Report 2

Actuarial Study of the Proposed National Social Security Fund

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ABBREVIATIONS AND ACRONYMS

CPI	Consumer Price Index
DC	Development Cooperation
DSD	Department of Social Development
EIU	Economist Intelligence Unit
GAP	General Average Premium
GDP	Gross Domestic Product
GEPF	Government Employees Pension Fund
IMF	International Monetary Fund
IOM	International Organization for Migration
MYPE	Mid Year Population Estimates
NDP	National Development Plan
NEDLAC	National Economic Development and Labour Council
NSSF	National Social Security Fund
OECD	Organization for Economic Co-operation and Development
PAYG	Pay-As-You-Go
PVFB	Present Value of Future Benefits
PVFS	Present Value of Future Salaries
QES	Quarterly Employment Statistics
QLFS	Quarterly Labour Force Survey
RMS	Rapid Mortality Surveillance Report
SARB	South African Reserve Bank
SASSA	South African Social Security Agency
StatsSA	Statistics South Africa
TFR	Total Fertility Rate
UIF	Unemployment Insurance Fund
VR	Vital Registration
WPP	World Population Prospects

1. INTRODUCTION

The Government of South Africa is in the process of reforming its social security system. The National Development Plan (NDP) dedicated a chapter to social protection. Following this, the Government elevated the reform agenda into a specific outcome in terms of the Medium-Term Strategic Framework 2014-2019. The Minister of Social Development was tasked with leading the coordination of Outcome 13: "An inclusive and responsive Social Protection system." In 2015, the Ministerial Committee on the Review of the Implementation of the White Paper for Social Welfare (1997), led by the former Commissioner responsible for Social Security in the National Planning Commission, recommended Cabinet to adopt the proposals on comprehensive social security.

In June 2016, Cabinet endorsed these recommendations and the comprehensive social security reform discussion paper tabled at the National Economic Development and Labour Council (NEDLAC) in November 2016. This has enabled social partners (Government, organized Labour, Business and Community) to engage on the identified gaps and recommendations.

According to the discussion paper, "the most notable gap in the social security system is the absence of a public fund that provides pensions and life insurance to the workforce as a whole. A large number of private occupational and voluntary schemes have been established to fill this gap, but some 6.2 million formal sector workers, including low-income earners, are excluded from such arrangements". The principal reform proposal is therefore the establishment of a National Social Security Fund (NSSF), which will be financed by contributions from all workers and employers and will pay pensions, disability and survivor benefits, and unemployment benefits.

The comprehensive social security reform includes the expansion of coverage of social security, including extended coverage under current schemes but also increase in tax-financed social protection for non-covered population, for example through the planned and on-going universalization of the old age pension consolidating pillar 0 of social security. The plan includes the harmonization of benefits and proposals for financing of schemes and a development of an occupational and voluntary tier with higher level of benefits.

The Department of Social Development (DSD) requested the International Labour Ogranization (ILO) to provide technical assistance support to further refinement to the design of the model of social security reform including actuarial valuation of the options for the NSSF and provide advice on its regulation, institutionalization and delivery mechanism. This will assist in the consultations with social partners in NEDLAC, as well as building and strengthening capacity in Government and design the implementation plans for the comprehensive social security reform.

The ILO will therefore contribute to the comprehensive social security reform programme, supporting the outputs of the national social dialogue through the NEDLAC, recommending improvements of the social security system; thereafter will assist with preparing submissions of draft policy, regulations and implementation plan to Cabinet. This will include recommendations of appropriate measure for achieving a better, sustainable and efficient social security system.

The three main outcomes of the development cooperation (DC) project are:

1) Increase knowledge and capacity of Government and social partners to engage in social dialogue on gender sensitive comprehensive social security reform
2) Improved institutional, administrative and regulatory framework of the National Social Security Fund
3) Support to the drafting of the proposed bill and an operationalization plan

In June 2018, a document prepared by the ILO was shared and discussed with DSD which presents the planed outputs and main activities to achieve the first outcome of the DC project as well as a list of data and information required for the actuarial valuation of the different reform options.

This report has been produced based on the information and data received from DSD. It should not be interpreted as a final version of the actuarial valuation of the future NSSF. It should be interpreted as one component of a work in progress where the final results will be based on discussions between stakeholders. It is the first report presenting actuarial estimates as part of the cooperation. The reader is invited to consult two other documents to better understand the context and the scenarios which are considered in this actuarial study:

- Design of the new NSSF in South Africa, July 2020
- South Africa, funding policy of the NSSF, July 2020

The Chapter 2 of this report presents the demographic an economic environment that have been used to undertake this actuarial study. In the Chapter 3, the data and assumptions pertaining to the future NSSF are presented and discussed. Chapter 4 presents the results of the actuarial study while Chapter 5 displays many sensitivity analyses to better understand the risks and the stakes that will face the new pension plan. A brief conclusion is presented in Chapter 6.

2. PROJECTED DEMOGRAPHIC AND MACROECONOMIC ENVIRONMENT OF SOUTH AFRICA

A social security pension scheme is one of the socio-economic and political systems which function within an environment of national economy. Therefore, it does not function independently of the demographic and economic context. The analysis of the various demographic and macroeconomic indicators is thus an important part of the actuarial valuation process of a social security system.

This chapter discusses the development of the main demographic and economic indicators of South Africa. It presents the general demographic and economic experience in South Africa along with demographic and economic projections up to year 2100.

The demographic and economic assumptions have been projected to year 2100 in order to appropriately measure the demographic and financial evolution of the scheme over the long-term. Such a long period of projection not only allows conclusions regarding the long-term sustainability of the scheme to be better drawn, but also contributes to providing a clearer picture of the scheme's sensitivity to assumptions or changes to benefits.

This section also addresses the impact of the COVID-19 crisis on the projections. It is important to keep in mind that, due to the very long-term nature of the projections, short-term[11] variations, like the COVID-19 crisis, will not affect considerably the long-term outlook of a not yet born social security pension scheme. It is also important to remind that the future will always be shaped through short-term variations, the COVID-19 crisis is not the first one and will not be the last one. The fact that NSSF is not yet implemented, diminishes considerably the impact of the crisis on the scheme. That said, we must not misrepresent the importance of the crisis, and that is why sensitivity analyses will be conducted in the actuarial valuation process. Our basic assumption is that, in 2022, the year of implementation of the new NSSF, the impact of the COVID-19 crisis on the macro-economic indicators will be over and that pre COVID-19 indexes may be used to undertake the projection and the analysis.

2.1. Population of South Africa

With the information available on the COVID-19, it is too early to know if vaccines are going to be found and what are going to be their efficiencies. So, it is difficult to project the impact of the COVID-19 crisis on the mortality experience. In the short-term, even if the elderly are going to be more impacted than younger one, it will not affect the projection because the scheme is young and there are no old-age pensioners. It is possible that variable like fertility rate may fluctuate in the short term, but currently, the COVID-19 is not affecting our short-term and long-term views on the new pension scheme. It is more on migration side that the impact may be more important, but, as it is discussed in the introduction of this section, we make the assumption that the situation is back to the pre COVID-19 crisis in 2022.

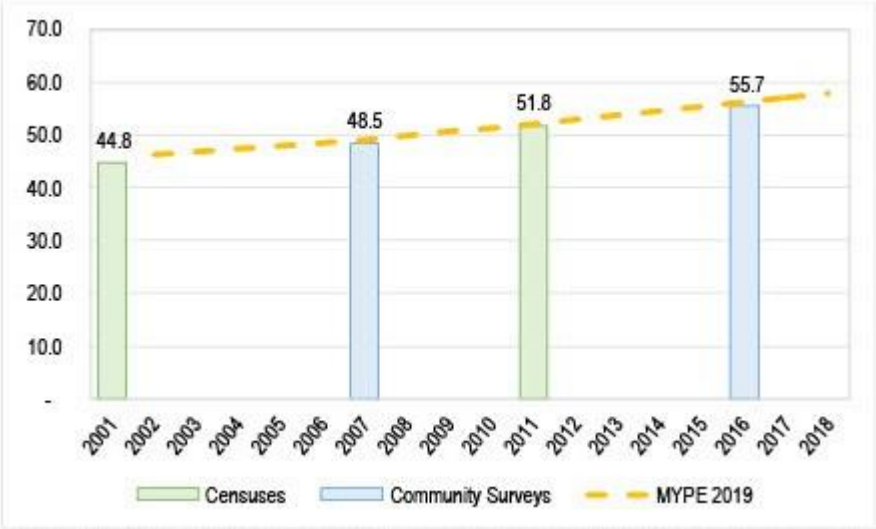
This section presents the recent demographic development observed in South Africa. It is mainly based on the censuses, community surveys and other studies produced by Statistics South Africa (StatsSA). Where appropriate, other internal or external sources of statistics are presented.

StatsSA conducts a population census every 10 years, with the last one being conducted in 2011. Since 2007, a community survey is also produced between each census to close the 10-year gap between two censuses.

Figure 1 presents the evolution of the total population since the Census of 2001.

[11] For actuarial projections of social insurance schemes, short-term is usually defined as less than 10 years.

Figure 1: Evolution of the total population in South Africa (in million)

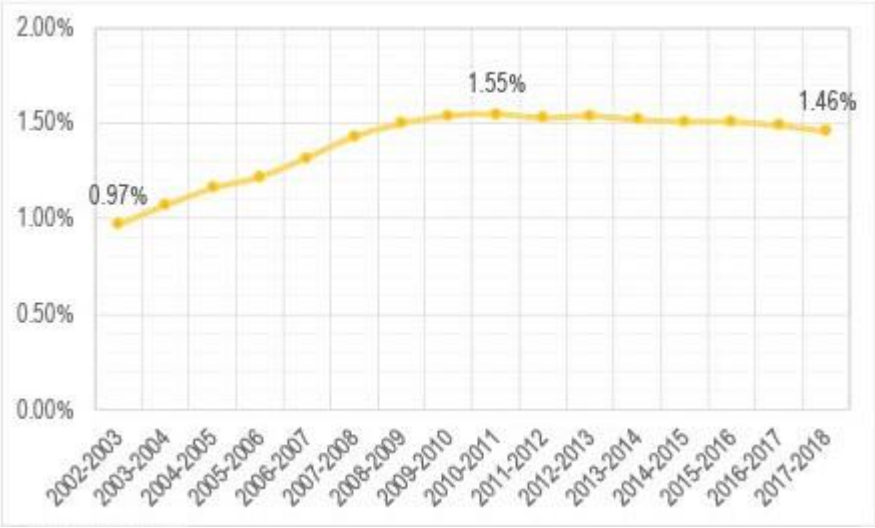


Source: Census 2001, Community Survey 2007, Census 2011, Community Survey 2016 and MYPE 2019

According to the recent censuses and community surveys, the total population in South Africa increased from 44.8 million in 2001 to 48.5 million in 2007, 51.8 million in 2011 and 55.7 million in 2016. The population increased annually by an average rate of 1.3 per cent between 2001 and 2007, 1.6 percent between 2007 and 2011, and 1.5 per cent between 2011 and 2016. According to the Mid-Year Population Estimates (MYPE) of 2019, the total population of the country reached approximately 57.9 million[12] in 2018.

Figure 2 presents the annual growth rate of the total population from 2002- 2003 to 2017-2018.

Figure 2: Annual growth rate of the total population in South Africa, 2002-2003 to 2017-2018



Source: MYPE 2019

[12] The Mid-Year Population Estimates (MYPE) of 2018 also produced by Stats SA and published on 23 July 2018 estimated the total population of South Africa to 57.7 million. The MYPE of 2019 published on 29 July 2019 presented the 2019 total population along with the annual growth rates of the total population since 2002-2003.

The annual growth rate of the South African population has increased between 2001-2002 and 2010-2011 and slightly decreased since then. The estimated overall growth rate increased from approximately 0.97 per cent per year for the period 2002-2003 to 1.55 per cent per year for the period 2010-2011 and decreased thereafter to 1.46 per cent per year in the period 2017-2018.

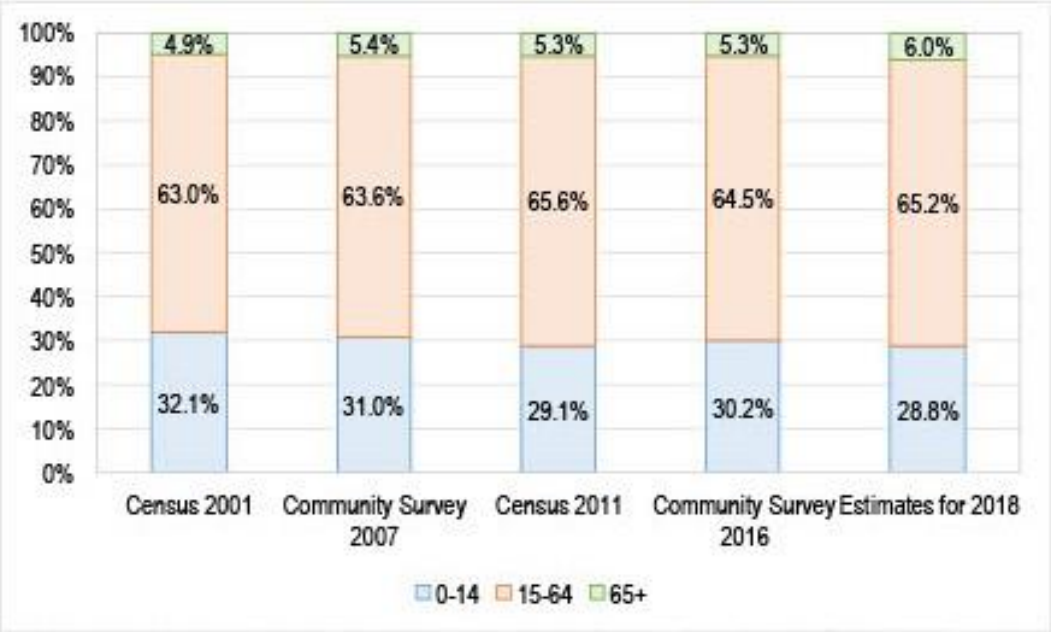
Table 1 and **Figure 3** present the development of the population structure since 2001.

Table 1: Total population of South Africa, by age groups, 2001, 2007, 2011, 2016 and 2018

Age	Census 2001	Community Survey 2007	Census 2011	Community Survey 2016	Estimates 2018
0–4	4 449 816	4 985 177	5 654 129	5 976 519	5 668 113
5–9	4 853 545	5 116 813	4 824 159	5 619 796	5 654 907
10–14	5 061 917	4 947 002	4 564 749	5 189 803	5 349 826
15–19	4 981 721	5 093 139	4 979 823	5 104 482	4 592 972
20–24	4 294 523	4 791 808	5 394 808	5 302 335	4 843 499
25–29	3 934 938	4 064 793	5 083 569	5 280 504	5 449 044
30–34	3 340 900	3 738 488	3 994 188	4 454 688	5 458 297
35–39	3 071 771	3 217 631	3 475 546	3 847 961	4 505 419
40–44	2 619 464	2 835 298	2 956 903	3 260 584	3 533 840
45–49	2 087 380	2 408 282	2 645 753	2 782 930	3 001 823
50–54	1 638 020	1 967 385	2 230 679	2 334 509	2 498 608
55–59	1 205 276	1 566 153	1 815 693	1 974 196	2 161 001
60–64	1 065 294	1 157 686	1 400 708	1 572 917	1 758 833
65–69	787 927	962 195	985 723	1 179 287	1 350 435
70–74	631 469	665 095	778 230	824 733	936 169
75–79	367 537	480 086	466 991	486 337	589 288
80+	428 278	505 033	518 909	462 071	594 316
Total	**44 819 776**	**48 502 064**	**51 770 560**	**55 653 652**	**57 946 389**

Source: Census 2001, Community Survey 2007, Authors' estimates based on figures from the Census 2011, Community Survey 2016 and Authors' estimates for 2018

Figure 3: Distribution of South Africa's population, by age groups 0-14, 15-64, 65+, years 2001, 2007, 2011, 2016 and 2018

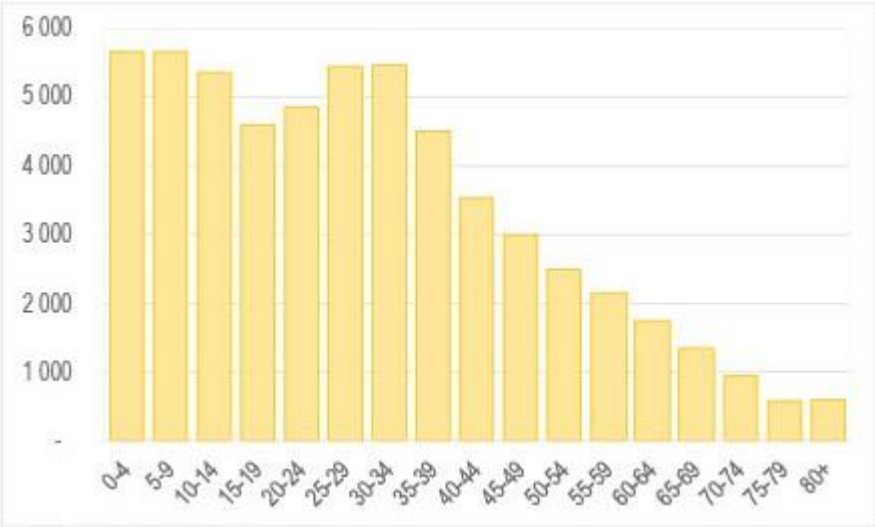


Source: Census 2001, Community Survey 2007, Census 2011, Community Survey 2016 and Authors' estimates for 2018

Between 2001 and 2018, the proportion of the population below age 15 has gradually decreased while the share of the working-age population (15 to 64 years) and those above age 65 has increased. The age-distribution still indicates a youthful population: as of 2018, about 28.8 per cent of the population (or around 16.7 million) is younger than 15 years and approximately 6.0 per cent of the population (or around 3.5 million) is 65 years or older.

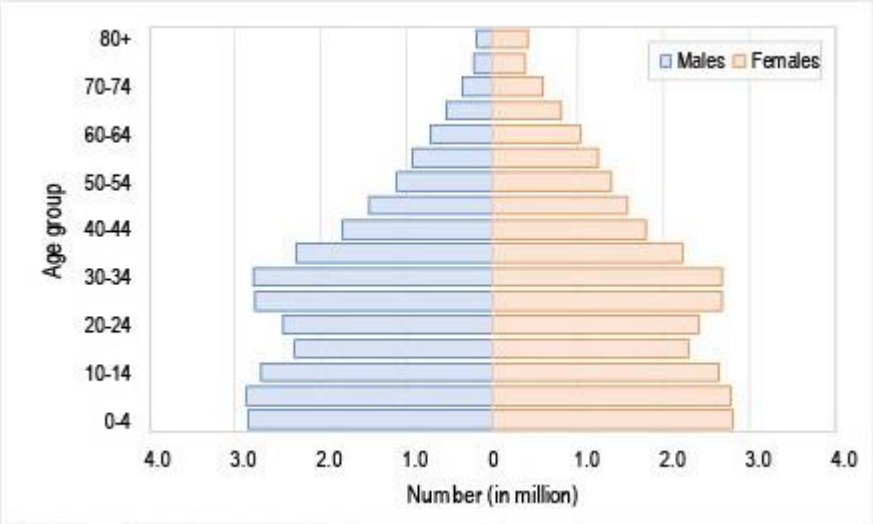
Figure 4 presents the estimated age-distribution of the population for year 2018. Figure 5 presents the structure of the national population (population pyramid) for year 2018, by age and sex.

Figure 4: Distribution of population, by age groups, years 2018 (in thousands)



Source: Authors' estimates for 2018

Figure 5: Structure of the national population, by age-groups and sex, 2018



Source: Authors' estimates for 2018

According to the various sources analyzed under the scope of this project, the sex ratio among age groups has remained relatively stable since 2001.

Table 2 presents the population of South Africa by age and sex for 2018.

Table 2: Population of South Africa, by age and sex, 2018

Age	Male	Female	Total
0–4	2 872 040	2 796 073	5 668 113
5–9	2 866 651	2 788 255	5 654 907
10–14	2 698 935	2 650 890	5 349 826
15–19	2 310 063	2 282 909	4 592 972
20–24	2 439 583	2 403 916	4 843 499
25–29	2 765 084	2 683 959	5 449 044
30–34	2 785 728	2 672 569	5 458 297
35–39	2 287 034	2 218 385	4 505 419
40–44	1 739 255	1 794 586	3 533 840
45–49	1 434 230	1 567 593	3 001 823
50–54	1 113 553	1 385 055	2 498 608
55–59	931 710	1 229 291	2 161 001
60–64	734 292	1 024 542	1 758 833
65–69	545 569	804 866	1 350 435
70–74	356 179	579 990	936 169
75–79	211 836	377 452	589 288
80–84	126 741	280 373	407 114
85–89	41 781	109 410	151 191
90–94	7 480	24 795	32 275
95–99	752	2 918	3 669
100+	12	56	68
Total	**28 268 509**	**29 677 880**	**57 946 389**

Source: Authors' estimates, ages 80+ distributed according to the World Population Prospects (WPP) 2019 estimates

2.1.1.Fertility

Levels of fertility in South Africa have been declining. According to the censuses produced since 2001, the Total Fertility Rate (TFR) declined from 2.84 children per woman in 2001 to 2,67 children per woman in 2011. In the latest MYPE report published (MYPE 2019 published on 29 July 2019), StatsSA has rather presented a TFR increasing from 2.45 children per woman in 2002 to 2.66 children per woman in 2008, gradually reducing thereafter to 2.51 children per woman in 2011 and 2.33 children per woman in 2018.

