A PROJECTION MODEL OF THE CONTRIBUTORY PENSION EXPENDITURE OF THE SPANISH SOCIAL SECURITY SYSTEM: 2004-2050(*)

Autores: *Joan Gil*[(a)]
Miguel-Ángel López-García[(b)]
Jorge Onrubia[(c)]
Concepció Patxot[(a) (**)]
Guadalupe Souto[(b)]

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(a) Universidad de Barcelona.

(b) Universidad Autónoma de Barcelona.

(c) Universidad Complutense de Madrid.

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(**) Corresponding author: Concepció Patxot, Departamento de Teoría Económica, Universidad de Barcelona, Avda. Diagonal 690, 08034 Barcelona, Telf. 93 402 18 64, E-mail: cio.patxot@ub.edu

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ABSTRACT

The need for long-term fiscal projections is self evident. Of these projections, pension expenditure is one of the most important since firstly it represents a large share of total expenditure, and secondly because of the positive correlation between this variable and demographic ageing. In this paper, we develop a model to project contributory pension expenditures in the Spanish Social Security System disaggregating the results by pension category and sex. The most salient of the results obtained is the expected steady growth of total expenditure in contributory pensions. This would lie around 15% of GDP around 2045 compared to its initial level of barely 8% even though the baseline scenario incorporates a substantial recovery of employment and female participation rates. By pension categories, retirement pensions are those that determine the tendency of total expenditure evolution. Interesting conclusions can also be extracted from the analysis by sex. For instance, even accounting for an increase in female retirement pensions due to their higher participation, the corresponding increase in widow male pensions implies a higher total increase of the total number of contributory pensions accruing to men.

Key words: Pensions system, sustainability, public expenditure.

JEL Classification: E62, H55.

1. INTRODUCTION: THE IMPORTANCE OF THE LONG-TERM PENSION EXPENDITURE PROJECTIONS

The concern about the need to make long-term fiscal projections can be dated back to the mid-1980s, just when the problem of demographic change began to emerge in industrialized countries. Regarding demographic variations, a decline in fertility rates, coupled with rising longevity, have resulted in a gradual ageing of the overall population. At that moment, the ratio of the elderly to working-age population was increasing fast in most Western countries, and the long-term projections of population gave few grounds for optimism (Franco and Munzi, 1996).

The great responsiveness of the pay-as-you-go (PAYG) pension systems to population ageing foreshadowed problems of sustainability for the public finances in these countries (Heller *et al*., 1986). This is the consequence of two facts. On the one hand, the decrease in the number of workers as a result of the low fertility since eighties, and on the other hand, the considerable increase of the life expectancy that will affect the large baby-boom generation after 2020. Obviously, other public policies as health or long-term care are also affected by this demographic change since their expenditure is highly dependent on the structure of the population.

The basic content of the public spending projections consists in modelling and assessing the annual forecasted budget cost for the main age-related expenditure programs, from a long-term perspective (which includes forecast at least to 20 or 30 years). As Franco *et al*. (2006) distinguish, these fiscal projections have followed two lines of research: most studies have provided projections of the ratio of some age-related expenditure to GDP, whereas other studies have pursued to get synthetic indicators of the long-tern fiscal performance.

Since the Maastrich Treaty, fiscal soundness, and therefore budgetary discipline, is considered an essential condition for the success of the European Economic Monetary Union (EMU). In this respect, one of the main causes of concern of the European Commission (EC) is the effect of population ageing on Member States' public finances. Consequently, the ECOFIN Council requested the Economic Policy Committee (EPC) to prepare biannual reports providing an analysis of long-term fiscal projections-based on the budgetary impact of ageing populations and examining the limitations of the approach used to assess the sustainability of the public finances of each country within the framework of the stability and convergence programmes.

In order to comply with this request, the EPC established in 1999 a technical working group, entitled the Ageing Working Group (AWG). The AWG is made up of experts from national Ministries of Finances, the EC, the

European Central Bank (ECB), and the OECD. The AWG's scope of analysis includes the following public expenditure headings: pensions, health care and long-term care, education, and unemployment benefits. In addition, the initial approach to these projections also planned to incorporate all the future changes in tax policy necessary to counterbalance the impact of ageing on public spending. However, this topic was later passed over owing to its great difficulty of measurement.

According to this mandate, the EPC (2001, 2003) published in 2001 and 2003 reports for each of the 15 European Union's Member States (at that time). These reports included both age-related expenditure projections and an assessment of the long-term sustainability of public finances. In 2003, the ECOFIN Council gave the EPC a mandate to produce a new set of age-related public expenditure projections for all 25 Member States covering the same headings (except tax revenues) and, whenever possible, contributions to public pensions systems. The projections horizon, just as in the two previous reports, was fixed in the year 2050. The report, including the results of these projections, has recently been published in EPC (2006).

All along, the main subject embodied in these age-related projections has been the public pensions systems. This fact is self-explanatory given the temporal nature of this expenditure and its quantitative importance within the national budgets. With complete certainty, we can say that it represents the most important of the immediate fiscal effects of ageing. It must also be taken into account that in the European Union, public PAYG pension systems represent the most important income source for the elderly, covering some 90% of retirement income provision.

Consequently, all European Union countries have developed models for projecting its pension spending until 2050. As Franco *et al.* (2006) say, till the mid-1990s the availability of projections in these countries was very uneven and their quality sometimes unsatisfactory. Undoubtedly, the EPC's compulsory mandate has influenced the development of better projection models on the part of EU Member States.

