Greece

PRELIMINARY TECHNICAL NOTE TO THE NATIONAL ACTUARIAL AUTHORITY

Actuarial projection results of the National pension scheme of Public Servants as of 31 December 2005

International Financial and Actuarial Service
Social Security Department
International Labour Office

Geneva, 18 July 2008

Introduction

This Preliminary Technical Note presents the results of the actuarial projections of the Public Servants (PS) pension scheme. The contents reflect the actuarial projection results and main background information in relation to the database and assumptions used to perform the set of projections under status quo benefit and financing provisions relevant to the national pension scheme of PS.

The International Financial and Actuarial Service of the ILO Social Security Department is mandated under the technical cooperation project between the ILO and the National Actuarial Authority of Greece (NAA) entitled "Actuarial support to the National Actuarial Authority of Greece (GRE/06/01/GRE)" to deliver a set of outputs to assist the NAA in building up its own national capacities and modelling tools applied to conduct the regular actuarial valuation of the Greek public pension system. This Preliminary Technical Note presents the limited results of the actuarial projections bearing in mind that a more comprehensive technical note will be delivered to the NAA by the end of August 2008 according to the agreed upon terms of the project to include the full discussion on data collection, experience analysis, construction of projection assumptions, analysis of projection results and recommendations.

The actuarial projections are performed as of the valuation date of 31 December 2005. The valuation period is of 50 years, i.e. ending in year 2055. The reader of the present preliminary technical note will appreciate the presentation of the main characteristics of the set of database and assumptions on the basis of which projections are performed. It is important to bear in mind the inherent high degree of uncertainty when projecting the long-term benefit promises of the national pension system, in this case for 50 years. This is inevitable for any pension actuarial valuation. The sensitivity of the financial results to variations in each variable, and in aggregate, needs to be taken into account. The present preliminary technical note does not go into this full level of details as sensitivity tests will be presented in the final technical note to be delivered in August 2008.

In Section 1, the projections of the general population and macro-economic factors affecting the national pension system are presented. Sections 2 presents the projections and main considerations relevant to the PS pension scheme whilst further details are provided in Appendix I.

The Director General of the ILO expresses his appreciation to the President of the NAA for its trust and support throughout the present project as well as to the staff of the NAA for their invaluable professional support and cooperation on a day to day basis.

1. General population and macro-economic projections

Future income and expenditure of PS will be closely linked to changes in the main macro-economic and demographic variables affecting the country as a whole namely, inter alia, the size and age structure of the general population, employment levels, economic and wage growth, inflation, and interest rates. The projection of the future finances of the different components of the national pension system and in aggregate requires to start from the projection of general population of Greece and the main variables affecting the national economic activity. The general population and economic projections are an intermediary step to derive actuarial projections of the different components of the national pension schemes.

General population projections provide the basis to estimate the size and composition of the labour force. Projections of gross domestic product (GDP) and workers' productivity growth indicate in turn how many workers, amongst the labour force, will be active and employed in the economy as well as what will be the level of their individual remuneration Since these factors are both directly and indirectly interrelated – for example, changes in the general population directly affect the economy whilst economic performance is in turn having an impact on migration that makes the general population change –, population and economic projections are performed together to ensure key interrelations are coherent throughout the projection process.

Assumptions have been developed following an analysis of past trends and a review of plausible future experience bearing in mind the various indications provided by the European Union Ageing Working Group to the extent they are relevant for the actuarial valuation of the Greek pension system. Where deviations are assumed, a full set of justifications is provided.

The main assumptions and projections related to general demographics and economics of Greece are discussed in the following sub-sections. Further details may be found in Appendix I.

1.1 General population projections

The determinants of future population changes are fertility, mortality and net migration. Fertility rates determine the number of births, while mortality rates determine how many, and at what ages people are expected to die. Net migration represents the difference between the number of people who permanently enter and leave Greece and is the most volatile of the three factors.

The resident population in 2003 was estimated at 11,006,000 persons based on the EU Ageing Working Group estimates. The present projections used this as a starting point for single age population cohorts by sex and age with the exception that adjustments for age-specific distribution had to be made for the ages above 90. The general population was projected starting in year 2004.

