net migration	103,5	67,9	57,2	44,7	30,5	27,4	24,4	2016
Net migration over population change	0,9	0,7	0,7	0,6	0,5	0,5	0,4	2016

Graph 3 – The number of persons who are 65 years and older per 100 persons in ages 20–64 years
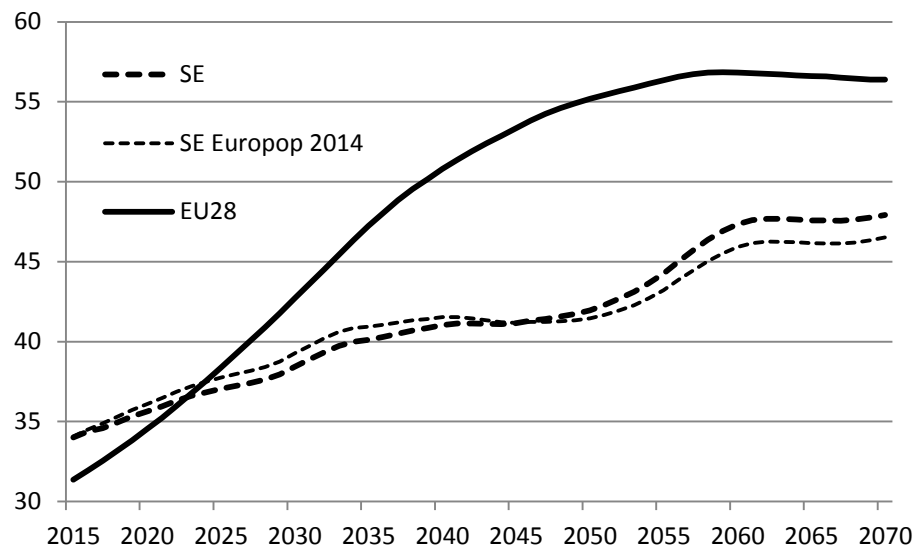
Source: Eurostat

The Age structure (not a pyramid any longer) in graph 4 illustrates the increase of the population 65 years and older. While some 5.1 percent of the population was 80 years or older in 2016, and some 19.6 percent 65 years and older, the same numbers are 10.0 percent and 24.9 percent in 2070. The share of the population in ages 20–64 years falls from 57.5 percent to 52.0 percent in the same period.

Graph 4: Age structure comparison: 2016 vs 2070

Population by age and sex as a share of total population

Males

Age groups

Females
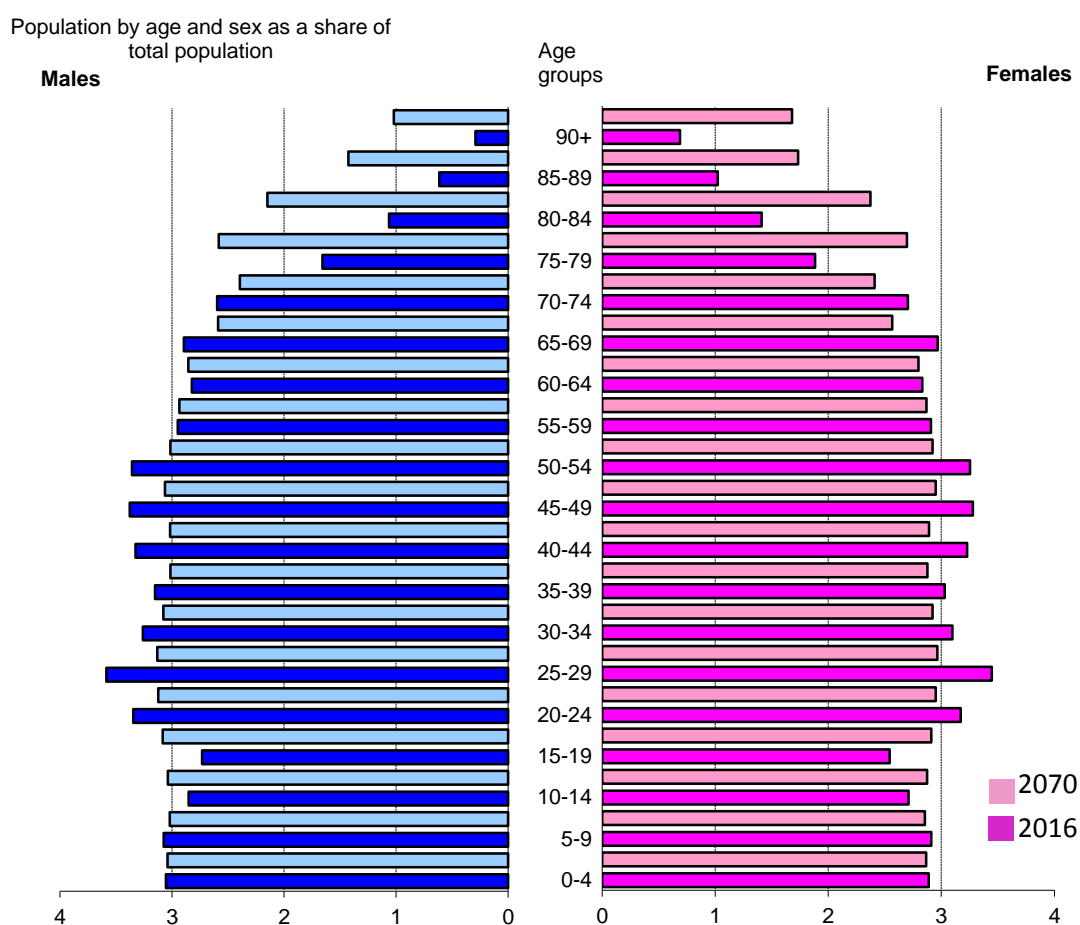
The labour force

Table 4 shows the change in participation and employment rates in the age groups, 55 to 74 years. There is no statutory retirement age in the Swedish pension system, and existing financial incentives, the fact that the benefit is reduced as life expectancy at the time of retirement increases, is assumed to have no effect on the labour supply in the calculations. Hence, according to the Cohort Simulation Model, the average participation and employment rates for the period 2016–2070 are more or less the same as the rates in 2016. Even if there is no clear trend, there are small fluctuations, so that the peak year for the older workers, ages 65-74 years, will occur in the mid-2050s.

The Cohort Simulation Model does not take origin into account, so all people coming to Sweden immediately acquires average age- and sex specific probabilities of joining the labour force and being employed. This means that the labour supply in the projections most probably is over estimated, as immigrants coming to Sweden will need some time to enter into the labour market, and on average work fewer hours than

people born in Sweden even after several years in the country. A high positive net migration will also mean that there will be more people entering the Swedish labour force at a more advanced age, which will shorten the average career length. This effect will be even bigger as immigrants are more likely to leave Sweden than people born here.

The fact that the age of retirement and exit from the labour market is assumed unchanged is reflected in tables 5a and 5b. The average effective exit ages falls somewhat between 2017 and 2020 and are unchanged in the period thereafter. The share of adult life spent in retirement increases steadily and will be above one third on average in 2070.

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	79,9	78,5	77,2	77,8	78,0	77,7	77,7	2016
Employment rate for workers aged 55-64	75,7	75,0	73,9	74,6	74,8	74,5	74,5	2017
Share of workers aged 55-64 on the labour force 55-64	94,7	95,6	95,8	95,8	95,8	95,8	95,9	2067
Labour force participation rate 65-74	16,0	16,1	17,4	16,7	17,1	16,9	16,9	2056
Employment rate for workers aged 65-74	15,7	15,8	17,1	16,4	16,8	16,6	16,6	2056
Share of workers aged 65-74 on the labour force 65-74	98,0	98,2	98,3	98,3	98,3	98,3	98,3	2067
Median age of the labour force	41,0	40,0	40,0	41,0	40,0	40,0	41,0	2016

The projected contributory period is shortened by a bit more than a year for men, while it increases by some 3.5 years for women. This is explained by the historic increase in the participation rate for women, i.e. that females that entered the labour market 1960'ies and 1970'ies have a shorter contributory period on average, and by more primarily male immigrants which will have shorter the average careers. In addition, the phasing in of the reformed NDC pension system, where periods outside the labour market, i.e. unemployment, parental-leave, generates pension rights, contributes to an increase.

The assumption of an unchanged retirement age in combination with the expected increase in the longevity will make the duration of the retirement increase with approx. 4.4 years for men and 5.7 years for women between 2017 and 2070. This means that the annuity divisor in the NDC and other actuarial parts of the pension system will increase, and that the yearly pension payments will be correspondingly lower. As pension payments from the NDC system does not keep up with growth, an increasing share of the retired population will receive guarantee pension.

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

	2017	2020	2030	2040	2050	2060	2070	Peak year
Average effective exit age (CSM) (II)	65,9	65,6	65,6	65,6	65,6	65,6	65,6	2017
Contributory period	41,1	41,0	40,0	36,7	38,8	38,3	39,9	2021
Duration of retirement	18,3	18,6	19,5	20,3	21,1	21,9	22,7	2070
Duration of retirement/contributory period	0,4	0,5	0,5	0,6	0,5	0,6	0,6	2044
Percentage of adult life spent in retirement	27,6	28,1	29,0	29,9	30,7	31,5	32,3	2070
Early/late exit	1,9	2,0	2,0	1,7	2,0	1,6	1,7	2016

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

	2017	2020	2030	2040	2050	2060	2070	Peak year
Average effective exit age (CSM) (II)	64,7	64,4	64,4	64,4	64,4	64,4	64,4	2017
Contributory period	39,1	39,9	39,8	37,5	40,4	40,0	41,5	2064
Duration of retirement	21,8	23,0	24,0	24,9	25,8	26,7	27,5	2070
Duration of retirement/contributory period	0,6	0,6	0,6	0,7	0,6	0,7	0,7	2047
Percentage of adult life spent in retirement	31,8	33,1	34,1	34,9	35,7	36,5	37,2	2070
Early/late exit	3,3	2,8	3,0	2,6	3,0	2,4	2,3	2017

Even if participation rates are unchanged, Sweden is doing well in comparison with the EU average, see graph 5. The average employment rate in the population in ages 15–74 years is expected to be higher than the EU-average even in 2070.