Pension expenditure projections usually assume the maintenance of current social insurance legislation both in relation to eligibility conditions and in terms of the amount of the pensions to pay. Nevertheless, projections are updated to incorporate ongoing reforms. The models used for making these projections are respectively prepared by the authorities of each country. In most Member States the responsibility for preparing long-term pension expenditure projections is allotted to Ministries of Finances or Economy, although in some countries Social Affairs or Labour Ministries are also involved. It does not necessarily follow that in many cases the preparation of the projection models, even the estimates, are made by independent academic or professional experts

and working groups or committees made up of public administration and independent experts.

The projections on pensions are made on the basis of a common population forecast carried out by Eurostat using information provided by National Statistical Offices. The starting point of these models is a baseline scenario that incorporates information on economic and demographic variables referred to a benchmark year (normally the last year of account available). The macroeconomic setting to be used for each country must be consistent with the one included in the stability or convergence programme approved by the EC. The projection results are to be provided as annual data for the period from 2004 (the base year) up to 2050.

Pension projection models prepared for the EPC follow a wide variety of methodologies, from the simplest to the most complex. Basic models only provide projection of changes in the population age-structure excluding alterations in macroeconomic variables and labour market. These simple models do not consider behavioural responses by governments or households to the demographic changes either. Consequently, they only evaluate the effects of demographic changes on public expenditure keeping the individual (per capita) retirement benefit constant over the projection period, although the average pension calculation is generally made distinguishing by age-group and sex in accordance with information from bases of administrative data or economic surveys. Thus, the impact of the demographic changes on the pension public spending is obtained comparing these age-related expenditure profiles projected in each year with the expenditure for the base year (see i.e. Franco and Munzi, 1996).

However, in the last years most models have become quite sophisticated. Usually, they are deterministic and tend to incorporate the possibility for introducing changes in wages, unemployment rates, productivity, inflation rate, and immigration, fertility or mortality levels. The approach is a partial equilibrium analysis that takes these macroeconomic and labour market variables as given. Notwithstanding, we can find with increasing frequency models that provide an endogenous treatment for relations among some of these variables (growth of GDP, population, employment, labour productivity, etc.).

These advanced models consist of several modules. The first one involves projecting the evolution of population using the demographic scenarios prepared by Eurostat. Generally, this population module includes forecasts of survival rates, survivors to each age, deaths at each age, life table populations and life expectancy for males and females all by single year of age. These estimates are usually constructed from the mortality rates previously calculated. In this respect, the methodology for calculating the evolution of population by

cohorts and sex is crucial to the success of pension expenditure projections (on that matter, see Lee and Tuljapurkar (2001) and HM Treasury (2005).

A second module deals with the pension-system's institutional aspects. In the majority of EU's Member States, the contributory pension system involves several kinds of benefits. Firstly, lifetime annuity retirement and early retirement pensions that cover the loss of a worker's incomes when he/she stops working and reaches the mandated age. Secondly, permanent disability benefits that cover the loss of a worker's incomes when her/his working ability is partly or totally reduced, be it attributable to an accident or a disease. Finally, the so-called survival pensions that are meant to compensate eventual needs a worker's family (spouse, children and other relatives) may be in after her/his demise. In addition to these pension categories, in some countries (e.g. Spain) the Social Security system comprises different contributory regimes according to economic sectors (agriculture, fishing, mining, self-employing, houseworking, etc.). Obviously, the amount and the contributory conditions associated with each kind of pension are usually different. Thus, to quantify accurately the pension liabilities year-by-year requires the incorporation of specific information for each of these groups, concerning both its respective legal regulation and the population share contained in each group.

Lastly, a third module defines the macroeconomic framework applicable in the projection-horizon. As has been said above, unlike the simplest models (which only confine to establish the predicted evolution of the main economic variables), there is growing use of models which yield this forecast under the definition of relations among macroeconomic variables in accordance with basic postulates of economic theory. In fact, many of current projection models allow to obtain the GDP growth rate taking population changes into consideration and its inflluence according to labour participation rate and the labour productivity. Labour supply modelling is even incorporated in some models, as the Norwegian MOSART (Fredriksen and Stolen, 2005). In recent years, the deepening in the overlapping generation models has allowed to develop complex general equilibrium models based in microfoundations, where the consumers maximize their lifetime utility and firms their profits (see Jimeno *et al*., 2006 and Bonin and Patxot 2005).

A more advanced type of pension spending projection models comprises dynamic microsimulation models. They allow to consider the interaction of a number of economic and demographic factors during projection-horizon. Essentially, the most valuable contribution of the dynamic microsimulation models is its potentiality for incorporating the effects induced by behavioural changes of individual or families as a result of public policy reforms. A complete review of these models can be found in Gruber and Wise (2004) and Zaidi and Rake (2001). The long experience in using administrative microdata places the

Scandinavian countries as pioneers in the building of this type of long-term projection models (see Fredriksen, 1998; and Fredriksen *et al*., 2005).

Other type of models developed over recent years have stochastic nature. Based on historical data, these models incorporate random variables to forecast the annual changes in the demographic process, operating through the number of births by sex, the number of marriages and divorces and the inmigrant flow, all by age-group and sex. Its main contribution is to offer expenditure forecasts based on iterated simulations of the model as an alternative for reducing the uncertainty about the input assumptions and its sensibility. Meyerson and Sobelhaus (2000) describe the main features of the stochastic pension projection model prepared by the US Congressional Budget Office.

One of the most important challenges in long-term pension spending modelling is how to include sources of heterogeneity that permit to differentiate among agents depending on their ages, productivity, probability of employment, etc. Its inclusion in the model allow to yield more accurate projections, but at the cost of increasing complexity and data needs (Jimeno *et al*., 2006). Traditional models usually take into account heterogeneity in age only, but overlook age-related aspects as heterogeneity in productivity despite that they are more relevant for wages. This matter is more complex since there is endogeneity among other heterogeneity factors, such as education by cohorts or state of health. Rojas (2005) includes income inequality as a source of heterogeneity. The most important limitation for incorporating this type of differentiation is the requirement of high-quality data. Nevertheless, advances in computational software and the ever-increasing microdata bases permit to be optimistic on this matter.