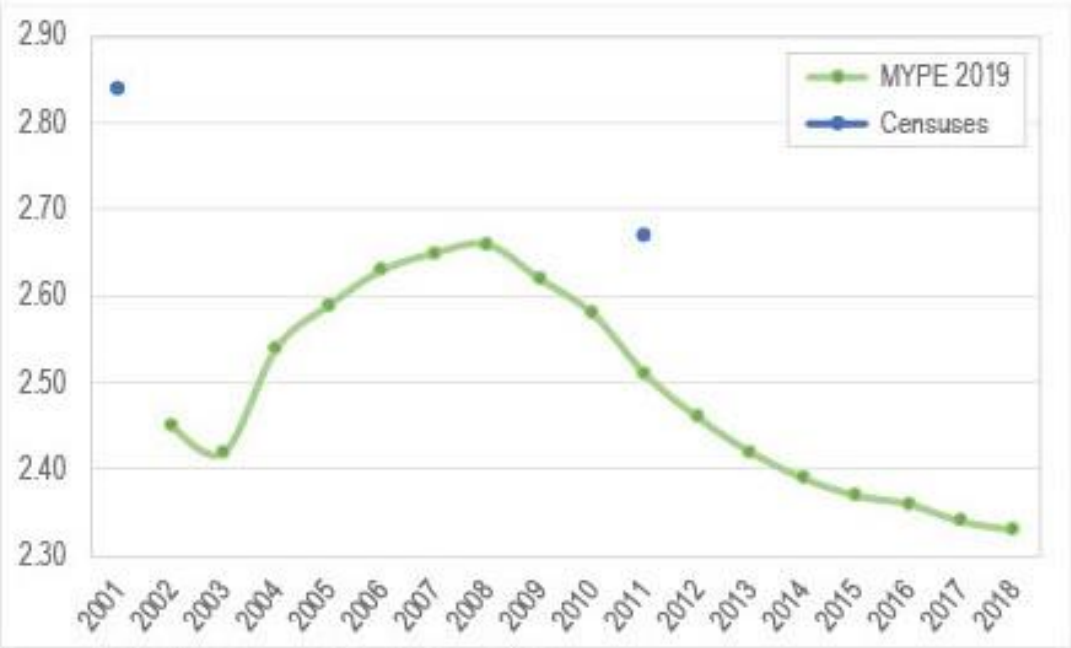
Data issues were sometimes observed in the censuses and community surveys. Given the extent of reported issues, the raw data have been adjusted to minimize the effect of the issues found on the estimates. StatsSA also review and adjust the past fertility trends and patterns from time to time to reflect recent experience and additional studies. Although the intention of the editing process is to have a positive impact on the quality of data, increases in the number of edits may also have a negative impact.

While data issues may have contributed to skew the fertility statistics presented in the censuses and community surveys in the past, the MYPE estimates were derived following a detailed review of TFR estimates (1985–2019),

published and unpublished, from various authors, methods and data sources. Thus, the latter statistics were deemed more accurate for the purposes of this study[13].

Figure 6 presents the evolution of the total fertility rates from 2002 to 2018 inclusively. For comparison purposes, the Census 2001 and Census 2011 are also shown in the figure.

Figure 6: Total fertility rates, 2001-2018

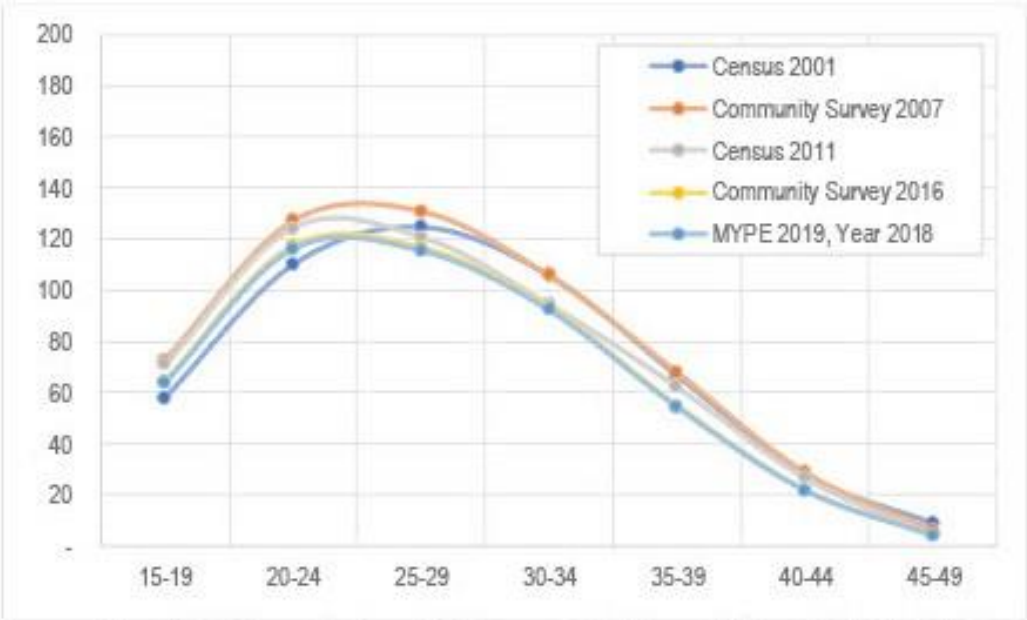


Source: MYPE 2019, Census 2001 and Census 2011

Figure 7 presents the evolution of the age-specific fertility rates from the Census 2001 to the MYPE 2019. The age-specific fertility rates from the censuses and community surveys have been adjusted to reflect the total fertility rates assumed in the MYPE of 2019. Age-specific fertility rates from the censuses and community surveys have been adjusted to reflect the total fertility rates estimates from the MYPE of 2019. The TFR of 2018 originating from the MYPE 2019 has been applied to the age-specific fertility rates from the last community survey, the Community Survey 2016, to obtain the age-specific fertility rates for year 2018.

[13] This methodology refers to the TFR estimated originating from the MYPE of 2019.

Figure 7: Age-specific fertility rates, in percent, 2001, 2007, 2011, 2016 and 2018

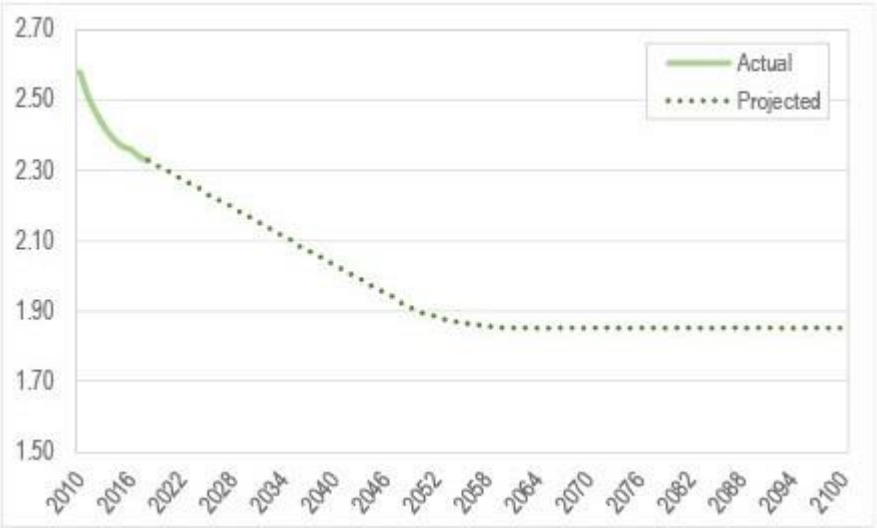


Source: Census 2001, Community Survey 2007, Census 2011, Community Survey 2016, MYPE 2019 and authors' adjustments based on TFR estimates from the MYPE 2019

Although the age-specific fertility rates and the trends in total fertility rate are consistent with what have been documented in prior surveys, censuses and studies, it is important to remain prudent. The fertility statistics presented above have been produced either by editing raw data or by calibration. Nonetheless, according to the various sources analyzed, the Total Fertility Rate for 2018 is likely to be between 2.3 and 2.4 children per woman.

The TFR in South Africa is assumed to decrease from its current level of 2.33 in 2018 to 2.17 in 2030, 2.03 in 2040 and 1.90 in 2050. The TFR is projected to reach its ultimate level of 1.85 in 2060. **Figure 8** presents the TFR assumed under this actuarial study.

Figure 8: Total fertility rates, 2010-2100



Source: MYPE 2019 and Authors' projections

For the first few years of the projection period, the total fertility rates have been estimated implicitly based on the population distributions at the valuation date: the projected number of births for the first few years were projected

consistently with the past trends. The age-specific fertility rates were assumed to shift gradually from their current pattern to the pattern proposed by the WPP 2019 for South Africa from 2050. The sex ratio of newborns has been estimated to 1.03 male per female throughout the projection period.

The age-specific fertility rates and TFR for years 2020, 2030, 2040, 2050 and 2060 appear in **Table 3**.

Table 3: Age-specific fertility rates and TFR, 2020, 2030, 2040, 2050 and 2060+

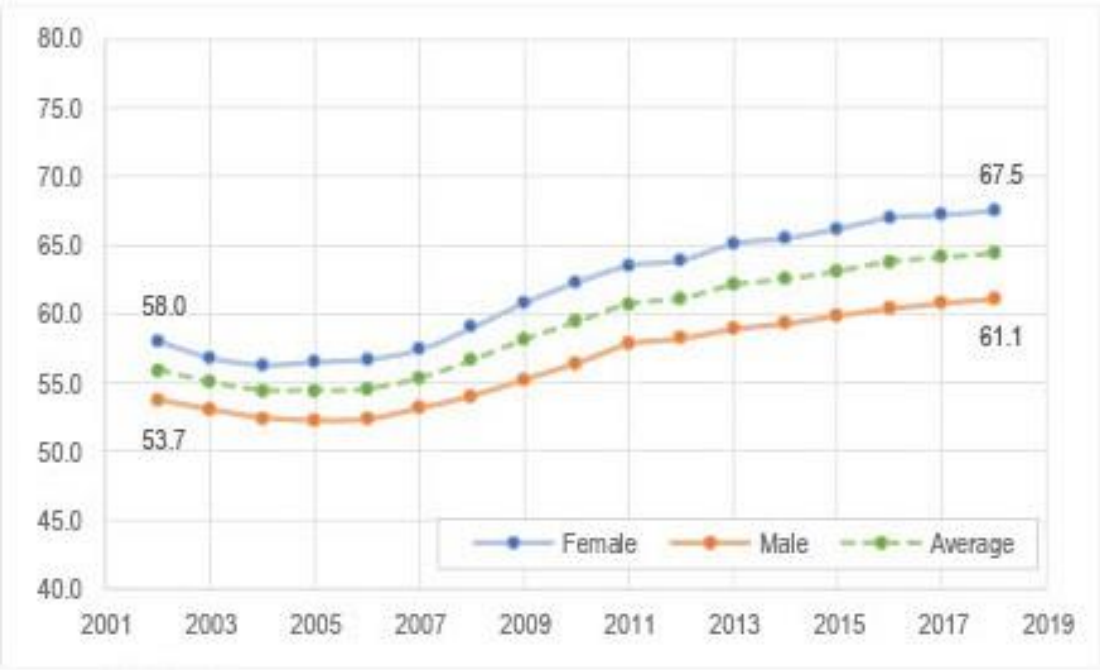
Age of mother	Fertility rates				
	2020	2030	2040	2050	2060+
15–19	0.31486	0.30198	0.28911	0.27624	0.25249
20–24	0.57115	0.52267	0.47418	0.42570	0.40263
25–29	0.57447	0.55756	0.54066	0.52376	0.51941
30–34	0.45612	0.43211	0.40810	0.38408	0.39229
35–39	0.26630	0.24807	0.22985	0.21162	0.21287
40–44	0.10327	0.09121	0.07915	0.06709	0.06518
45–49	0.01677	0.01401	0.01126	0.00851	0.00734
Total fertility rate	**2.30**	**2.17**	**2.03**	**1.90**	**1.85**

2.1.2.Mortality

The various sources[14] analyzed during the scope of this project show that South Africa is continuing to make progress in extending life expectancy and reducing mortality.

Figure 9 illustrates the evolution of the life expectancy at birth for males and females since 2001.

Figure 9: Life expectancy at birth, by sex, 2002-2018



[14] The sources include the YMPE 2019, the Rapid Mortality Surveillance Report of 2017, the 2019 Revision of the World Population Prospects, the World Bank and the Global Burden of Disease report of 2017 (see the Rapid Mortality Surveillance Report of 2017 for more details).

Source: MYPE 2019

Among the various sources analyzed, there is some consistency in the overall conclusion that life expectancy at birth for both males and females reached a minimum between 2004 and 2006. According to the MYPE of 2019, the average life expectancy in South Africa has increased by 10.0 years from the low of 54.4 years in 2005, reaching a level of 64.4 years in 2018[15].

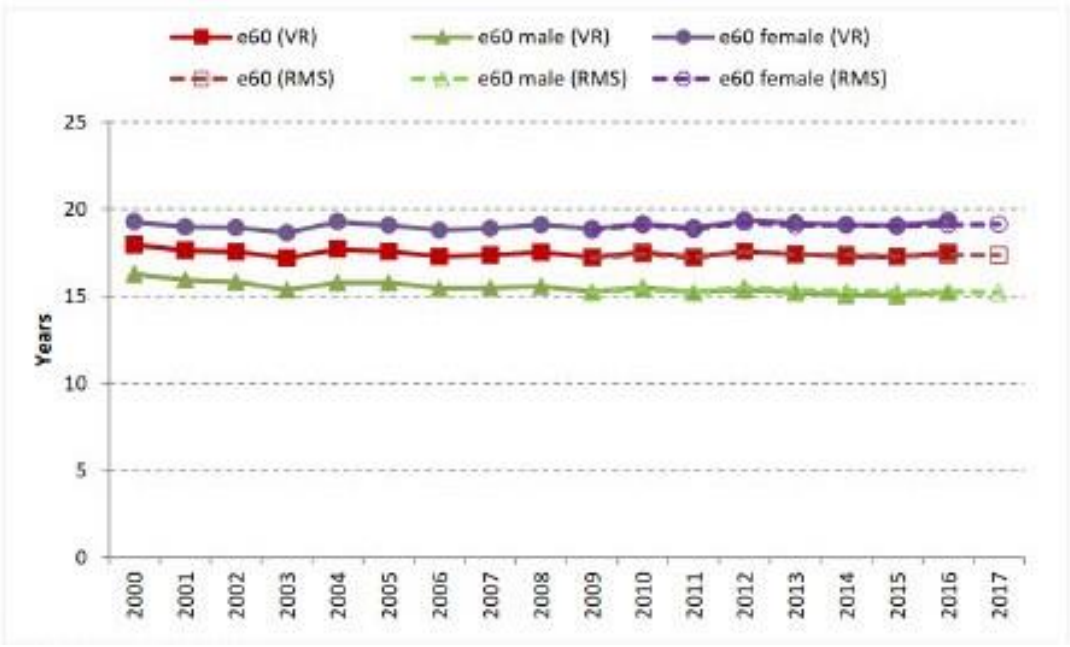
In all cases, the life expectancy of females is higher than that of males throughout the period with the difference getting higher from around 2008. In fact, while the difference between the life expectancy at birth of males and females averaged at 4.2 years between 2001 and 2007, the difference has gradually increased from 5.0 years in 2008 to 6.4 years in 2018.

The MYPE of 2019 are almost entirely consistent with the estimates originating from the Rapid Mortality Surveillance Report (RMS) of 2017[16]. It is noted that the WPP 2019 estimates slightly underestimate the life expectancy at birth for both males and females compared to MYPE 2019 and RMS 2017. According to the latter, the WPP overestimates the adult mortality and underestimates the mortality related to the youths.

Life expectancy at age 60 is a useful summary of the mortality experienced by older South Africans. The MYPE 2019 does not present life expectancies at age 60. However, according to the RMS 2017, although the life expectancy at birth improved significantly in the past few years, the mortality rates in older ages have shown little change. The life expectancy at age 60 has been around 15 years for men since 2000 and around 19 years for women for the same period. This suggests that the mortality between ages 0 and 59 has been the main driver of the increases in the life expectancy in South Africa since 2001. The RMS report estimates the residual life expectancy at age 60 to 15.2 years for males and 19.1 years for females for year 2017.

Figure 10 presents the evolution of the life expectancies at age 60 for males and females since 2012.

Figure 10: Life expectancy at the age of 60 (e60) from VR[17] and RMS 2017, 2000-2017 (after adjusting for incompleteness)



Source: RMS 2017

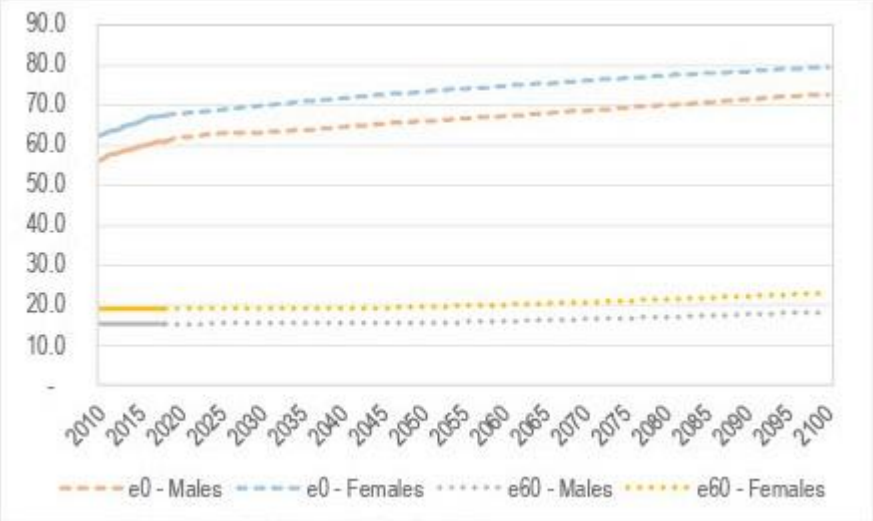
[15] Similar conclusions were drawn from the Rapid Mortality Surveillance Report of 2017. According to the latter, the average life expectancy has increased by 10.5 years from between the low of 53.7 years in 2005 and the level of 64.2 years estimated in 2017.
[16] The Rapid Mortality Surveillance Report of 2017 estimated the life expectancy at birth to 61.2 years for males and 7 years for females for year 2017.
[17] VR refers to Vital Registration

The mortality rates assumed in years 2018 have been adjusted to match the general life expectancy at birth of males and females (as estimated in the MYPE of 2019) as well as the residual life expectancy at age 60 of males and females (as estimated in the RMS 2017). The estimates of the general infant mortality rates and the mortality rates under 5 years old made by the RMS 2017 have been incorporated in the mortality Table. Other mortality indicators not published in the MYPE 2019 but computed in the RMS 2017 have been incorporated in the mortality rates assumed for 2018[18]. The mortality rates have been calibrated and adjusted to ensure general consistency.

In the short run, which is about up to the year 2031, the general life expectancy at birth is assumed to increase in line with the projections made by StatsSA[19]. For the medium- and long-term projections, information of the WPP are used to estimate the increases in the life expectancy. Over the projection period 2018-2100, the general life expectancy at birth is assumed to increase from 61.1 years to 72.7 years for males and from 67.5 years to 79.5 years for females. Similarly, to the recent trends, the residual life expectancy at age 60 is assumed to remain relatively stable for the first 20-30 years of the projection period. The residual life expectancy at age 60 is ultimately projected to reach 18.3 years for males and 22.9 years for females in 2100, as South Africa moves towards universal health coverage through the implementation of the National Health Insurance.

Figure 11 illustrates the actual and projected life expectancies at birth for both males and females, along with the actual and projected life expectancies at age 60.

Figure 11: Life expectancy at birth and at age 60, by sex, 2010-2100



Source: MYPE 2019, RMS 2017 and Authors' projections

2.1.3.Migration

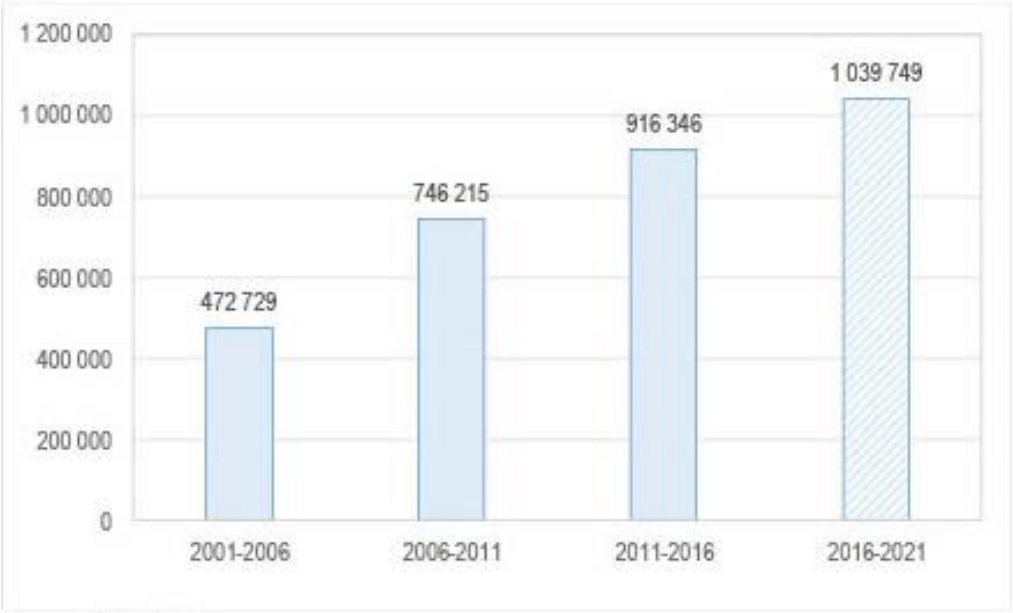
Migration is an important demographic process, as it shapes the age structure and distribution of the provincial population.

Figure 12 presents the estimated development of the net migration per 5-year periods since 2001. The period 2016-2021 includes migration estimates from StatsSA published in the MYPE of 2019.

[18] Includes mortality rates among children and young adolescents (10q5) for both males and females, mortality rates among older adolescents and youths (10q15) for both males and females and adult mortality (45q15) for both males and females.

[19] StatsSA projects until year 2051. It is however necessary to deviate from their short-term projections to come up with long-term assumptions.