Graph 5 – Average employment rate in population 15–74 years
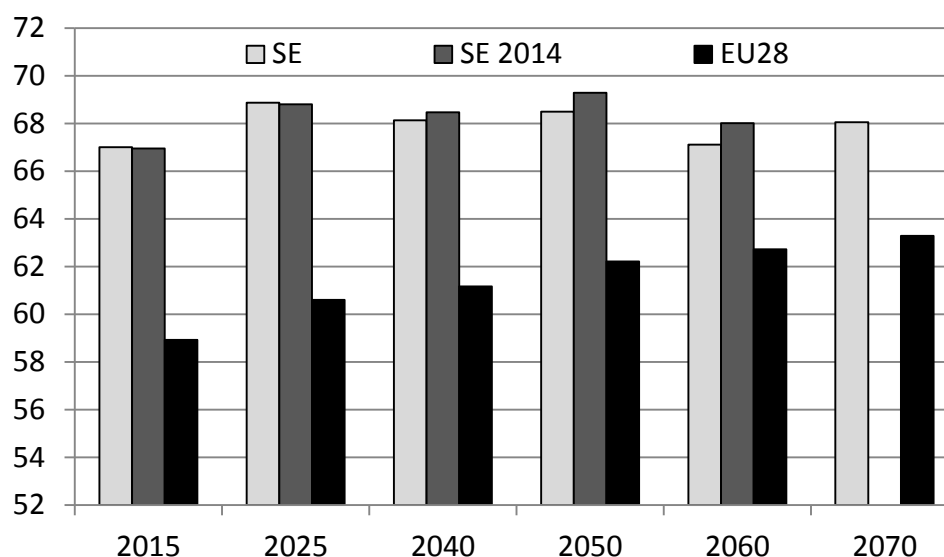
The number of employed people is set to increase at a more rapid rate in the short run, compared to the previous calculation, and grow by some 10 per cent till 2025 compared to 2030 the last time. In the long run differences even out and in 2050 the number of employed people is roughly 25 per cent higher than in 2015 in both calculations.

Graph 6 – Employment, 15–74 years
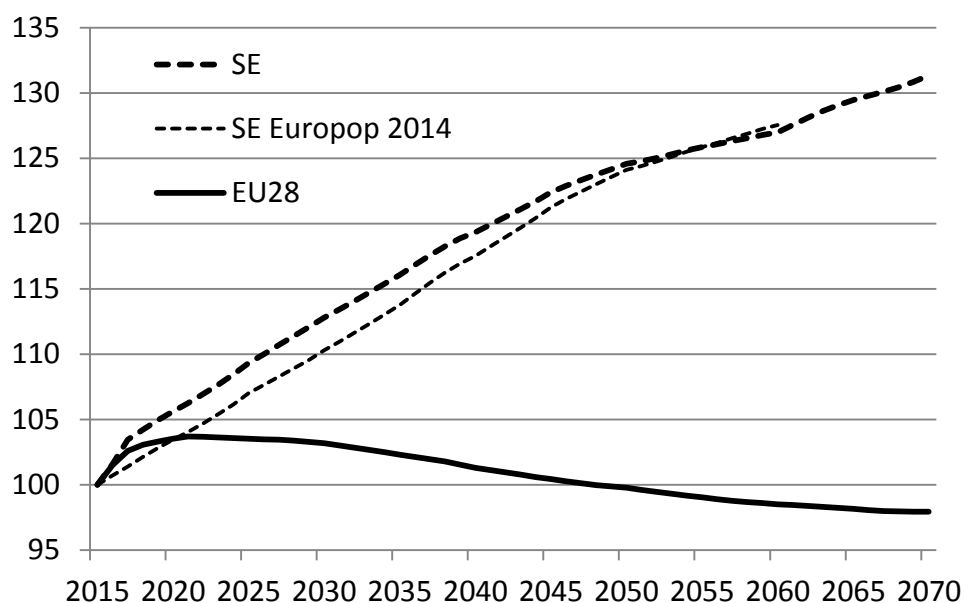
3   Pension projection results

3.1   Extent of the coverage of the pension schemes in the projections
The projections include the public income pension and the means
tested guarantee pension, as well as disability and survivor's pensions.
The calculations also include occupational and private pension
schemes. Also *Housing supplement for pensioners* and other means
tested transfers for pensioners are included.[17] Apart from the
population living in Sweden, the calculations cover individuals with
Swedish pension rights living abroad.

There are minor differences between the ESSPROS data presented by
Eurostat and the data used by AWG, see table 6. First, there is a small
difference between the ESSPROS data presented by Eurostat and Statistics
Sweden. Second, there are definition differences between the ESSPROS
numbers from Statistics Sweden and the data used in the AWG
calculations, see table 6. The AWG numbers exclude the work injury
benefit and some minor benefits for handicapped, but include the housing
supplement for the elderly and disabled. The excluded and included items
are of the same magnitude, and the GDP-ratio for the public expenditures
remains approximately the same.

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[17] In ESSPROS the housing subsidy is seen as a benefit in kind (function 7, housing), but in
practise it is closely integrated with the pension system. The benefit is not a part in any other
item in the projection.

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	10,9	11,1	12,2	11,3	11,1	11,6	11,9	11,5
2 Eurostat public pension expenditure	8,7	8,8	9,6	8,8	8,3	8,6	8,8	8,5
3 Public pension expenditure (AWG)	8,8	8,9	9,7	8,9	8,4	8,7	8,9	8,5
4 Difference (2) - (3)	-0,1	-0,1	-0,1	-0,1	-0,1	-0,1	-0,1	-0,1
5 Expenditure categories not considered in the AWG projections								
5.1 Work injury benefit	-0,2	-0,2	-0,2	-0,1	-0,1	-0,1	-0,1	-0,1
5.2 Economic integration of the handicapped and Care allowance	-0,2	-0,1	-0,1	-0,1	-0,1	-0,1	-0,1	-0,1
6 Expenditure categories considered in the AWG projections, but not a cash benefits in ESSPROS								
6.1 Housing supplement for elderly	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2

Source: *Eurostat, Statistics Sweden and Ministry of Finance*

3.2 Overview of the projection results

Projected gross public pension spending as a percentage of GDP will end up at 7.0 % in 2070 in the baseline scenario, a decrease of 1.2 percentage points compared to the starting year 2016. The decrease of the public pensions is mainly explained by the demographic and macro developments. To some extent, the growing importance of the premium pension (which statistically speaking is a private mandatory system) strengthens this development. This system will mature gradually and grow in importance until 2070, and thus the private part of total pension expenditure will increase. Other factors that hold back public sector expenditure is the phasing out of the widows pension and a relatively small inflow into disability pension.

The importance of occupational pensions will grow until approx. 2040. A higher coverage will result in a higher expenditure to GDP ratio until approximately 2030, mainly because of the increase in female participation rate until 1995, and re-negotiations of occupational pension plans which widens their eligibility. The share will peak around 2040. After this, the effect of the ageing population in combination with an assumed fixed retirement age will lead to a decreasing share. The importance of the occupational and private individual schemes is amplified by the fact that they are mainly DC, and that the interest rate is assumed to exceed income growth, leading to higher pensions compared to PAYG systems, given the same contribution rate.

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

Expenditure	2016	2020	2030	2040	2050	2060	2070	Peak year*

Gross public pension expenditure	8,2	7,6	7,2	6,8	6,6	7,0	7,0	2016
Private occupational pensions	1,9	2,1	2,6	2,7	2,4	2,3	2,1	2036
Private individual pensions	0,6	0,7	0,9	1,1	1,2	1,3	1,2	2058
Mandatory private	0,1	0,2	0,6	1,0	1,2	1,2	1,2	2059
Non-mandatory private	0,5	0,5	0,3	0,1	0,1	0,0	0,0	2016
Gross total pension expenditure	10,7	10,4	10,7	10,6	10,2	10,5	10,2	2033
Net public pension expenditure	6,3	5,8	5,5	5,2	5,1	5,5	5,5	2016
Net total pension expenditure	8,2	7,9	8,1	8,2	8,0	8,3	8,1	2059
Contributions	2016	2020	2030	2040	2050	2060	:	Peak year*
Public pension contributions	5,9	5,8	5,7	5,7	5,7	5,7	5,7	2016
Total pension contributions	7,9	7,8	7,7	7,6	7,6	7,5	7,6	2016

Source: Commission Services

The development of the private individual pensions depends on two offsetting factors. Mandatory private premium pensions will increase from zero in 2003 to 1.2 per cent of GDP in 2060, as the system is maturing. On the other hand, non-mandatory private pensions will gradually fade out due to the abolition of tax deductibility in 2016 for wage earners. Consequently, most people are expected to stop saving in the system. However, a small part will remain in the system as contributions from self-employed still will be tax deductible.

Pensions are taxed in the same way as other income in Sweden. Thus, it is not possible to link taxes to different pension schemes. The downward trend of tax revenues from public pensions (1.9% of GDP in 2016 versus 1.4% of GDP in 2070), is mainly explained by the fall in gross pensions. The average implicit tax rate for pensioners will decrease somewhat until 2070, as lower replacement rates will result in lower marginal taxes.

The earnings–related pensions will decrease until approx. 2050 due to the ageing effect, see table 8. The fall in the earnings–related pension ratio is mitigated by the gradual transition from the old DB system to the NDC system. In the old DB system the effect of the growing female labour participation had a larger impact on pensions, as the benefits in the old system depend on the 15 best out of 30 years, and not on the whole career as in the reformed NDC system.

The minimum top-up guarantee pension (including the housing supplement) will grow from 0.5 percent to 1.4 of GDP in 2070, as a result of decreasing replacement rates from earnings-related pensions, which in turn is the consequence of longevity increasing more than the retirement age. Note that the guarantee pension is indexed with average earnings from 2021, despite being price indexed in the legislation. The indexation rules of the guarantee pension have not been changed since the system was introduced in 2003. The income indexation from 2021 might therefore be too cautious.