In this paper we develop a model to project the pension expenditure for the Spanish contributory system and its results for the period 2004-2050. Our model belongs to the class of advanced models prepared for the EPC. In fact, the fundamental information used in the macroeconomic and population modules has been provided respectively by the European Commission and Eurostat. Regarding technical design of the projection model, the main contributions relate to pensioners' heterogeneity, specifically in terms of sex, category of pension and social security regime. It is our belief that to differentiate between male and female allow us to improve the expenditure projections in so far as we capture the gaps associated with both the participation rate and pension benefits. Besides, the projection model gives explicit account of the way the demographic and macroeconomic modules interact with the institutional aspects module. This allows carrying out meaningful sensitivity analysis using alternative scenarios on growth productivity, labour market participation and relevant demographic aspects as the number of migrants.

The structure is as follows. In Section 2 a description of the contributory pension system in Spain is made. The projection model used is presented in Section 3, and the data in Section 4. Sections 5 and 6 are devoted to present the main results of the projection model, as well as some sensitivity analysis. Finally, Section 7 summarizes the main conclusions.

2. THE CONTRIBUTORY PENSION SYSTEM: INSTITUTIONAL FRAMEWORK

The Spanish contributory pension system is organised on a pay-as-you-go basis under a defined-benefit scheme. Workers and pensioners are classified into different regimes (i.e., the General Regime and five Special Regimes like Self-Employment, Agrarian, Coal Mining, Sea Workers and Domestic Employees)[1] covering a set of contingencies: retirement, permanent disability and survival pensions (e.g., widow, orphan and family pensions). The nature of the contributory pension system relies basically on two characteristics: first, a minimum period of contribution payments is required (as long as other conditions are met) and, second, the pension amount is determined by the past wages of the worker. We present along these lines the main characteristics of each pension benefit that have been taken into account in the simulation exercise.

2.1. Contributory retirement pension

The contributory retirement pension is an economic benefit of indefinite duration and covers the loss of income suffered by a person who, after ending his/her working career, reaches the retirement condition. The beneficiaries are affiliated workers (or under a situation assimilated to being affiliated)[2] who meet the legally established conditions of a) retirement, normally at age 65, and b) a minimum period of 15 years of contribution, although 2 years must belong to the 15 years period immediately before retirement.

Initial retirement pension

The initial retirement pension benefit is determined by applying the corresponding percentage (that depends on the number of contribution years)

[1] There is also a residual scheme under extinction, called SOVI, consisting of old-age and disability pension benefits.

[2] This collective is formed by individuals under unemployment, compulsory leave, periods of inactivity between temporary jobs, temporary disability, etc.

to the Regulating Base (hereafter *RB*). Since 2002 (after the Law 24/97, of 15 July, was passed)[3] the RB is the result of dividing the worker's monthly contribution basis, composed by gross wages and salaries from the 180 months immediately prior to retirement, by 210 (i.e., it is the result of multiplying 15 years by 14 months) following the expression:

$$RB_t = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{180} CB_i \frac{CPI_{25}}{CPI_i}}{210} \qquad [2.1]$$

where RB_t is the RB in year t, CB_i is the contribution basis in month i before retirement, and CPI_i is the Consumer Price Index (CPI) in month i. It is worth noting that contribution basis for the 24 months immediately prior to the date of retirement is taken by its *nominal value*. The remaining contribution basis will be updated according to the evolution of the CPI for the months to which they correspond, up to the 25th month prior to retirement[4]. Interestingly, if there are months for which the worker had no obligation to contribute to Social Security, these contribution gaps will be integrated to the minimum contribution basis at the time, for workers over 18 years of age[5]. In order to avoid the incentive to "buy" pensions, those wage increments, for the last 2 years before retirement, exceeding the average annual wage increment, are not considered in the calculation of the RB. This is valid for all wage increments except those that result from seniority and standard promotion of a worker, as well as increments due to any other salary concept that is also regulated by law or union agreements. Whenever a worker contributes to more than one Social Security scheme, the contribution basis in the secondary activity may be accumulated along with those of the scheme that does entitle the worker to collect benefits, exclusively for the purpose of determining the RB. Of course, the sum of these contribution bases may not exceed the maximum contribution limit set annually by the government. The worker must be registered under pluri-activity scheme for the 10 years immediately prior to retirement.

The percentage which is applied to the RB to deduce the amount of the initial retirement pension is variable according to the number of years contributed to Social Security: 50% if the worker accredits 15 years of contributions, and it is

[3] The abovementioned Law introduced an increase in the number of years from 8 to 15.

[4] Worker's CB's are bounded every year by virtue of the General Budget Act. For instance, in the General Regime these bases are subjected to a minimum and maximum limit depending on the professional category of the worker. However, there is just one upper and lower limit in the Special Self-Employed Regime and Agrarian Regime (for self-employed workers). In case of the Domestic Employees and the Agrarian (salaried workers) Regimes CB are unique.

[5] This adjustment by minimum contribution basis is not allowed in the Special Agrarian Regime (self-employed workers), Self-Employed Workers Regime and the Domestic Employees Regime.

increased by 3% for each additional year between the sixteenth and twenty fifth year and by 2% from the twenty sixth year until it reaches 100% at 35 years of payments[6]. Besides, a differential treatment is given to workers with contributions before and after January 1st 1967, since a Spain's true modern public insurance system begins its development from 1967 on. This means that workers with contribution payments to the old SOVI and/or Labour Mutuality schemes prior to January 1st 1967 are granted an extra 'bonus days'[7], according to the age reached on January 1st 1967[8]. Moreover, there is an incentive for a prolonged working career. In effect, for workers aged 65 and over, the percentage to be applied to the RB results from adding an additional 2% to the 100%, for each complete year that they have contributed, as long as the worker can accredit 35 years of contribution[9].