Figure 12: Net migration, by 5-year periods, 2001-2021[20]



Source: MYPE 2019

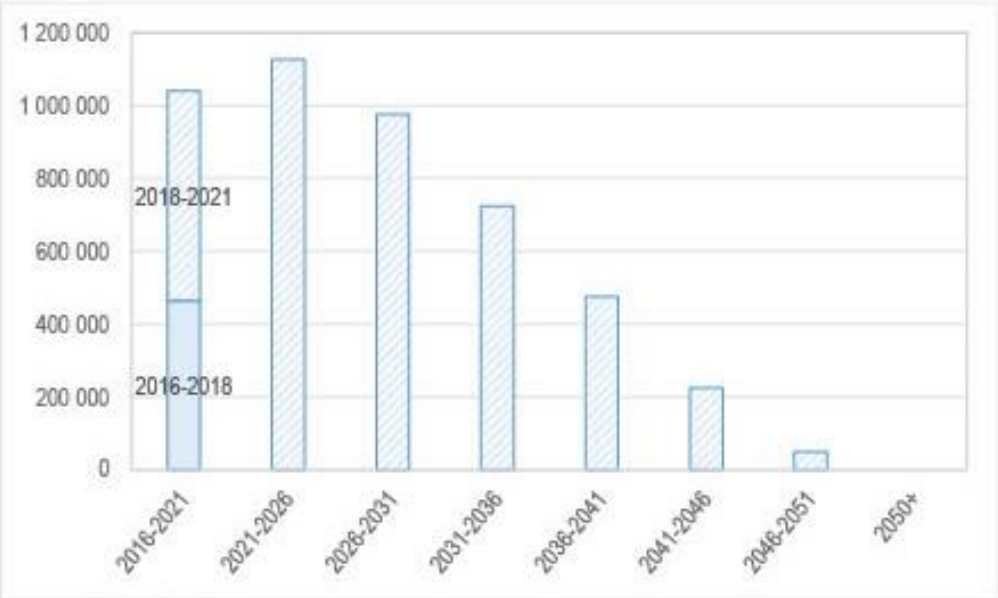
Net international migration estimates were derived by StatsSA using the Census 2011, but also migration data from various other authors, methods and data sources such as the Organization for Economic Co-operation and Development (OECD), International Organization for Migration (IOM) as well as census data from National statistics offices of other countries. A clear trend can be drawn from the figure above: the net migration in South Africa is largely positive and has continuously increased since 2001.

Migration can be seen as the most difficult component of growth to forecast accurately as migration rates are subject to much greater volatility than either fertility or mortality rates. Compared to other components of change (fertility and mortality), net migration is more significantly impacted by economic and political changes. The latest estimates from the MYPE 2019 were used as a starting point for the demographic projections and calibrations were done to match annual population growth rate expected in the first few years of the projection. Because of its underlying uncertainties and its potential on the overall results of the actuarial valuation, it has been assumed that the migration flow will remain relatively high in the next few years but will eventually stops by 2050. Positive net migration tends to reduce the cost of a social security system. This approach is therefore considered reasonable in the long run to avoid the cost of the plan being "too" influenced by external, volatile and difficult to control sources.

Figure 13 presents the migration assumptions retained under this actuarial valuation. The projections assume a reduced level of migration for years 2020 and 2021 to reflect the short-term impacts of the COVID-9 crisis.

[20] The estimate refers to the periods from the 30 June of the first year to the 1 July of the last year.

Figure 13: Net migration, by 5-year periods, 2016-2050+



Source: Authors' projections

2.1.4.Population projection

The total population of South Africa, estimated at 57.9 million in 2018 and 58.8 million in 2019[21], is projected to reach a peak in 2070 at 79.0 million and decrease gradually thereafter to 76.7 million in 2100.

Table 4 presents detailed population projections by age group. The number of persons aged 65 and over will grow from 3.5 million in 2018 to 14.9 million in 2100, the fastest growth among the three groups. At the same time, the working-age population aged between 15 and 64 who will potentially support the elderly will increase from 37.8 million in 2018 to 52.4 million in 2070 and start decreasing thereafter to reach 48.4 million in 2100. As a result, the number of working-age persons who support one elderly person aged 65 and over will fall from 10.9 in 2018 to 3.2 in 2100, as seen in the last Column of **Table 4**.

Figure 14 illustrates the gradual ageing of the population of South Africa over the projection period. For comparison purposes, the estimates from the Census 2001 and the Census 2011 are also presented.

[21] MYPE of 2019.

Table 4: Projected population of South Africa, 2018–2100 (in millions)

Year	Age group				Working age (15–64)/65+ ratio (in %)
	0–14	15–64	65+	Total	
2018	16.7	37.8	3.5	57.9	10.9
2020	16.9	39.0	3.6	59.5	10.7
2030	17.0	45.3	4.7	67.0	9.6
2040	17.1	50.0	5.9	73.0	8.5
2050	16.6	52.1	8.0	76.7	6.5
2060	15.6	52.3	10.5	78.5	5.0
2070	15.1	52.4	11.5	79.0	4.5
2080	14.6	51.1	13.0	78.7	3.9
2090	13.9	50.0	14.0	77.9	3.6
2100	13.4	48.4	14.9	76.7	3.2

Source: Authors 'estimates for year 2018 and Authors 'projections for years 2020-2100

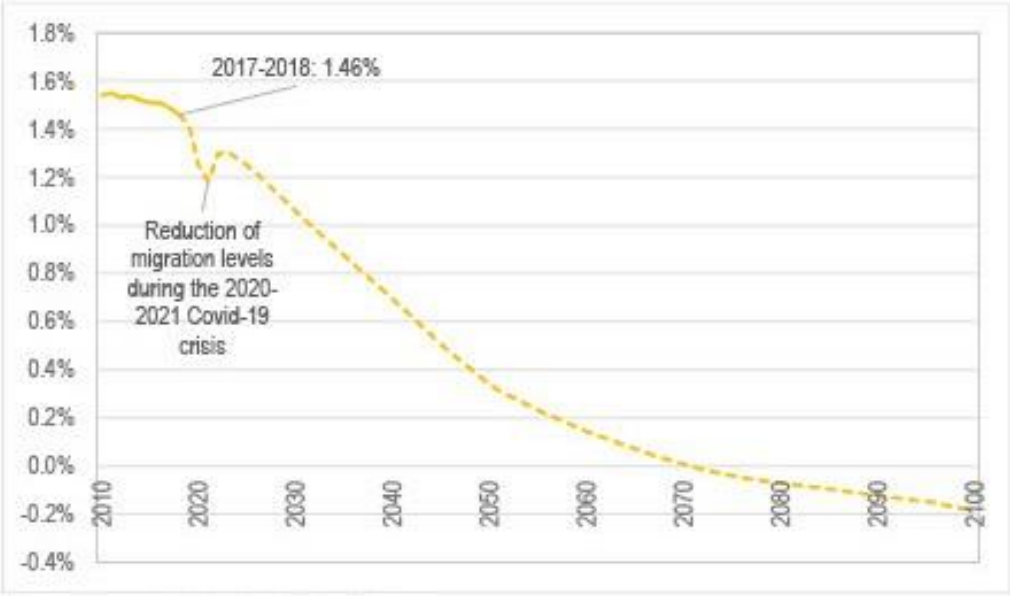
Figure 14: Projected ageing of the population, 2018-93 (in millions)

Source: Census 2001, Census 2011 and Authors' estimates and projections

The above figure shows that the working-age population will remain relatively stable as a percentage of the total population over the projection period, varying from 63 to 68 per cent of the total population. On the other hand, the ratio of the children to the total population will gradually decrease over the projection period as a result of the projected decline in fertility rates. Also, the ratio of the elderly (aged 65 and above) to the total population will continue to increase over the projection period.

Figure 15 presents the projected annual growth rates of the total population of South Africa. For comparison purposes, the figure also presents the period from 2010 to 2018 as per MYPE 2019 estimates.

Figure 15: Projected annual growth rates of the total population of South Africa, 2018-2100



Source: MYPE 2019 and Authors' projections

2.2. Macroeconomic framework

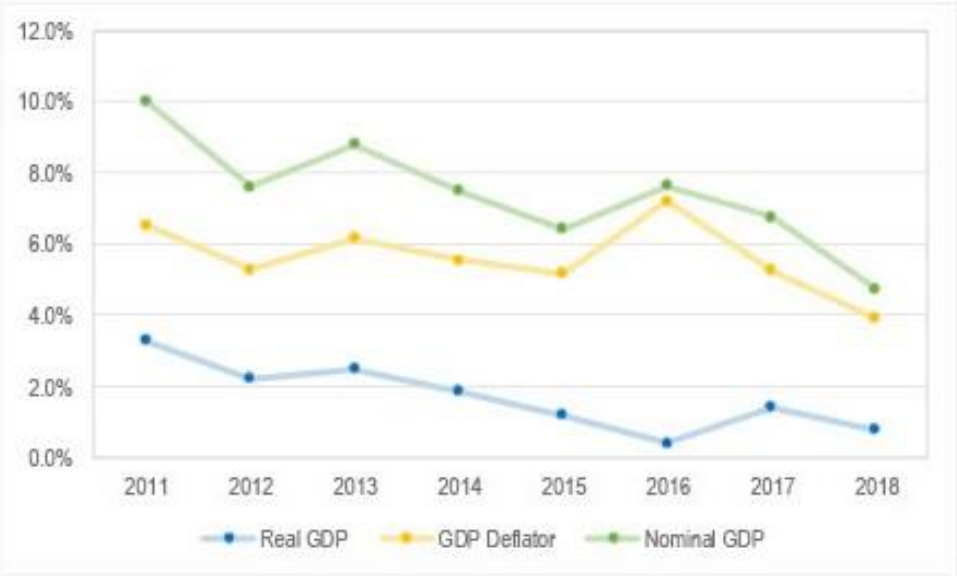
This section presents the recent macro-economic experience in South Africa as well as the economic assumptions used under this valuation.

2.2.1. Experience between 2011 and 2018

According to StatsSA, the annual real Gross Domestic Product (GDP) growth rate averaged at 1.7 per cent between 2010 and 2018 inclusively while the nominal GDP growth rate increased at an average rate of 7.4 per cent per year during the same period[22]. The GDP deflator increase on average at an annual growth rate of 5.6 per cent between 2010 and 2018 inclusively. **Figure 16** contrasts the growth rates of the real GDP, the GDP deflator and the nominal GDP over the period 2011-2018.

[22] Also consistent with the estimates from the *Economist* Intelligence Unit (EIU) and the International Monetary Fund (IMF).

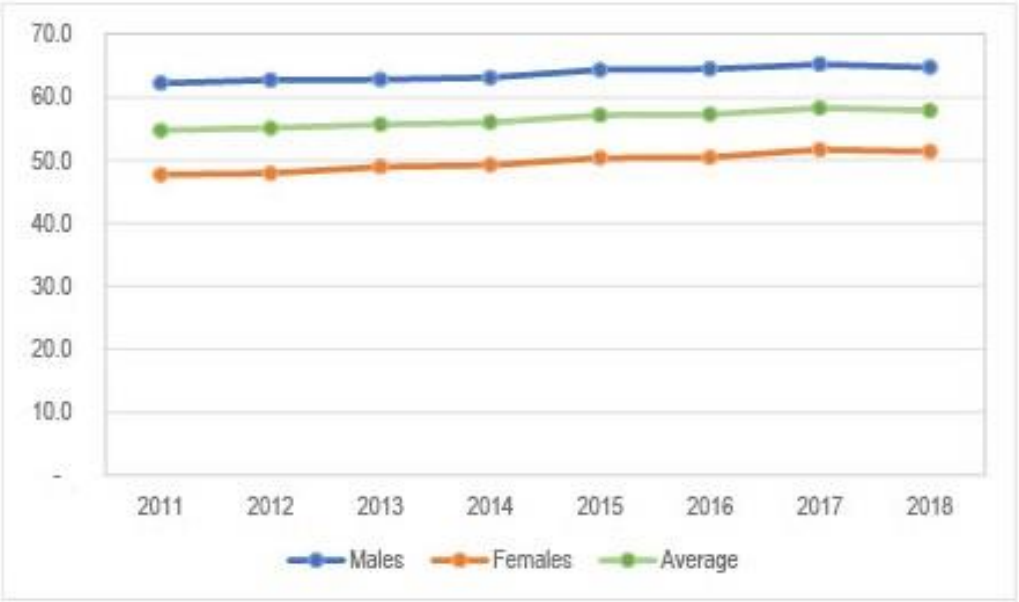
Figure 16: Real GDP, GDP Deflator and Nominal GDP, 2011-2018



Source: StatsSA

Figure 17 illustrates the evolution of the labour force participation rates (ages 15-69) between 2008 and 2018 inclusively.

Figure 17: Labour force participation rate (ages 15-69), 2011 to 2018 (in percentage)

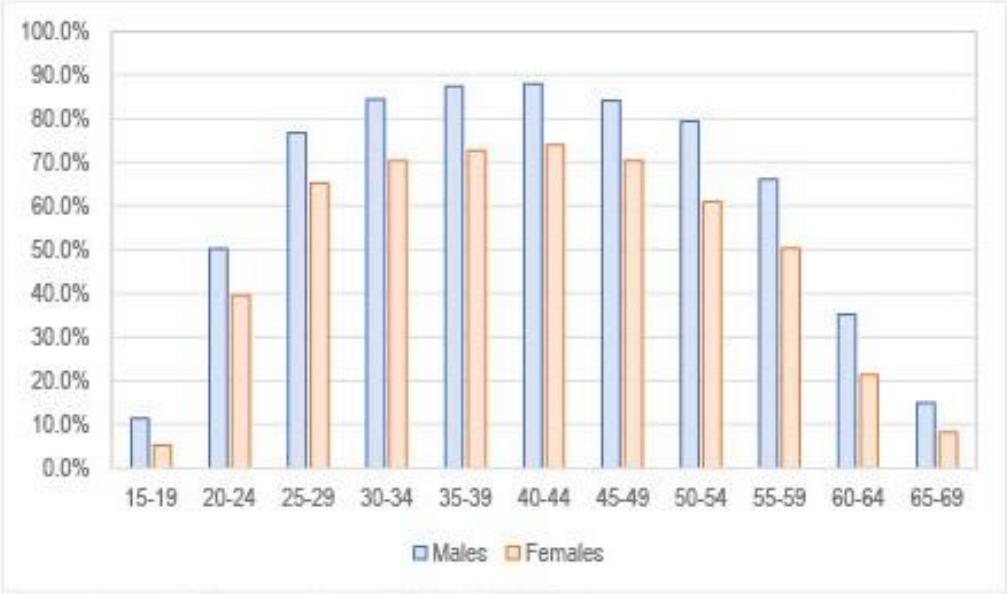


Source: Quarterly Labour Force Surveys 2011 to 2008

The overall labour force participation rate was estimated to 57.9 per cent (ages 15-69) for 2018. Between 2011 and 2018, the general participation rate among males has increased by 2.5 per cent, from 62.2 to 64.7 per cent and the general participation rate among females has increased by 3.7 per cent, from 47.7 to 51.4 per cent.

Figure 18 presents the labour force participation rates by age groups and sex for year 2018.

Figure 18: Labour force participation rates, 2018, by age groups and sex



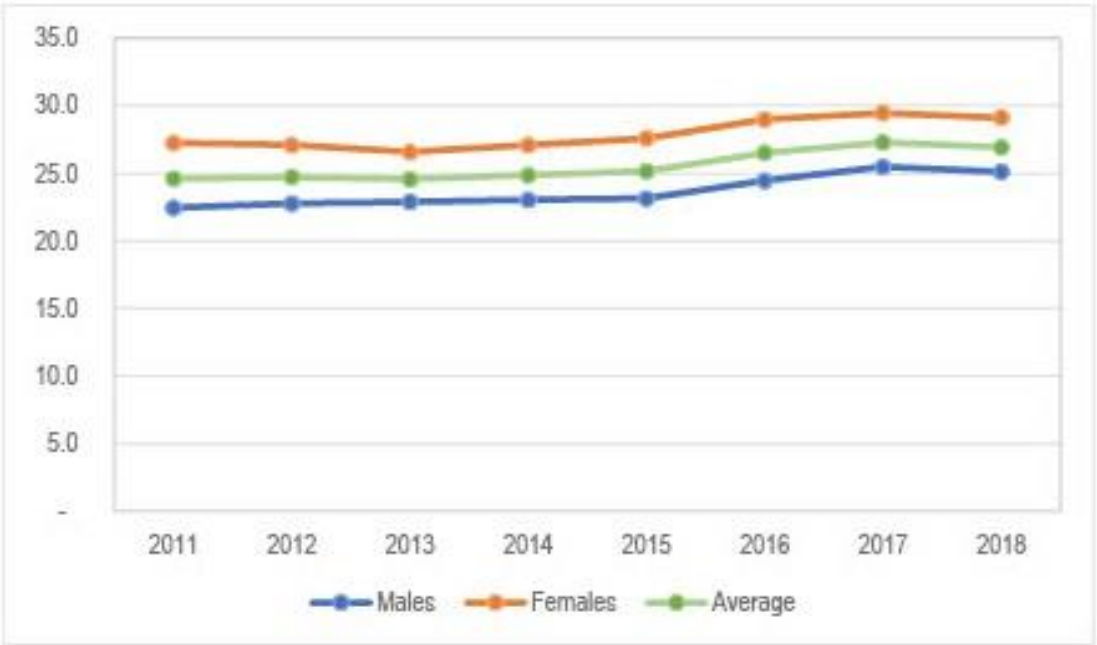
Source: Quarterly Labour Force Survey 2018 (QLFS-2018)

Figure 19 illustrates the evolution of the unemployment rate between 2011 and 2018.

The overall unemployment rate was estimated to 26.9 per cent for 2018. Between the 2011 and 2018, the unemployment rates among males have increased by 2.7 per cent, from 22.4 to 25.1 per cent and the unemployment rates among females have increased by 1.9 per cent, from 27.2 to 29.1 per cent.

As per the QLFS 2018, the youth aged 15–24 years are the most vulnerable in the South African labour market. In fact, the overall unemployment rate among this age group was estimated at 51.9 per cent in 2018. The unemployed persons aged below 35 explain for more than 60 per cent of the total number of unemployed persons in South Africa.

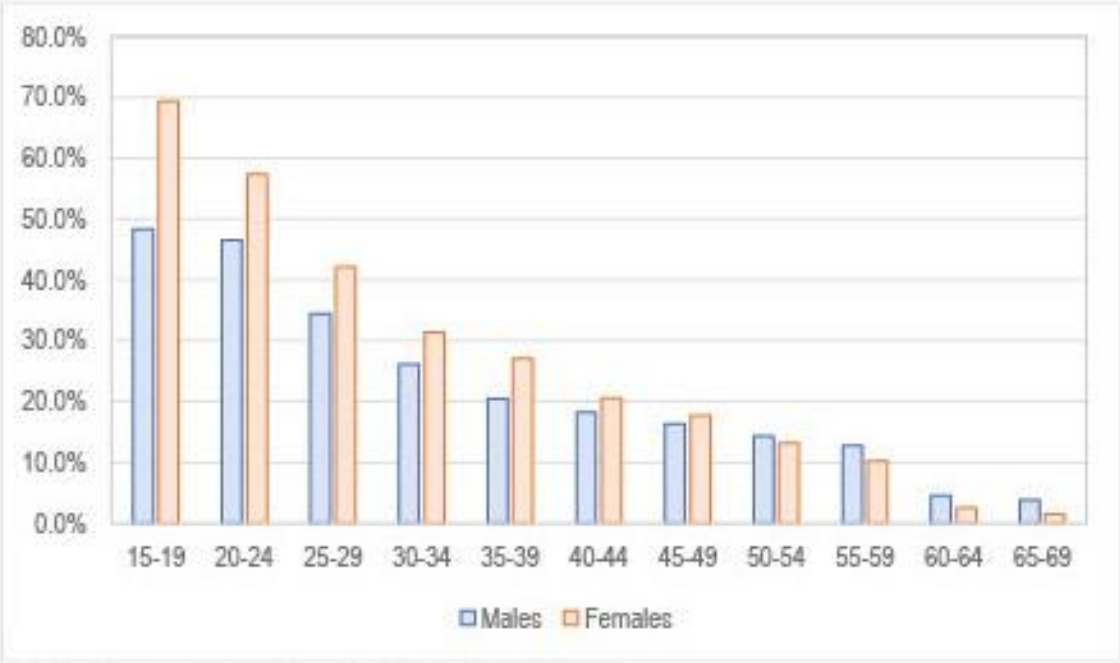
Figure 19: Unemployment rate, first quarter of 2011 to last quarter of 2018 (in percentage)



Source: Quarterly Labour Force Surveys 2011 to 2008

Figure 20 presents the unemployment rates by age-groups and sex in year 2018.

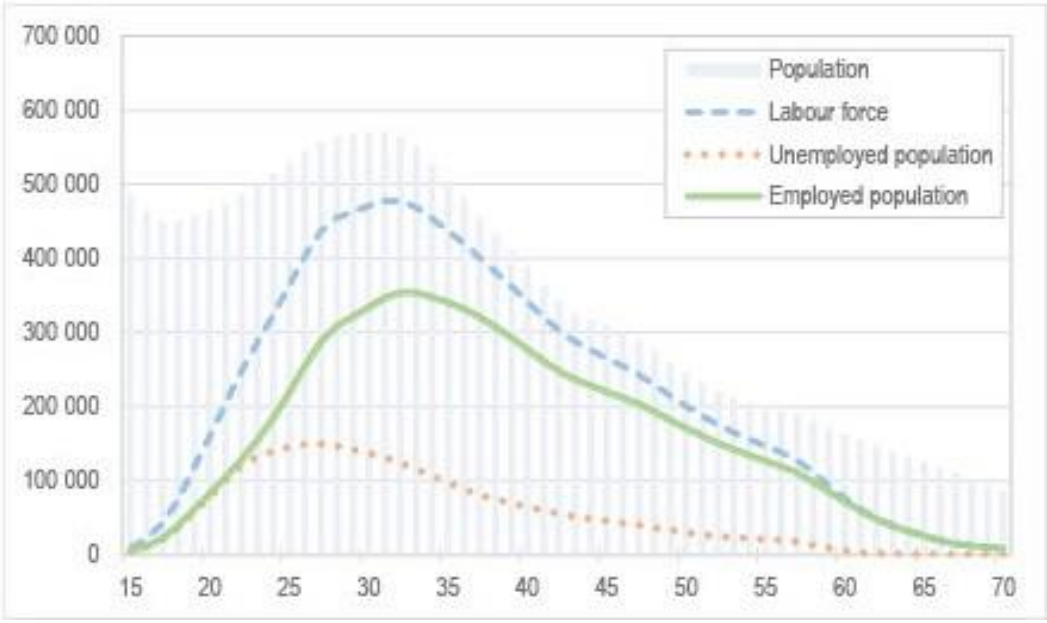
Figure 20: Unemployment rates, 2018, by age groups and sex



Source: Quarterly Labour Force Survey 2018 (QLFS-2018)

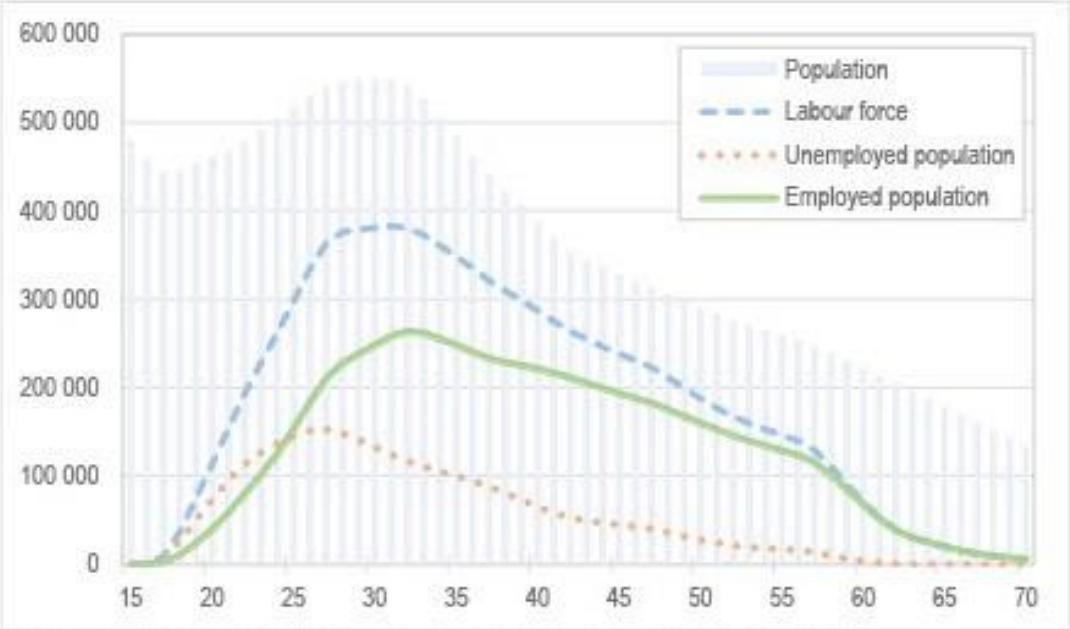
Figure 21 and **Figure 22** illustrate the age-distributions related to the population, the labour force population, the employed and the unemployed population for year 2018.