Pension scheme	2016	2020	2030	2040	2050	2060	2070	Peak year *
Table 8 - Projected gross public pension spending by scheme (% of GDP)								
Total public pensions	8,2	7,6	7,2	6,8	6,6	7,0	7,0	2016
of which								
Old age and early pensions:	6,9	6,7	6,3	6,0	5,8	6,3	6,3	2016
Earnings related	6,4	6,2	5,7	5,2	4,8	5,0	4,9	2017
Minimum pensions (non-contributory) i.e. minimum income guarantee for people above 65	0,5	0,5	0,6	0,7	1,0	1,2	1,4	2070
Disability pensions	0,95	0,77	0,77	0,75	0,75	0,67	0,66	2016
Survivor pensions	0,29	0,24	0,12	0,05	0,03	0,03	0,03	2016

Source: Commission Services

Note: The peak year is the year in which the particular variable reaches its maximum over the projection period 2016 to 2070.

The number of individuals with a disability pension started to increase sharply in 2003. After a peak of nearly 556 000 individuals in the spring of 2007, the yearly average went down to 368 000 in 2013 because of both higher outflow and lower inflow, i.e. a reduction of 1/3 from the peak. Disability pension continue to decrease in the projections, which is in line with recent forecasts from the Swedish Social Insurance Agency.[18] In the calculations, a prudent approach has been chosen, as the low inflow might not be sustainable. Therefore, the inflow to disability pension is aligned to outcome and recent budget forecasts. For the years 2018-2024 the probability of inflow (as a share of the population at risk) is assumed to revert gradually to the average for the period 2008-2018. The risk to be disabled is then kept constant for the rest of the projection period, resulting in a decrease in the number of disability pensioners with 8.7% between 2016 and 2070.[19]

The widow's pension is being phased out and replaced by a new, temporary and gender-neutral adjustment allowance. Even if the widow's pension only affects couples which were married or had common children before 1989, benefits will continue to be paid out for several decades. In the end of the projection period, only the relatively small temporary adjustment allowance remains, which is paid out for 12 month to surviving spouses younger than 65, mainly to families with children.

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[18] The age limit 64 years remains unchanged throughout the projection period.
[19] The disability pension is sensitive to the inflow into the system and the choice of reference period.

3.3 Description of the main driving forces

To explain the development of the ratio of pensions to GDP, this ratio is decomposed into its main driving factors.[20] The demographic change in the dependency ratio contributes to an increase of the public pension expenditures. The increase is higher at the beginning of the projection, but remains positive until 2070. The continued rise of the *dependency ratio* is due to increased longevity, but mitigated by the fact that net migration and fertility rates are positive, which make the working age population continue to grow during the entire projection period.

	2016-20	2020-30	2030-40	2040-50	2050-60	2060-70	2016-70	Average annual change
Table 9a - Factors behind the change in public pension expenditures between 2016 and 2070 (in percentage points of GDP) - pensions								
Public pensions to GDP	-0,5	-0,5	-0,4	-0,2	0,4	0,0	-1,2	-0,023
Dependency ratio effect	0,3	0,6	0,4	0,2	0,8	0,1	2,4	4,4%
Coverage ratio effect	-0,3	0,4	0,3	0,5	0,3	0,3	1,7	2,5%
*Coverage ratio old-age**	-0,1	0,5	0,5	0,6	0,5	0,3	2,2	3,5%
*Coverage ratio early-age**	-1,0	-0,1	-0,5	0,0	0,0	0,0	-1,6	-3,5%
*Cohort effect**	-0,2	-0,7	-0,4	0,1	-1,0	0,2	-2,0	-3,8%
Benefit ratio effect	-0,4	-1,4	-1,1	-0,9	-0,7	-0,5	-4,9	-8,8%
Labour Market/Labour intensity effect	-0,1	0,0	0,0	0,0	-0,1	0,1	-0,1	-0,3%
Employment ratio effect	-0,1	0,0	0,0	0,0	0,0	0,0	-0,1	-0,3%
Labour intensity effect	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0%
Career shift effect	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0%
Residual	0,0	-0,1	-0,1	0,0	0,0	0,0	-0,2	-0,1%

Source: Commission Services

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

The *coverage ratio effects* are different in tables 9a and 9b, as the number of pensions (tab 9a) is much higher than the number of pensioners (9b). The increase in the coverage ratio old-age is due to high migration, which will result in more cross-border pensioners, often with shorter than average contribution periods. The decreasing coverage ratio in early ages is the result of fewer disability pensioners in ages 50-64.

The *employment ratio effect* and especially the *benefit ratio effects* act as offsetting factors on the demography. Several factors contribute to the fall

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[20] See Annex 3 for definitions and technical details about the decomposition.

in the *benefit ratio*. The reformed NDC income pension system works on an actuarial basis. At the time of retirement an annuity is calculated by dividing the individual's account value by a divisor reflecting unisex life expectancy at the specific date of retirement, thus offsetting the effect of the increased longevity. Another important factor is the reclassification of the premium pension from the government to the private sector, which leads to a lower public but a higher private benefit ratio. In addition, the phasing out of the widow's pension also contributes.

Table 9b - Factors behind the change in public pension expenditures between 2016 and 2070 (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	-0,5	-0,5	-0,4	-0,2	0,4	0,0	-1,2	-0,023
Dependency ratio effect	0,3	0,6	0,4	0,2	0,8	0,1	2,4	4,4%
Coverage ratio effect	-0,1	0,1	0,0	0,2	0,2	0,3	0,6	1,1%
*Coverage ratio old-age**	0,1	0,2	0,1	0,3	0,3	0,3	1,3	2,3%
*Coverage ratio early-age**	-1,0	-0,1	-0,5	0,0	0,0	0,0	-1,6	-3,4%
*Cohort effect**	-0,2	-0,7	-0,4	0,1	-1,0	0,2	-2,0	-3,8%
Benefit ratio effect	-0,6	-1,1	-0,7	-0,6	-0,5	-0,4	-4,0	-7,4%
Labour Market/Labour intensity effect	-0,1	0,0	0,0	0,0	-0,1	0,1	-0,1	-0,3%
Employment ratio effect	-0,1	0,0	0,0	0,0	0,0	0,0	-0,1	-0,3%
Labour intensity effect	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0%
Career shift effect	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0%
Residual	0,0	0,0	0,0	0,0	0,0	0,0	-0,1	-0,1%

Source: Commission Services

Note: 'Average pension' = public pension expenditure divided by the number of pensioners

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Evolution of the benefit and the replacement and ratios
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The evolution of the benefit ratio (BR) and the replacement rate (RR), i.e. the first pension of those who retire a given year over an economy wide average wage, is reported in Table 10.[21] The RR and BR from the public pensions will decrease. The assumption of an unchanged effective retirement age in combination with the expected increase in the longevity will make the duration of the retirement increase with approx. 4 years for

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[21] The replacement rate (RR) is defined as the first pension of retirees a given year compared to the economy-wide average wage for individual's aged 60 64 years the same year. Only domestic pensioners are counted in the RR, but all in the BR.

men and 5 years for women until 2070. This means that the annuity divisors used in the NDC, but also in other actuarial parts of the pension system, will increase and the yearly pension payments will be correspondingly lower. If the conservative assumption of a fixed pension age is dropped, and people will work longer when life expectancy at 65 increases, the fall in BR and RR will be mitigated or eliminated.

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)	38,6	36,2	31,2	28,0	25,4	23,5	22,1
Public scheme (RR)	34,3	33,4	33,0	31,3	30,6	28,5	27,6
Coverage	100,0	100,0	100,0	100,0	100,0	100,0	100,0
Public scheme old-age earnings related (BR)	35,6	33,7	27,9	23,9	20,7	18,6	17,0
Public scheme old-age earnings related (RR)	32,6	32,6	29,2	24,8	23,8	22,3	22,3
Coverage	84,7	87,4	89,3	90,0	90,2	91,4	91,5
Private occupational scheme (BR)	12,1	12,8	14,6	13,7	11,1	8,8	7,7
Private occupational scheme (RR)	18,5	19,1	19,8	15,9	14,2	12,0	12,8
Coverage	73,9	76,0	78,8	81,7	84,6	86,9	86,4
Private individual scheme (BR)	0,9	1,4	2,9	4,5	5,0	4,6	4,1
Private individual scheme (RR)	6,3	6,5	6,9	6,4	5,5	4,7	4,6
Coverage	62,6	73,3	85,2	88,4	89,6	91,2	91,5
Total (BR)	50,5	49,1	46,5	43,8	39,5	35,4	32,6
Total (RR)	40,3	40,4	41,2	37,9	36,6	34,0	33,0

Source: Commission Services

Note: The coverage is calculated as the ratio of the total number of pensioners within the scheme, and the total number of pensioners (including disability and survivors) in the country.

As the old DB system is being phased out and replaced by the NDC part of the reformed system, the public RR will decrease significantly. This is counter-acted by an increase in the second part of the reformed system, the privately classified premium pension. Still, the BR and the RR will decrease significantly over the projection period. The fast decrease till 2020 is also explained by that the old ATP-system was more generous. The reform of the NDC system and the decision on the contribution rate aimed at keeping the RR of the old DB system. However, the increase in the longevity was underestimated, resulting in a somewhat lower RR than expected. Individuals born after 1953 receive all pensions from the reformed system, and thus, the last people in the old system will retire around 2020.

There is a discrepancy between the development of the BR and the RR. The public BR is higher than the RR in 2016 but this relation will be reversed

around 2030, due to the quicker fall in the BR. There are several explanations for this development. One is that the benefit ratio is more affected by the increasing time in retirement due to the frontloading mechanism. That means that the BR, which is the average of all pensions, will have a smoother development than the RR that only reflects the first pension.

On aggregate pensions are indexed with average earnings. However, for the individual the replacement rate from the public income pension will become lower when the individual grows older, as payments from the NDC system are frontloaded, i.e. the pensioner receive a share of the real economic growth in advance. Technically this is achieved by calculating the annuity factor with a 1.6 per cent discount factor, resulting in a higher initial benefit than a simple application of the actuarial principles would give. The indexation is then reduced during the pay-out time by subtracting 1.6 per cent from the yearly income indexation, see annex 2 for details.

The calculations include pensions to individuals with a Swedish pension living abroad. Many emigrants have only spent a part of their career in Sweden, and their benefits are thus relatively lower. Migrants often move in and out of Sweden several times. Therefore, the number of pensioners with earnings-related pension (but not the expenditure) is over-estimated. Hence, only domestic pensioners are counted when calculating the RR from public earnings-related pensions. If pensioners with Swedish pension living abroad were included, the RR would be lower than the numbers presented in table 10. It is not possible to quantify this effect exactly but a rough estimate indicates the interval of 2-4 percentage points.