To conclude, retirement pensions are subject to upper and lower limits annually determined by the Government's General Budget Act. Minimum pensions are guaranteed according to age and family responsibilities. Additionally, the system guarantees by law the real value of pensions since they are increased, at the start of each year, according to the predicted CPI. Finally, retirement pensions are taxable in the terms established by personal income tax laws (the so-called Impuesto sobre la Renta de las Personas Físicas, IRPF), and subject to the applicable contributions and withholdings.

Retirement age

Although the ordinary retirement age in Spain is at 65, there are notable exceptions to this general rule and retirement age can be reduced in some special cases: *a*) early retirement, *b*) special retirement at age 64, *c*) partial and flexible retirement, *d*) retirement of certain collectives, and e) retirement of

[6] The computation of this percentage entails considering years of payments made to the General and Special Regimes and also to the old schemes of SOVI (Obligatory Old-age and Disability Insurance) and/or Labour Mutuality. In addition, other payments like those made to the Civil Servants and Armed Forces Regimes, Public Administrations (and organisations dependant on them) prior to January 1st 1959 for staff who did not hold the status of civil servant, other welfare organisations, which act as substitutes for those corresponding to the scheme or schemes which are pending integration, are considered as well.

[7] Day's bonuses, however, are not foreseen in the Special Self-Employed Workers, Agrarian (self-employed) and Domestic-Employees Regimes.

[8] In particular, starting from the age of 21 until that of 65 a figure of 250 days is additionally granted to compute the above commented percentage. For example, a worker aged 25 on 1-1-1967 is awarded with an extra of 3 years plus 157 days of contributions. These considerations have been taken into account in the projection exercise.

[9] If the worker cannot accredit this period of time, the additional percentage will be applied, once he/she has reached the age of 65, from the date on which that contribution period can be accredited.

disabled workers[10]. Since few years ago, early retirement from the age of 60 was an option just reserved to those workers who had been contributors in any of the Employment Mutual before january 1st 1967[11]. In this case, the early retirement pension benefit is computed applying to the RB a reduction percentage that depends on the number of contribution years. There are two situations: firstly, when the worker accredits 30 or less years of contribution the amount of the pension is reduced by 8% for each year or fraction of a year that is short of 65 years of age, according to the following scale: a reduction coefficient of 0.6 at age 60, 0.68 at age 61, 0.76 at age 62, 0.84 at age 63 and 0.92 at age 64. Secondly, when the worker has 30 o more years of contribution the applicable reduction coefficient depends on the years of complete contribution: between 31 and 34 accredited years of contribution 7.5%; between 35 and 37 accredited years of contribution 7%; between 38 and 39 accredited years of contribution: 6.5%; with 40 or more accredited years of contribution: 6%.

However, after the approval of the Law 35/2002, of july 12th, workers not insured or not having contributed to Mutual Society or Mutuality before january 1st 1967, may apply for an early retirement pension, provided that next requirements are met: 1) retirement from age 61; 2) certify a minimum effective contribution period of: i) 30 full years (without taking into account the proportional part for extra payments or the payment of years and days for contributions prior to january 1st 1967), ii) at least 2 years of the contribution period must be within the last 15 years of the working career; 3) registered as a job seeker, in the public employment service offices, during a period of 6 months immediately prior to the date of the retirement application; 4) job termination, as a result of the termination of the contract, has not been caused by reasons of the worker's free will[12]. Again, the corresponding reduction coefficient to be applied on the RB is the following: with 30 full years of certified contributions: 8%, 31-34: 7.5%, 35-37: 7%, 38-39: 6.5% and with 40 or more full years of certified contributions: 6%. Moreover, the age reduction coefficients for

[10] The modalities of early retirement without having the condition of insured in a Labour Mutuality, partial retirement, special retirement at age 64 and retirement of disabled workers are not recognised in the Special (self-employed) Agrarian, Self-Employed Workers and Domestic-Employees Regimes.

[11] This 'threshold year' is different in other circumstances. For instance, July 14th 1967 for RENFE (Spanish Railroads) workers; December 19th 1969 for FEVE workers; January 31st 1969 for workers under the Coal Mining Regime; or August 1st 1970 for workers of the Sea Workers scheme.

[12] The worker's free will is understood to be an unequivocal demonstration of will by someone who decides to terminate the contract but who could continue the working relationship and no objective reason exists to prevent the worker doing so. The working relationship will be assumed to have been terminated involuntarily when the termination has occurred for any of the reasons indicated in art. 208.1.1 of the General Social Security Act (LGSS).

arduous, toxic, dangerous or harmful jobs are taken into account to determine the corresponding reduction coefficients for the retirement pension.

Another option is to anticipate retirement as of age of 64 as a way to encourage employment, without applying the age reduction coefficients, allowing the employee to obtain the retirement pension with the same economic rights as if he/she had reached the age of 65. The beneficiaries are employees who belong to companies that, due to a collective bargain or agreement, are replaced with other workers (once registered as unemployed in the corresponding Employment Office). It is worth to note regarding the company, that the contract to replace the retiring worker must meet the conditions required by the specific regulations and may be any of those legally established, except part-time and temporary hiring due to market conditions, work accumulation or excessive orders. The replacement contract must have a minimum duration of one year.