Figure 21: Population, labour force population and unemployed population, 2018, by age, males



Source: Authors' estimates based on Quarterly Labour Force Survey 2018 (QLFS-2018)

Figure 22: Population, labour force population and unemployed population, 2018, by age, females



Source: Authors' estimates based on Quarterly Labour Force Survey 2018 (QLFS-2018)

The evolution of the productivity growth rate was derived from the real GDP growth rates, the employment growth rates, and the wage share of GDP and is shown in the following table. According to StatsSA, the wage share of GDP has increased gradually since 2011, from 44.9 per cent in 2011 to 47.7 per cent in 2018.

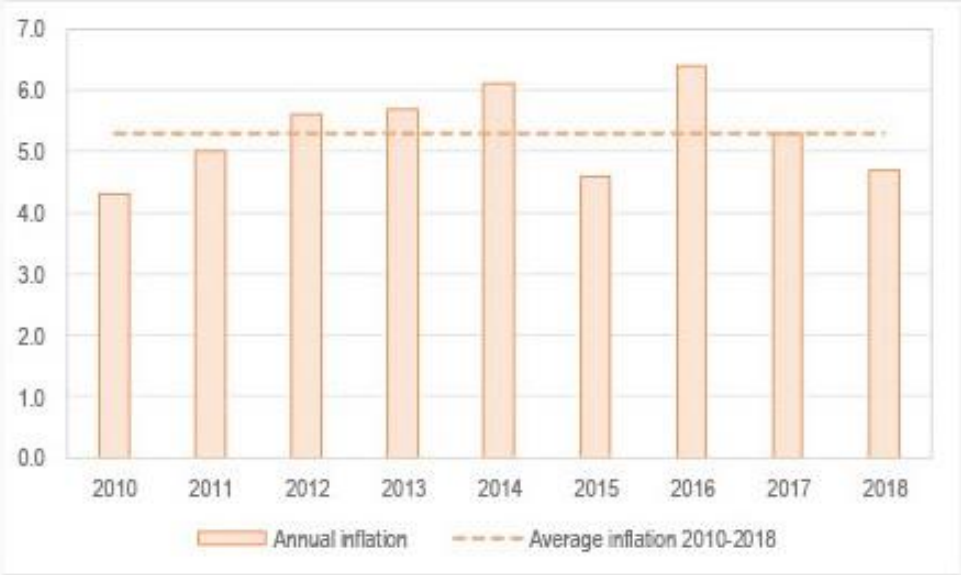
Table 5: Wage share of GDP and Real GDP, Employment and Productivity growth rates, 2011-2018 (in percent)

Year	Wage share of GDP	Real GDP growth rate	Employment growth rate	Productivity growth rate
2011	44.9	3.3	2.0	3.1
2012	45.0	2.2	2.5	-0.2
2013	45.5	2.5	3.1	0.6
2014	46.0	1.8	1.9	1.1
2015	46.5	1.2	3.9	-1.6
2016	47.0	0.4	0.3	1.3
2017	47.4	1.4	2.5	-0.2
2018	47.7	0.8	2.5	-1.1
Average	**46.3**	**1.7**	**2.3**	**0.4**

Source: StatsSA (wage share of GDP, real GDP growth rate and employment growth rate) and authors' calculations (wage growth rate)

Since 2010, the inflation increased annually at an average rate of 5.3 per cent. **Figure 23** presents the inflation growth rates from years 2010 to 2018 along with the average inflation rate observed over the period.

Figure 23: Inflation rate and average inflation rate, 2010-2018



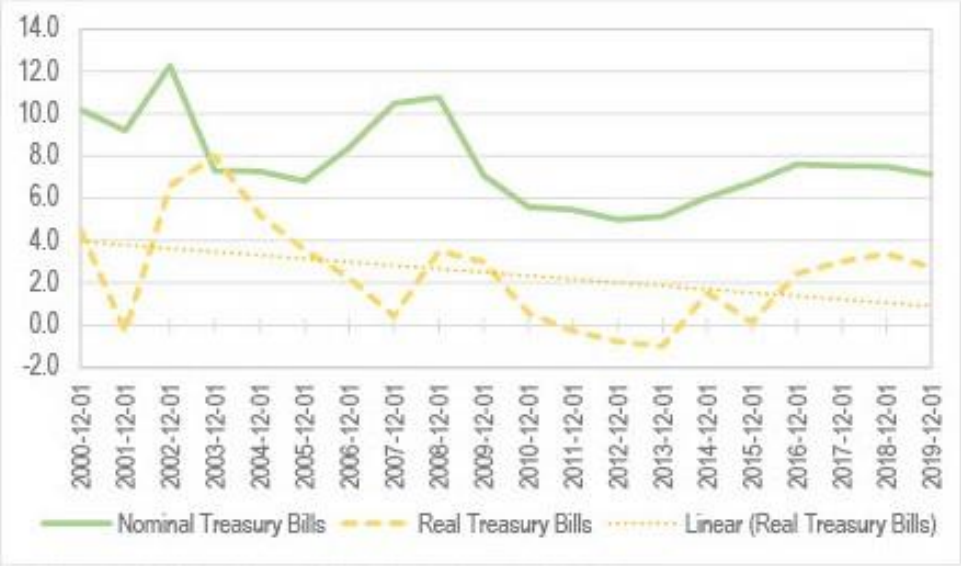
The evolution of the real gross earnings for the years 2011 to 2019 is presented in **Figure 24**. It has increased on average by 1.46 per cent per year over the period analysed.

Figure 24: Real gross earnings and average real gross earnings increase, 2011-2019, percentage

Source: StatsSA, QES 2019, calculations made by the Authors

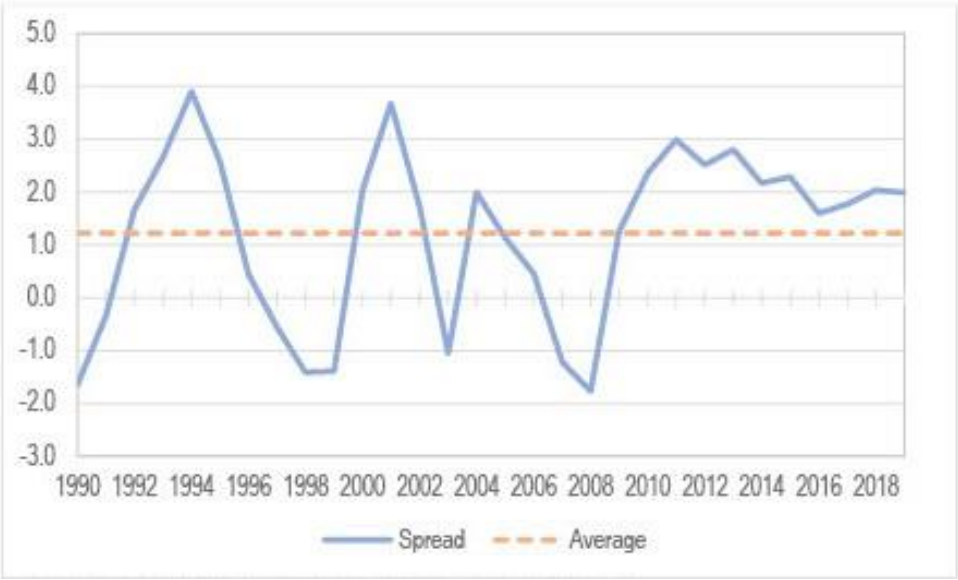
Over the last 20 years, the Treasury Bills, net of inflation, have shown a downward trend. Over the last twenty years, ten years and five years the average real rate was respectively 2.3 per cent, 1.1 percent and 2.2 percent. The spread between the Government 10-year bonds and the Treasury Bills for a period starting in 1990 has been 1.2 per cent. Over the last decade it was 2.3 per cent.

Figure 25: Treasury Bills, nominal and real, 2000-2019, percentage



Source: Federal Reserve Bank of St. Louis, Economic Research Division

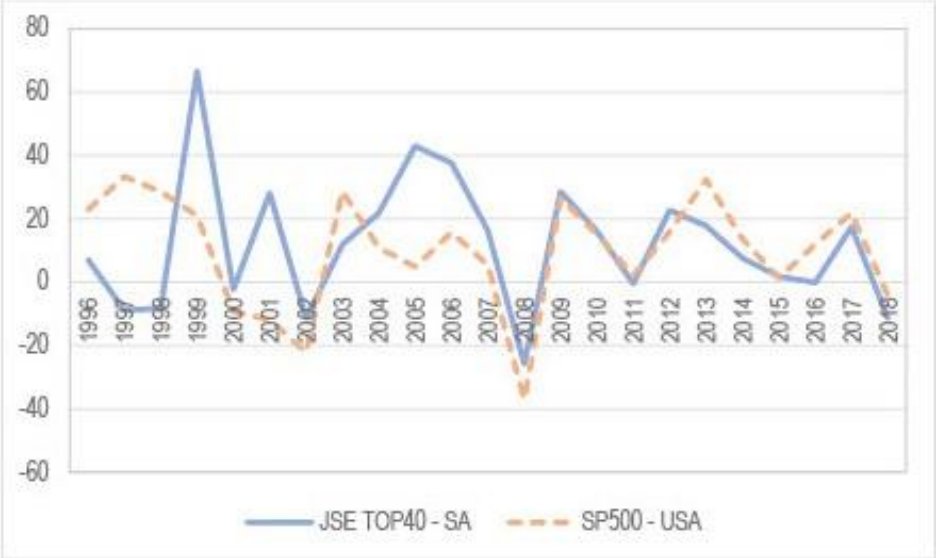
Figure 26: Spreads between Government 10-year Bonds and Treasury Bills, 1990-2019, percentage



Source: Federal Reserve Bank of St. Louis, Economic Research Division

The average nominal return of the Johannesburg Stock Exchange Top 40 Tradeable Index (JSE TOP40) from January 1996 to June 2019 has been 10.3 per cent If the effect of the inflation is removed, the real return of the JSE TOP40 has been close to 4.5 per cent. As illustrated on the following figure, the return of the JSE TOP40 is highly correlated with the SP 500 of the USA.

Figure 27: Return of the JSE TOP40 and, SP500 USA, 1996-2018, percentage

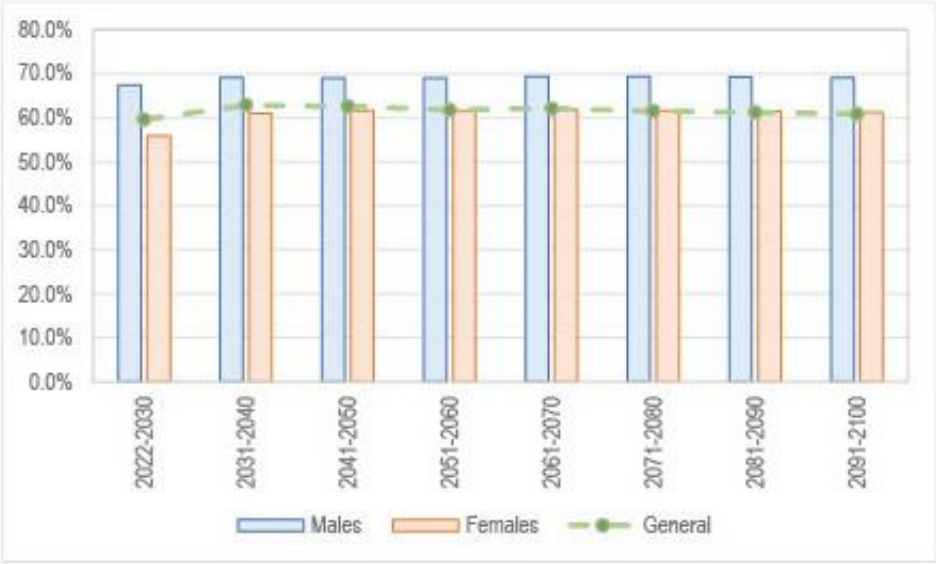


Source: DSD, Canadian Institute of Actuaries

2.2.2. Projection assumptions

The participation rates among males and females are expected to continue increasing in the future following a pattern similar to that observed in the past few years before the COVID-19 crisis. The overall participation rate over the population aged 15 to 69 is projected to exceed 60 per cent over the long-term. Although a difference in the participation rates of males and females is projected to remain in the future, the gap between males and females' participation rates is projected to slightly reduce over time. Over the first 20 years of the projection period, the participation rate among males aged 15-69 is expected to increase by 3.0 per cent, from 64.7 to 67.7 per cent while the participation rate among females is expected to increase by 8.5 per cent, from 51.4 to 59.9 per cent.

Figure 28: Labour force participation rate, 2022-2100 (in percentage)



Similarly, to what was experienced in the last few years, the unemployment rate is assumed to continue increasing over the next few years, reaching up to 30.0 per cent over the population aged 15 to 69 by 2024. Between 2024 and 2040, the unemployment rate is assumed to remain relatively stable around 30-31 per cent. The unemployment

rate is then projected to decrease gradually to 13.3 per cent over the population aged 15 to 69 in 2100 as a result of the gradual aging of the population and the decreasing growth rate of the working-age population over the projection period.

The evolution of the total population of South Africa as well as the various components of the labour force appear in **Table 6**.

The real wage growth is expected to be in line with the labour productivity growth rate. Wage growth takes into account the history as well as a long-term reasonable assumption. The annual real wage increase is expected to be 1.1 per cent for all the projection years.

The South African Reserve Bank (SARB) is responsible for the monetary policy of South Africa. South Africa's monetary policy is conducted within an inflation targeting framework and the refinancing system is the mechanism used by the Bank for the implementation of monetary policy. According to the Monetary Policy Statement of 21 November 2019, the SARB will continue to focus on anchoring inflation expectations near the mid-point of the inflation target range in the interest of balanced and sustainable growth.

Given that the SARB will continue to focus on anchoring inflation expectations near the mid-point of the inflation target range, the inflation has been projected at 4.5 per cent per year from 2022.[23]

Table 6: Population, labour force and employment, 2022-2100

	2022	2025	2050	2075	2100
Population (in million)	61.0	63.4	76.7	78.9	76.7
Male	29.8	31.0	37.3	37.9	36.8
Female	31.2	32.4	39.4	41.0	40.0
Working-age population (15–69) (in million)	41.7	43.9	55.4	55.9	52.8
Male	20.4	21.5	27.2	27.4	26.0
Female	21.3	22.4	28.2	28.6	26.8
Labour force participation rate (%)	58.9%	59.6%	61.9%	61.5%	60.6%
Male	65.3%	65.6%	65.8%	65.7%	65.0%
Female	52.8%	53.9%	58.1%	57.4%	56.5%
Labour force population (in million)	24.6	26.2	34.3	34.4	32.0
Male	13.3	14.1	17.9	18.0	16.9
Female	11.3	12.1	16.4	16.4	15.1
Employed population (in million)	17.3	18.3	25.9	28.4	27.8
Male	9.6	10.2	13.8	15.1	14.8
Female	7.7	8.1	12.1	13.3	13.0
Unemployed population (in million)	**7.3**	**7.9**	**8.4**	**6.0**	**4.3**
Male	3.7	3.9	4.1	2.9	2.1
Female	3.6	3.9	4.3	3.1	2.2
Unemployment rate (%)	29.6%	30.1%	24.4%	17.5%	13.3%
Male	27.6%	28.0%	22.7%	16.3%	12.4%
Female	32.1%	32.6%	26.4%	18.8%	14.4%

[23] The SARB's inflation target range is situated between 3 and 6 percent per year.

3. SCHEME-SPECIFIC DATA AND ASSUMPTIONS

In addition to the demographic and economic data and assumptions presented in Chapter 2, the financial projection of the scheme requires data and assumptions specific to its membership and some other specific actuarial assumptions.

The database used to make the projections comes mainly from information from GEPF and UIF as they are the two main groups that will make up the insured population of the new NSSF, at least at the time of implementation. When possible, the selection of assumptions takes into account the recent experience of the GEPF and UIF (where information is available). Also affecting the choice of assumptions are long-term trends, which may be more meaningful than recent results.

For simplicity, the actuarial valuation is going to be done by calendar year. It is possible that the financial year of the new NSSF will be from 1 April to 31 March like UIF. This simplicity will not affect the nature of the work as well as the results.

Establishing assumptions for a non-existent scheme like the new NSSF is difficult because some information simply does not exist. While it is possible to have a good idea of the insured population or the number of months of contribution, it is not possible to have information about the family, the mortality or the invalidity experience. Consequently, some assumptions are based on the best available information and new emerging experience of the scheme must be used to adjust these assumptions. Sensitivity analyses are conducted in the actuarial analysis to evaluate the impact if the experience deviates from the expectation.

It is important to note that scheme-specific assumptions may change after discussions with the stakeholders.

3.1. Data gathering

Collection of the data required to perform the actuarial valuation was carried out by the Department of Social Development of South Africa (DSD) in strong collaboration with the South African Social Security Agency's (SASSA), StatsSA, the Government Employees Pension Fund (GEPF) and the Unemployment Insurance Fund (UIF). Validation of the data received was made by the authors of this report. The data requested included general information on the demography, in particular on the mortality, and economy of South Africa as well as GEPF and UIF specific data.

To distribute the NSSF active contributors by age and sex, the data obtained from GEPF and UIF in 2018 have been used. Those whose age and sex were unknown at the date of valuation have been allocated in proportion to the distribution of insured population aged 15-69, by age and sex. The following section presents the data collection process and the quality of data obtained from GEPF and UIF. It worth mentioning that it is the responsibility of the DSD to ensure that the quality of data used is good.

3.1.1. GEPF

The following items have been obtained from GEPF:

- Audited financial statements for financial year 2018.
- Active contributors' individual information for financial years 2013 to 2018.

Some comments concerning the data collection process and the quality of data include the following:

- The information transmitted by the GEPF concerning the active insured population is good overall in terms of quality. Cross-checking with the audited financial statements highlights no significant inconsistencies[24]. Few issues have been found, e.g. members aged below 15 or over 69 years, or with inconsistent number

[24] The database of GEPF members obtained for this study did not include the categories of contributing members. Such information would have allowed to reconcile with the financial statements as of 31 March 2018. Nonetheless, it was possible to confirm that the data obtained was reasonable and mostly consistent with those used under the Statutory valuation of the Government Employees Pension Fund as at 31 March 2018.

of past credits (e.g. members aged 25 with 30 years of credits). Where statistically appropriate, those members have been distributed according to the age, sex and credit structure of the remaining population.

- The number of GEPF active members considered in this report (1,268,282[25]) differs slightly from the report of the board of trustees reflected in the fund's audited financial statements at the 31 March 2018 (1,273,784). It was impossible for the authors of this report to reconcile those two numbers. The gap observed between these two sources remain marginal.
- Consistency checks have been performed by the authors of this report on the data obtained from GEPF (tests on duplicates, age below 16 or above normal retirement age, missing salaries, etc.). Despite some minor data issues observed within the GEPF database, the authors of this report were satisfied with the general accuracy and completeness of the data provided and with its suitability for the specific purpose of this valuation.

3.1.2. UIF

The following items have been obtained from UIF:

- Audited financial statements for financial years 2015 to 2018.
- Active contributors' individual information in 2015, 2016, 2017 and 2018.

Some comments concerning the data collection process and the quality of data include the following:

- Cross-checking between the audited financial statements of the UIF, the membership databases and the Quarterly Employment Statistics (QES) of StatsSA has highlighted some inconsistencies. The UIF individual data have been adjusted to reflect as much as possible the general observations from both the audited financial statements and the QES. The adjustments made to the UIF individual data include the following: (1) those with full-time monthly salaries below Rnd 2,600 (which correspond approximately to the estimated minimum monthly salary of domestic workers) have been given a monthly salary of Rnd 2,600, and (2) The number of members and well as the densities have been adjusted to reflect that a significant portion of members (mainly low-income members) who leaves and re-enters the scheme each month.
- Other consistency checks have been performed by the authors of this report on the data obtained from UIF (tests on duplicates, age below 16 or above normal retirement age, missing salaries, etc.). Despite some data issues observed within the UIF database, the authors of this report were satisfied with the data provided and with its suitability for the specific purpose of this valuation.

3.2. Data and assumptions

It has been observed in both the GEPF and the UIF that the low-income workers tend to accumulate less contribution months compared to the high-income workers. Because the workers' profile varies significantly by income level, three specific sub-groups of members have been considered in this valuation: the low-income workers, the medium-income workers and the high-income workers. The contributing members have been distributed by age, sex and income level based on the individual data collected from GEPF and UIF. This approach is expected to capture properly the different profiles and characteristics of the workers who will contribute to the scheme.