In addition, the replacement rate from occupational pensions is expected to decrease in the future, due to both higher longevity and the growing importance of funded defined contribution components. In the calculations, only occupational pensions to individuals who receive public pension are considered. Thus, different types of early retirement option programs in collective agreements, i.e. supplements to the disability pensions, etc. are not included.

Sometimes a part of the occupational and the private voluntary DC-pensions is paid out during a fixed time period, usually the first five years of retirement, resulting in a higher average RR at the time of retirement and a shift down after 5 years.

The development of the BR and the RR for private pensioners depends on two offsetting factors. The mandatory private premium pension will increase rapidly as the system is maturing. As the premium pension is funded and earns a market rate of return, that is assumed to be higher than the income growth, the effect of increasing longevity is mitigated. On the other hand, the replacement rate for private voluntary pensions will decrease close to zero due to the abolished tax-deductions for private pension savings for wage earners. The effect of the latter will be higher on the RR than the BR as most recipients choose to get their saving paid out during a limited time-period, normally 5-years. After this period, the RR will be substantially lower but the BR essentially unchanged. These two offsetting factors also explain the increase in the coverage ratio for private individual pensions, from 63% to 93%. At the same time as fewer pensioners will get voluntary private pension, more retired will get a premium pension, as the latter system is mandatory and covers all taxpayers in Sweden.

System dependency ratio

Table 11 – System Dependency Ratio and Old-age Dependency Ratio							
	2016	2020	2030	2040	2050	2060	2070
Number of pensioners (thousand) (I)	2501,7	2635,1	3049,9	3405,5	3796,6	4422,1	4849,5
Employment (thousand) (II)	4921,8	5117,8	5464,8	5781,8	6035,6	6151,9	6363,1
Pension System Dependency Ratio (SDR) (I)/(II)	50,8	51,5	55,8	58,9	62,9	71,9	76,2
Number of people aged 65+ (thousand) (III)	1963,8	2087,6	2397,0	2684,9	2891,0	3282,8	3460,8
Working age population 15 - 64 (thousand) (IV)	6217,6	6404,8	6875,1	7260,9	7589,3	7694,5	8019,3
Old-age Dependency Ratio (ODR) (III)/(IV)	31,6	32,6	34,9	37,0	38,1	42,7	43,2
System efficiency (SDR/ODR)	1,6	1,6	1,6	1,6	1,7	1,7	1,8

Source: Commission Services

The number of pensioners is expected to increase the whole projection period. In addition, employment is projected to increase until 2070, but in a slower pace, resulting in an increase in the pension system dependency ratio (SDR) by 25.4 percentage points, see table 11. The old-age dependency ratio is expected to increase with 11.6 percentage points, resulting in an increase in the system efficiency quota, occurring after 2040.

Inactivity

The total number of pensioners by age group has been divided by the inactive population in the same age group, i.e. the population minus

labour supply in the actual age group, to analyse the coverage ratio and the consistency between the labour force, demographics and the pension projections. For the age groups below 65 the ratio falls over time due to decreasing disability and a better labour market. For older age groups there will be an increase due to the growing participation among retired and a growing number of Swedish pensioners living abroad. The increase is most pronounced after 2040.

The total number of pensioners as a share of the inactive population is above 100 % for all age groups 65+, see Tables 12a and 12b. One explanation for this is that the numbers include pensioners living abroad.[22] Another reason is that pensioners are working, and part of the labour force, even if they are receiving pension benefits at the same time.[23]

Table 12a – Pensioners (public schemes) to inactive population ratio by age group (%)							
	2016	2020	2030	2040	2050	2060	2070
Age group -54	5,9	5,0	4,8	4,6	4,3	4,3	4,3
Age group 55-59	101,9	77,7	67,2	74,5	69,0	71,3	72,3
Age group 60-64	106,2	91,3	79,8	79,8	77,7	76,9	78,5
Age group 65-69	139,9	154,1	150,8	154,7	166,3	166,7	178,0
Age group 70-74	124,1	119,0	125,4	122,3	132,7	139,8	143,1
Age group 75+	102,9	104,8	109,8	112,0	113,3	120,0	125,4

Source: Commission Services

Note: Inactive population is defined as the population minus labour supply in the actual age group.

Table 12b – Pensioners (public schemes) to population ratio by age group (%)							
	2016	2020	2030	2040	2050	2060	2070
Age group -54	2,3	1,9	1,9	1,8	1,7	1,7	1,7
Age group 55-59	12,6	10,4	8,8	9,7	9,0	9,2	9,4
Age group 60-64	29,8	27,9	26,1	25,5	24,5	24,8	25,0
Age group 65-69	108,9	113,3	111,5	114,8	123,2	124,0	131,8
Age group 70-74	112,6	111,9	116,2	113,6	122,9	129,3	132,8
Age group 75+	102,9	104,8	109,8	112,0	113,3	120,0	125,4

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[22] If cross border pensioners are excluded the ratio in the age group 65-69 years will decrease.
[23] The high number in the age group 65-69 years is also explained by that many pensioners in this age group have earned income which is expected to become more common in the future.

Compared to AWG15 the inactivity rate below 65 is lower. This is due to the combined effect of less disability pensioners and a better labour market compared to the previous projection. The higher inactivity rate for old pensioners this time is the result of the higher migration assumptions that in the long-run lead to more pensioners with Swedish pension living abroad. [24]

The inactivity ratio for women is similar to the inactivity ratio in the population as a whole, see 13a and 13b. However, the development in the age group 55-64 is different - the inactivity ratio is decreasing more for women than for men. One explanation for this is that the disability rates are higher for women, and that thus the decrease in the number of female disability pensioners is projected to be more significant than for men. Another is that the number of women with widows' pension will decrease.

Table 13a – Female pensioners (public schemes) to inactive population ratio by age group (%)							
	2016	2020	2030	2040	2050	2060	2070
Age group -54	6,3	5,4	5,2	5,1	4,7	4,7	4,7
Age group 55-59	100,0	69,3	68,1	71,0	65,3	71,6	67,3
Age group 60-64	100,6	81,8	69,2	70,1	69,2	67,8	70,9
Age group 65-69	141,1	155,5	142,0	145,5	153,9	155,7	165,9
Age group 70-74	122,7	120,9	127,7	120,3	126,1	136,5	135,6
Age group 75+	103,5	106,3	113,8	115,2	113,7	117,4	122,9

A more technical explanation for the high ratio is that the calculated numbers in tables 12a to 13b are a mix of numbers originating from the exogenous AWG assumptions and endogenous numbers that are generated in the model.

Table 13b – Female pensioners (public schemes) to population ratio by age group (%)							
	2016	2020	2030	2040	2050	2060	2070
Age group -54	2,5	2,1	2,1	2,0	1,9	1,9	1,9

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[24] The number of pensioners outside Sweden is probably over-estimated as many migrants are moving in and out of the country several times, which cannot be modelled. However, the corresponding expenditures will be correct.

Age group 55-59	14,8	11,7	10,3	10,5	9,5	10,2	9,7
Age group 60-64	31,4	29,7	26,5	26,3	25,2	25,2	26,0
Age group 65-69	114,3	119,3	112,2	114,6	121,0	122,7	130,2
Age group 70-74	115,5	115,8	121,0	114,2	119,4	129,1	128,6
Age group 75+	103,5	106,3	113,8	115,2	113,7	117,4	122,9

Source: Commission Services

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New public expenditure
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In Table 14a-14c new earnings-related pension expenditure in the public NDC system is reported. New pensioners, born 1938 to 1953, will get some of their pension from the old transitional DB system, see table 14d.[25] Also, note that the numbers in the tables excludes pensioners with Swedish pension rights living abroad.

The shorter contributory period for women is the result of their historically lower participation rates and the transition from the old DB-system.[26] The contributory period is expected to increase for women and decrease for men. The reason for this is the increasing employment rate for woman and the decreasing for men. Note that individuals also get non-contributory pension rights for e.g. studies and parental leave, and that the average contributory period therefore exceeds the average working career.

The annuity factor is the same for men and women. In addition, the accrual rate is the same. Technically the base for the calculation of new pension expenditure is the accumulated pension wealth, which is the sum of "implicit pensionable earnings", which consist of earlier credited pensionable income, pension entitlements credited for income replacement social insurances, inheritance gains and possibly reduction in case of an automatic balancing. The pensionable earnings are also adjusted for the phasing in until about 2020, depending on when the individual was born.[27]

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

New pension	2016	2020	2030	2040	2050	2060	2070
I Projected new pension expenditure (millions EUR)	1493,1	1736,1	2506,6	2945,5	4294,4	6267,7	8681,9

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[25] Individuals born before 1938 who only get DB pension from the old system are already retired.

[26] Pension rights were only credited for years with a pensionable income exceeding one price base amount.

[27] Thus, note that the method of deriving the pensionable earnings makes the identities hold by definition.

II. Average contributory period	39,9	40,5	39,9	37,1	39,6	39,2	40,7
III. Monthly average pensionable earnings	2,6	3,4	4,4	6,1	7,8	10,9	15,1
IV. Average accrual rates (%)	0,9	0,9	0,9	0,9	0,8	0,8	0,8
Notional-accounts contribution rate (c)	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Annuity factor (A)	16,9	16,9	17,6	18,2	18,9	19,4	19,8
V. Sustainability/Adjustment factor	1,0	1,0	1,0	1,0	1,0	1,0	1,0
VI. Number of new pensioners ('000)	107,5	112,3	129,8	123,9	136,0	148,4	146,2
VII Average number of months paid the first year	12,0	12,0	12,0	12,0	12,0	12,0	12,0
Monthly average pensionable earnings / Monthly economy-wide average wage	78,8%	92,8%	88,6%	86,1%	78,5%	76,7%	75,0%

Source: Commission Services

Note: rows II * III * IV *V * VI * VII equals row I by definition. The used sustainability factor is set to 1, as the effect of the balance ratio is not possible to report separately.