The total fertility rate (TFR) represents the average number of children each woman of childbearing age would have if she had all her children in a particular year. If there is no migration, a TFR of 2.1 is required in principle for each generation to replace itself over

time. In 2003, Greece TFR was estimated at 1.29, a level substantially lower than the natural replacement TFR. The base scenario assumes that the TFR will increase until 2025 to 1.5 and will remain at that level until the end of the projection period. The assumption on the overall TRF is based on EU Ageing Working Group estimates whilst the pattern of fertility rates by single age corresponds to the medium variant projections of the United Nations.

Initial life expectancy is based on the EU Ageing Working Group estimates. For the base scenario, life expectancy at birth in 2005 is 76.8 for males and 81.8 for females. Life expectancy at advanced ages is a key driver of the cost of retirement pensions. At age 65, the remaining life expectancy is 16.8 and 20.0 respectively for males and females in 2005. Mortality improvements are assumed to occur in accordance with the pattern of fast increase of UN estimates.

Net migration was set at 45,000 persons in year 2003 and was assumed to decline linearly to 40,000 in 2010, to 38,000 in 2020, and to 35,000 in 2030, remaining constant afterwards. This assumption was set based on the EU Ageing Working Group estimates. On one hand, considerable migration movements have been observed in the recent past and are highly probable to take place in the future as well; on the other hand, exact number of migrants depends on a set of political and economical conditions that are difficult to forecast. In such circumstances, the simplistic assumption for net migration was considered the most appropriate approach since migratory phenomena would have to be more pronounced than those observed until now on the covered population to significantly influence the long-term financial situation of the social security system. There is an inevitable and inherent high degree of uncertainty in this assumption concerning migration.

Table 1.1 indicates the main general demographic assumptions used in this actuarial review.

Table 1.1 Main assumptions for general population projections

General population variable	Assumption	Source
Total fertility rate	Increasing from 1.29 to 1.50 until year 2025 and remaining constant at 1.50 thereafter	EU Ageing working group
Mortality improvements	Life expectancy at birth in 2005 Male: 76.8 Female: 81.8 Life expectancy at birth in 2055 Male: 82.1 Female: 87.0	Life expectancy at birth in 2005 Based on the EU- Ageing working group Life expectancy at birth in 2055 Based on the middle variant UN projections
Net migration	Declining linearly from 45000 to 40000 in 2010, to 38000 in 2020, and to 35000 in 2030 and remaining constant thereafter	EU Ageing working group

The following Chart 1.1 shows the projected general population up to year 2055 according to the three main population age groups: children, working-age and pension-age. The changes in the relative size of each population age group illustrate the inevitable ageing process already encountered by the population of Greece. The number of children will decline slightly while the number of pension-age persons will increase at much higher pace over the projection period.

Chart 1.1 Projected general population, 2005-2055 (in thousands)

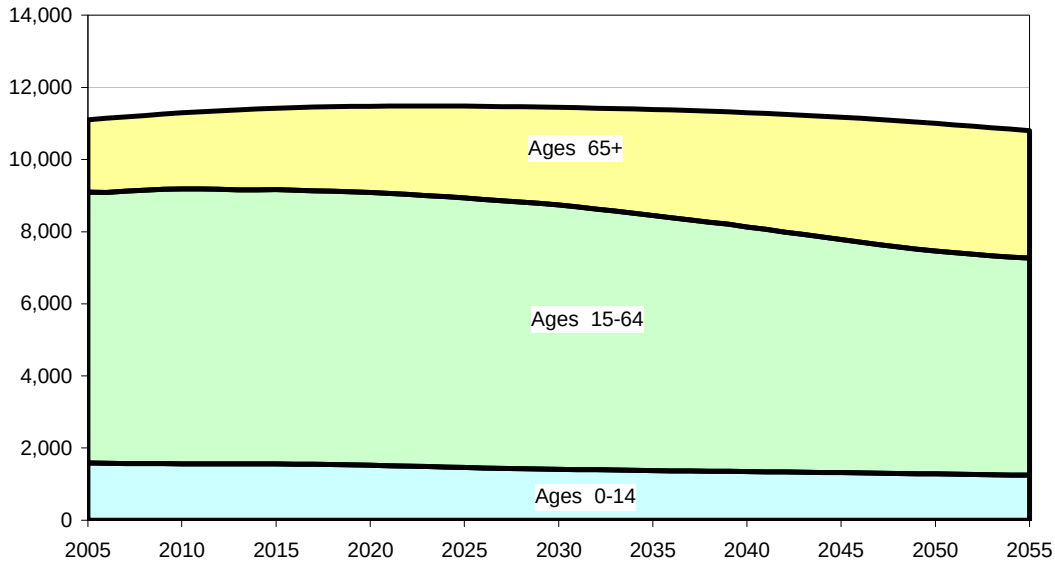


Table 1.2 presents population projections details under the baseline scenario. Given the assumptions would materialize, the highlights are:

- The general population will increase to approximately 11.5 million persons by 2023 and then will initiate a decrease to reach 10.8 million persons by 2055.