3.2.1. Distribution of active contributors

The total number of NSSF active contributors would reach about 10.1 million in 2018. Calibration has been done using the latest QES statistics. Smoothing has been applied on resulting distributions in order to eliminate any major statistical bias.

Table 7 presents the distribution of monthly active contributors during year 2018, by age and sex. The insured members have been adjusted slightly to be more consistent with the employed population.

[25] The database obtained from GEPF contained 1,272,301 members who have contributed to the scheme during the financial year 2018. From those 1,272,301 members, 4,019 were deceased as of 31 March 2018. Those members have been excluded from the number of active insured members at 31 March 2018.

Table 7: Distribution of average monthly active contributors during year 2018, by age and sex

Age	Male	Female	Total
15–19	40 312	32 135	72 447
20–24	522 816	362 970	885 786
25–29	930 748	826 614	1 757 363
30–34	950 247	871 656	1 821 902
35–39	797 782	718 235	1 516 017
40–44	667 194	604 705	1 271 899
45–49	547 930	507 356	1 055 286
50–54	427 003	395 417	822 420
55–59	302 655	277 866	580 522
60–64	127 085	102 007	229 092
65–69	31 112	24 221	55 334
Total	**5 344 884**	**4 723 183**	**10 068 067**

Source: GEPF and UIF databases, authors' adjustments.

It was assumed that no member would exceed age 70. In other words, NSSF members are projected to retire no later than age 70.

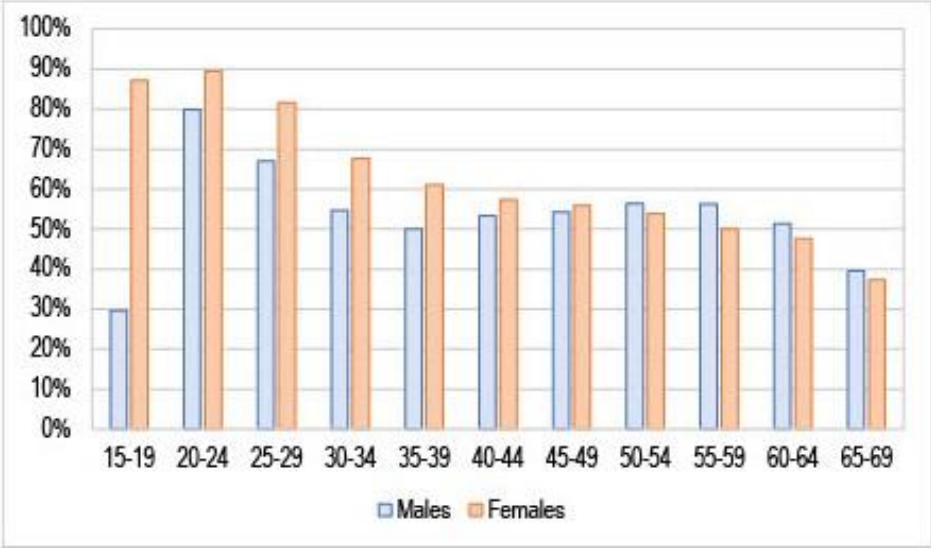
3.2.2. Coverage rate

All covered members of the scheme are formal sector employees.

Figure 29 presents the coverage rates of active contributors in 2018, based on the data from the Quarterly Labour Force Survey of the same year[26], by age and sex. The coverage rate is defined as the ratio of the active contributors to the employed population, by age and sex.

[26] See Chapter 2 for more details on the demographic and economic environment of South Africa.

Figure 29: Coverage rate of active contributors, year 2018, by age and sex



Source: GEPF and UIF databases, authors' adjustments, and employment statistics in South Africa.

In this valuation, it is assumed that the general coverage rate by age and sex will remain unchanged over the projection period. In other words, the number of male and female covered under the scheme will increase at the same pace as the number of male and female employed in South Africa over the projection period.

3.2.3. Salary scale

Monthly salaries for the active insured members were extracted from the individual data transmitted by the GEPF and UIF. Adjustments and smoothing have been applied on the salary distributions obtained in order to eliminate any major statistical bias. Further adjustments have been made to ensure that the estimated distribution of active members during financial year 2018 and the distributions of densities were consistent with the members' contributions received during financial year 2018.

The actuarial model used for this actuarial valuation distributes average salaries into three categories (low, medium and high), with the aim of measuring the effect of the contribution floor, the contribution ceiling and the minimum and maximum pensions, where applicable.

Table 8 presents the distribution of monthly salaries of those who were actively contributing to the scheme in 2018, by age, sex and income level. It is worth noting that the monthly salaries presented below reflect the applicable ceiling of Rnd 23,000 in 2018.

It has been observed that the average full-time salary sometimes decreases with the age in both sectors. This valuation assumes that this pattern will not last: the salary scales of all cohorts of members is projected to gradually evolve over the projection period, increasing at least with the inflation rate each year. Salaries are projected using the assumptions presented in Section **2**.

The salaries displayed in the table have been multiplied by 1.22 to consider the time between the data collection and the date of implementation of the scheme[27].

[27] The data are from the year 2018 and NSSF is expected to be implemented in 2022.

Table 8: Distribution of monthly salaries capped at Rnd 23,000, by age, sex and income level, year 2018 (Rnd)

Age	Males			Females		
	Low	Medium	High	Low	Medium	High
15–19	2 609	3 318	7 575	2 601	3 107	6 681
20–24	2 737	4 583	12 484	2 629	4 065	12 021
25–29	3 141	6 998	18 528	2 747	5 793	18 033
30–34	3 657	9 737	21 634	2 894	7 533	20 761
35–39	4 059	11 687	22 619	2 979	8 798	21 804
40–44	4 328	13 377	22 938	3 024	10 244	22 489
45–49	4 625	15 415	22 998	3 064	11 917	22 897
50–54	4 903	16 778	23 000	3 054	12 655	22 993
55–59	5 027	17 133	23 000	3 089	13 104	23 000
60–64	5 225	16 979	23 000	3 295	13 411	22 996
65–69	4 096	14 537	23 000	2 984	10 054	21 739
Average	**3 929**	**11 216**	**20 769**	**2 928**	**8 839**	**20 497**

Source: GEPF and UIF databases, authors' adjustments.

3.2.4. Density of contribution

The density of contribution represents the number of months of the year during which members pay contributions to the scheme and accrue social security benefits.

As previously mentioned, a significant portion of low-income members leaves or re-enters the scheme each month. It is indeed estimated that each month, about 19 per cent of all members does not actively contribute to the scheme.

Table 9 presents the distributions of density, by age, sex and income level, for the members who were actives as in 2018. The various sets of individual data obtained showed consistent and similar density distributions by age and sex from a year to another. The density of contribution is higher among the high-income earners and significantly lower among the low-income workers. In other words, the low-income earners accrue less contribution months annually than the high-income earners.

As previously mentioned, a significant portion of low-income members leaves or re-enters the scheme each month. It is indeed estimated that each month, about 19 per cent of all members does not actively contribute to the scheme.

Table 9: Average density, by age, sex and income level, active members, 2018 (in month)

Age	Males			Females		
	Low	Medium	High	Low	Medium	High
15–19	4.2	5.2	6.6	4.2	5.0	6.5
20–24	5.1	7.1	8.4	5.0	7.0	8.6
25–29	6.0	8.4	9.6	5.6	8.4	9.9
30–34	6.6	9.1	10.1	6.0	9.2	10.4
35–39	6.9	9.5	10.2	6.1	9.5	10.5
40–44	7.1	9.8	10.3	6.2	9.8	10.7
45–49	7.3	10.0	10.5	6.2	10.0	10.9
50–54	7.5	10.2	10.6	6.1	10.1	11.1
55–59	7.5	10.0	10.4	6.2	10.1	11.0
60–64	7.3	9.3	9.8	6.1	9.6	10.4
65–69	6.5	7.9	8.7	6.0	7.8	8.8
Average	**6.6**	**9.1**	**9.9**	**5.9**	**9.2**	**10.4**

Source: GEPF and UIF databases, authors' adjustments.

3.2.5. Family statistics

Information on the family structure of the insured population is necessary for the projection of survivors' benefits. The NSSF is projected to provide pensions or benefits to surviving dependents.

To assess the probability of having surviving dependents, and estimate the average length of time the survivors' pensions are payable, assumptions were established regarding the probability of being married at the time of death, the average age of spouses, the average number of dependent children and the average age of dependent children. The assumptions used in this valuation have been based on (1) the GEPF statistics collected on members and pensioners' dependents, (2) the most recent census and surveys conducted by StatsSA[28], and (3) the recent trends in terms of fertility rates in South Africa have also been used.

Examples of the assumptions used appear in **Table 10**.

The NSSF survivors' benefit is distributed among the eligible dependents. Once the spouse becomes ineligible to receive the survivors' pension (e.g. for reasons of death or remarriage), his/her pension stops being paid. Once a child becomes ineligible to receive the survivors' pension (e.g. for reasons of death, marriage, attainment of 18 years old, end of school), his/her pension reverts to the remaining eligible children. For simplicity, the projection assumes that the children' pensions will be paid to the youngest children (maximum of two) at a rate of 25 per cent each. The reversion rate in the model has been increased to 28 per cent to take into account the full orphans.

[28] Census 2011: Income dynamics and poverty status of households in South Africa, StatsSA, and StatsSA Survey 2018.

Table 10: Family statistics

Age	Probability of having a spouse (in percentage)		Average age of spouse		Average number of dependent children		Age of the youngest child	
	Male	Female	Male	Female	Male	Female	Male	Female
15	0.0	0.0	15.0	19.0	0.0	0.0	-	-
20	0.0	0.2	16.0	24.0	0.0	0.0	0.3	1.5
25	0.9	2.4	21.0	29.0	0.0	0.0	1.7	2.7
30	8.8	13.3	26.0	34.0	0.0	0.2	3.0	4.7
35	32.7	35.1	31.0	39.0	0.2	0.5	5.2	7.5
40	56.0	53.4	36.0	44.0	0.6	0.8	8.1	11.1
45	65.8	60.8	41.0	49.0	0.9	1.0	11.9	15.0
50	73.1	58.5	46.0	54.0	1.0	0.9	15.4	16.6
55	78.4	56.3	51.0	59.0	0.9	0.7	16.7	16.9
60	82.2	54.3	56.0	64.0	0.6	0.2	16.9	17.7
65	84.2	53.7	61.0	69.0	0.2	0.0	18.0	19.1
70	85.5	51.5	66.0	74.0	0.0	0.0	19.4	21.0
75	88.3	51.3	71.0	79.0	-	-	-	-
80	89.9	50.6	76.0	84.0	-	-	-	-
85	90.0	47.1	81.0	89.0	-	-	-	-
90	87.3	40.1	86.0	94.0	-	-	-	-
95	74.1	32.1	91.0	99.0	-	-	-	-
100	50.9	24.1	96.0	104.0	-	-	-	-

Source: StatsSA
Note: Average number of dependent children excludes any child ineligible to receive benefits because of his/her age. For simplicity, the model assumes that the survivor pension is paid to a maximum of two eligible children at a of 25 per cent each

3.2.6. Invalidity rates

It is difficult to find studies that look at the disability rates of working-age population in South Africa, or disability statistics pertaining to the entire covered population of the upcoming NSSF. The challenges faced for estimating the invalidity rates are numerous. In fact, the eligibility requirements and the ease of access to disability benefits as well as the exact definition of disability are some of the items that vary significantly from a scheme to another, making national and international comparisons difficult, if not impossible.

For this valuation, the invalidity rates have been estimated based on the individual data obtained by SASSA and GEPF. The definition of invalidity coming from those two sources are similar, which contribute to provide a broad picture of disability in the working-age population. SASSA provides a means tested invalidity benefit which is based on persons' income and assets. Those eligible to receive SASSA's benefit are the poorest. Invalidity rates estimated using SASSA's data were used to estimate the invalidity rates applying to the lowest-income members of the NSSF. On the other side, the GEPF is providing ill-health retirement benefits to those working in the government sector (more stable jobs and better income). Invalidity rates estimated using those ill-health retirement rates were used to estimate the invalidity rates applying to government sector employees as well as to private sector employees earning a similar income as those working in the government sector.

Table 11 presents the invalidity rates assumed for males and females in this valuation, by age and sex. Those invalidity rates have been assumed unchanged over the entire projection period.

Table 11: Sample of disability rates, by age and sex (per 1,000)

Age	Males	Females
15	0.3037	0.0014
20	1.3297	1.0140
25	1.6590	1.5336
30	1.9751	2.0659
35	2.3079	2.6674
40	2.9973	3.5841
45	4.1013	4.7304
50	6.0245	6.4877
55	8.7090	8.4885
60	12.7813	11.1694

Source: Authors' assumptions.

3.2.7. Mortality rates of the contributors

Information from GEPF and UIF that is necessary to estimate a mortality Table for the contributors of the NSSF was not enough complete to be used. To overcome the problem, the mortality rates of the contributors have been derived using the paper of JC Clur, RE Dorrington, KA Schriek and PL Lewis: Modelling the mortality of members of group schemes in South Africa. The study concerns the group-scheme members underwritten by South African life insurance companies over the period 2005–2009. This study displays mortality rates, by sex and age, according to 5 salary bands and 3 classes of risks (light, mid and heavy). The salary bands of the study have been actualized to 2018 to help to determine the salary breakdown of the population by age and sex in 2018. The distribution by category of risks have been estimated by using an internal study that has been requested by DSD and made available for this valuation.

The following table displays a sample of the mortality rates.

Table 12: Sample of mortality rates for the contributors, by age and sex (percentage)

Selected ages	Males			Females		
	2022	2061	2100	2022	2061	2100
15	0.103	0.045	0.036	0.053	0.028	0.028
20	0.150	0.071	0.037	0.099	0.028	0.028
25	0.196	0.102	0.042	0.201	0.030	0.028
30	0.302	0.152	0.064	0.275	0.048	0.026
35	0.428	0.206	0.105	0.256	0.088	0.037
40	0.498	0.256	0.142	0.232	0.115	0.109
45	0.556	0.319	0.182	0.241	0.130	0.105
50	0.644	0.411	0.243	0.295	0.150	0.044
55	0.746	0.547	0.345	0.333	0.188	0.029
60	0.852	0.744	0.502	0.360	0.265	0.112
65	1.049	0.988	0.705	0.420	0.375	0.248
69	1.351	1.272	0.942	0.560	0.513	0.371

Source: JC Clur, RE Dorrington, KA Schriek and PL Lewis

3.2.8. Mortality rates of the old age pensioners

The mortality of the pensioners is derived using the Report on pensioner's mortality 2005-2010 from the Actuarial Society of South Africa and the GEPF data.

The following table displays a sample of mortality rates.

Table 13: Sample of mortality rates for the old age pensioners, by age and sex (percentage)

Selected Ages	Males			Females		
	2022	2061	2100	2022	2061	2100
60	1.858	1.623	1.095	0.936	0.690	0.292
65	2.382	2.243	1.601	1.175	1.048	0.693
70	3.512	3.289	2.456	1.848	1.682	1.216
75	5.327	4.849	3.770	3.181	2.801	2.034
80	7.902	7.098	5.720	5.414	4.744	3.571
85	11.499	10.294	8.458	8.984	7.786	5.914
90	19.528	17.463	14.215	17.177	14.417	10.633
95	34.282	30.759	25.029	34.028	28.332	20.722
100	49.049	44.156	36.039	41.293	34.374	25.138
105	58.978	53.699	44.495	50.951	42.837	31.700
110	94.223	92.490	88.472	91.729	87.854	80.330
115	99.999	99.999	99.996	99.999	99.996	99.982
120	100.000	100.000	100.000	100.000	100.000	100.000

Source: Actuarial Society of South Africa and the GEPF data

According to the report on pensioner's mortality 2005-2010 from the Actuarial Society of South Africa, the mortality rates of the pensioners vary according to the level of the pensions. Like in many other societies, those having the highest pensions have the highest life expectancy. To consider this situation, a loading has been introduced in the actuarial valuation. The loading takes the form of an additional adjustment to the pension in payment. It is charged in addition to the inflation. The adjustment is higher at the beginning of the projection and lower by the end with an average level of 0.36 per cent over the projection period.

3.2.9. Mortality rates of disabled members

Although recent censuses and surveys have contributed to improve the understanding of the incidence, prevalence and pattern of disabled persons in South Africa, very little research has been done on the mortality of the disabled in the country. The few recent studies published on the subject still show some limitations explained among others by the fact that the cause-of-death statistics from the civil registrations are not yet of the quality desired. The exact results of those studies remain difficult to use and adapt for this actuarial valuation.

The challenges faced for estimating the disability mortality rates of disabled pensioners are numerous. To be considered to receive a disability pension, a worker must have met the eligibility requirements stated in **Annexure 1:** . This eligibility condition is different from that of SASSA or GEPF. In fact, the eligibility requirements and the ease of access to disability benefits, the differences in the processing of disability pensions as well as the exact definition of disability are some of the items that vary significantly from a scheme to another, making national and international comparisons difficult, if not impossible.

In light of the above-mentioned challenges, the mortality rates of disabled members used in this valuation have been estimated using a simplified approach and are supported by general principles, observations made by the authors of this report and the few studies on disabled mortality in South Africa.

Disabled people face a higher mortality risk than nondisabled people do, especially those who are severely disabled. In the same way, the life expectancy of disabled persons is lower than that of nondisabled persons. Results from the *Estimates of Injury Mortality and Disability based on the Cape Metropole Study*[29] suggest that disability could reduce the residual life expectancy of a person by 20 to 40 per cent[30], depending on a person age and sex. Another study incorporating a broader definition of disability, Disability in South Africa[31], shows that the residual life expectancy of a working-age disabled person could be reduced by 10 to 25 per cent compared to a disability-free person of the same age and sex. Taking into account the above-items, as well as the relatively low sensitivity of the assumption pertaining to mortality rates of disabled members, it was assumed that the residual life expectancy of newly disabled members would be reduced by 17 to 23 per cent compared to nondisabled members of the same age and sex. **Table 14** summarizes the disabled members' mortality parameters used for this actuarial valuation.

Table 14: Sample of mortality parameters used for disabled members, by age and sex

Age (x)	Male			Female		
	qx	Life Expectancy (LE)	% of LE lost Due to Disability	qx	Life Expectancy (LE)	% of LE Lost Due to Disability
20	0.00423	41.8	18.5	0.00254	48.0	17.5
25	0.00590	37.8	19.4	0.00448	43.7	18.4
30	0.00825	34.0	20.3	0.00678	39.9	19.1
35	0.01066	30.5	21.2	0.00843	36.3	19.5
40	0.01270	27.2	22.0	0.00922	32.8	19.6
45	0.01512	23.9	22.7	0.00984	29.3	19.6
50	0.01863	20.8	23.2	0.01101	25.7	19.7
55	0.02206	17.7	23.3	0.01175	22.1	20.0
60	0.02845	14.7	23.3	0.01420	18.3	20.6
65	0.03905	11.8	23.4	0.02065	14.7	21.8
70	0.05459	9.2	24.7	0.03269	11.3	23.6
75	0.08130	6.8	28.1	0.05438	8.3	26.7
80	0.12902	4.8	33.6	0.09347	5.7	31.0
85	0.21261	3.1	40.1	0.16863	3.6	36.8
90	0.37392	1.8	45.1	0.32993	2.1	41.4
95	0.61050	1.1	48.8	0.55714	1.2	43.0
100	0.79953	0.7	51.0	0.70193	0.9	49.5

Source: Authors' assumptions.

[29] Norman R. Estimates of Injury Mortality and Disability based on the Cape Metropole Study, Cape Town: South African Medical Research Council, 2002.

[30] Those estimates were derived from the Disability-adjusted life years, the Years of life lost due to premature mortality and the Years of life lost due to premature mortality. This study highlights the heavy injury burden.

[31] Heston Phillips & Amadou Noumbissi: Disability in South Africa, 2004

3.3. Other assumptions

This section discusses other assumptions used in this valuation:

3.3.1. Projected contribution rate

A contribution rate of 10 per cent has been assumed on the insurable earnings starting in financial year 2022 (the assumed implementation year of the fund) to project the contribution income and the scheme's projected reserve.

3.3.2. Administrative expenses and other expenses

The overall administrative expenses, including expenditure other than benefits, have been assumed at 0.25 per cent of the total insurable earning over the projection period.

3.3.3. Investment rate

The annual rate of return on assets, net of fees, has been projected at 3.5 per cent in real term over the projection period.

3.3.4. Early retirement factors

The normal retirement age is 65 but a worker can retire as early as age 60. Adjustment to the pension is brought for those taking their retirement before the normal retirement age to reflect the fact that they will receive a pension, on average, over a longer period of time. The adjustment of the pension is 0.6 per cent for each month before the retirement age. If someone takes its retirement age after the normal retirement age, the pension is increased by 0.7 per cent for each month after the retirement age.

3.3.5. Retirement rates

At the start of the projection, the number of members who leave to retirement each year is derived by the coverage rates. The proportion of those who will retire at age 60 is increased gradually during the first 50 years of projection to recognize the fact that it will take a generation of contributors so that people will retire with a full career. The following table presents an overview of the implicit retirement rates derived from the coverage rates over the projection period, by age and sex. The average retirement rate is 63.8 for male and 63.6 for female in 2022 while it is respectively 62.9 and 62.8 50 years later.

Table 15: Implicit retirement rates derived from the coverage rates, by age and sex, 2022 and 2072

Age	Males_2022	_Males_2072	Females	Females_2072
60	25.0%	50.0%	30.0%	60.0%
61	10.0%	10.0%	15.0%	15.0%
62	10.0%	10.0%	5.0%	5.0%
63	15.0%	15.0%	15.0%	15.0%
64	20.0%	20.0%	20.0%	20.0%
65	40.0%	40.0%	40.0%	40.0%
66	30.0%	30.0%	25.0%	25.0%
67	10.0%	10.0%	10.0%	10.0%
68	10.0%	10.0%	10.0%	10.0%
69	10.0%	10.0%	10.0%	10.0%
70	100.0%	100.0%	100.0%	100.0%

4. DEMOGRAPHIC AND FINANCIAL PROJECTIONS OF THE NSSF

This part of the valuation deals with the ability of the social security scheme to meet its future obligations at the time they fall due. This is done under three approaches:

1. **Open group**: it is assumed that all the workers of the formal sector will continue to be insured with NSSF indefinitely, thus paying contributions and accruing benefit entitlements, and later receiving benefits. The period used should be long enough to see stability in the contribution rate (PAYG).
2. **Closed group**: workers who are in the scheme on the implementation date will pay a contribution rate that is necessary to finance their own benefits.
3. **Open and closed group**: over a period, for example 50 years, the projection considers both the workers who are in the scheme on the implementation date as well as new entrants. After that period, no new entrants are considered. The contribution rate is the one necessary to finance entirely the benefits of all the people in the projection.