There is therefore no straightforward relation between the growth of the "implicit pensionable earnings" and the average income growth. In the tables 14a-14d the sustainability factor is set to 1, because the effect of the balancing is already counted for implicitly in pension payments and pension wealth.[28] In the computations the average number of months paid out during the first year is 12, but in real life the number is close to 6.

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[28] The balance indexation is terminated in 2018 and not applied again in the calculations after this.

Table 14b - Projected and disaggregated new public pension expenditure (old-age and early earnings-related NDC pensions) - Male

New pension	2016	2020	2030	2040	2050	2060	2070
I Projected new pension expenditure (millions EUR)	827,4	932,1	1359,7	1530,9	2210,1	2978,9	4565,4
II. Average contributory period	41,6	41,0	40,0	36,7	38,8	38,3	39,9
III. Monthly average pensionable earnings	2,7	3,6	4,7	6,3	8,3	11,3	16,0
IV. Average accrual rates (%)	0,9	0,9	0,9	0,9	0,8	0,8	0,8
Notional-accounts contribution rate (c)	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Annuity factor (A)	16,9	16,9	17,6	18,2	18,9	19,4	19,8
V. Sustainability/Adjustment factor	1,0	1,0	1,0	1,0	1,0	1,0	1,0
VI. Number of new pensioners ('000)	54,2	56,1	66,2	62,2	67,9	69,2	73,9
VII Average number of months paid the first year	12,0	12,0	12,0	12,0	12,0	12,0	12,0
Monthly average pensionable earnings / Monthly economy-wide average wage	83,6%	98,4%	93,9%	90,1%	82,8%	80,0%	79,6%

Source: Commission Services

Table 14c - Projected and disaggregated new public pension expenditure (old-age and early earnings-related NDC pensions) - Female

New pension	2016	2020	2030	2040	2050	2060	2070
I Projected new pension expenditure (millions EUR)	665,7	804,0	1146,9	1414,6	2084,3	3288,8	4116,5
II. Average contributory period	38,2	39,9	39,8	37,5	40,4	40,0	41,5
III. Monthly average pensionable earnings	2,4	3,1	4,2	5,8	7,4	10,5	14,2
IV. Average accrual rates (%)	0,9	0,9	0,9	0,9	0,8	0,8	0,8
Notional-accounts contribution rate (c)	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Annuity factor (A)	16,9	16,9	17,6	18,1	18,8	19,4	19,8
V. Sustainability/Adjustment factor	1,0	1,0	1,0	1,0	1,0	1,0	1,0
VI. Number of new pensioners ('000)	53,3	56,2	63,5	61,7	68,2	79,2	72,3
VII Average number of months paid the first year	12,0	12,0	12,0	12,0	12,0	12,0	12,0
Monthly average pensionable earnings / Monthly economy-wide average wage	73,4%	87,1%	83,0%	82,1%	74,4%	73,9%	70,5%

Source: Commission Services

Transitional DB-pensions

The cohorts born until 1953 will get some of their pension from the old DB system. The last cohort eligible for DB pension will only get a small part of their public earnings-related pension from the old DB pension.

The transition period ends in about 2020 for new retirees, depending on when they choose to retire. However, payments of the old DB pension will be substantial for several decades. It is expected that there will be a few remaining pensioners born before 1953 even as late as 2060.

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

New DB pension	2016	2020
I Projected new pension expenditure (millions EUR)	244,4	2,4
II Number of new pensions (in 1000)	94,8	2,1
Average new pension	2,6	1,2
III Average contributory period (in years)	40,5	36,1
IV Average accrual rate (implicit)	1,5%	1,7%
V Monthly average pensionable earning	0,179	0,069
VI Sustainability/adjustment factors	1	1
VII Average number of months of pension paid the first year	12	12
Monthly average pensionable earnings / Monthly economy-wide average wage		

Source: Ministry of Finance

New earnings-related public pensions are thus the sum of new NDC pension and new DB pension. The average new DB pension will decreases fast, but at the same time the NDC pension will increase. The same applies for the pensionable earnings that gradually shift from DB to NDC.

3.4 *Financing of the pension system*
From 2016 to 2070 the number of pensioners will increase by 91 %. During the same period the number of contributors will grow only by 27 % and employment by 29 %. The combined effect of this is that the support ratio, i.e. the number of contributors per employee, and contributions as a share of GDP, will remain approx. unchanged.

The number of pensioners substantially exceeds the number of individuals older than 65 as the calculations cover individuals with Swedish pensions living abroad as well as disability pensioners and survivors younger than 65. The number of contributors also exceeds the number of employed, as contributions are paid by the central government to cover pension entitlements for unemployment, sickness, disability and parental leave. Self-employed individuals also participate in the system. The number of contributors is expected to grow slower than the number of employees as the number of disability pensioners is projected to decrease.

Table 15 – Contribution rates

	Public employees	Private employees	Self-employed
Contribution base	Pensionable income	Pensionable income	Pensionable income
Contribution rate / contribution	18.5%	18.5%	18.5%
Employer	10,21%	10,21%	10,21%
Employee	7,0%	7,0%	7,0%
State	"Employer contribution" for social insurances	"Employer contribution" for social insurances	"Employer contribution" for social insurances
Other revenues	Buffer funds.	Buffer funds.	Buffer funds.
Maximum contribution	8.07 income base amounts	8.07 income base amounts	8.07 income base amounts
Minimum contribution	0	0	0

Source: Ministry of Finance

Note: The income base amount is SEK 61 500 (approx. 6 500 €) in 2017. Hence, the contribution ceiling is SEK 496 300 or approx. 52 400 €. The contribution are calculated on earnings net of the employee contribution, i.e. (0.07+0.1021)/(1-0.07) = 0.185

Table 16 – Revenue from contribution (million), number of contributors in the public scheme (in 1000), total employment (in 1000) and related ratios (%)

	2016	2020	2030	2040	2050	2060	2070
Public contribution	27234	31422	45665	67471	99927	143572	212142
Employer contribution	12622	15025	22648	34186	51382	74794	111309
Employee contribution	11846	13536	19074	27538	40144	57228	83975
State contribution	2610	2704	3787	5592	8246	11395	16702
Other revenues	:	:	:	:	:	:	:
Number of contributors (I)	5762	5876	6247	6636	6929	7044	7351
Employment (II)	4922	5118	5465	5782	6036	6152	6363
Ratio of (I)/(II)	1,2	1,1	1,1	1,1	1,1	1,1	1,2

Source: Ministry of Finance

Note: The *support ratio* is defined as a number of contributors relative to the number of pensioners in public pension schemes.

3.5 Sensitivity analysis

The sensitivity scenarios can be divided into three groups:

1. Productivity (higher / lower/ risk)
2. Demographics (higher life expectancy, lower migration)
3. Labour market (higher employment, older workers, policy)

In the first group of scenarios the effects are limited as pensions and GDP will grow in the same pace, and all systems (tax brackets, ceilings etc.) are income indexed in the calculations. The outcome in the TFP risk scenario and the lower productivity are identical. The remaining small difference in the lower and higher total factor productivity

scenarios is explained by a change in the dependency on minimum pensions.

Table 17 - Public and total pension expenditures under different scenarios (deviation from the baseline in pp.)

	2016	2020	2030	2040	2050	2060	2070
Public Pension Expenditure							
Baseline	8,2	7,6	7,2	6,8	6,6	7,0	7,0
Higher life expectancy (2 extra years)	0,0	0,0	0,0	0,1	0,2	0,2	0,3
Higher Total Factor Productivity Growth (+0.4 pp.)	0,0	0,0	0,0	0,0	0,0	0,0	0,0
Lower Total Factor Productivity growth (-0.4 pp.)	0,0	0,0	0,0	0,0	0,1	0,1	0,0
Higher emp. rate (+2 pp.)	0,0	0,0	-0,2	-0,2	-0,1	-0,2	-0,2
Lower emp. rate (-2 pp.)	0,0	0,0	0,2	0,2	0,2	0,2	0,2
Higher emp. of older workers (+10 pp.)	0,0	-0,1	-0,4	-0,3	-0,3	-0,3	-0,3
Higher migration (+33%)	0,0	-0,1	-0,3	-0,3	-0,3	-0,3	-0,3
Lower migration (-33%)	0,0	0,1	0,3	0,4	0,4	0,4	0,3
Lower fertility	0,0	0,0	0,0	0,1	0,4	0,7	1,1
Risk scenario	0,0	0,0	0,0	0,0	0,1	0,0	0,0
Policy scenario: linking retirement age to increases in life expectancy	0,0	-0,1	-0,4	-0,4	-0,5	-0,8	-0,7
Total Pension Expenditure							
Baseline	10,7	10,4	10,7	10,6	10,2	10,5	10,2
Higher life expectancy (2 extra years)	0,0	0,0	0,0	0,0	0,2	0,3	0,4
Higher Total Factor Productivity Growth (+0.4 pp.)	0,0	0,0	0,0	-0,2	-0,3	-0,4	-0,5
Lower Total Factor Productivity growth (-0.4 pp.)	0,0	0,0	0,0	0,2	0,4	0,6	0,6
Higher emp. rate (+2 pp.)	0,0	0,0	-0,3	-0,2	-0,2	-0,2	-0,2
Lower emp. rate (-2 pp.)	0,0	0,0	0,2	0,3	0,2	0,2	0,2
Higher emp. of older workers (+10 pp.)	0,0	-0,1	-0,5	-0,3	-0,3	-0,3	-0,4
Higher migration (+33%)	0,0	-0,1	-0,4	-0,6	-0,6	-0,5	-0,4
Lower migration (-33%)	0,0	0,1	0,4	0,6	0,7	0,7	0,5
Lower fertility	0,0	0,0	0,0	0,2	0,6	1,1	1,6
Risk scenario	0,0	0,0	0,0	0,1	0,2	0,3	0,3
Policy scenario: linking retirement age to increases in life expectancy	0,0	-0,1	-0,6	-0,7	-0,6	-1,0	-0,8

Source: Commission Services

In the demographic scenarios sensitivity is more evident. The biggest difference is in the *Lower fertility* scenario where the number of pensioners will grow faster than the labour force. Also in the

Higher/Lower migration scenarios the sensitivity is large. The effects are amplified by changes in the contributory period, as immigrants often have shorter careers.