- The total population and the working-age population group will decrease by 3% over the projection period, the number of older persons in the pension-age population group of age 65 and over will increase by 75%.

- By year 2055, pension-age persons of age 65 and over will be three times more numerous than the children population group.

- The ratio of the number of working-age persons for each pension-age person will fall from 3.74 today to 1.7 by 2055. This is a trend in line with other countries observed to be facing a rapid ageing process.

- The projected change in the population structure will bear an inevitable heavy burden on the long-term finances of the national public pension system, namely in the case of the scheme of PS.

Table 1.2 Projected general population, 2005 – 2055 (in thousands)

Year	Total	Age			Ratio of no. persons 15-64 to no. persons 65+
		0 – 14	15 – 64	65 and over	
2005	11,098	1,591	7,502	2,005	3.74
2006	11,142	1,581	7,506	2,055	3.65
2007	11,184	1,575	7,545	2,063	3.66
2008	11,223	1,571	7,576	2,076	3.65
2009	11,259	1,569	7,607	2,083	3.65
2010	11,293	1,566	7,618	2,109	3.61
2011	11,324	1,562	7,620	2,141	3.56
2012	11,352	1,560	7,608	2,183	3.49
2013	11,377	1,559	7,599	2,219	3.42
2014	11,399	1,561	7,597	2,242	3.39
2015	11,419	1,561	7,601	2,257	3.37
2020	11,473	1,527	7,561	2,385	3.17
2025	11,475	1,467	7,470	2,538	2.94
2030	11,441	1,412	7,325	2,704	2.71
2035	11,385	1,375	7,075	2,936	2.41
2040	11,299	1,346	6,785	3,168	2.14
2045	11,171	1,318	6,468	3,386	1.91
2050	11,000	1,284	6,180	3,536	1.75
2055	10,795	1,250	6,017	3,529	1.70

1.2 Key macro-economic variables projections

Projected changes in the population and labor force provide the capacity for additional output through more workers and an increased productivity. Labor force participation by age of the male population is assumed to grow slightly at younger and older ages while decreasing for at the mid-career ages. Age-specific female labour force participation rates are assumed to increase substantially for all ages in line with the EU Ageing Working Group estimations based on cohort methodology.

GDP growth is the combined result of productivity and employment variation. The nominal interest rate is the combined result of the real rate of interest of 2.9 per cent and consumer price inflation of 2 per cent in the reference year. Thus, the nominal interest rate is assumed at 5.0 per cent per annum.

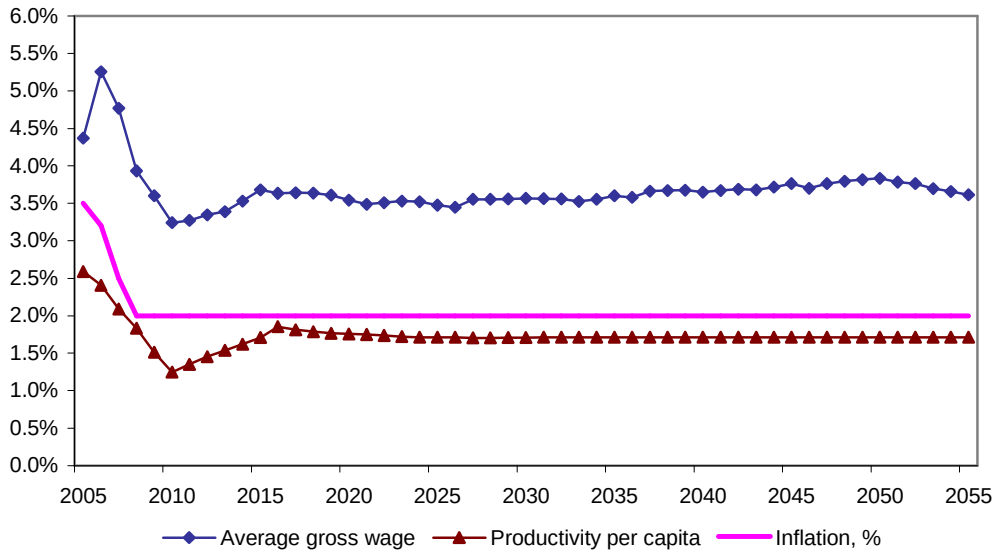
Table 1.3 indicates the principal economic assumptions used in this actuarial review. Further details may be found in Appendix I.