Certainly, partial retirement is an option to retire early since the Law 35/2002, of July 12th, came into effect. Under the new regulation, wage earner workers who have reached the age of 60 and meet the conditions required to earn the contributory retirement pension, may apply for a partial retirement pension. In this case, by agreement with the company, the worker arranges a part-time contract that reduces the working day and salary by a minimum of 25% and a maximum of 85% each. These percentages relate to the working hours of a comparable full-time worker[13]. There are two different situations: if the worker is younger than 65 the company needs to arrange a simultaneous relief contract ("contrato de relevo") with another unemployed worker or one who has arranged with the company a contract of a specific duration, in order to fill the working day left vacant by the partially retired worker. But if the worker opts for partial retirement at the age of 65, it is not necessary to arrange a relief contract. Therefore, the initial partial retirement pension benefit is the result of multiplying the working day reduction percentage by the amount of the pension for which the worker would be eligible, based on the years of contribution certified by the worker. Nevertheless, it is established that this pension amount may not be lower than the amount resulting from applying the same percentage to the amount of the minimum pension for pensioners over the age of 65 (depending on the family situation of the pensioner). Interestingly, to determine the above percentage applicable to the RB of the partial retirement pension, when the worker is younger than 65, reduction coefficients based on age will

[13] A comparable full time worker means a full time worker in the same company and work centre, with the same type of contract and who carries out an identical or similar job. If there were no comparable full time workers in the company, the full time working day specified under the applicable collective agreement will be taken, or if it does not exist, the maximum legal working day.

not be applied. Of course, partial retirement pensions are subject to price adjustments in the same terms as the other contributory pensions.

Another possibility is the flexible retirement formula (firstly introduced by Law 35/2002, of 12 of July), which is aimed at making the retirement pension compatible, once in effect, with a part time contract, within the limits of the working day (a minimum of 25% and a maximum of 85%)[14]. Under this new scheme the amount of the pension is reduced (from the day on which he/she starts the activity) in inverse proportion to the reduction in the working day carried out by the pensioner, in relation to that of a comparable full time worker. Meanwhile, contribution payments to Social Security carried out during the flexible retirement period have the effect of improving the pension benefit. Once these activities have ended, the full receipt of the retirement pension is accordingly readjusted. Effectively, the RB is recalculated by taking into account the new contribution bases of the worker and applying the rules in force at the time of the end of the activity[15]. At the same time, the percentage applicable to the RB is modified according to the extended period of contribution years accredited by the worker. Interestingly, this will reduce or, if applicable, suppress the reduction coefficient which would have been applied, at the time of applying for an early retirement pension, for having or not the condition of insured or mutualist.

The Spanish Social Security system recognises the possibility to anticipate retirement to two special groups of collectives. On the one hand, since january 1st 2004 workers (included in the General Regime and the Special Agrarian, Sea Workers and Coal Mining Regimes) who are in paid work and affected by a disability, equal to or greater than 65%, may apply for early retirement without a reduction in the amount of their pension by applying the reduction coefficients. For this collective the ordinary retirement age (65) is reduced by a period equivalent to the result of applying the following coefficients to the time "effectively worked": a coefficient of 0.25 if the worker has a degree of disability equal to or greater than 65% and a coefficient of 0.50 if the degree of disability is equal to or greater than 65% and the individual accredits the need for another person to carry out the essential daily living activities. On the other hand, the ordinary retirement age may also be reduced for certain occupational groups or activities whose jobs are exceptionally dangerous, toxic, harmful, etc. It is the case, for instance, of workers included in the Mining Statute, flight personnel or railway workers. Again, these collectives can anticipate retirement

[14] Flexible retirement is applied to all Social Security schemes. The exceptions are the State Civil Servants Regime, the Armed Forces Regime and Legal Service Personnel Regime.

[15] If as a consequence of applying these rules the early RB is reduced, the latter will be maintained once considering the price-revaluation of the pension amount from the day the RB was determined to the end of the working activity.

by reducing the ordinary retirement age by a period equivalent to the result of applying a scale of reducing coefficients[16] to the years actually worked (this period of time excludes all absences from work, except sick live and authorised absences with pay). Importantly, the period of time by which the ordinary retirement age is reduced is considered as years contributed to Social Security, when determining the percentage applicable on the RB. In this category, two other collectives are allowed to retire early: artists (i.e., singers, dancers and trapeze) may retire at the age of 60 without applying reduction coefficients when have worked, in the occupation, for at least 8 years during the 21 years before retirement, and bullfighting professionals may retire as of age of 55 or 60 depending on specific category and number of bullfights performed.

2.2. Contributory disability pension

The objective of the contributory disability pension is to provide a social safety net against income losses associated with a total or partial loss of capability to work. Benefits are contingent upon the origin and the degree of disability, as well as the type of recipient. Their assessment is to be done separately. Permanent disability is always derived from a situation of temporal disability[17]. In particular, it makes reference to a worker who, after having received treatment and taken medical leave, displays serious physiological and anatomic dysfunctions making it objectively impossible to fully put her/his capabilities at work (art. 136 *Ley General de la Seguridad Social*). In accordance to the severity of such dysfunctions, 4 types or degrees of permanent disability are considered; nonetheless it is worth mentioning that the former gives right to a lump sum indemnification, while the compensations from the latter three take the form of a lifetime annuity. In any event, in case of a worker not reaching the minimum retirement age the legislation establishes that the disability may be subject to 'discretionary' revision under two conditions: a worsening or improvement of the degree of disability, or because of eventual misdiagnoses. Should we also mention that by 1997 disability pension recipients older than 65 years are categorized as retirement pensioners (with no effect on their compensations or benefits). Moreover, beyond that age no disability report is allowed. The following sub-sections give a description of the four types of disability for which the Spanish legislation makes provision.

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[16] These coefficients are established by the RD 2336/1984, of 26 December, for workers included in the Mining Statute; RD 1559/1986, of 28 June, for flight personnel (pilots, co-pilots, mechanics, etc.) and RD 2621/1986, of 24 December, for railway workers.