In the higher life expectancy scenario, the effects are explained by the fact that public earnings-related pensions, as well as occupational and private funded pensions, are adjusted on an actuarial basis, thus compensating for the increase in the longevity. When the actuarially calculated pensions are decreasing, the minimum top-up guarantee pension and the housing supplement will increase, thus explaining the increase in the pensions to GDP ratio.

The scenarios with higher employment lower the pension to GDP ratio as higher employment result in higher production, but also in higher earnings-related pensions after some years. This lowers the dependency of minimum pension. In the older workers scenario, the difference compared to the baseline is growing fast during the first decades. After this, the effect will gradually become smaller, as the extra working years will lead to higher earnings-related pensions for the individuals who are prolonging their working lives.

The story is similar in the policy scenario, where the GDP ratio is expected to decrease even more. In this scenario, the retirement age is linked to the increase in life expectancy. At the same time as all age limits in the pension system and related social insurances are indexed with two thirds of the increase in longevity.[29] This will cause higher GDP and earnings-related pensions and lower dependency of non-contributory pensions. The effect is strongest at the beginning when people start working longer at the same time as no one retires. After some decades, the prolonged working life will lead to higher pensions, and the difference compared to the baseline becomes smaller. However, as long as life expectancy is growing and retirement delayed, the pensions to GDP ratio will remain lower.

3.6   Description of the changes in comparison with earlier projections

Compared to the 2015 projections the public pensions to GDP ratio will be slightly higher, even if the contributions from the different components are similar. The dependency ratio and the coverage ratio will increase the pension to GDP ratio, whereas a lower benefit ratio will counter-act this effect.

The effect of fewer disability pensioners lowers the coverage ratio in early-ages, but the increasing number of old-age pensioners, due to

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[29] More details about the method can be found in section 4.4.

higher migration and a higher number of cross-border pensioners, increases the old-age coverage ratio, so as the net effect is positive.

Compared to AWG15 the benefit ratio now is slightly more negative, which is explained by the revision downward of the average pensions.[30] The average pension is dependent on the average contributory period, which in its turn depends on the number of people who come to and leave Sweden. Hence, the division of the net migration assumption into inflows and outflows is important for the calculation results. In the calculations for the 2015 Ageing Report a constant outflow of some 52 000 persons per year was assumed, and the inflow calculated residually to match Eurostat net migration. In these calculations, emigration from Sweden is more realistically dependent on earlier immigration to Sweden, which means that the number of people who leave Sweden now is higher and increasing to nearly 90 000 persons in 2070. Larger in- and outflows for a given net migration will result in a shorter average contributory period, all else equal, and a smaller average pension balance at the time of retirement. For this reason, the average pension in relation to the average wage is somewhat lower in these calculations than in the 2015 Ageing Report.

Table 18 - Average annual change in public pension expenditure to GDP during the projection period under earlier projection exercises

	Public pensions to GDP	Dependency ratio	Coverage ratio	Employment effect	Benefit ratio	Labour intensity	Residual (incl. Interaction effect)
2006 *	0,88	4,75	-0,20	-0,64	-2,79	:	-0,23
2009 **	-0,13	5,61	-0,37	-0,41	-4,32	:	-0,63
2012 ***	0,63	5,02	-0,76	-0,50	-2,73	-0,01	-0,39
2015****	-1,41	2,65	1,26	-0,36	-4,69	-0,01	-0,27
2018*****	-1,20	2,40	1,67	-0,11	-4,95	0,00	-0,23

Source: Commission Services

Note: * 2004-2050; ** 2007-2060; *** 2010-2060; **** 2013-2060; *****2016-2070
Table 18 presents the average annual change of pension expenditure and the contribution of the underlying components to that change, in analogy with Table 9b above. The components do not add up because of a residual component.

The decomposition in table 19 is somewhat rough. The change due to the decreasing disability and the rest of the differences are classified as "*Change in assumptions"* and calculated residually. The changes in the

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[30] Between the projections in 2006 and 2009 the premium pension was reclassified from the public to the private sector.

assumptions include both the demographic and economic assumptions. Regarding the revised disability pension projection, the same methodology was used as in AWG15, but the long-run average was calculated on another reference period 2006-2014 compared to 2008-2018 this time, see also section 3.2.

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

	2016	2020	2030	2040	2050	2060
Ageing report 2015	8,8	8,6	8,2	7,8	7,5	7,8
Change in assumptions	-0,6	-1,0	-1,0	-1,0	-0,9	-0,8
Improvement in the coverage or in the modelling	0,0	0,0	0,0	0,0	0,0	0,0
Change in the interpretation of constant policy	0,0	0,0	0,0	0,0	0,0	0,0
Policy related changes	0,0	0,0	0,0	0,0	0,0	0,0
New projection	8,2	7,6	7,2	6,8	6,6	7,0

Source: Ministry of Finance

4 Description of the pension projection model

4.1 Introduction

As in the previous exercises, the projections have been made with the dynamic microsimulation model SESIM. Originally the model was developed at the Swedish Ministry of Finance in close cooperation with researchers at Swedish universities. The model has been further developed at the Ministry of Health and Social affairs.[31] SESIM is a general microsimulation model that can be used for a broad set of analyses. The model has for example been used for analyses of health amongst elderly.[32] It has also been used by the Pension age committee, and the in the ongoing review of the pension system.

All the AWG projections and model simulations have been made at the Ministry of Health and Social Affairs. No peer review has been done nationally. For the period until 2021, the results have been validated against National Accounts outcome and projections from The Swedish Pension Agency. The results have also been validated against the AWG demographic and macroeconomic assumptions as well as the previous round of AWG pension projections.

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[31] A detailed documentation can be found in Flood et.al [2005], or at www.sesim.org.
[32] *The future need for care - Results from the LEV project,* Ministry of Health and Social Affairs, 2010.

4.2 Overview of the model

SESIM is a mainstream dynamic microsimulation model in the sense that the variables are updated in a yearly sequence. The initial sample of the Swedish population includes approximately 320 000 individuals and is from 1999.[33] All individuals are subject to a large number of possible events, reflecting real life phenomena, such as education, marriage, parenthood, work or retirement.

SESIM has a recursive structure, where different modules are executed in a predetermined order, see figure 3.1 below. The unit of simulation is the individual but households are also important, as many of the simulated processes refer to household as well as individual properties. The simulation sequence starts with a set of demographic modules (mortality, adoption, migration, household formation and dissolution, disability pension, rehabilitation and regional mobility). In later steps, calculations relating to education and the labour market (unemployment, employment etc.) are executed.

Every individual is assigned one out of nine possible statuses during a specific year.[34] Every status is related to a source of income. Employment results in earnings; retirement brings pensions etc. For employed individuals an earnings equation is used to determine the income. For other statuses, for example unemployment, current rules are applied to calculate the income. Next to income, capital income from financial assets and housing is calculated.[35]

Then transfers and pensions will be calculated. The rules for all types of pensions are implemented in all relevant detail (i.e. public, occupational and private pensions). All persons are assumed to claim full time pension, since the model cannot handle part time retirement (or any other mixed statuses), but pensioners can also earn work income. Also, the automatic balancing mechanism is implemented in the model, but not used in the AWG calculations, as it will not affect the results in the long run (but can disturb the general picture if pensions are balanced a year that is reported in the fiche).

SESIM allows for a more extensive definition of income since the value of various non-cash benefits can be included, e.g. education, childcare and health care.
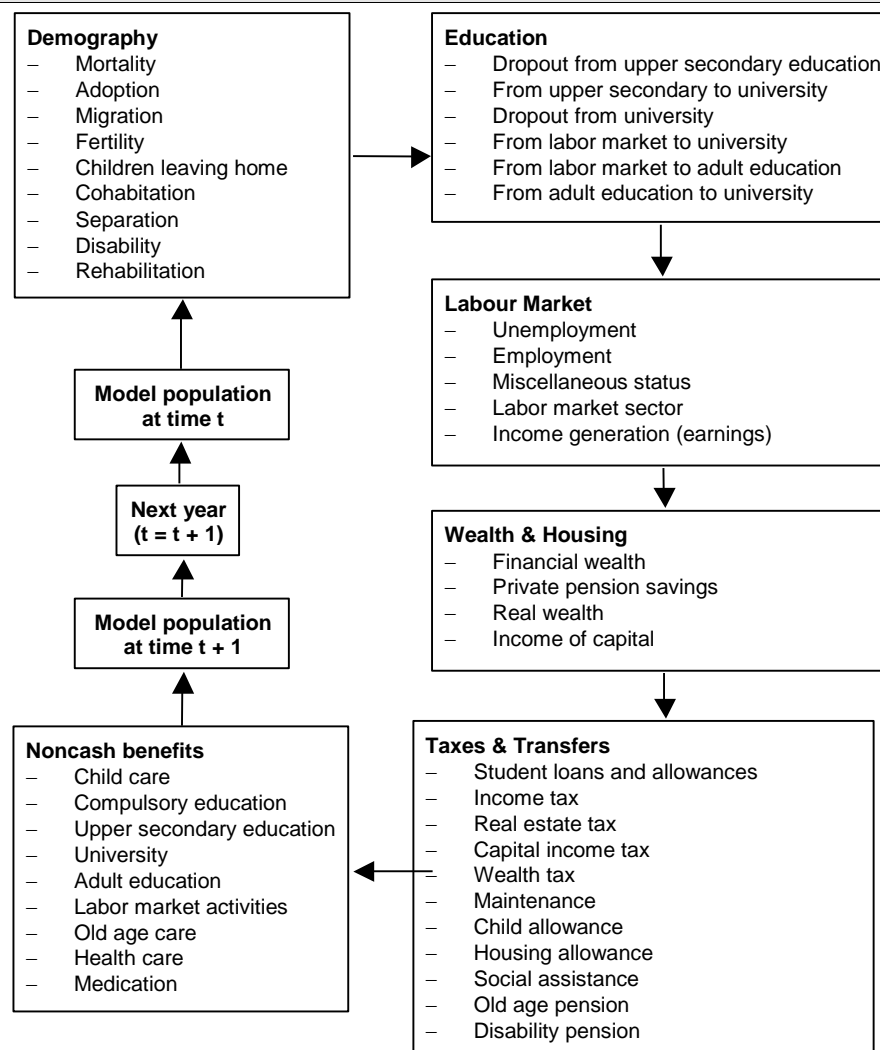
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[33] If necessary, the sample can be extended.

