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Measuring and recording of pensions

Modeling and estimating social security pension entitlements in Spain

Note by the National Statistical Institute, Spain

Summary

A gradual ageing takes place in most European countries. In the future the population structure will no longer be as pyramid shaped as used to be. This demographic development will be reflected in the planning of the general government pension schemes. This paper presents the demographic situation, general government pension schemes and analysis of the problems with calculation of the pension entitlements of households in Spain.

I. Introduction

1. In Spain, as in most European countries, the increase in population longevity in addition to moderate birth rates, has determined a gradual ageing in the demographic structure. This entails that the weighting of advanced ages in the future population will be greater than it is in the current population pyramid.

2. Indeed, considering the long-term projections of the Spanish population estimated by National Statistical Institute of Spain (INE) (2009-2048), life expectancy at birth can go up more than six years by first half of 21st century (from 84 to 90 years in women and from 78 to 84 years in men). Moreover, life expectancy of the population aged over 64 years could increase in more than four years by the aforementioned period (from 84 to 91 years in women and from 83 to 87 years in men):

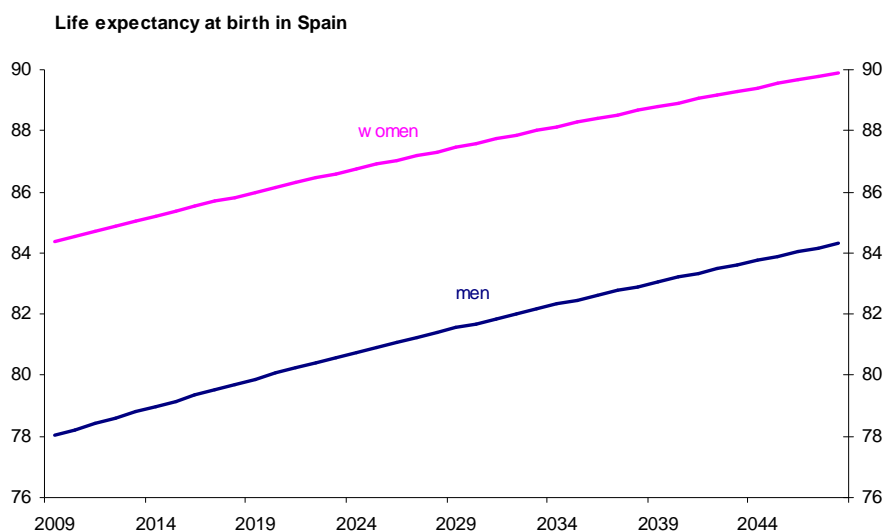
3. The expected ageing of population becomes patently clear in the population pyramids projected for 2009 and 2048 (see next page).

4. Consequently, the population aged over 64 years is set to double in 40 years, jumping from 7.6 to 15.32 million people, and coming to constitute 32 per cent of the total Spanish population.

5. Taking into account the change in the composition by age expected for the population pyramid, it becomes useful to estimate the impact of this fact on pension entitlements of households in social security schemes financed by Pay-As-You-Go (PAYG) systems, i.e., systems where contributions paid by active members (younger ages) at that moment, finance the current expenditure of pensioners (advanced ages).

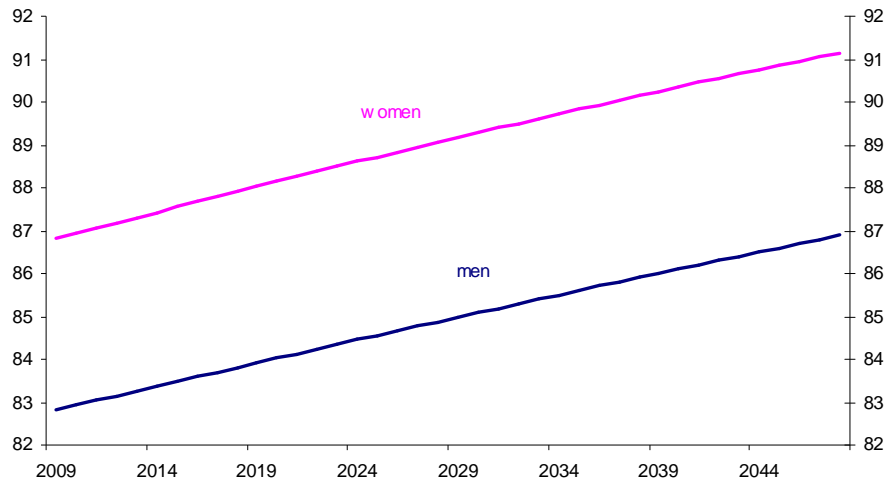
6. In the case of Pay-As-You-Go systems, as they are social security schemes, these estimated pension entitlements should not be included in the core accounts. As these schemes are not funded, governments do not have a real liability towards citizens and therefore, these schemes are not considered public debt.