Future contributions and benefits are calculated according to the demographic and economic assumptions and the fund-specific assumptions presented in Chapters 2 and 3.

The general methodology of the ILO valuation model is described in **Annexure 2**. For the present study, a basic scenario was produced based on best-estimate assumptions. Also, additional scenarios were made to better understand major factors that have an impact on the financial soundness of NSSF, to assess uncertainties related to the assumptions used and to analysed the impact of potential modifications to the provisions of the scheme.

The main purpose of an actuarial valuation is to find out whether the financing of NSSF will be on course over the long-term, not to exactly forecast numerical values. Due to the long-term nature of assumptions and to the fact that no experience of the scheme is available, absolute figures include a high degree of uncertainty. Therefore, results should be interpreted carefully, and future actuarial reviews should be undertaken on a regular basis to revise actuarial assumptions considering the actual experience of the scheme.

In this section, the contribution rate is applied to the total insurable earnings. In a next section, special features like the exemption of the contribution rate on a floor are considered.

4.1. Open group

4.1.1. Demographic projections

Demographic projections are shown in **Table 16**. The table shows the demographic ratio which is defined as the number of pensioners divided by the average monthly number of contributors. **Figure 30** also shows the projection of the demographic ratio for Old Age, Disability and Survivors benefits. The trend in the ratio of pensioners to contributors is normally a good indicator of the increasing cost of the scheme. The total number of contributors follows a rate of growth derived from the projections of South Africa's national population, labour force and employed population as described in Chapter 2. There are no pensioners at the beginning of the projection, but their number grows rapidly during the projection period. Thus, the ratio of all pensioners (Old Age, Invalidity and Survivors) to contributors (demographic ratio) grows from 0 to 129 per cent in 2097 and 170 per cent in 2177. In other words, there will be 0.6 contributors for each pensioner in 155 years. The reader should however be careful with these figures. The number of contributors in the table refers to the average monthly number of contributors. All the contributors will not contribute 12 months a year. In fact, on average they contribute 8.3 months a year. It means that during a year, there are more people effectively contributing to the scheme. So, if the demographic ratio was presented as the ratio of pensioners to the total number of contributors during a year, the demographic ratio would have been considerably lower. In fact, at the end of the projection it would have been 117 instead of 170[32]. The way to present the demographic ratio is not affecting the financial results. As mentioned previously, this is the trend in the demographic ratio which is important and behind of the trend in the cost.

[32] According to the preliminary design, if a contributor pays contributions for only one month, he will deserve a pension. So, on retirement, there will be many workers with low number of years of service and small pensions.

Figure 30: Demographic ratio: Number of pensioners divided by the number of contributors, 2022-2177

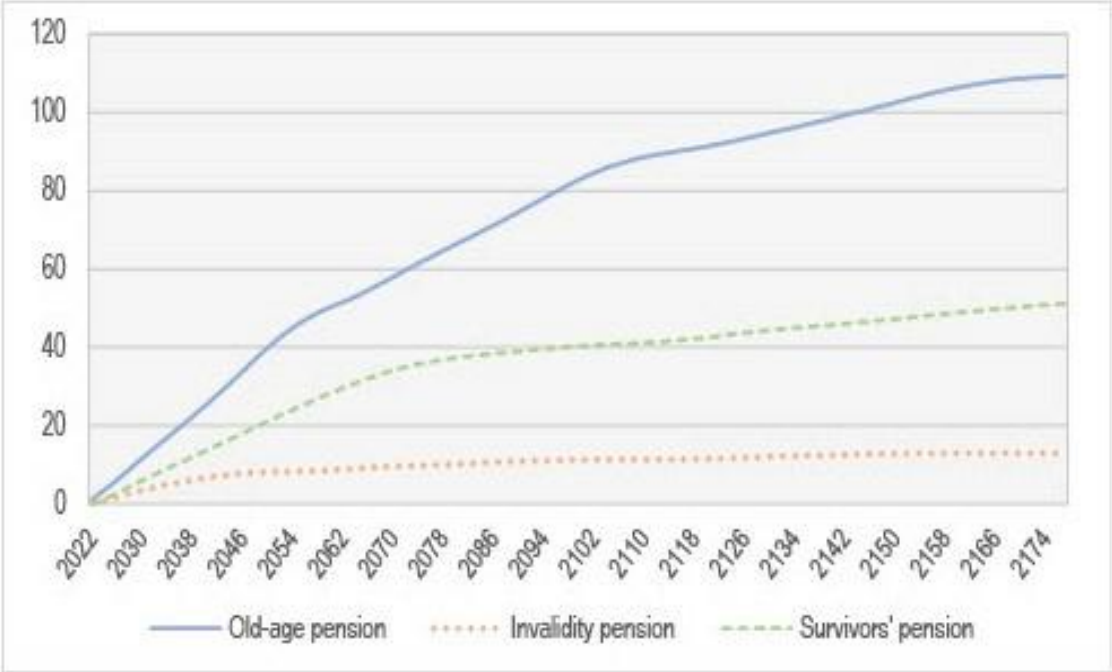


Table 16: Demographic projections, 2022-2177

Years	Numbers of active members and beneficiaries					Demographic ratio (pension) (in %)		
	Actives	Old-age	Invalids	Survivors				
		Pension	Pension	Pension	Funeral benefit	Old-age	Invalids	Survivors
2022	10 350 213	125 187	0	0	0	1.2	0.0	0.0
2027	11 196 143	837 574	249 044	201 847	20 071	7.5	2.2	1.8
2032	12 130 171	1 736 878	515 842	525 875	51 229	14.3	4.3	4.3
2037	13 022 034	2 724 251	763 147	977 173	90 922	20.9	5.9	7.5
2042	13 904 983	3 874 101	989 514	1 554 250	140 185	27.9	7.1	11.2
2047	14 715 929	5 213 761	1 164 666	2 230 669	197 276	35.4	7.9	15.2
2052	15 428 873	6 563 298	1 270 063	2 953 359	255 464	42.5	8.2	19.1
2057	15 977 685	7 656 057	1 342 481	3 658 855	306 817	47.9	8.4	22.9
2062	16 303 548	8 400 479	1 428 239	4 303 582	349 824	51.5	8.8	26.4
2067	16 470 596	9 122 326	1 534 400	4 854 547	387 059	55.4	9.3	29.5
2072	16 549 190	9 876 004	1 602 115	5 283 004	418 351	59.7	9.7	31.9
2077	16 553 103	10 570 925	1 650 645	5 572 722	441 818	63.9	10.0	33.7
2087	16 407 389	11 808 874	1 755 724	5 876 719	473 153	72.0	10.7	35.8
2097	16 275 289	13 124 815	1 822 896	6 116 821	506 381	80.6	11.2	37.6
2107	16 174 460	14 127 062	1 827 584	6 269 119	556 244	87.3	11.3	38.8
2117	16 008 930	14 475 351	1 826 114	6 375 653	590 066	90.4	11.4	39.8
2127	15 469 354	14 480 597	1 839 421	6 432 445	604 346	93.6	11.9	41.6
2137	14 855 277	14 456 414	1 837 457	6 384 223	602 968	97.3	12.4	43.0

2147	14 287 002	14 457 187	1 822 014	6 328 724	599 815	101.2	12.8	44.3
2157	13 735 099	14 456 114	1 775 530	6 303 293	599 240	105.2	12.9	45.9
2167	13 198 453	14 265 645	1 705 948	6 258 892	595 445	108.1	12.9	47.4
2177	12 689 888	13 857 637	1 639 805	6 170 227	586 235	109.2	12.9	48.6

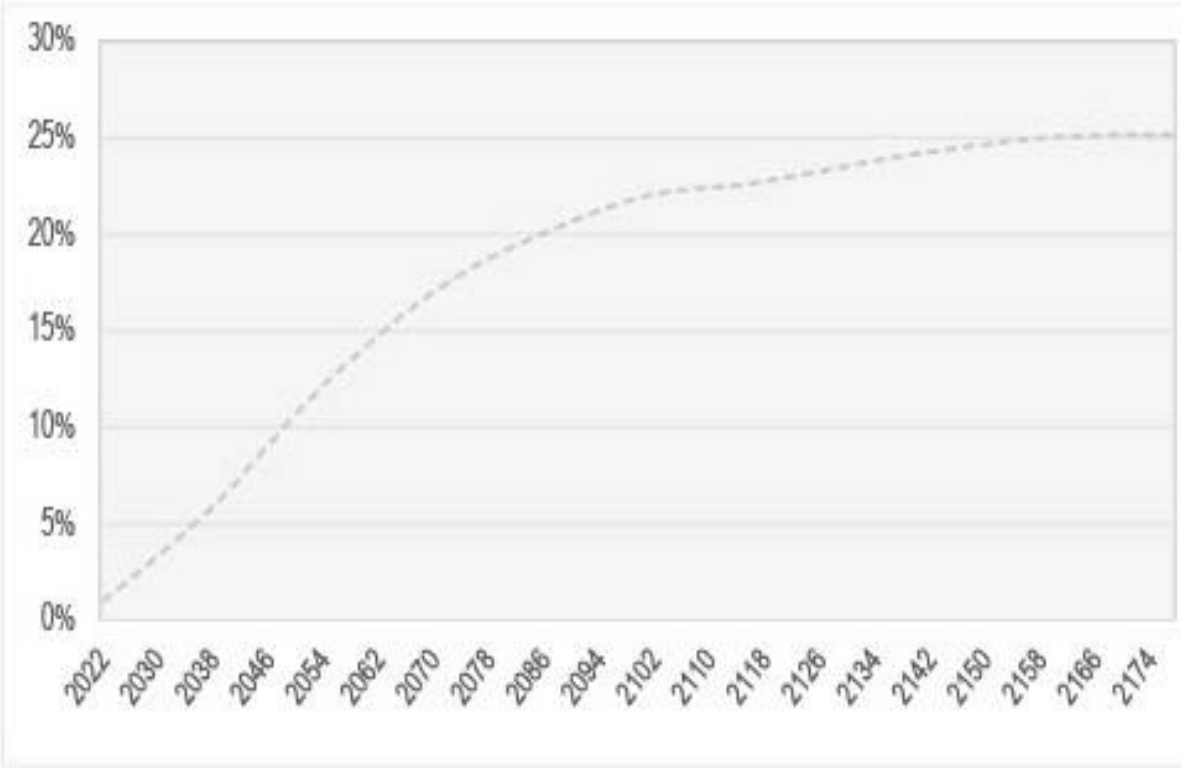
4.1.2. Financial projections

As shown in **Figure 31**, total expenditure as a percentage of insurable earnings (which is called the Pay-As-You-Go (PAYG) rate) rises from 0.3 per cent in 2022 to 21.2 per cent in 2097 and 25.2 per cent in 2177. The PAYG rate represents the contribution rate that would be required to pay all the expenditures of the scheme (benefits, administrative and other expenses), year after year, in the absence of a reserve (investment). This high increase in the PAYG rate is mainly due to the increase in the demographic ratio, as explained in the previous section. In fact, there are more and more pensioners receiving benefits, with more years of service, while the number of contributors is not growing as fast.

Table 17 shows the results of the financial projections for cash flows and reserves. In the base scenario, the contribution rate is 10 per cent. The main observations are as follow:

1. Annual contributions are sufficient to pay for all annual expenditures (benefits and administrative expenditures) until 2051.
2. Starting in 2052, investment income must be used to pay for annual expenditures. Contributions and investment income are not enough to pay all the expenditure throughout the projection period.
3. In the year 2091, contributions and investment incomes are no longer enough to pay the expenditures. The reserve starts to decrease.
4. In the year 2104, the reserve is depleted. At this moment, the PAYG rate is 22.0 per cent.

Figure 31: Projected PAYG rates, 2022-2177 (percentage of insurable earnings)



The reserve ratio, which is the ratio of the end-of-year reserve over the annual expenditures for the year, moves from 40 to 0 in 2104. This ratio can be interpreted as the number of years during which annual expenditures could be paid by the reserve if there were no contributions, no investment income and no other income. The evolution of the reserve ratio is illustrated in **Figure 32**.

Figure 32: Projected reserve ratio, 2022–2122

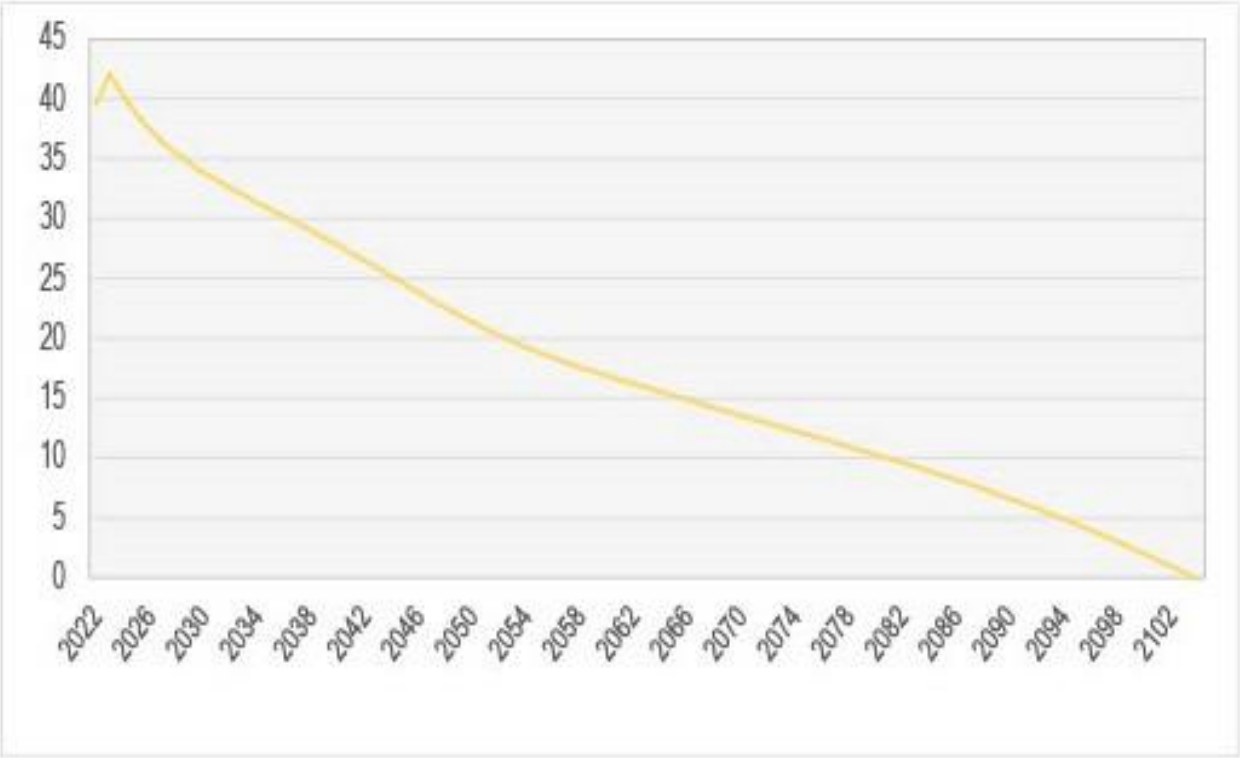


Table 17: Financial projections: Cash inflows, cash outflows and reserve, 2022-2177, contribution rate = 10% (Rand millions)

Years	Income			Expenses		Reserve at the end of the year	PAYG (%)	Reserve ratio
	Contributions	Investment earnings	Benefits	Administrative expenses	Surplus / (Deficit)			
2022	170 821	6 656	99	4 271	173 107	173 107	0.3	39.6
2027	244 143	98 518	32 699	6 104	303 859	1 410 903	1.6	36.4
2032	348 952	252 829	97 996	8 724	495 061	3 475 659	3.1	32.6
2037	494 057	496 839	214 658	12 351	763 887	6 723 562	4.6	29.6
2042	693 601	863 301	419 413	17 340	1 120 149	11 577 152	6.3	26.5
2047	962 849	1 385 029	770 959	24 071	1 552 847	18 449 174	8.3	23.2
2052	1 324 112	2 088 867	1 332 460	33 103	2 047 416	27 674 441	10.3	20.3
2057	1 802 055	2 998 150	2 154 029	45 051	2 601 124	39 549 042	12.2	18.0
2062	2 420 988	4 135 347	3 289 031	60 525	3 206 780	54 355 765	13.8	16.2
2067	3 219 998	5 507 296	4 873 292	80 500	3 773 502	72 135 459	15.4	14.6
2072	4 258 251	7 074 847	7 037 188	106 456	4 189 453	92 331 994	16.8	12.9
2077	5 606 377	8 752 769	9 917 556	140 159	4 301 431	113 780 674	17.9	11.3
2087	9 626 095	11 598 683	18 781 051	240 652	2 203 075	148 993 077	19.8	7.8
2097	16 520 250	10 019 405	34 662 780	413 006	-8 536 132	123 384 225	21.2	3.5
2107	28 389 235	-7 675 656	62 293 738	709 731	-42 289 890	-119 415 263	22.2	-1.9
2117	48 610 024	-70 372 644	108 353 145	1 215 251	-131 331 016	-964 123 436	22.5	-8.8
2127	81 366 225	-247 959 982	186 100 365	2 034 156	-354 728 279	-3342 047 111	23.1	-17.8

2137	135 380 842	-707 538 894	318 800 880	3 384 521	-894 343 453	-9476 249 152	23.8	-29.4
2147	225 580 221	-1836 473 871	544 212 605	5 639 506	-2160 745 760	-24514 492 526	24.4	-44.6
2157	375 725 248	-4518 174 124	923 668 138	9 393 131	-5075 510 145	-60189 054 509	24.8	-64.5
2167	625 511 760	-10743 022 987	1554 221 234	15 637 794	-11687 370 255	-142919 493 414	25.1	-91.0
2177	1041 958 960	-24957 178 956	2596 279 143	26 048 974	-26537 548 113	-331704 366 191	25.2	-126.5

4.2. Closed group

If the workers who are members of the NSSF in 2022 are required to pay for their own benefits, their contribution rate would be 13.0 per cent.

Under this approach, the contribution rate is equal to the to the Present Value of Future Benefits (PVFB) divided by the Present Value of Future Salaries (PVFS). The projections are done assuming that:

1. There are no new entrants to the scheme beyond the valuation date.
2. Insured members accumulate additional service beyond the valuation date.
3. Salaries of members at the valuation date are projected according to the assumptions related to increases in salary. Those projected salaries will become the basis to calculate their pension once they retire, die or become invalid.

There are elements in this approach that are putting unnecessary upward pressure on the contribution rate:

1. Many workers are aged on the valuation date, and a complete career is not considered to calculate the pension (and contribution) like it will be the case with future generation of workers.
2. The price of some features, like the minimum pension, are expensive because, the workers at the start of the plan, have not yet contributed to the scheme.

4.3. Open and Closed group

This approach is a mix the two preceding ones. Instead on looking only at one generation of contributors, it encompasses more generations. It aims to have a fully funded pension scheme, like in the preceding exercise, but by considering more generations, which is part of the quintessence of a social security pension scheme. Under this approach, an open group approach is used for the first 50 years of the projection. After 50 years, no more new entrants are considered in the projections and the members become part of a closed group. The contribution rate that is necessary is calculated like in the preceding section and is equal to the Present value of future benefits (PVFB) divided by the Present value of future salaries (PVFS) over the projection period.

The contribution rate under this approach is 12.0 per cent. This is the approach that is recommended to calculate the fully funded portion of the new NSSF.

The following table shows the results of the projection with a 12.0 per cent contribution rate. Unlike the scenario with a 10 per cent contribution rate, there are assets at the end of the projection. The reserve ratio is 20.1 in 2177.