[34] The different statuses are: Child (0-15 years old), Old-age pension, Student, Disability pensioner, on parental leave, Unemployed, Employed, Miscellaneous, Emigrated (individuals living abroad with Swedish pensions rights).

[35] Four separate assets are considered in the household portfolio: financial wealth, own homes, other real wealth and private pension savings.

In the AWG analysis, the module for the labour market is central, especially employment, unemployment, retirement or disability. These functions are statistical rather than economic, in the sense that the probability of an event is influenced by individual characteristics, but not by financial incentives. For example, the probability of retirement is a function of the individual's education, age, gender, income etc., but not by the marginal taxes. One important feature is that the retirement model also takes into account that spouses tend to coordinate their retirement.

There are several ways of simulating the date of retirement. The number of new pensioners is aligned by picking the individuals with the highest estimated probability to retire. People retire according to an observed age distribution. Most people retire at 65. Note that the average pension age is endogenously determined, although the average effective retirement age is aligned to track the AWG labour market assumptions. Some pensioners continue to work after they started to draw their public pension, and are thus counted as employed in LFS terms.

Figure 1: Structure of SESIM

Demography
- Mortality
- Adoption
- Migration
- Fertility
- Children leaving home
- Cohabitation
- Separation
- Disability
- Rehabilitation

Education
- Dropout from upper secondary education
- From upper secondary to university
- Dropout from university
- From labor market to university
- From labor market to adult education
- From adult education to university

Model population at time t

Labour Market
- Unemployment
- Employment
- Miscellaneous status
- Labor market sector
- Income generation (earnings)

Next year (t = t + 1)

Model population at time t + 1

Wealth & Housing
- Financial wealth
- Private pension savings
- Real wealth
- Income of capital

Noncash benefits
- Child care
- Compulsory education
- Upper secondary education
- University
- Adult education
- Labor market activities
- Old age care
- Health care
- Medication

Taxes & Transfers
- Student loans and allowances
- Income tax
- Real estate tax
- Capital income tax
- Wealth tax
- Maintenance
- Child allowance
- Housing allowance
- Social assistance
- Old age pension
- Disability pension

4.3 Data Issues

The primary database for SESIM, both for the estimation of the statistical models and for the creation of the base population, is the Statistics Sweden longitudinal database LINDA.[36] The database is created from administrative registers and covers about 3.5 percent of the Swedish population. In 1999, the primary sample was 308 000 individuals. Including other household members the total sample size was 786 000 individuals. The selected individuals are followed over time and all relevant information is collected. Some information, for instance pension rights, can be traced back as far as 1960. New individuals replace individuals that disappear from the data set due to death or emigration in order to maintain the statistical representability.

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[36] For a more detailed description of the data set, see e.g. Flood et al (2012) and Edin & Fredriksson (2000).

4.4   Assumptions and simulations

The most important exogenous economic variables in SESIM are inflation, real income growth per capita, short- and long-term interest rates and return on stocks. All relevant macro numbers are aligned to the AWG assumptions. In the calculations, the model is adjusted to the average unemployment and participation rates for five-year groups, so that the simulated population and labour force tracks the AWG-assumptions closely. The model results are, when possible, calibrated to NA levels 2016 where possible.

The calculations are made in current prices. The indexation rules are implemented in detail in the model. All items that are price indexed by legislation, have been income indexed from 2021 in the projections (for example the housing allowance for pensioners and the guarantee pension). It is also assumed that the rate of return on funded assets in the individual public DC funds and the individual occupational pension accounts will be the same for all individuals. Upon retirement, individuals get their public DC pension as a fixed annuity. The ongoing balancing period is expected to end in 2018.

In the sensitivity scenarios, the pension age is normally based on actual pension behaviour. However, in the *"Policy scenario"*, the age limits and the pension behaviour is shifted to increase the effective pension age in line with longevity. This is done by making people "younger", i.e. letting older people borrow the behaviour of younger. In the policy scenario also, all relevant age limits are increased with two thirds of the increase in longevity, approximately keeping the share of adult life spent in retirement constant.[37]

4.5   Additional information about the modelling

*   The exchange rate 9.4689 SEK/Euro, according to Eurostat (2017-09-05), has been used from the base year 2016 and onwards.
*   Areal interest rate of 3 percent is used in the calculations. No deductions for costs for administration of the public funds are assumed.
*   Major pension expenditures and public contributions are adjusted to national account levels until 2016. From 2013 constant add factors have been used.
*   In SESIM, only individuals with a public pension receive an occupational pension. Thus, different types of collectively agreed early retirement options, agreed disability pensions etc. are not included. The numbers are not adjusted to NA-levels due to lack of data.

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[37] This is in line with the proposals from the Swedish Pensions age committee. For more details see Ministry of Health and Social affairs [2014] (in Swedish only).

- Only DC contributions to occupational pensions are reported, not DB contributions that are financed (and funded) by the employers on an actuarial ground.
- The decomposition of private individual pensions only includes the mandatory part (the DC premium pension).
- The longevity in Sesim is not truncated at 100 years, as in the Eurostat forecast.
- Sesim is a stochastic model, and the population is endogenous, but of course based on the AWG assumptions. The population is therefore aligned (calibrated).
- The Eurostat demographic projections only include net migration. To calibrate Sesim both emigration and immigration flows are needed. The emigration is therefore assumed to be same as in the latest projection from Statistics Sweden and the immigration is calculated residually. This division of the net migration assumption into inflows and outflows is important for the calculation results, see section 3.6

References

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- Flood L, Jansson F, Pettersson T, Pettersson T, Sundberg O, Westerberg A [2012] *"The Handbook of SESIM – a Swedish dynamic micro simulation model"* (www.sesim.org)
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Annex 1: Additional reporting

Economy- wide average wage at retirement

The economy-wide average wage is somewhat lower than the average wage at retirement. The average wage is growing at the same pace as the productivity. The average gross wage at retirement is calculated as the average for earned income for individuals 60-64 years old. The growth in the wage at retirement is basically the same, but small deviations occur as a result of composition effects in the population and stochastic variation in the model.[38]

Table A1 – Economy wide average wage at retirement evolution (in thousands euro)							
	2016	2020	2030	2040	2050	2060	2070
Economy - wide average wage	39,1	43,3	60,0	84,4	119,7	170,0	241,3
Average gross wage at retirement	42,3	47,2	66,3	95,4	132,4	188,9	266,5

Source: Ministry of Finance

Pensioners vs Pensions

Both the number of pensioners and the number of pensions are calculated in the microsimulation model. Most people get their pension from more than one source. The average number of pensions per pensioner varies over the projection period due to phasing in and out of different systems.

Pension taxation

The taxes are modelled for each individual in line with the taxation rules legislated. The average tax and earnings for different groups are then summed up, and an implicit tax ratio calculated for every year. The same implicit tax ratios are then used for all kinds of pension.

Disability pension

The modelling of the disability pension is done with estimated equations for the in- and outflow from the system. Also programmed rules, e.g. age limits, affect the calculations. The inflow of pensioners is then aligned to the average incidence for the reference period 2008-2018. See section 3.2 for more details. Compared to AWG15 the numbers are lower, as outcome data indicates a continued fall in the inflow.

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[38] In the microsimulation model used in the calculations the individual wages are calculated using an estimated equations, including explaining variables as e.g. age, sex and education.

The low inflow, result in a gradual decrease as existing disability pensioners reaches age 64 and are shifted to old-age pension. Table A.2 shows that disability is increasing with age, but decreases over time. No one over age 64 get disability pension. In the model calculations, they are therefore shifted to old-age pension. Even though this is the normal procedure in real life, it is formally up to the individuals if they want to apply for old-age pension or not. In the policy scenario, when linking the retirement age to increases in life expectancy, the age limit for disability, as well as other relevant age limits, is shifted in line with the pension age.

Table A2 – Number of disability pensioners by age groups (%)							
	2016	2020	2030	2040	2050	2060	2070
Total	287	254	253	267	290	284	307
Age group -54	121	102	105	117	116	124	127
Age group 55-59	68	62	56	61	71	64	72
Age group 60-64	98	90	91	90	103	96	108
Age group 65+	0	0	0	0	0	0	0

Source: Ministry of Finance

Survivor pensions

In the microsimulation households are modelled. If any member in the household dies the eligible survivors will get the benefit. In the calculations the very complicated legal rules are simplified due to model constraints. All amounts are income indexed.

Alternative pension spending decomposition

Table A3 - Factors behind the change in public pension expenditures between 2013 and 2060 (in percentage points of GDP) - pensions							
	2016-20	2020-30	2030-40	2040-50	2050-60	2060-70	2016-70
Public pensions to GDP	-0,5	-0,5	-0,4	-0,2	0,4	0,0	-1,2
Dependency ratio effect	0,3	0,7	0,6	0,2	1,3	0,1	3,2
Coverage ratio effect	-0,3	0,4	0,4	0,7	0,5	0,5	2,2
Coverage ratio old-age*	-0,1	0,6	0,6	0,8	0,7	0,5	3,0
Coverage ratio early-age*	-1,0	-0,1	-0,5	0,0	0,0	0,0	-1,6
Cohort effect*	-0,2	-0,7	-0,4	0,1	-1,0	0,1	-2,1
Benefit ratio effect	-0,4	-1,4	-0,9	-0,7	-0,5	-0,3	-4,2
Labour Market/Labour intensity effect	-0,1	0,0	0,0	0,0	-0,1	0,1	-0,1
Employment ratio effect	-0,1	0,0	0,0	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
Career shift effect	0,0	0,0	0,0	0,0	-0,1	0,0	0,0
Residual	0,0	-0,2	-0,4	-0,5	-0,8	-0,4	-2,3

Table A4 - Factors behind the change in public pension expenditures between 2013 and 2060 (in percentage points of GDP) - pensioners

	2016-20	2020-30	2030-40	2040-50	2050-60	2060-70	2016-70
Public pensions to GDP	-0,5	-0,5	-0,4	-0,2	0,4	0,0	-1,2
Dependency ratio effect	0,3	0,7	0,6	0,2	1,3	0,1	3,2
Coverage ratio effect	-0,1	0,1	0,0	0,3	0,2	0,3	0,8
*Coverage ratio old-age**	0,1	0,2	0,1	0,3	0,4	0,4	1,6
*Coverage ratio early-age**	-1,0	-0,1	-0,5	0,0	0,0	0,0	-1,6
*Cohort effect**	-0,2	-0,7	-0,4	0,1	-1,0	0,1	-2,1
Benefit ratio effect	-0,6	-1,0	-0,7	-0,5	-0,4	-0,3	-3,6
Labour Market/Labour intensity effect	-0,1	0,0	0,0	0,0	-0,1	0,1	-0,1
Employment ratio effect	-0,1	0,0	0,0	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
Career shift effect	0,0	0,0	0,0	0,0	-0,1	0,0	0,0
Residual	0,0	-0,2	-0,2	-0,2	-0,6	-0,3	-1,6

Non-earnings related minimum pension

The non-earnings related minimum pension, the guarantee pension, is endogenously calculated in the microsimulation model, depending on other sources of income. The guarantee pension is price indexed formally, but in the AWG projections income indexation is assumed from 2021.