Figure 1



Source: INE Spain. Long-term projections of the population: 2009-2048

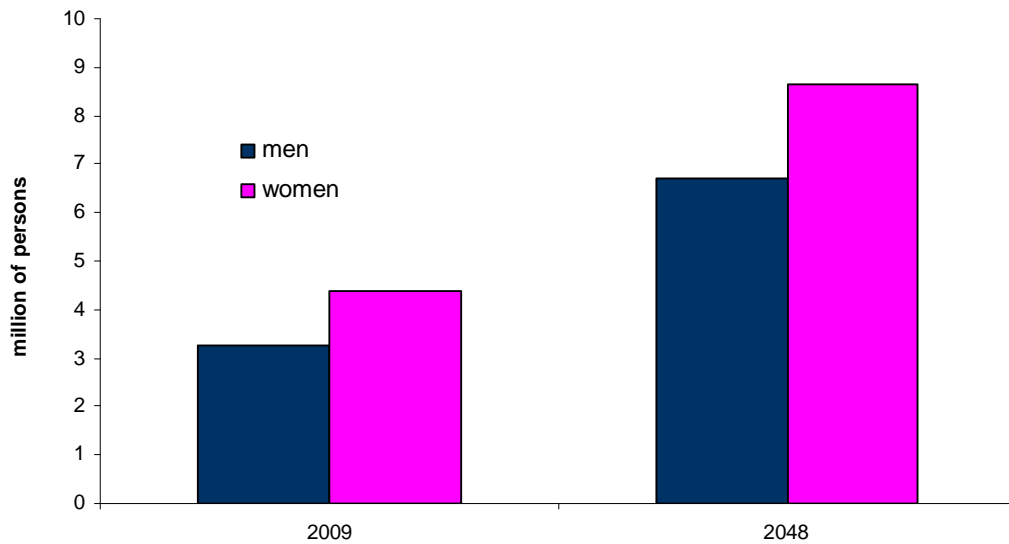
Figure 2
Life expectancy at 65 years old in Spain



Source: INE Spain. Long-term projections of the population: 2009-2048

Figure 3

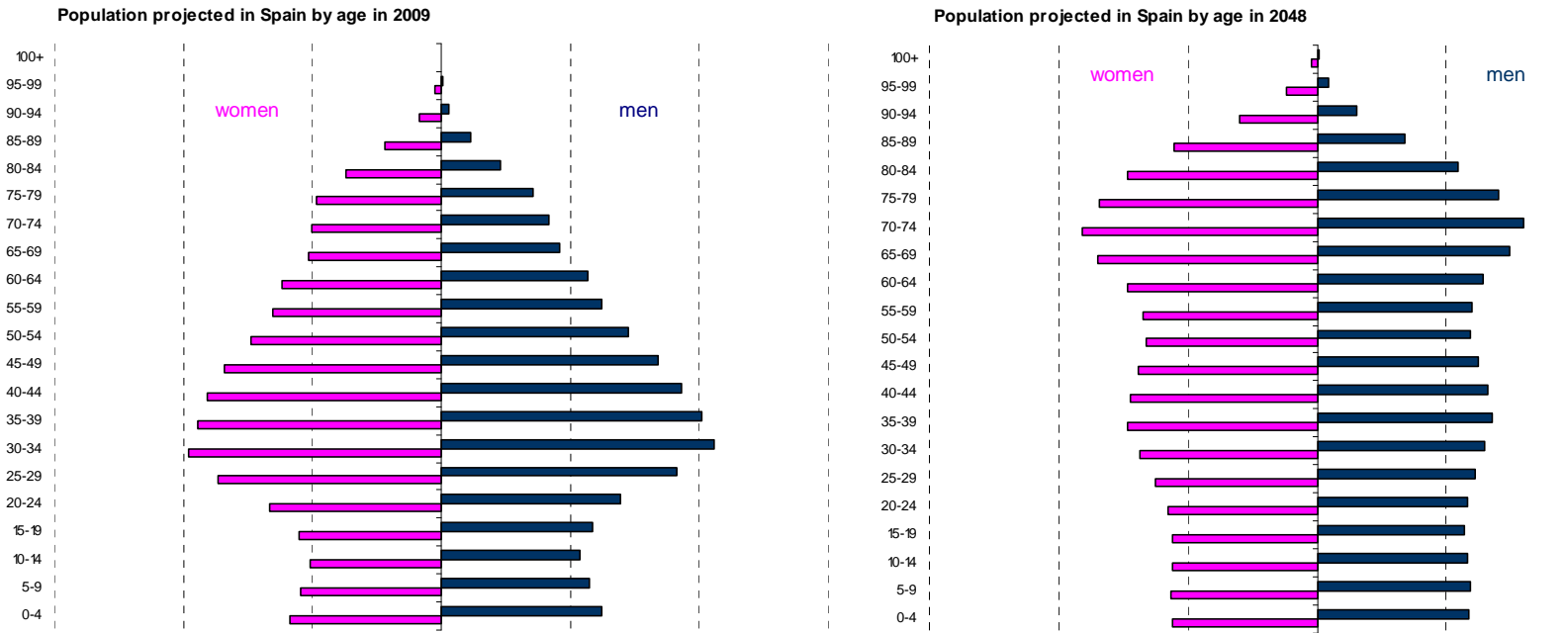
Population projected over 65 years old in Spain