Table 18: Financial projections: Cash inflows, cash outflows and reserve, 2022-2177, contribution rate = 12% (Rand millions)

Years	Income			Expenses		Reserve at the end of the year	PAYG (%)	Reserve ratio
	Contributions	Investment earnings	Benefits	Administrative expenses	Surplus / (Deficit)			
2022	204 481	8 002	99	4 271	208 114	208 114	0.3	47.6
2027	292 253	119 692	32 699	6 104	373 142	1 716 161	1.6	44.2
2032	417 715	311 624	97 996	8 724	622 619	4 290 262	3.1	40.2
2037	591 413	622 932	214 658	12 351	987 337	8 445 022	4.6	37.2
2042	830 278	1 105 010	419 413	17 340	1 498 535	14 851 574	6.3	34.0
2047	1 152 582	1 819 675	770 959	24 071	2 177 227	24 308 733	8.3	30.6
2052	1 585 033	2 838 434	1 332 460	33 103	3 057 904	37 745 705	10.3	27.6
2057	2 157 157	4 252 954	2 154 029	45 051	4 211 031	56 367 094	12.2	25.6
2062	2 898 054	6 189 167	3 289 031	60 525	5 737 665	81 829 868	13.8	24.4
2067	3 854 511	8 809 867	4 873 292	80 500	7 710 587	116 246 599	15.4	23.5
2072	5 097 356	12 311 293	7 037 188	106 456	10 265 005	162 188 022	16.8	22.7
2077	6 711 136	16 962 827	9 917 556	140 159	13 616 248	223 198 225	17.9	22.2
2087	11 522 955	31 268 532	18 781 051	240 652	23 769 784	410 755 894	19.8	21.6
2097	19 775 630	56 000 089	34 662 780	413 006	40 699 934	734 685 980	21.2	20.9
2107	33 983 447	98 014 764	62 293 738	709 731	68 994 742	1284 749 766	22.2	20.4
2117	58 188 822	169 683 939	108 353 145	1 215 251	118 304 366	2223 587 897	22.5	20.3
2127	97 399 763	292 359 832	186 100 365	2 034 156	201 625 075	3830 042 263	23.1	20.4

2137	162 058 176	500 175 087	318 800 880	3 384 521	340 047 862	6550 017 232	23.8	20.3
2147	270 031 702	849 255 733	544 212 605	5 639 506	569 435 325	11117 338 317	24.4	20.2
2157	449 763 404	1432 033 046	923 668 138	9 393 131	948 735 181	18740 450 191	24.8	20.1
2167	748 771 343	2402 826 820	1554 221 234	15 637 794	1581 739 134	31439 666 908	25.1	20.0
2177	1247 281 122	4025 562 505	2596 279 143	26 048 974	2650 515 509	52672 554 831	25.2	20.1

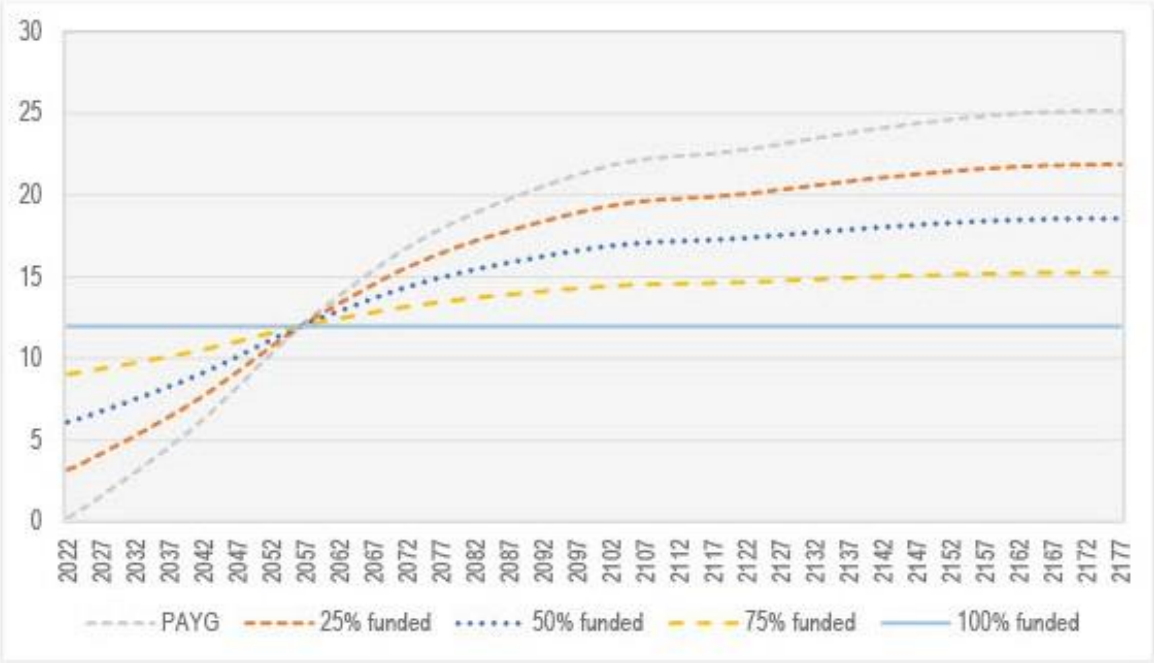
4.4. The funding policy: a mix of two approaches

The next Figure regroups together the results of the pure PAYG method (no accumulation of a reserve) with the one of the fully funded method under different level of funding objectives. This exercise is the foundation behind the thinking of the proposed funding policy for the new NSSF. It is based on the relation that a social security pension scheme which is targeting a funding ratio of 25 per cent is the same as one where 25 per cent of the benefits are fully funded and 75 per cent are not funded (based on the pure PAYG methodology). This mix of two approaches allows decision makers to:

1. Define a funding level and establish appropriate measures and rules to maintain it.
2. Always be able to attach the maximum contribution rate related to a funding strategy. This is sustainability part of the funding strategy.

According to the **Figure 33**, the maximum contribution rate over the 155 years projection period goes from 12 per cent to 25.2 percent depending on the funding strategy chosen.

Figure 33: Mix of funding strategy, 0% funded (PAYG), 25% funded, 50% funded, 75% funded and fully funded



The pitfall of such approach is that, unless the fully funded approach is chosen, the contribution rate will increase each year because of the component of the scheme which is under the PAYG approach. It is important to remind that in a pure PAYG system; the contribution rate increases each year to finance the upward trend in the expenditures. Annual increases in the contribution rate makes the process administratively complicated. It is however possible to overcome the situation by adopting a system based on the Scaled Premium (SP) approach instead of a pure PAYG system. Difference between a PAYG system and a SP system is explained in Annex 3. The following figure explains the concept. Instead of adopting a pure PAYG (the blue line), policy makers are adopting the SP approach (the orange line). The SP approach allows the contribution rate to be maintained without increase for a reasonable period. In this example, it has been decided to not change the contribution rate for the first 25 years. After the 25 years, the contribution rate is increased each 15 years according to the schedule presented in **Table 19**. The ultimate contribution rate under a SP system is going to be lower than the one of a pure PAYG system because of the presence of a small amount of reserve as explained in Annexure 3.

In this example, the funding policy is targeting a minimum funding ratio of 25%. To reach this objective, the legal contribution rate is going to be a mix of the fully funded approach and the SP approach, as presented in the **Table 19**. In the long run, such strategy gives a reserve ratio (the yellow sticks) that is a little bit higher than 5.

Figure 34: Funding strategy 25% funded with a SP approach

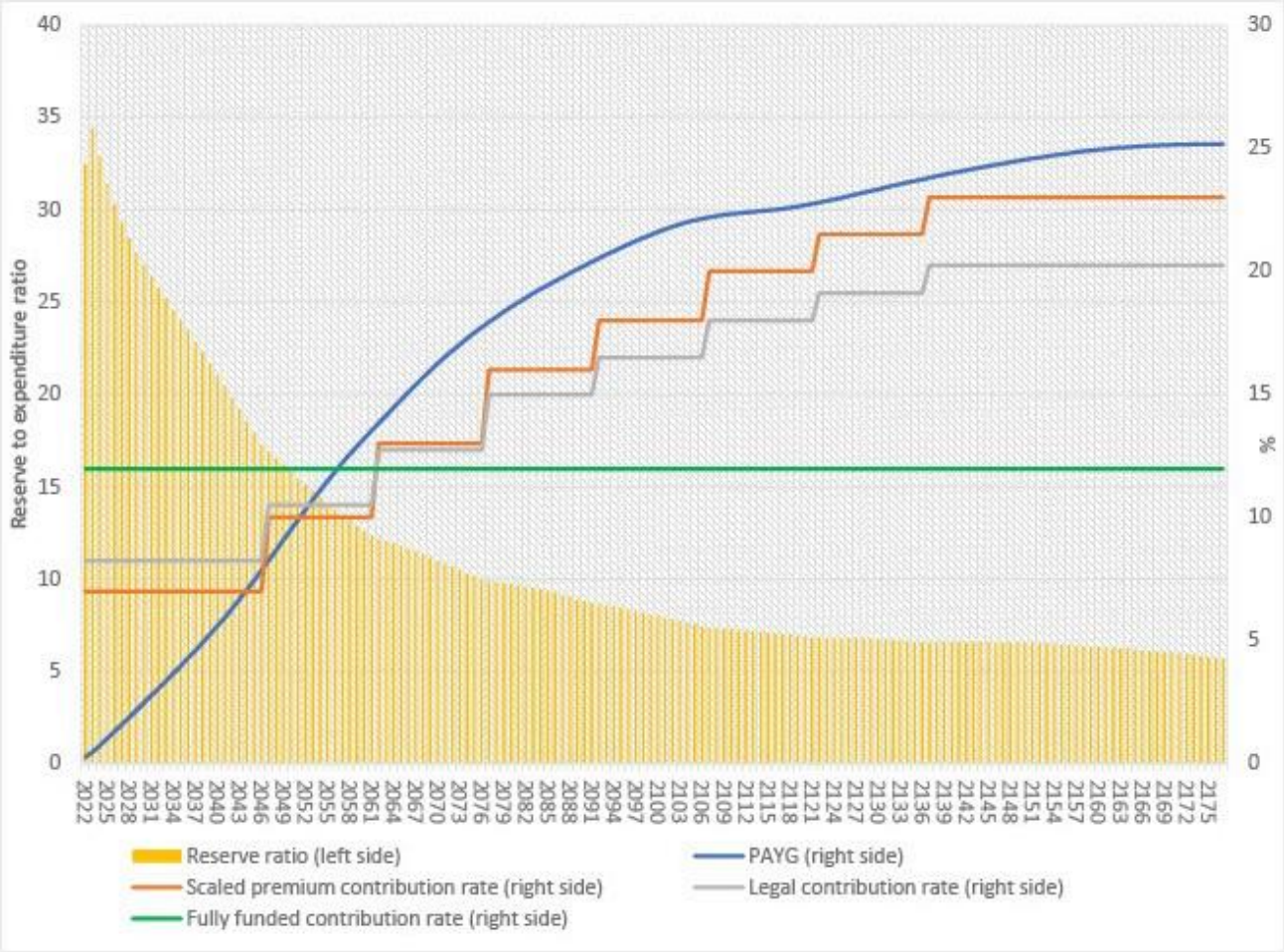


Table 19: Contribution rate, 2022-2177, Scaled premium approach, fully funded approach, and targeted contribution rate in the funding policy, percentage

	Scaled Premium (A)	Fully Funded (B)	Targeted contribution rate (funding policy) 75% x A + 25% x B
2022–2046	7.0	12.0	8.2
2047–2061	10.0	12.0	10.5
2062–2076	13.0	12.0	12.7
2077–2091	16.0	12.0	15.0
2092–2106	18.0	12.0	16.5
2107–2121	20.0	12.0	18.0
2122–2136	21.5	12.0	19.1
2137–2177	23.0	12.0	20.2

Under the basic scenario, a contribution rate of 12.0 per cent is necessary to pay all the expenditures under a full funding approach. This chapter discusses some other scenarios to better understand the risks a new pension scheme like NSSF may face.

In addition to the full funding approach, impacts for each scenario on the PAYG rate in 25 years, 50 years and at the end of the projection as well as on the year the reserve will be zero with a 10 per cent contribution rate are also shown. This section is divided in two: sensitivity tests on the assumptions and sensitivity tests on policy options.

4.5. Sensitivity tests on assumptions

4.5.1. Return of the Fund

The assumption concerning the real return on assets in the base scenario is 3.5 per cent for all the projection years. **Table 20** shows the impact of having a return 0.5 per cent lower and 0.5 per cent higher than in the base scenario. A change in the return on assets has no impact on the PAYG rate, because when calculating this rate, the amount of reserve is not considered.

Table 20: Sensitivity analysis: Return of the Fund (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
+0.5%	10.8	7.8	16.5	25.1	2124
–0.5%	13.3	7.8	16.5	25.1	2095

Note: The year the reserve is depleted is calculated with a contribution rate of 10 per cent.

With a lower return on assets of 0.5 per cent, the reserve will be zero in 2095, nine years earlier than in the base scenario. The impact on the full funding contribution rate is particularly important.

4.5.2. Inflation rate

For this actuarial valuation, the assumed inflation rate is 4.5 per cent for all the projection years. The next scenarios show the impact on the projection of a change of plus or minus 0.5 per cent in the rate of inflation (**Table 21**). This section also presents a test as if the inflation rate will remain at its level when this report was prepared. The assumption regarding the inflation rate affects many variables in the actuarial valuation: adjustment to pensions in payment, salary growth and return on investment. According to the projections, inflation is not the biggest risk, if all other variables move in parallel to the inflation as assumed in this sensitivity test.

Table 21: Sensitivity analysis: Inflation rate (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
+0.5%	11.9	7.8	16.4	25.0	2105
–0.5%	12.0	7.9	16.6	25.3	2103
Inflation = 3%	12.1	8.0	16.8	25.5	2102

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

4.5.3. Salary Increase

Very often in pension plans, pensions are indexed annually according to the increase in the Consumer Price Index (CPI) while salaries increase faster according to the inflation plus a productivity component. The fact that the annual increase in salaries is higher than the pension adjustment has the effect of lowering the PAYG cost because the basis to calculate contributions increases more rapidly than the average amount of benefits. For the full funding approach, the impact is in the opposite direction: for the someone who is contributing, a higher salary increase means a bigger pension and consequently, a higher cost. For this actuarial study, it is assumed that pensions in payment will increase according to the inflation.

What is important in an actuarial valuation is the relation between the salary increase and the benefit increase. In our base scenario, it is expected that, in the long run, increase in the average salary will be 1.1 per cent higher than the inflation rate. A sensitivity analysis has been produced to show the financial impact of an increase in real salaries that is 0.5 per cent higher or lower than the one in the base scenario. The following table shows the results.

Table 22: Sensitivity analysis: Salary increase (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
+0.5%	12.5	7.5	15.6	23.4	2102
–0.5%	11.5	8.2	17.6	27.1	2107

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

4.5.4. Fertility rate

Over the long-term, the PAYG rate is extremely sensitive to the assumption related to fertility rate which affects the growth of the insured population. In the base scenario, the fertility rate drops from 2.33 in 2018 to 1.85 in 2059 and stays at this level for the rest of the projection.

Two sensitivity analyses are done by assuming lower and higher fertility rate.

1. Low fertility growth scenario: the fertility rate has been decreased to reach 1.4 in the long run.
2. High fertility growth scenario: the fertility rate is assumed to decrease to reach 2.1 in the long run.

Under the base scenario, the average annual growth rate over the projection period of the insured population is 0.2 per cent. Under the low fertility growth and high fertility growth scenarios, the average annual growth rate is respectively -0.3 per cent and 0.3 per cent.

Depending on the degree of funding of the scheme, the cost can be sensitive to the assumption related to insured population growth. The PAYG rate at the end of the projection period is significantly affected by this assumption.

Table 23: Sensitivity analysis: Fertility rate (Insured population growth) (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
High fertility	11.9	7.8	16.5	21.0	2104
Low fertility	12.1	7.8	16.5	34.1	2104

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

It is important to understand the impact of population growth for a pension scheme. Higher population growth means that there are more people available to pay for benefits. This has the effect of delaying the ultimate cost of a pension plan by lowering the PAYG rate over the projection period, as shown in **Table 24**. The opposite applies to the lower growth scenario. According to these scenarios, the PAYG rate at the end of the projection period for low growth and high growth are 34.1 and 21.0 per cent, respectively. There is also no material impact on the full funding rate. This sensitivity analysis illustrates clearly one of the most important risks of social security systems that are pure PAYG.

4.5.5. Mortality rates

In the base scenario, at the start of the projection, the life expectancy at age 60 is 18.6 and 22.6 for males and females, respectively. 100 years later, it will increase to 21.8 and 26.5. The next scenarios show the impact on the projection of mortality rates that are 15 per cent higher or lower than the best-estimate assumption. If 85% of the

mortality rates is used, the life expectancy at age 60 will increase by about 1.4 years. 115% of the mortality decreases the life expectancy at age 60 by about 1.2 years.

Table 24: Sensitivity analysis: Mortality rates (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
High mortality	11.7	7.9	16.1	24.2	2107
Low mortality	12.3	7.8	17.0	26.3	2101

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

4.5.6. Density of contributions

The density of contribution represents the proportion of the year during which members pay contributions to the scheme. The density of contributions affects the number of years of service accrued by the members which is used in the calculation of the pension. The number of years of service is also used to verify if members qualified or not to a pension. One of the reasons explaining the low density of contributions in South Africa is the high unemployment rate. In the base scenario, the workers are contributing 8.3 months per year on average. Two sensitivity analyses have been produced:

1. by increasing the density of contributions by 15% (the average number of months of contribution increases to 9.5).
2. by decreasing the density of contributions by 10% (the average number of months of contribution decreases to 7.5).

The sensitive test shows that there is additional pressure on the cost of a pension scheme when there are no eligibility conditions, and the density of contributions is high.

Table 25: Sensitivity analysis: Density of contributions (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
High density	11.5	7.5	16.0	24.1	2112
Low density	12.5	8.3	17.2	26.1	2096

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

4.5.7. No changes in the employment variables

In the base scenario, the global labour force participation rate increases in the first part of the projection period (from 58.9 per cent in 2022 to 61.9 per cent in 2050) while it decreases in the second part to reach 60.6 per cent in 2100. In the long run, the unemployment rate is assumed to decrease from 29.6 per cent to 13.3 per cent. A sensitivity analysis is produced assuming that the current labour force participation rates as well as the employment rates by sex and single ages are going to stay at their current level (at the time of writing this report) throughout the projection period.

Table 26: Sensitivity analysis: No changes in the employment variables (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
No changes in the employment variables	12.0	8.6	19.0	23.8	2097

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

4.5.8. Gradual increase of the coverage

In the base scenario, it is assumed that 100 per cent of the workers of the formal sector are going to be insured by the new NSSF in 2022. In this scenario, it is assumed a slower implementation of the scheme: in 2022, 2/3 of the potential members are covered by NSSF and the coverage rate will increase linearly to 100 percent over the first 10 years of existence of the scheme.

Table 27: Sensitivity analysis: Gradual increase of the coverage (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
Gradual increase of the coverage	11.9	7.3	16.2	25.1	2106

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

4.6. Sensitivity tests on policy options

4.6.1. Eligibility conditions

In the base scenario, as requested, there are no eligibility conditions. It has been raised in the documents on the design that a scheme where there are no eligibility conditions may create some anti-selection issues. No eligibility conditions also create financial pressure on the scheme regarding the invalidity and survivor's pensions. In the present sensitivity analysis, eligibility conditions are considered: 5 years of contributions for all types of pensions and the payment of accumulated contributions with interest for members not qualifying. This scenario decreases the cost as illustrated in the following table.

Table 28: Sensitivity analysis: Eligibility conditions (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
5 years eligibility condition	11.3	7.0	16.0	24.3	2120

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

4.6.2. Automatic increases in the retirement age

In the base scenario, the retirement age remains unchanged at 65. This scenario assumes that the normal age of retirement will automatically increase with the increase in the life expectancy. Four years after the confirmation by StatsSA that there is an increase of 1 year in the life expectancy at the normal retirement age (age 65 at the implementation of the scheme) the retirement age starts to increase: it will increase by one month each year up to a maximum of 6 months.

Table 29: Sensitivity analysis: Automatic increases in the retirement age (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
Automatic increases in the retirement age	11.8	7.8	16.5	24.5	2105

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

In the actuarial valuation, it is assumed no mortality improvements after 100 years. It is important to state that the impact of increasing the retirement age may differ according to the way people react to the increase. However, increasing the retirement age should have an important positive impact on the financial sustainability of the scheme.

4.6.3. Normal retirement age at 60

In the base scenario, the normal retirement age is 65. It is however possible to start to receive the retirement pension at 60. In this case, the pension is reduced by 0.6 per cent for each month before age 65. For those who elect to delay the retirement after the age 65, the pension is increased by 0.7 per cent for each month after 65. In this scenario, it is assumed that the normal retirement age is 60 instead of 65 and it is possible to take the retirement at age 55 with a reduction.

Table 30: Sensitivity analysis: Normal retirement age at 60 (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
NRA = 60	14.3	9.6	19.9	29.4	2081

4.6.4. Indexation of pensions in payment

In the base scenario, the pensions in payment are adjusted each year according to the CPI. In the present sensitivity analysis, pensions are adjusted each year according to the salary growth rate.

Table 31: Sensitivity analysis: Indexation of pensions in payment (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
Adjustment to salary growth	13.1	8.4	18.0	28.0	2092

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

4.6.5. Revalorisation of the salary

In the base scenario, the pension formula is based on a career indexed pension plan. All the salaries earned during the working life of the members are revalorised according to a factor and are used in the calculation of the pension. The revalorisation factor is based on the average salary increase. In the design of the funding policy, it will be possible to adjust downward the revalorisation factor when the financial situation of the scheme required it. This sensitivity analysis shows the impact of adjusting the salary to 90 per cent of the salary growth, instead of 100 per cent like it is the case in the base scenario.

Table 32: Sensitivity analysis: Revalorisation of the salary (percentages)

Scenarios	Full funding	PAYG 2046	PAYG 2071	PAYG 2171	Year reserve = 0
Base	12.0	7.8	16.5	25.1	2104
90% of the salary growth	11.0	7.5	15.1	22.6	2125

Note: the year the reserve is depleted is calculated with a contribution rate of 10 per cent.

4.6.6. Introduction of a floor

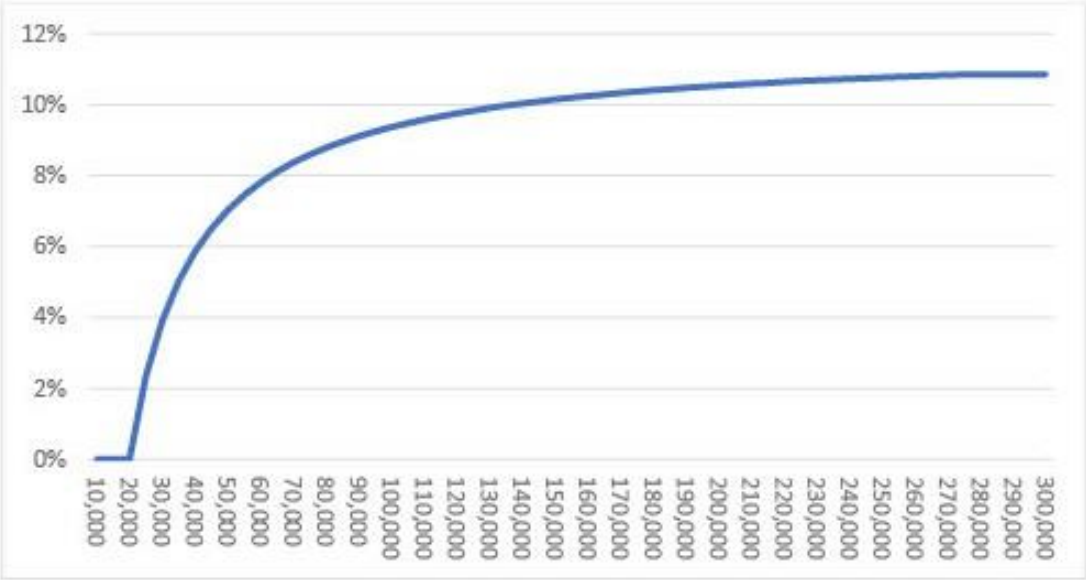
It is possible to introduce a new parameter in the design of the scheme to make the scheme less expensive in terms of contribution rate for individuals having lower income. This parameter is the contribution floor where the

contribution rate does not apply on a first level of salary, but benefits accrue on this first level of salary. Such feature is interesting to:

- Redistribute from the rich to the poor.
- Respond to the principal critic that social security pension schemes are skewed in favor of rich people.
- Incite to contribute for those with low earnings.