Table 1.3 Main assumptions for key macro-economic variables projections

Macro-economic variable		Assumption	Source
Real GDP (annual, in millions Euro)		Increasing from 170,418 in 2005 to 313,344 in 2050	EU Ageing working group
Consumer price inflation (% p.a.)	2005 to 2007 (actual) 2008 and over	Decreasing to 2.0 % in 2008 2.0 % p.a.	EU Ageing working group
GDP deflator variation (% p.a.)	2005 to 2007 (actual) 2008 and over	Decreasing to 2.0 % in 2008 2.0 % p.a.	ILO own assumption
Real rate of return (% p.a.)		Constant at 2.9 %p.a.	ILO own assumption
Labour force participation rates		Single-age rates	EU Ageing working group
PS benefit indexation rate		Consumer price inflation + 0.5%-point	ILO own assumption

Chart 1.2 shows the pattern of the main economic assumptions over the projection period to year 2055. This allows an appreciation of the coherence between them. The price inflation and the productivity per capita exhibit the same pattern, decreasing in the first projection years and becoming stable afterwards. According to the assumptions used, the GDP deflator is equal to consumer price inflation over the whole projection period. GDP deflator and productivity per worker are used as the components to model future wage growth levels.

Chart 1.2 Projected pattern of the main macro-economic variables, 2005-2055



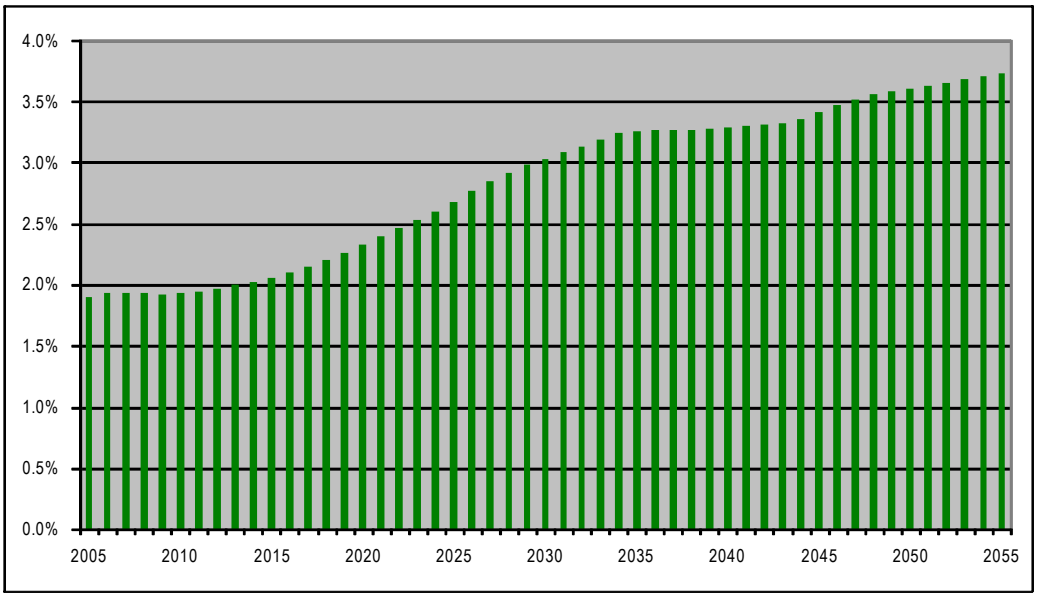
2. Actuarial projections of the PS pension scheme