[17] Except for the cases affecting people somehow not insured against temporal disability, as is the case of those who benefit from permanent disability despite not being a contributor to Social Security.

Partial permanent disability for the usual occupation

Under this category worker's efficiency is supposed to have been reduced by no less than 33%, nonetheless he/she is still capable of performing the fundamental tasks the usual occupation requires. The eligibility criteria for compensation are, on the one hand, being an affiliated worker or situation alike. If the disability is a result of a common disease, a minimum of 1800 day contribution to the Social Security is required within the 10 years prior to the temporal disability. The compensation consists of a lump sum transfer (which means it is not a pension) equivalent to 24 times the RB which served to determine the temporal disability compensation. Such compensation is compatible with any kind of activity. Since it is not a pension it is not taken into account in the forecast analysis.

Total permanent disability for the usual occupation (IPT)

In this case the worker is incapable of performing all or the fundamental tasks of her/his usual occupation, but yet can attend other kind of occupation. The eligibility criteria are, once again: be a contributor to the Social Security System and, if the disability is a result of a common disease, a minimum period of contribution to the Social Security is required. This will vary according to the worker's age at the time of the contingency. Thus, a worker younger than 26 years old must have contributed half the time in the interval between 16 years of age and the moment of the contingency. By 26 years of age, the mandatory contribution period is one fourth the time elapsed between 20 years of age and the moment of the contingency. In this last case, a minimum of 5 year contribution is imposed and one fifth of this contribution period is to fall within the ten years prior to the date of the contingency. On the contrary, if the disability is the result of an accident, be it a workplace accident or not, or a disease attributable to the occupation, no contribution period is required.

The IPT compensation consists of a lifetime annuity that represents 55% of the RB. Attending the same kind of occupation in the same enterprise is incompatible with this kind of compensation. Nonetheless, other occupation within the same or different enterprise is permitted. The amount of pension received can be augmented up to 75% of the RB once the worker has turned 55 or is jobless. As it is shown in table 2.1, the RB is determined by the origin of the total disability (common disease, non workplace accident or causes attributable to the occupation), or by the minimum contribution period required, whenever this one is applicable.

Absolute permanent disability for any type of occupation (IPA)

Under this category the worker is totally inhibited from taking on any occupation or activity. The eligibility criteria for compensation are slightly different

from the ones applicable to the IPT. Firstly, if the worker is an affiliated (or assimilated to being affiliated) at the time of the contingency, no contribution period is required if the disability is the result of an accident in the workplace or for causes attributable to the occupation. However, a contribution period is required if the disability stems from a common disease (the contribution in this case is as in the IPT case, a function of the worker's age).

Besides, if the disability is attributable to causes related to the occupation it is perfectly possible that a worker be eligible without being a contributor to the Social Security at the moment of the contingency. In such case no contribution period is required. For disability derived of common disease or non workplace accident 15 years of contribution are required. Of those 15 years, at least one fifth must be during the 10 years prior to the moment of the contingency. The benefit consists of a lifetime annuity that represents 100% of the RB and is compatible with other activities that do not go into conflict with the worker's health status and do not affect her/his capability to work. Be these activities for profit or not.

Complete disability

In such a case, in addition to total inhibition from taking on any occupation or activity, the worker needs other people's assistance to carry out the basic daily living activities. Eligibility criteria for compensation are the same as in the IPT case. That is, being a contributor, or not being a contributor if the minimum contribution period criterion has been met. The benefit amounts to 100% of the RB with a 50% increment for the person in charge (such an increment may be traded for room and board in a public institution financed by the Social Security). The indemnity is not incompatible with remunerated activities, provided that the worker's health condition allows it. Table 2.1 below summarizes the eligibility criteria for disability pensions depending on the cause of the disability. Also, the computation norms for the RB of each case are provided.

Table 2.1

DEGREE OF PERMANENT DISABILITY

Causes of the disability	Total Permanent Disability (IPT)	Absolute Permanent Disability (IPA)	Complete Disability (GI)
Common disease	*Eligibility criteria*: a) Be a contributor b) Minimum contribution period according to the worker's age: <26 years, ½ the elapsed time since the individual has turned 16 and the date of the contingency ≥26 years, ¼ the elapsed time since the individual has turned 20 and the date of the contingency, 5 years minimum and 1/5 within 10 prior to the moment of the contingency *Regulating base*: $RB = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{96} CB_i \frac{I_{25}}{I_i}}{112}$ if pc ≥ 96 months $RB = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{pc} CB_i \frac{I_{25}}{I_i}}{1.16\,pc}$ if 25 ≤ pc ≤ 95 $RB = \frac{\sum_{i=25}^{pc} CB_i}{1.16\,pc}$ if pc ≤ 24	*Eligibility criteria*: a) If the individual is a contributor the minimum required contribution period varies according to the worker's age, as is stipulated in the IPT b) If not a contributor, 15-year contribution, and at least 1/5 must be within the 10 years prior to the moment f the contingency *Regulating base*: $RB = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{96} CB_i \frac{I_{25}}{I_i}}{112}$ $RB = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{pc} CB_i \frac{I_{25}}{I_i}}{1.16\,pc}$ $RB = \frac{\sum_{i=25}^{pc} CB_i}{1.16\,pc}$	*Eligibility criteria*: a) If the individual is a contributor the minimum required contribution period varies according to the worker's age, as is stipulated in the IPT and the IPA b) If not a contributor, 15-year contribution, and at least 1/5 must be within the 10 years prior to the moment of the contingency *Regulating base*: $RB = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{96} CB_i \frac{I_{25}}{I_i}}{112}$ if pc ≥ 96 months $RB = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{pc} CB_i \frac{I_{25}}{I_i}}{1.16\,pc}$ if 25 ≤ pc ≤ 95 $RB = \frac{\sum_{i=25}^{pc} CB_i}{1.16\,pc}$ if pc ≤ 24