Source: INE Spain. Long-term projections of the population: 2009-2048

7. The point for estimating these entitlements is related to economic forecasting of countries. The ageing of population will entail a higher expenditure on pensions and this can have an impact on the sustainability of public finance. Consequently, it is advisable to estimate household pension entitlements in public pension schemes periodically and make a follow-up of their temporary evolution.

Figure 4



8. The fact that household entitlements in public pension schemes represent a substantial amount (compared to the Gross Domestic Product (GDP), for instance) does not have any implication in the capacity of the government to meet this cost in the medium or in the long term. In the end, it is the government who decides on subjects as the retirement age, the period to be considered for the pension calculations and other issues that allow adjusting of the value of these entitlements.

9. Therefore, estimations should be considered as an indicator that can warn the government and make it think about the necessity of carrying out changes in the pension schemes, with the aim of guaranteeing the sustainability of the system.

10. In the European Union, the Committee on Monetary, Financial and Balance of Payments Statistics (CMFB) agreed to set up a Task Force in order to analyse the problem of measuring the flows and stocks related to household entitlements in public pension schemes. A group of countries, among which Spain was included, actively participated in this Task Force. Indeed, the Spanish delegation consisted of two representatives, one from the Central Bank and another from the National Statistical Institute.

11. As a result, all the parameters implied in pension calculations were analysed and the aforementioned pension entitlements were estimated using different models and methodologies. One of the main outputs of this group was a table (supplementary table, as the information contained will not be part of the core accounts) designed to present the country estimations in a homogeneous way.

12. Spain carried out an estimation, for years 2005 and 2006 at the first stage, and afterwards for years 2007 and 2008, of household pension entitlements related to public pension schemes. The estimation was based on a national model, developed by a working group which involved all the units dealing with pensions. This group was chaired by the National Statistical Institute.

13. In the following section there is a description of the two government social security schemes existing in Spain. Next, an explanation of the methodology used for the estimation of household pension entitlements related to these schemes is described.

II. Pension schemes sponsored by general government in Spain

14. In Spain there are two pension schemes sponsored by the General Government:

(a) A Government Employer social security scheme covering civil servants belonging to the so called *Administración General del Estado (AGE)*

(b) A general social security scheme for the rest of workers.

15. In the case of Spain, both schemes are very similar. Population is obliged by law to participate and duplicity does not exist. This means that whenever pension entitlements have been accumulated for both schemes, just one of them has to be chosen.

16. Both schemes are extremely close in terms of risk exposure (borne by the Government in both cases), legal framework, funding (both are unfunded) and ability of General Government to change the conditions or the benefit formula (in both cases the Government has the discretion to change unilaterally the conditions for accessing a pension or the benefit formula at any point in time and thereby partially default on its pension obligations). Therefore, the modelling for estimating pension entitlements in both schemes is rather similar.

17. The first scheme (AGE) covers civil servants (from Central Government, the Army, Justice and Law Courts, Public Universities related to the State.....). It also covers those

civil servants that used to work for the Central Government and are currently working for the State Government (regions) after powers have been transferred to them. Finally it also includes another group integrated by Ex Presidents, Vice Presidents, Ministers and others.