The actuarial projections are performed as of the valuation date of 31 December 2005. The valuation period is of 50 years, i.e. ending in year 2055. This section presents and analyses projections of PS for the years 2006 to 2055. The purpose of these projections is to identify long-term trends on the revenue and expenditure sides, limited to contributions and benefits, to assess the main drivers of the financial situation of the PS system. As previously mentioned, actuarial projections are based on the projection of the general population and the main macro-economic variables as presented in Section 1 as well as on an extensive series of PS-specific assumptions derived from an in-depth past performance review to adjust the initial database and to derive assumptions on the most likely future course. Projections assumed the financing and benefit provisions governing the PS scheme as of 31 December 2005 remain unchanged in future. [1]

Chart 3.1 summarizes the projected annual deficit of the PS such that it will overall increase from a level of less than 2 per cent of GDP today to slightly more than 3.5 per cent of GDP by 2055, given the assumptions materialize.

The demographic and financial projections are summarized in Tables 2.1 and 2.2 respectively. At the valuation date as of 31 December 2005, the total number of insured persons was estimated at 550 thousand persons approximately whilst the total number of pensioners was of about 335 thousand persons. These numbers include public servants, municipality servants, firemen, police forces and militaries. For the purpose of the projections, the total number of insured is assumed to stay constant, i.e. exits due to death, invalidity and retirement are exactly compensated by new entries.

Chart 2.1 PS projected net annual deficit, 2005-2055 (in percentage of nominal GDP)



[1] Unless otherwise specified, the monetary value of the projections presented in Section 2 is in current Euro terms (2005).

2.1 PS demographic projections

Table 2.1 provides the projected demographic development of PS under the baseline projection assumptions. The ratio of the number of active contributors for every pensioner will be in 2055 exactly one whereas it was 1.63 in 2005.

Table 2.1 PS demographic projections, 2005-2055

Year	Number of contributors	Number of pensioners			Total number of pensioners	Ratio of contributors to pensioners
		Old-age	Invalidity	Survivors		
2005	548,552	227,334	7,585	100,796	335,715	1.63
2006	548,555	230,702	7,810	101,936	340,448	1.61
2007	548,555	231,778	7,992	102,900	342,670	1.60
2008	548,555	232,336	8,118	103,780	344,234	1.59
2009	548,555	233,004	8,226	104,540	345,770	1.59
2010	548,555	234,405	8,328	105,113	347,846	1.58
2011	548,555	236,866	8,432	105,589	350,887	1.56
2012	548,555	240,217	8,538	106,010	354,765	1.55
2013	548,555	244,239	8,646	106,665	359,550	1.53
2014	548,555	248,605	8,756	107,148	364,509	1.50
2015	548,555	253,696	8,868	107,606	370,170	1.48
2025	548,555	327,495	10,152	111,710	449,357	1.22
2035	548,555	386,082	11,611	124,842	522,535	1.05
2045	548,555	373,272	12,225	148,481	533,978	1.03
2055	548,555	376,484	12,603	159,722	548,809	1.00

2.2 PS benefit projections

Table 2.2 below provides the financial projections for PS in terms of total expenditure by benefit category and in relation to total insurable earnings.

Table 2.2 PS benefit expenditure projections by benefit category, 2005-2055

Year	Pensions, grants & benefits				Benefits as % of insurable base
	Old-age	Invalidity	Survivors'	Total	
2005	3,144	85	781	4,010	40.9%
2006	3,395	92	818	4,305	42.2%
2007	3,614	100	855	4,569	42.2%
2008	3,778	105	880	4,763	42.5%
2009	3,944	110	905	4,959	42.8%
2010	4,130	115	931	5,176	43.4%
2011	4,343	121	959	5,423	44.1%
2012	4,584	126	987	5,697	45.0%
2013	4,850	132	1,018	6,000	46.0%
2014	5,135	138	1,051	6,324	46.9%
2015	5,450	145	1,085	6,680	47.9%
2025	10,170	228	1,575	11,973	61.2%
2035	16,179	365	2,635	19,179	69.4%
2045	21,296	544	4,635	26,475	67.2%
2055	31,243	799	6,972	39,014	68.7%

2.3 PS financial projections

The overall financial projections of the PS are summarized in Table 2.3 below. They are limited to the revenue from contributions, assuming the present contribution rate remains in force and the benefit expenditure.