(Sigue)

(Continuación)

Causes of the disability	Total Permanent Disability (IPT)	Absolute Permanent Disability (IPA)	Complete Disability (GI)
Non workplace accident	*Requirements*: a) Be a contributor b) No minimum period of contribution is required *Regulating base*: $RB^{(1)} = \frac{\sum_{i=1}^{24} CB_i}{28}$	*Requirements*: a) If the individual is a contributor no minimum contribution period is required b) If not a contributor, 15-year contribution, and at least 1/5 must be within the 10 years prior to the moment of the contingency *Regulating base*: If a contributor, the same as in IPT: $RB = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{96} CB_i \frac{I_{25}}{I_i}}{112}$ if not a contributor	*Requirements*: a) If the individual is a contributor no minimum contribution period is required b) If not a contributor, 15-year contribution, and at least 1/5 must be within the 10 years prior to the moment of the contingency *Regulating base*: If a contributor, the same as in IPT: $RB = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{96} CB_i \frac{I_{25}}{I_i}}{112}$ if not a contributor
Causes attributable to the occupation	*Eligibility criteria*: a) Be a contributor b) No contribution period is required *Regulating base*: $RB = \frac{w_d 365 + a_d 365 + e + b + \frac{p}{d} 273}{12}$	*Eligibility criteria*: No minimum contribution period is required *Regulating base*: If a contributor, the same as in IPT: $RB = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{96} CB_i \frac{I_{25}}{I_i}}{112}$ if not a contributor	*Eligibility criteria*: No minimum contribution period is required *Regulating base*: If a contributor, the same as in IPT and IPA: $RB = \frac{\sum_{i=1}^{24} CB_i + \sum_{i=25}^{96} CB_i \frac{I_{25}}{I_i}}{112}$ if not a contributor

Notes: pc =contribution period; CB_i = contribution base in the month *i* prior to the moment of the contingency; w_d=daily wage; a_d=seniority (in days); e=special payments; b=profits in the last 12 months; p=extra payments and additional compensations, including overtime in the last 12 months; d=effective working days in the last 12 months.

(1) The worker chooses her/his preferred 24 months within the 7 years prior to the moment of the contingency.

2.3. Contributory survivors' pensions

Contributory survivor's pensions include those pensions paid to widows and orphans (and where appropriate, other dependants which have to fulfil the necessary requirements) in order to compensate the financial needs of certain people. The originator of the widow pension are, on one hand, affiliated workers (or under an assimilated situation) with a minimum contribution period of: i) 500 days within an uninterrupted period of 5 years before the death of the worker caused by common disease, or ii) if the death is caused by a work accident, then no previous contribution period is required. On the other hand, retired pensioners who receive contributory benefits and pensioners with permanent disability. The beneficiaries of the widow pension are: the surviving spouse (whether female or male) and the separated and divorced people who have not remarried, in which case the amount of the pension will be proportional to the time lived as a married couple with the deceased.

The widow pension is compatible with any income from the beneficiary's work and with the retirement or permanent disability pension. The pension amount is obtained by applying the following percentages: *a*) in general, a 52% on the RB or *b*) a qualified 70% on the corresponding RB whenever the following requirements are met for the entire period in which the beneficiaries receives the pension: b.1) if the widow has dependent relatives (i.e., children under the age of 26 or older but with disabilities) and simultaneously the yearly family unit's income, including this pension, divided by the number of family members, does not exceed 75% of the minimum wage; *b.2*) this pension is the sole or primary (the annual pension is greater than 50% of pensioner's total income) source of income for the beneficiary; *b,3*) the pensioner's annual income from all sources can not exceed the amount resulting from adding the annual benefit, for each fiscal year, that corresponds to the widow's minimum pension (based on the age of the pensioner), to the maximum amount that yearly is established for recognition of the right to the minimum supplement for contributory pensions. Currently, this income limit is 12,264.47 € for aged 65 or older, and 11,845.45 € for under the age of 65[18].

The RB which serves to compute the widow pension depends on whether the deceased was an active worker or a pensioner, and the cause of death was a professional contingency or not: *a*) if the deceased was a retired or a permanent disabled pensioner, the RB is the same as it was used to determine the originator's initial pension amount, but increased by the cumulated revaluations for the

[18] The three requirements must all be simultaneously met. Failure to fulfil any one of them will lead to the application of the general 52%.

widowhood pensions[19]; *b*) if the deceased was an active worker, two main situations can be distinguished: *b.1*) if the death was due to common contingencies, the RB results from dividing the sum of the deceased's contribution bases during an uninterrupted period of 24 months by 28. This period is selected by the beneficiaries at their convenience within the 15 years immediately prior to the date of the death[20]; *b.2*) if the death was due to work–related injury or occupational disease, the RB results from dividing by 12, the daily wage and seniority pay of the worker on the date of the injury multiplied by 365 days. Nevertheless, there are some specific rules for part–time, relief and permanent–intermittent contracts.

Widow pensions are also subject to upper and lower limits fixed by the Government's General Budget Act. At the beginning of each year, the amount of the annual pension, including the minimum pension amount, is adjusted based on the CPI forecast for that year. Minimum monthly amounts are guaranteed, based on the age and dependent family members of the beneficiary (beneficiary aged 65, between the ages of 60 and 64, and beneficiary under the age of 60 with and without dependent family members). The right to collect this pension can end by any of the following causes: *a*) remarriage[21], *b*) due to having been found guilty, in a final sentence, of originator's death, *c*) the death of the beneficiary, *d*) when it is proven that the worker who disappeared in an accident did not die and e) due to conviction with a final sentence, of committing a felony of aggravated homicide in any of its forms, or injuries, when the victim was the spouse or ex-spouse, except when, where appropriate, they had been reconciled. The pension for widows is subject to taxation under the terms established in the regulations for the personal income tax (IRPF) and is subject, when appropriate, to the general system of tax withholdings, unless those due to acts of terrorism.