18. The other scheme, social security, covers a larger group by far. It is responsible for 95 per cent of the population.

19. Social security covers some civil servants as well (not belonging to AGE), but it is mainly integrated by all kind of employees (those with a contract, grants or in a training period), self-employed people, students and partners in cooperatives.

20. The following table shows the active population covered by both schemes and the pensioners allowed to each one (year 2005):

Table 1

<i>Active population (thousands)</i>	
Active population (thousands)	938
Social Security	19.325
<i>Pensioners (thousands):</i>	
System of civil servants of AGE	515
Social Security	7.395

III. Model for estimating household future pension entitlements

A. Background

21. After the first meeting of the Task Force, in 2006, a working group was set up in Spain in order to analyse the problem of the calculations of the pension entitlements of households and carry out the modelling for these calculations.

22. The working group, chaired by the National Statistical Institute, was integrated by experts of the following institutions:

- (a) Ministry of Labour and Social Affairs
- (b) Social Security Treasury
- (c) Ministry of Finance
- (d) Audit Office of the General Government
- (e) Spanish Central Bank
- (f) National Statistical Institute

23. The working group met several times in the period 2006-2008, in parallel and after the Task Force meetings. It discussed widely the estimation of pension entitlements and agreed on some guidelines about the modelling and assumptions in the key parameters to be used.

24. During 2007, a pilot exercise was carried out by the Ministry of Labour and Social Affairs. As a result, the first estimates of social security pension entitlements following a national model were available. After that, following similar steps, in 2008, the managers of

the AGE's pension scheme in the Ministry of Finance, carried out the estimations of the entitlements of households related to this pension scheme.

B. Model for social security pension scheme

25. The model and the calculations made are related exclusively to contributory pensions, i.e., pensions with benefits related to a social contribution made in the past.

26. Non-contributory pensions are kept out of the modelling (in Spain they account for 700 thousands of pensioners, more or less). They relate to benefits of people who have not paid social contributions for the minimum time, following the Government rules.

27. As regards contributory pensions, total of 7.395 thousands of pensioners broken down in six types have been considered:

- (a) Retirement: 3.761 thousands
- (b) Retirement by disability: 895 thousands
- (c) Disability allowance: 825 thousands
- (d) Widowhood: 1.627 thousands
- (e) Orphanage: 251 thousands
- (f) Pension for Family Members: 35 thousands

28. The individuals considered are divided into two groups:

- (a) current pensioners (individuals who currently are receiving a pension)
- (b) active population (individuals who currently are paying social contributions, not having generated pension yet)

29. Those included in the latter have not generated pension yet. In this case, the amount estimated refers to the pension the individuals will presumably generate in the future taking into account the following 2 assumptions:

- (a) The law is not going to change,
- (b) Those individuals working in the reference year will continue to do so until they generate pension.

30. Anyway, the estimated amount for this second group does not refer to the total pension to be generated, but to that part that matches with the contributions already paid. In the Spanish system there is no direct correspondence between the contributions paid and the pension that will be generated, therefore the percentage of the future pension that correspond to the contributions paid has been imputed using the Projected Unit Credit Method (PUCM) that will be mentioned later.

31. As individuals have been classified in two groups, the total pension entitlements of households up to the date will be the sum of the entitlements calculated for each group.

- (a) Total of pension entitlements =
- (b) + Pensions of existing pensioners
- (c) + Future pensions of current active population

32. Pension entitlements are obtained starting from some preliminary data and applying actuarial techniques taking into account a bundle of assumptions. These assumptions make reference to the discount rate, revaluations, life expectancy and other factors, and will be described later in the document. Whereas these assumptions and the actuarial techniques

assume mainly the same for both groups, the available information in the starting point varies considerably from one group to the other. The case of current pensioners is rather simple, whereas the calculations for the active population become more complicated. Let us describe how to obtain these preliminary data for each case.

1. Pensions of existing pensioners

33. For this estimation, we consider all the contributory pensions that exist the 31st of December each year, classified by the year of birth of the pensioner, sex and type of pension. The starting point is the number of these pensions and the average amount of contributory pension (classified as above). Using actuarial techniques and a set of assumptions on revaluations, life expectancy and discount rate, it is possible to estimate the present value of these future pension entitlements for the expected lifetime and the widowhood pensions (if it is the case) that will be derived.

2. Future pensions of current active population

34. On the other hand, for future pensions of current active population, the starting point should be the pensions generated by the whole active population (individuals who have paid contributions at any time of the year considered) classified by age and sex. This calculation entails difficulties, as the active population is such a huge group that it is impossible to go case by case.