Table 2.3 PS financial projections summary, 2005-2055 (millions of Euro)

Year	Revenue (Contribution income)		Expenditure (Benefits)		Annual deficit	Annual deficit as % of GDP
	Nominal	In % of GDP	Nominal	In % of GDP		
2005	654	0.37	4,010	2.27	-3,356	1.90
2006	681	0.36	4,305	2.30	-3,624	1.93
2007	722	0.36	4,569	2.31	-3,846	1.94
2008	747	0.36	4,763	2.30	-4,015	1.94
2009	772	0.36	4,959	2.28	-4,187	1.93
2010	795	0.35	5,176	2.29	-4,381	1.94
2011	819	0.35	5,423	2.30	-4,603	1.95
2012	844	0.34	5,697	2.32	-4,854	1.98
2013	871	0.34	6,000	2.34	-5,130	2.00
2014	899	0.34	6,324	2.37	-5,425	2.03
2015	930	0.33	6,680	2.40	-5,750	2.06
2025	1,305	0.33	11,973	3.02	-10,668	2.69
2035	1,843	0.35	19,179	3.61	-17,336	3.26
2045	2,629	0.38	26,475	3.79	-23,845	3.42
2055	3,786	0.40	39,014	4.15	-35,227	3.74

Two key indicators useful for the assessment of the performance of a social security scheme are the components of the PAYG rate: the demographic and the system replacement ratios. The demographic ratio is obtained by dividing the number of pensioners by the number of insured. The system replacement ratio is the average pension over the average insurable base.

The system demographic ratio is given by the number of beneficiaries divided by the number of active contributors, as shown in Chart 2.2; and the system replacement ratio is given by the average benefit divided by the average insurable earnings, as shown in Chart 2.3. The PAYG is the product of those two ratios and is presented in Chart 2.4.