Contributions

The different sources of income are calculated for each individual. The different contribution rates are then applied for each source of income and summed up. The different contribution rates are assumed constant over the projection horizon.

Pensioners inside and outside Sweden

The number of pensioners with Swedish pension living abroad were approx. 152 000 in 2016 (outcome).[39] The number is projected to increase to 1.1 million in 2070, an increase of the cross-border share from 6.5% in 2016 to 24.3% in 2070. The number may seem high, but even in 2014 there were around 600 000 individuals with Swedish pension rights living abroad. However, there is a risk that the number is over estimated as some individuals move in and out from Sweden several times. In money

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[39] Source: Swedish Pensions Agency

terms the overseas share is lower, 1.2% in 2016 and 4.5% in 2070, but the relative increase until 2070 is expected to be the same. [In December 2015, the average monthly public pension was 11 800 SEK for domestic pensioners and 3 500 SEK for overseas pensioners.]

Graph A1: The number of Swedish pensioners (1000)
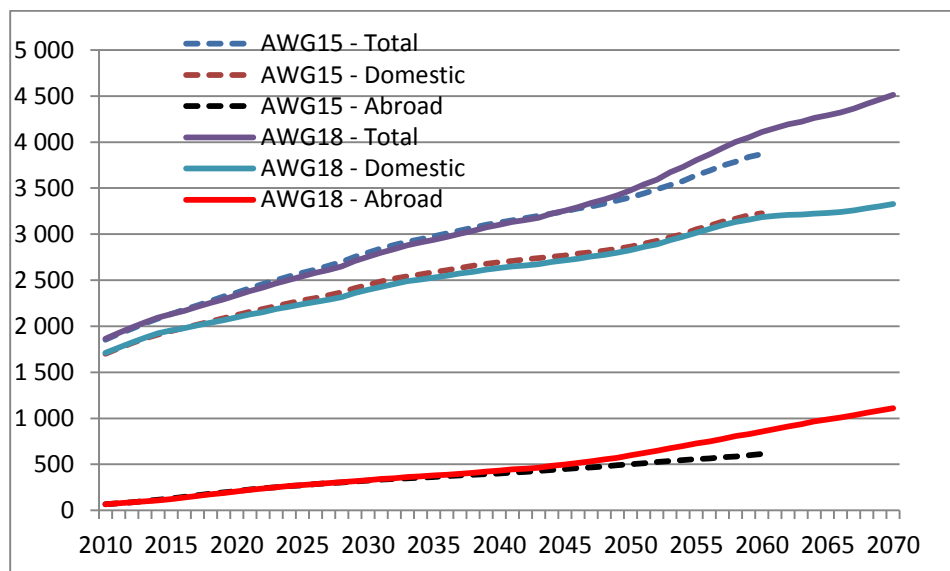
Compared to the 2015 projections the number of pensioners starts to increase around 2045. The reason for this is that the many immigrants that arrive in 2015-2025 begin to retire, and many choose to emigrate as they retire.

Annex 2: Indexation and automatic balancing

Income indexation

The PAYG-pensions is on average indexed by wages. The system is front-loaded, though, and the pensioners receive a share of the real economic growth in advance. Technically this is achieved by calculating the annuity factor with a 1.6 per cent discount factor, resulting in a higher initial benefit than a straightforward application of the actuarial principles would give. The indexation is then reduced during the pay-out time by subtracting 1.6 per cent from the yearly income indexation.

The development of income is measured by the income index, which measures the change in average income for individuals who are active in the labour market. The income index is based on pensionable income for individuals between age 16 and 64, without any income ceiling. From 2017 the smoothing of the income index has been removed.

Income indexation
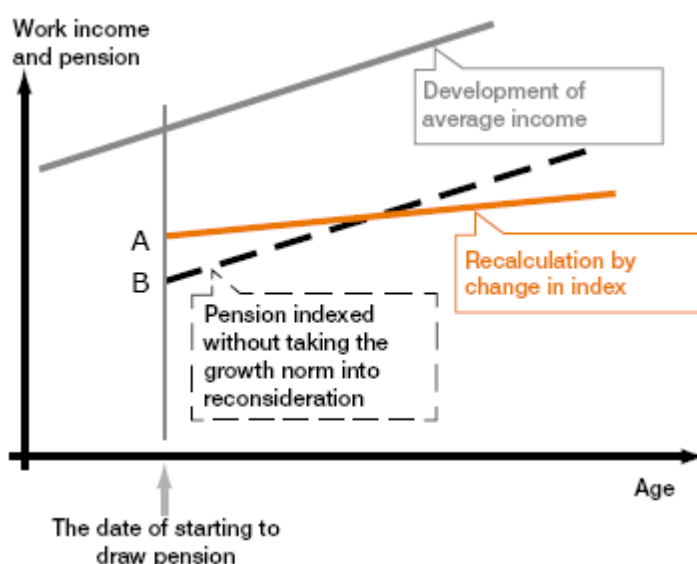
Automatic balancing

The Swedish PAYG NDC income pension system has an automatic balancing mechanism that will secure the financial stability of the system. Regardless of the demographic or economic development, the system will be able to finance its obligations with a fixed contribution rate and fixed rules for calculation of benefits. This is achieved by reducing the rate of indexing, if necessary.

If the current liabilities of the system are greater than the calculated assets, the balance ratio falls below one (1) and the balancing is activated. The balance ratio is calculated by the Swedish Social Insurance Agency, and published yearly in the pension system annual reports.

When balancing is activated, pension balances and pension benefits will be indexed by the so-called balance index instead of the change in the income index. From 2017, the smoothing of the different components has been replaced by a dampening of the balance ratio. Only one third of the deviation of the unsmoothed balance ratio affects the indexation.

An example: If the balance ratio falls from 1.00 to 0.99, while the income index rises from 100 to 104, the smoothed balance ratio will be 0.9967 (i.e. 1+(0.99-1)/3). The balance index is then calculated to 103.65. The up-rating of the pensions will then be 3.65 instead of 4 percent.

If the balance ratio exceeds 1 during a period when balancing is activated, pension balances and benefits will be indexed at a higher rate than the increase in the income index. When the level of the balance index reaches the level of the income index, the balancing is deactivated and the system returns to indexation by the normal income index.

Income and Balance indexation
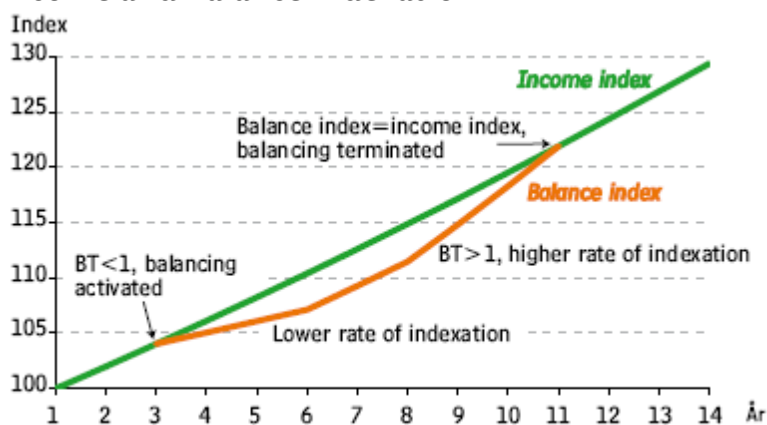
Annex 3: Decomposition of pension expenditures

The ratio of pension expenditures to GDP can be decomposed into different factors; the dependency, coverage, benefit ratio, employment rate and labour intensity.

[1]

$$\frac{\text{Pension Exp}}{\text{GDP}} = \underbrace{\frac{\text{Population } 65+}{\text{Population } 20-64}}_{\text{Dependency Ratio}} \times \underbrace{\frac{\text{Number of Pensioners (Pensions)}}{\text{Population } 65+}}_{\text{Coverage Ratio}}$$

$$\times \underbrace{\frac{\text{Average income from pensions (Average Pension)}}{\dfrac{\text{GDP}}{\text{Hours Worked } 20-74}}}_{\text{Benefit Ratio}} \times \underbrace{\frac{\text{Population } 20-64}{\text{Hours Worked } 20-74}}_{\text{Labour Market / Labour Intensity}}$$

The coverage ratio is further split with the scope of investigating the take-up ratios for old-age pensions and early pensions:

[2]

$$\underbrace{\frac{\text{Number of Pensioners}}{\text{Population } 65+}}_{\text{Coverage Ratio}} =$$

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

The labour market indicator is further decomposed according to the following:

[3]

$$\underbrace{\frac{\text{Population } 20-64}{\text{Hours Worked } 20-74}}_{\text{Labour Market / Labour Intensity}} =$$

$$\underbrace{\frac{\text{Population } 20-64}{\text{Working People } 20-64}}_{1 / \text{Employment Rate}} \times \underbrace{\frac{\text{Working People } 20-64}{\text{Hours Worked } 20-64}}_{1 / \text{Labour intensity}} \times \underbrace{\frac{\text{Hours Worked } 20-64}{\text{Hours Worked } 20-74}}_{1 / \text{Career shift}}$$

where the former term "*Career Shift*" is labelled "*Career prolongation*".