The introduction of such feature is not going to make the scheme more expensive. It has the objective to change the effective contribution rate, depending on the level of salary. People having the lowest salary are going to have the lowest contribution rate while those having the highest salary, the highest contribution rate. The following figure shows the effective contribution rate according to the level of annual earnings. A salary floor of Rand 20,000 is used which means that the first Rand 20,000 are not subject to contribution. In this example, an overall contribution rate of 10 per cent is used. The ratio of the total contributions on the total insurable earnings minus the floor increases to 11.7%

Figure 35: Effective contribution rate for a floor of R 20,000



5. CONCLUSION

This actuarial study deals with the implementation of a new NSSF in South Africa. To carry out the projections, it is expected that the scheme will be in force in 2022. The methodology used for the pension branch is based on a model developed by the ILO for reviewing the long-term actuarial and financial status of national pension schemes. The model has been adjusted to fit the situation of the NSSF. The ILO's model is based on methodologies that are appropriate and consistent with accepted actuarial practice. The data related to the NSSF (contributors) used in this actuarial valuation are in general complete and of enough quality to undertake an actuarial valuation and to obtain a picture of the financial soundness of the NSSF. Some elements in the data collection process bring some uncertainties to the actuarial valuation:

1. The mortality rates, the invalidity rates, and the retirement rates of the new insured populations because no experience exist.
2. The impossibility to match the financial statement of UIF with the data that has been transmitted.

An actuarial study requires many assumptions. The assumptions in this study are appropriate both individually and as a whole. They are also consistent taken together. Assumptions are established to reflect long-term trends rather than giving undue weight to recent experience. The objective of pension projections is not to forecast the exact development of the scheme's income and expenditures, but to verify its financial viability over the long-term.

This actuarial study shows that:

- The 10 per cent contribution rate is not sufficient to finance all the expenditures on a fully funded approach. According to the provisions described in **Annexure 1:** , the full funding contribution rate is 12 per cent.
- If a 25 per cent funding ratio is desired, as it is presently discussed, the contribution rate will have to double in the very long run.
- With a contribution rate of 10 per cent:
  - Total expenditures will be higher than contributions starting in 2052. In 2052, investment incomes will be used to pay the expenditures
  - In 2091, the contributions and the investment income are no longer enough to pay the expenditures, the reserve starts to decline.
  - In 2104, the reserve is depleted.
- The non-introduction of eligibility conditions may increase considerably the cost of the scheme particularly for the invalidity and survivors' branch.
- The risks the new NSSF will face depends considerably on the way the scheme will be financed.

Consultations with the tripartite partners were used to suggest a possible design for the new NSSF that would be compliant with the ILO standards and compatible with the policies promoted by the ILO. The ILO remains ready, on the basis of the discussions to be held between the social partners, to further support the Government in its social security reforms.

Annexure 1: General Description of the Scheme for the Base Scenario

1. Introduction

The following summary provides a general overview of the key coverage and benefits provisions for the scheme to be implemented. Only future services are considered in the National Social Security Fund. The provisions presented in this section may change according to the discussions that will take place between the different stakeholders.

2. Scope of the NSSF

The National Social Security Fund provides for the following benefits: Old Age Pension, Invalidity Pension, Survivors' Pension and Funeral Benefit.

2.1. Coverage

- The National Social Security Fund will be mandatory for workers in the public and the private formal sectors
- The minimum age at which a person may join the social security scheme is 16 years and the maximum age is 69 years. People working after age 69 will not be required to contribute. They will stop accruing benefits after 69.

3. Insurable earnings and contributions

The insurable salary includes the basic salary, all the allowances and bonuses, but excludes the commissions.

Contributions will be paid on the excess of the minimum annual insurable salary, up to the maximum insurable salary, at a rate of 10 per cent. In the base scenario, the is no minimum annual insurable salary. The maximum annual insurable salary will be R276,000 in 2018.

The level of the minimum and maximum insurable salaries will be revalorised annually based on the average salary increases in the economy.

4. Contribution rate

The contribution rate is 10%.

5. Qualifying conditions and benefit rates

5.1. Old Age Pension

5.1.1. **Eligibility conditions**: Every contribution creates a right to a pension.
5.1.2. **Age requirement**: Normal retirement age is 65 (with no reduction); Between ages 60 and 65, with a reduced pension (6 per cent per year prior to age 65); Between ages 65 and 70, with an increased pension (8.4 per cent per year after age 65).
5.1.3. **Pension amount**: Monthly payments equivalent to 1.09 per cent of career average indexed insurable salary for every 12 months of contributions.
5.1.4. **Pension indexation**: The pension amounts will be revalorised annually based on the increase in the cost of living, or the CPI.

5.2. Invalidity Pension

5.2.1. **Eligibility conditions (2 scenarios analysed)**: 24 months of contributions over the last 36 months or 50 percent of the contribution period (at least 3 years) or 5 years of contribution OR without eligibility conditions.

5.2.2. **Pension amount**: Monthly payments equivalent to 1.09 per cent of career average indexed insurable salary for every 12 months of contributions with a minimum pension of 32.7 per cent.

5.2.3. **Duration of pension**: As long as invalidity continues, up to normal retirement age. At normal retirement age, the disability pension is transformed to an old-age pension. The years the members have received the disability benefits are then treated as years of services.

5.2.4. **Pension indexation**: The pension amounts will be revalorised annually based on the increase in the cost of living, or the CPI.

5.3. Survivors' Pension

5.3.1. **Eligibility conditions (2 scenarios analysed)**: 12 months of contributions over the last 24 months or 50 percent of the contribution period (at least 2 years) or 5 years of contribution or in receipt of an old-age pension or an invalidity pension OR without eligibility conditions.

5.3.2. **Pension amount**: Where an insured member dies having satisfied the minimum contribution period, a monthly pension equivalent to 1.09 per cent of last insurable salary for every 12 months of contributions, provided that it is not less than 40 per cent of the last insurable salary. Where a pensioner dies, a monthly pension equivalent to the pension that was paid to him/her prior to his/her death. Under both cases, the Survivors' Pension is distributed between dependents in the following ways: 50 per cent for one dependent, 75 per cent for two dependents, and 100 for three dependents and more.

5.3.3. **Pension indexation**: The pension amounts will be revalorised annually based on the increase in the cost of living, or the CPI.

5.4. Funeral Benefit

5.4.1. **Eligibility conditions**: None.

Annexure 2: Methodology of the Actuarial Valuation

1. Introduction

This actuarial review makes use of the comprehensive methodology developed at ILO for reviewing the long-term actuarial and financial status of national social security systems. These modelling tools include a population model, an economic model, a labour force model and a long-term benefits model.

The actuarial valuation starts with a projection of the future demographic and economic environment of South Africa. Next, projection factors specifically related to the pensions are determined and used in combination with the demographic/economic framework.

2. Modelling the Demographic and Economic Environment

The use of the ILO actuarial projection model requires the development of demographic and economic assumptions related to the general population, the economic growth, the labour market and the increase and distribution of wages. Other economic assumptions relate to the future rate of return on investments, the indexation of benefits and the adjustment of parameters, if any.

2.1. General population

General population is projected starting with the most current data on the general population, and applying appropriate mortality, fertility and migration assumptions.

2.2. Inflation

Inflation rates are exogenous inputs to the economic model.

2.3. Labour force, employment, and insured population

The projection of the labour force, i.e. the number of persons available for work, is obtained by applying assumed labour force participation rates to the projected number of persons in the general population. Unemployment rates are assumed for the future and employment is calculated as the difference between labour force and unemployment.

2.4. Wages

Wages inflation are exogenous inputs to the economic model. Real wage development is checked against the labour productivity growth.

Wage distribution assumptions are also needed to simulate the possible impact of the social protection system on the distribution of income, for example through minimum and maximum pension provisions. Assumptions on the differentiation of wages by age and sex are established, as well as assumptions on the dispersion of wages between income groups.

3. Modelling the Financial Development of NSSF

The present actuarial review addresses all revenue and expenditure items of the NSSF. Income and expenditures are projected separately using a model specifically developed by the ILO for the pension branch. **Figure 36** presents a projection of the flow of financial balance. All benefits are projected separately for each sex and age.

Figure 37 summarizes the projection methodology of insured persons and beneficiaries.

Figure 36: Projection of the flow of financial balance

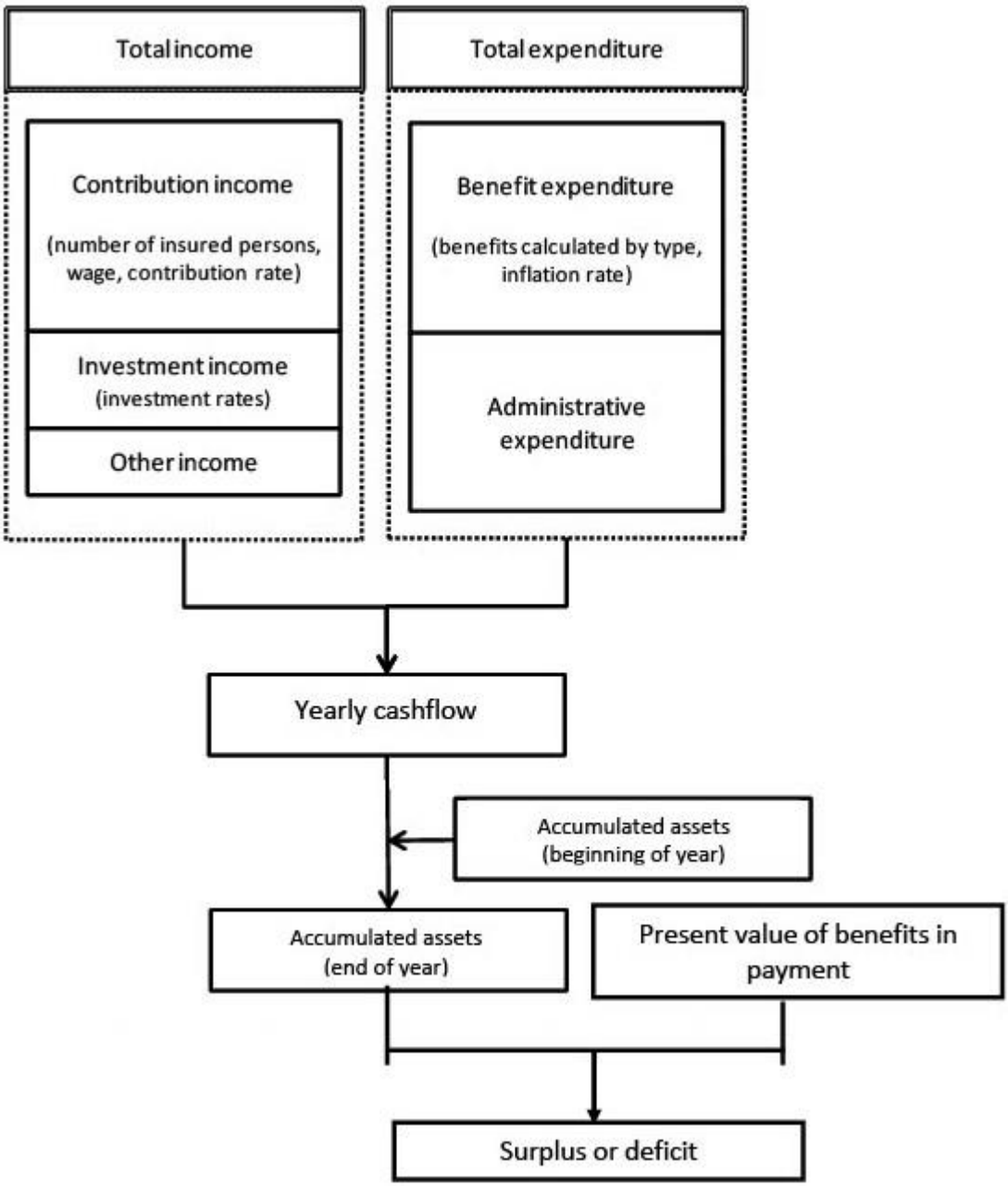
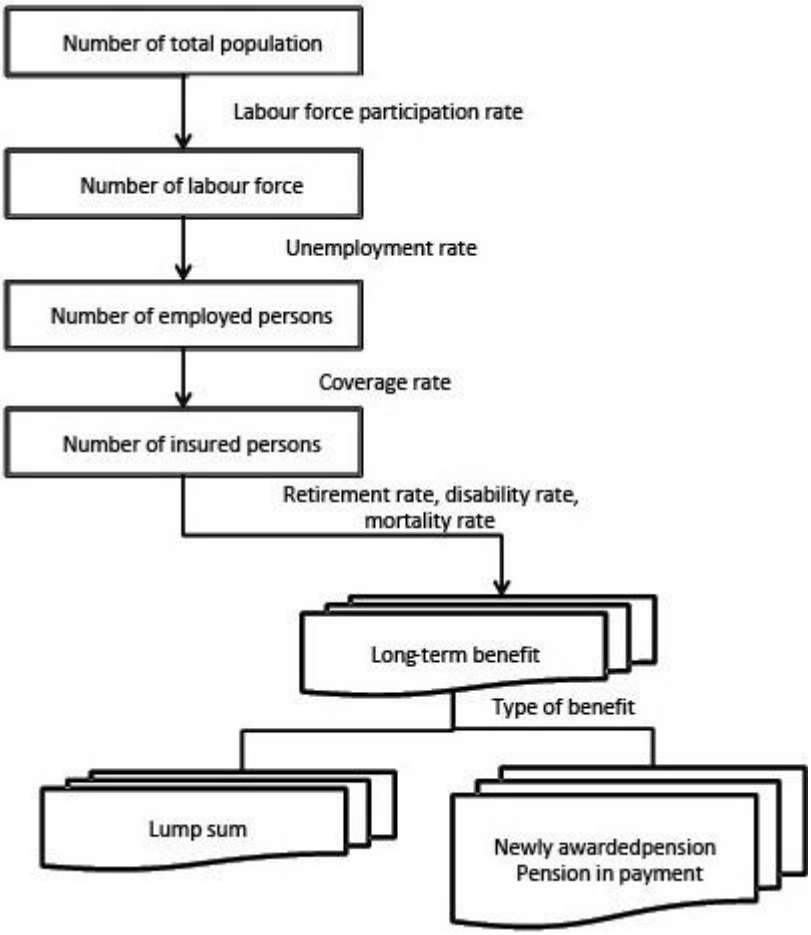


Figure 37: Projection methodology of insured persons and beneficiaries



4. Purpose of pension projections

The purpose of the pension model is twofold. First, it is used to assess the financial viability of the long-term benefits of the schemes. This refers to the measure of the long-term balance between income and expenditure of the system. In case of imbalance, a revision of the contribution rate or the benefit structure is recommended. Second, the model may be used to examine the financial impact of different reform options, thus assisting policy-makers in the design of benefit and financing provisions. More specifically, the pension model is used to develop long-term projections of expenditures and insurable earnings under the system, for the purpose of:

- assessing the options to build up a contingency or a technical reserve;
- proposing schedules of contribution rates consistent with the funding objective; and
- testing how the system reacts to changing economic and demographic conditions.

5. Pension data and assumptions

In addition to the demographic and macroeconomic frame already described, benefit projections require a set of assumptions specific to the NSSF.

The database as of the valuation date includes the insured population, the distribution of insurable wages among contributors and pensions in payment. Data are disaggregated by age and sex. This information comes from information transmitted by UIF and GEPF.

There is no past experience to estimate system-specific assumptions such as the retirement rates, mortality rates and invalidity rates. External sources of information, studies and best judgment have been used in the establishment of such assumptions.

The projection of the annual investment income has been done using a typical investment portfolio. A rate of return assumption is formulated on the basis of the nature of the system's assets and assumptions on future financial variables.

6. Benefit projection approach

Pension projections are made following a year-by-year cohort methodology. The existing population is aged and gradually replaced by successive cohorts of participants on an annual basis according to the demographic and coverage assumptions. The projection of insurable earnings and benefit expenditures is then made according to the economic assumptions and the scheme's provisions.

Pensions are long-term benefits. Hence, the financial obligations that a society accepts when adopting financing provisions and benefit provisions for them are also of a long-term nature: participation in a pension scheme extends over a whole adult life, either as contributor or beneficiary, i.e. up to 60 years for someone entering the scheme at the age of 20 years, retiring at the age of 60 years and dying some 20 or so years later. During their working years, contributors gradually build entitlement to pensions that will be paid even after their death, to their survivors.

It is not the objective of pension projections to forecast the exact progression of a scheme's income and expenditure, but to verify its financial viability. This entails evaluating the scheme with regard to the relative balance between future income and expenditure.

Annexure 3: Concepts on the Funding of Social Insurance

1. Introduction

The role of the actuarial methods in the funding policy of a pension scheme is to allocate the cost of the benefits and to calculate the required level of funding. It is important to have in mind that whatever the actuarial method chosen, the level of benefits to be paid will remain the same, all other things being equal. So, in terms of the ultimate amount of money to be paid (amount of benefits), the actuarial method does not change anything. It only changes the timing of the amount of money necessary to fund the benefits.

Actuarial methods to be used for an actuarial valuation will first depend on the financing system that is chosen. There are three financing systems: the pure pay-as-you-go (PAYG), the partially funded and the fully funded systems.

2. Pure assessment – PAYG system

Under this financial system, the contribution rate during a given period, for example one year (annual assessment) or a few years, is determined in such a way that income from contributions during a period will just cover the expenditure of the scheme during the same period, with a small margin to allow the constitution of a contingency reserve. This is the system usually applied to finance short-term benefits such as sickness and maternity cash benefits. Annual benefit expenditure is expected to remain at a relatively constant level once the scheme has attained a certain maturity unless the benefit provisions themselves have been changed. The contingency reserve enables coverage of unexpected expenditure due to temporary fluctuations of the risk factors involved. The reserve should, therefore, be maintained in a sufficiently liquid form so that it can be readily resorted to when necessary. If a pure assessment system were applied to a new pension scheme, it would involve frequent revisions of the contribution rate. The annual expenditure under a new pension scheme would begin at a comparatively low level and increase continuously over a long period of time. This is because there will be an increasing number of surviving pensioners. Another reason for escalating annual expenditure is that each new group of pensioners will be drawing higher rates of pension due to longer insurance periods compared with previous generations of pensioners.

3. Partially funded system

There are different approaches that can be used to partially fund a system, depending on the level of funding that is targeted. Two of these approaches are the General average premium (GAP) and the Scale Premium.

3.1. General average premium approach

A general average premium (GAP) approach provides for a theoretically constant rate of contribution ensuring financial equilibrium ad infinitum. At any time, the present values of all probable future contributions income plus accumulated reserves should be equal to the present value of all probable future outlays, both in respect of the initial population and of future entrants. The contribution rate determined under this system would be relatively high and would lead to the formation of high reserves. Though theoretically constant, in practice the contribution rate is likely to be revised at periodic actuarial reviews. If this approach were applied to a new pension scheme from the start, the rate of contributions would be relatively high and this could cause an undue burden on the economy and on the contributing parties. In this case, the economy should be able to invest and maintain a very large number of investments with appropriate investment management and risk analysis techniques. At the start of the pension scheme, when using this approach with a very long projection period, like 150-200 years, this approach produces a level of funding which is a proxy of a fully funded system. An interesting feature of this approach is that, by considering a very long period of time, the financing strategy includes many generations of contributors which is a desired characteristic for a social security pension scheme.

3.2. Scaled premium approach

It is possible to devise many intermediate systems of finance between the basically unfunded (PAYG) pure assessment system and the GAP approach. The following factors frequently lead to the adoption of an intermediate system of finance:

1. The contribution rate must not be excessive (with respect to the capacities of the members and the economy in general).
2. The initial, and any subsequent contribution rates established under the system of finance applied to the scheme, should remain relatively stable for reasonable periods of time. Increases in the contribution rate should be gradual, particularly when they are not accompanied by an improvement in benefits.

An example of an intermediate level of funding is the scaled premium approach. Under this approach, a contribution rate is established so that during a specified period, which is known as the period of equilibrium, the contribution income and the interest income on the reserves of the scheme will, in each year, be adequate to meet the expenditure on benefits and administration in that year. In order to avoid a decrease in the reserves after the end of a period of equilibrium, the contribution rate must be revised prior to this and a new higher contribution rate applied during a new period of equilibrium. Thus, the financial equilibrium would be assured for limited periods, such as 20, 15 or 10 years, within each of which the contribution rate is supposed to remain stable. Subsequently, it would be increased by stages – 20, 15 or 10 years, respectively. There would be a moderate accumulation of funds, the amount of which depends on the length of the period of equilibrium. A short period of equilibrium would result in a low contribution rate, which would have to be increased rather frequently, and would bring about a low degree of accumulation of funds, thus approaching the system of annual assessment. However, a long period of equilibrium would result in a relatively high initial contribution rate and a larger accumulation of funds, and consequently approaches the GAP approach. The scaled premium approach is flexible, as it permits adaptation to changes in the conditions determining the financing of the scheme. It should be emphasized, however, that the approach requires periodic increases of the contribution rate, which are not accompanied by benefit improvements. Although the contribution rate during the initial period of equilibrium will be lower than that under the GAP approach, eventually a stage will be reached when it will exceed the contribution rate required under the latter approach.

4. A fully-funded system

A fully funded system is a system where liabilities are fully funded. Instead of relying on younger generations of workers to pay the benefits, each generation is required to set aside enough money to pay their own benefits. At each moment during the life of the pension plan, accumulated contributions and investment income shall be enough to pay all the promises. If not, deficits should be amortized during a stated period. This kind of financing system is more prevalent in the private pension world because it protects workers if the pension plan ends, whereas a public pension scheme is supposed to be in place for ever. A fully funded scheme is also the approach that tries to minimize the intergenerational transfer of cost. Consequently, this approach is the one with the least intergenerational solidarity. For example, in Canada, in 2019, an additional income replacement rate has been introduced to increase ultimately the current level from 25% to 33.33 %. This additional 8.33%, which was the response of the provincial and federal governments for securing adequate retirement savings because of the decreasing of occupational pension plans, has the particularity to be fully funded because of the wish of the Canadian society to minimize intergenerational transfers.

5. Which system is better?

There is no single answer to that question. It depends on the particular context of each country, the objectives of the stakeholders and the limits and constraints in which the pension scheme operates. All methods have their risks, advantages and disadvantages.

However, to a very few exceptions, all social insurance pension schemes have historically been established on the principle of social solidarity, including intergenerational solidarity and are therefore partially funded. These social insurance schemes are in fact a social contract under which the current generation of contributors accept that their contributions be used to pay the benefits of current pensioners. This creates for the current generation of contributors a right to the contributions of the future generation of contributors to pay for their pensions.

In an economy where there is real salary growth (i.e. in excess of inflation), future generations of workers will have higher salary in real terms than the current generation of workers and may therefore be able to afford higher contributions. Partial funding also allows for gradual contribution rate increases which may take into account the economic development of a country.