35. Therefore, it was agreed to start from a workers sample (the sample of working lives) and, using the PUCM, estimate the pension to be generated by each individual in the sample. The pensions that would be generated by the whole active population will then be obtained applying grossing-up factors by age and sex to the previous amount.

36. As the process above is rather complex, the technical aspects of the procedure itself are worth analysing in more detail. Below, there is a description of the three main tools used: the sample of working lives, the Projected Unit Credit Method and the assumptions used.

a) Sample of working lives

37. The sample of working lives constitutes a representative sample of all the people related to social security in a given year, both actives and pensioners. It is a set of anonymous micro data obtained from different registers: Social Security, Municipal Registers from INE and fiscal data from the Tax Agency. It is updated every year. The first sample accounts for year 2004.

38. It is named working lives because it reproduces the history, in terms of social security variables, of all the individuals selected, and goes backwards in time up to beginning of the computerized records.

39. As social security is not in possession of all the relevant data for each individual in the sample, the information is matched with other sources (see above).

40. In order to obtain a sample, the target population is formed by merging all the individuals who are belong to the social security scheme or who have received some kind of contributory pension from the social security scheme during the reference year. Almost 30 million people belong to this target population.

41. The size of the sample was around 1.1 million people, which represents approximately 4 per cent of the target population. Of this total, 835 thousands correspond to active population and the rest are pensioners.

42. Starting from the part of the sample related to the active population, it was distributed as follows:

(a) 607 thousands (72.6 per cent) will receive a retirement pension with different ages from 50 to 99 (random draw).

(b) 154 thousands (18.5 per cent) will receive a disability pension with different ages from 18 to 66 (random draw).

(c) 63 thousands (7.6 per cent) will receive a widowhood pension by decease of the partner included both in the sample with different ages from 15 to 73 (random draw).

(d) 11 thousands (1.3 per cent) will not receive any benefit by decease without a partner (random draw).

43. Simple random sampling is applied with no stratification. From the target population, those individuals are extracted whose identification (ID) code contains a randomly selected chain of figures. This randomly selected chain of figures is kept the same from one year to the other. It has been proved that the figures placed in the positions used for this selection follow a uniform distribution. It is guaranteed that the sample is representative of the population.

44. This kind of sampling presents two advantages:

(a) On the one hand it guarantees that the same individuals will be selected every year provided that their ID code does not change, and that they to belong to the social security.

(b) On the other hand, it provides an automatic process to select new incorporations.

45. Once the sample has been chosen, social security records provide part of the information. In parallel, INE searches in the Municipal Register for the information related to the individuals in the sample and these data are integrated with those from social security. Finally, the Tax Agency adds information from the income tax for the individuals in the sample. These data are kept anonymous and they become the sample of working lives.

46. Regarding the estimation process, for each individual in the sample it is necessary to establish two pieces of information in the reference year:

(a) The number of days of paying contributions to social security.

(b) The average contribution's base (depending on the salaries).

47. With this information a simulation process is carried out, using stochastic methods like Projected Unit Credit Method (PUCM) and a set of assumptions, to obtain the type, date and amount of the pension that will be generated for each individual in the sample. Taking into account the size of the sample, the estimates are grossed up by 25.

b) Projected Unit Credit Method

48. In general terms, this actuarial method tries to reflect the periodic compensation received by beneficiaries through post employment benefit plans. In it, each year worked generates an additional unit of pension entitlements.

49. Its basic principle is to allocate the final cost of benefits over the period of service which gives rise to an accrual of deferred rights under each benefit plan.

50. In our particular case, the PUCM is used to impute for each individual in the working lives sample the percentage of future pension that corresponds to the contributions paid in the reference year.

51. It is an individual method, i.e., it values each person in the sample separately in order to calculate the liability towards the whole sample.

52. The value of the future pension is multiplied by a coefficient obtained as the quotient of the time the individual has paid contributions and the total expected working life of the individual.

3. Assumptions

53. Assumptions can be divided into two groups: those related to the benefits guaranteed and those related to the financial and demographic variables used for the valuation.

a) *Assumptions related to the benefits*

(a) Retirement: It has been assumed that there are no retirement pensioners under the age of 50. Thus, those under this age are considered as if they were 50.

(b) Retirement by disability: It has been assumed that all people in this group will retire at the age of 65.

(c) Disability: It is supposed that disability pensioners under 16 do not exist. Thus, the cases under this age are treated as if they were 16.