Chart 2.2 PS System demographic ratio, 2005-2055

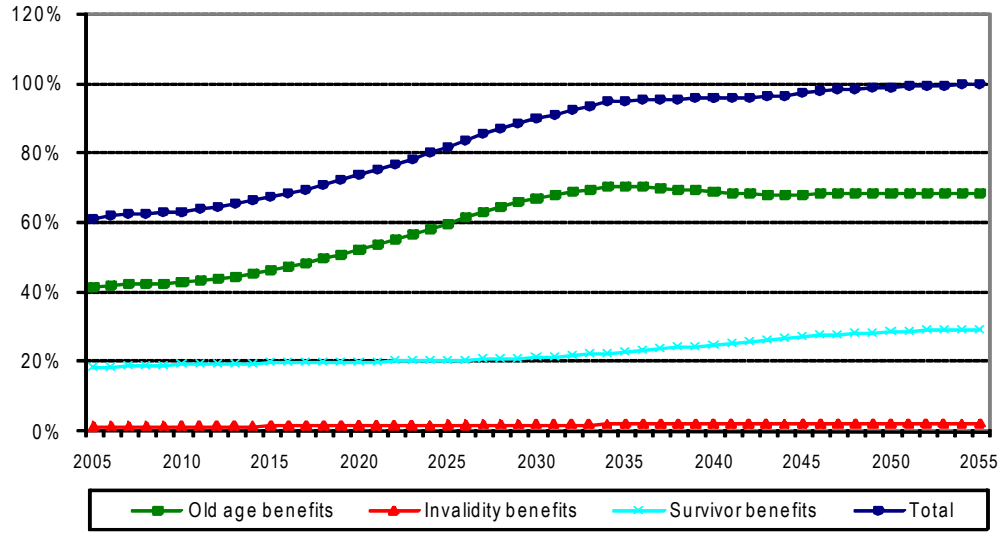


Chart 2.3 PS replacement ratio, 2005-2055

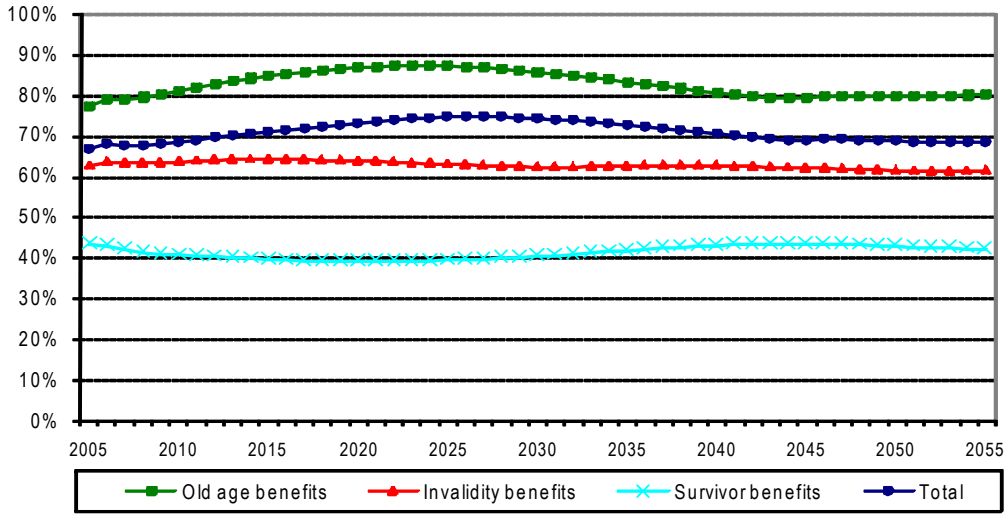


Chart 2.4 PS projected Pay-as-you-go cost rate, 2005-2055 (% of insurable earnings)

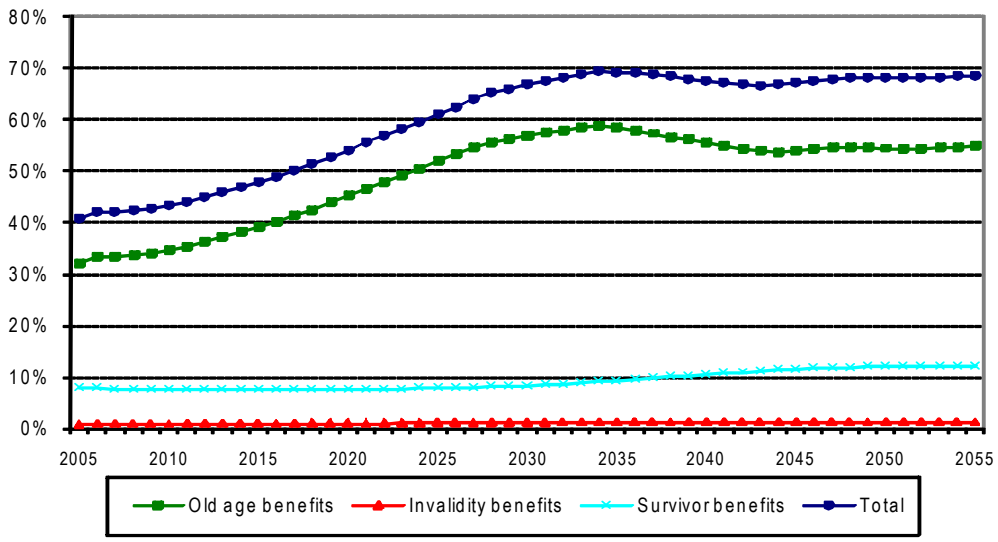


Table 2.4 provides the summary of the GAP and PAYG at specific points in time.

The general average premium (GAP) is the average uniform contribution rate required over the projection period (2006 to 2055) to cover total expenditure during that period. The GAP is calculated by making the ratio of the present value of total expenditure over (for benefits and administration) to the present value of the insurable base. The Pay-as-you-go (PAYG) cost rate is the contribution rate with which annual contribution income exactly matches annual benefit expenditure.

Table 2.4 PS projected benefit cost rates, 2005, 2025 and 2055 (% of insurable earnings)

	Reference	% of insurable earnings
Present average contribution rate	2005	6.67
General average premium	2005-55	60.3
Pay-as-you-go cost rate	2005	40.9
Pay-as-you-go cost rate	2025	61.2
Pay-as-you-go cost rate	2055	68.7

Note: The above benefit cost rates do not take into account administration expenditure.

Appendix I: Methodology, initial data and assumptions

I.1 Demographic and economic assumptions

This actuarial review makes use of the comprehensive methodology developed by the International Financial and Actuarial Service of the ILO (ILO FACTS) for reviewing the long-term actuarial and financial status of a national pension scheme. The review has been undertaken by modifying the generic version of the ILO modeling tools to fit the specific case of PS. These modeling tools include a population model, an economic model, a labour force model, a wage model, a model of old-age, disability and survivor benefits model and an employment injury benefits model.