(d) Widowhood: It is supposed that widowhood pensioners under 16 do not exist. Thus, the cases under this age are treated as if they were 16.

(e) Orphanage: It has been assumed that orphans ranging from zero to 21 years old are included in this group and they receive the pension until they go over this age.

(f) Pension for Family Members: It is supposed that every pensioner under 18 years old receives benefits until he reaches this age.

b) *Assumptions related to the valuation*

(a) The demographic tables used have been provided by the Spanish NSI (men, women and total population) and social security records (only for disability pensioners).

(b) The frequency of death, invalidity and retirement is estimated by age and gender and it is assumed to remain constant in the future (dynamic mortality tables are not used).

(c) Assumptions related to the discount rate, salary increase and inflation (revaluations) have been provided by the Ministry of Finance and are in line with those use in the Ageing Working Group (AWG).

(d) Future salaries are in line with the Projected Benefits Obligation (PBO) method. Thus, a rate of 1.8 per cent annual increase in real terms over the working life has been considered.

(e) The discount rate considered is 3 per cent in real terms. The inflation rate has been assumed to be 2 per cent. Therefore, the discount rate in nominal terms would go to 5 per cent.

(f) The age difference between married couples considered is 3 years.

(g) The marriage rate of pensioners is 92 per cent.

(h) Instalments are made in 12 payments.

(i) The reversion in case of widowhood is considered to be 60 per cent of the retirement pension.

(j) In this model, estimates have been calculated using the life expectancy of the holder.

54. As a result, the calculations made for social security pension entitlements of households account for approximately 2,4 – 2,5 times Spanish GDP in 2005.

C. Model for government employer pension scheme

55. Following the steps of the social security pension scheme, the Directorate for Staff Expenditure and Public Pensions of the Ministry of Finance developed a model for calculating household entitlements related to the AGE's Government Employer pension scheme. In Spain, this scheme is called Clases Pasivas.

56. As both models are quite similar and the methodology for social security has been described in detail, for Clases Pasivas the document will just underline its main features.

57. As in the previous scheme, non-contributory pensions are kept out of the modelling. As regards contributory pensions, a total of 515 thousand pensioners have been considered, broken down in the following six types:

- (a) Retirement pensions: 214 thousand,
- (b) Disability pensions: 36 thousand,
- (c) Widowhood pensions: 165 thousand,
- (d) Orphanage pensions: 82 thousand,
- (e) Pensions for family members: 4 thousand, and
- (f) Others: 14 thousand.

58. Actuarial projections of public pensions consist of a demographic projection and a financial projection. In both cases two different projections should be considered:

(a) Projection of current pensioners and the way they disappear progressively. The procedure is the same followed for this group in the social security scheme. The present value of future pension entitlements is estimated using actuarial techniques, a set of assumptions and the number and average amount of contributory pensions that exist the 31st of December every year

(b) Projection of current active contributors and pensions derived. In this case, as the above mentioned group is considerably smaller than the correspondent one for social security, the pensions generated by the whole group of active contributors are calculated (using the PUCM method) considering all the individuals one by one. This makes a difference with the methodology for social security, where a sample of working lives is used.

59. As in the previous scheme, the projection related to current active contributors is the most relevant for the calculation of future pension entitlements.

60. Concerning the assumptions used, those related to the valuation (PBO method, discount rate, inflation rate) are identical to the ones previously mentioned for social security estimations.

61. As regards demographic tables, the INE tables used in the case of social security were complemented by Swiss tables for pensioners (EVK).

62. Finally, some slight differences with the previous method relating to benefits were established.

63. Based on earlier experience, the incapacity rate chosen has been the same that was used in the social security modelling, corrected with different factors for civil servants and military personnel. For biometrical survival functions, the Swiss EVK tables have been used adding some corrections for the average number of children for civil servants and military personnel.

64. The modelling used is based on different actuarial projections of the International Labour Organization (ILO), ranging from a first version of J-P. Tullen to the current ILOPENS model.

65. The basic model starts from the formulas of J-P. Picard and J-P. Tullen with some variations as:

- (a) The use of average ages of spouses and children instead of age distribution matrices,
- (b) The use of average estimated pensions instead of theoretical percentages for attributing pensions,
- (c) Values of actuarial income for life have been used for current pensions, for pensions derived and for active workers' pensions.

66. These estimations carried out for the Government Employer pension scheme, add up to approximately 20 per cent of GDP in 2005.