The actuarial valuation begins with a projection of Greece's future demographic and economic environment. Next, projection factors specifically related to the PS are determined and used in combination with the demographic/economic framework to estimate future cash flows and reserves. Assumption selection takes into account both recent experience and future expectations, with emphasis placed on long-term trends rather than giving undue weight to recent experience.

I.2 Modeling the demographic and economic developments

The general Greek population has been projected beginning with census data in 2003 and by applying appropriate mortality, fertility and migration assumptions. The total fertility rate (TFR) was estimated at 1.29 in 2003 and it is assumed that it will increase rapidly to 1.5 in 2025 remaining constant thereafter. The pattern of fertility rates by age corresponds to the medium variant projections of the United Nations.

Table AI.1 Fertility rates at specified ages, 2005-2055

Age	2005	2010	2020	2025-2055
20	0.067	0.073	0.079	0.080
25	0.089	0.095	0.101	0.101
30	0.066	0.067	0.067	0.067
35	0.030	0.031	0.032	0.032
40	0.008	0.010	0.011	0.012
Total fertility rate	**1.29**	**1.39**	**1.49**	**1.50**

Mortality rates have been established according to the United Nations' medium variant. Consistency checks have been performed to ensure they reproduce with a reasonable degree of accuracy the number of deaths in the population and among the pensioners of PS. Mortality rates of the population base are provided in Table AI.2.

Table AI.2 Mortality rates, 2005-2055

	Male		Female	
Age	2005	2055	2005	2055
20	0.0008	0.0002	0.0003	0.0001
25	0.0010	0.0003	0.0004	0.0001
30	0.0009	0.0003	0.0004	0.0002
35	0.0010	0.0004	0.0006	0.0002
40	0.0015	0.0007	0.0009	0.0005
45	0.0023	0.0015	0.0014	0.0008
50	0.0041	0.0022	0.0022	0.0011
55	0.0061	0.0040	0.0032	0.0017
60	0.0095	0.0061	0.0049	0.0027
65	0.0151	0.0093	0.0076	0.0045
70	0.0239	0.0153	0.0130	0.0078
75	0.0428	0.0255	0.0248	0.0148
80	0.0747	0.0441	0.0488	0.0267
85	0.1230	0.0734	0.0904	0.0472
90	0.1920	0.1281	0.1554	0.0854
95	0.2806	0.2147	0.2438	0.1668

Table AI.3 shows life expectancies at certain ages.

Table AI.3 Life expectancies

	Males			Females		
Life expectancy at:	2005	2030	2055	2005	2030	2055
Birth	76.8	79.7	82.1	81.8	84.8	87.0
Age 60	20.7	22.8	24.6	24.4	26.7	28.6
Age 65	16.8	18.7	20.4	20.0	22.1	24.0

Net migration was set at 45000 in year 2003 and assumed to decline linearly to 40000 in 2010, to 38000 in 2020, and to 35000 in 2030, remaining constant afterwards.

The projection of the labour force, i.e. the number of people available for work, is obtained by applying assumed labour force participation rates to the projected number of people in the total population. The total participation for ages 15-64 changes over time due to the variation in the age composition of the population. Table AI.4 shows the age-specific labour force participation rates for selected ages.

Table AI.4 Age-specific and total labour force participation rates (active persons as % of total population)

Age	Males		Females	
	2005	2055	2005	2055
17	12%	12%	6%	6%
22	61%	63%	47%	50%
27	91%	90%	77%	72%
32	96%	95%	73%	76%
37	97%	96%	70%	78%
42	97%	97%	70%	79%
47	96%	97%	61%	78%
52	88%	92%	50%	70%
57	75%	79%	36%	55%
62	47%	46%	23%	38%
67	22%	22%	10%	10%

Year	Population 15-64	
	Males	Females
2005	69%	66%
2030	66%	62%
2055	57%	54%

The projected real GDP is obtained by applying the projected labour productivity per worker to the number of employed people required to produce total output. Unemployment is calculated from assumed unemployment rates and labour force.

Estimates of increases in total wages as well as the average wage earned are required.

Annual average real-wage increases are assumed equal to the increase in labour productivity as it is expected that wages will adjust to efficiency levels over time. Such increases are assumed to decrease gradually in the first years of the projection period from 2.6 per cent in 2005 to 1.2 percent in 2010, then to increase to 1.9 in 2016 and remaining constant at the level of 1.8 thereafter. The GDP deflator assumption affects nominal average wage increases.