With regard to orphan pensions the originator is the same as for the pensions for widows. The beneficiaries are the children of the deceased, whatever the legal nature of their relationship, as long as on the date of the originator's death,

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[19] If the deceased was under partial retirement, the RB corresponding to the period of part-time work will be taken into account, increased up to 100% of the amount that would have applied if the worker had been employed full-time during that period.

[20] If a worker does not fullfil this requisite and his/her death was due to non–work–related injury, the RB will be the most beneficial of the following two alternatives: 1) the RB described in the previous point; or 2) the result of dividing the sum of the minimum contribution bases (corresponding to the last contracted working day) in force for the 24 months immediately prior to death, by 28.

[21] The widowhood pension may still be received, even if the pensioner remarries, when *a*) the beneficiary is over the age of 61, (or younger when also granted an absolute permanent disability or outstanding disability pension or certifying a degree of disability greater than 65%), *b*) the widowhood pension is the pensioner's primary or sole source of income, *c*) the married couple has an annual income including the widowhood pension, that does not exceed twice the annual minimum interprofessional wage.

the children are under 18 years of age or over 18 with a reduced work capacity (at a percentage valued at a degree of absolute permanent disability or outstanding disability). It also includes the children under 22 years of age, or 24 if none of the parents survive, when they are not carrying out lucrative work as self–employed or employed by another person, or when doing so, the annual income that they obtain is less than 75% of the minimum interprofessional wage. Importantly, the annual payment of the pension for orphans is calculated by applying a 20% on the same RB as for widowhood pensions. There is a family limit for this benefit: when there are several beneficiaries the total amount of all survival pensions may not exceed 100% of the RB corresponding to this event. However, if the death has been due to a work–related injury or occupational disease, each orphan is also granted by a compensation raised sum equivalent to one monthly payment of the base pension. In case of an absolute orphanage pension (i.e., if no surviving spouse is left or they die while enjoying the widowhood pension or abandoned the home), this benefit will be increased by 52%, from the widowhood pension. Of course, if there are several orphans with a right to a pension, the increase will be distributed amongst all of them in equal parts. In cases of orphans over 18 years of age who *a*) are incapacitated for any kind of work, and also, *b*) can accredit the requirements for accessing the economic allowance for dependant disabled child over the age of 18, the amount of this pension (once the minimum complement has been guaranteed) will be increased with the amount, in annual calculation, of the allowance that, in each financial year, is established in favour of the dependant child over 18 years of age, according to the degree of disability accredited.

The orphan pension is compatible with any income from work. However, if the orphan is under 18 years of age (or has reduced working capacity at a degree of absolute permanent, disability or outstanding disability) the pension will be paid independently of the amount of the income earned from their work. If the orphan is over 18 years of age and not disabled, the pension will be suspended. Lastly, the benefit for pensions of orphans will end in the following circumstances: *a*) on reaching 18 years of age (unless, at that moment, he/she were to have reduced capacity for work at a percentage evaluated at a degree of disability), except for the new age limits established in particular cases; *b*) due to the end of the disability which granted the right to the pension; *c*) due to adoption; *d*) by marriage, *e*) for death, *f*) for checking that the missing worker did not die in an accident.

3. THE MODEL

The starting point takes into account that total pension expenditure in year t (TE_t) is the result of multiplying the number of pensions during that year (NPA_t) by the average pension benefit (pm_t):

$$TE_t = NPA_t \cdot pm_t \qquad [3.1]$$

To obtain the number of pensions throughout a year t, it is important to recognize that these can belong to three different types: *a*) those received throughout the year, named *common pensions* (C_t), that is, those that were already granted on january 1st and have not caused withdrawal from Social Security by december 31st; *b*) the *new registrations* (NR_t), i.e., those pensions that were started to be received at some point in year t; and *c*) the *withdrawals* that correspond to year $t\,(W_t)$, i.e., those that were no longer received during that year, at some point before december 31st.

Total pension expenditure for a year is thus the sum of the pension benefits corresponding to the three categories. Now, the new registrations and withdrawals do not receive the total benefits for the whole year under consideration, just one part is granted. Assuming that the flow of new registrations and withdrawals is distributed evenly throughout the period, they will be received during one half of the year[22]. That way, the equivalent number of pensions during the year $t\,(NPA_t)$, which is the relevant variable in [3.1], can be obtained as:

$$NPA_t = C_t + 0.5NR_t + 0.5W_t \qquad [3.2]$$

The computation of NPA_t requires previous knowledge of the number of pensions of each type $(C, NR \text{ and } W)$. Since the data on the number of pensions always refers to a specific date, generally December 31st of each year, they are not readily usable for this projection model. Let NP_t be the number of existing pensions as of December 31st of the year t, and let NP_{t+1} be the same variable for the next period. It can then be assumed that:

$$NP_{t+1} = NP_t + NR_{t+1} - W_{t+1} \qquad [3.3]$$

That is, starting from the number of pensions at the end of year t, those for the year $t+1$ can be computed by summing up the new registrations and then subtracting the withdrawals for that year. To do so, it is necessary to have a projection of the number of new registrations and withdrawals for that period. In turn, the number of common pensions in $t+1$ can be obtained from the difference between the number of existing pensions at the end of $t+1$ and the withdrawals during $t+1$, that is [23]:

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[22] Following Blanco, A.; Montes, J. and Antón, V. (2001).

[23] For that we have to assume that no withdrawal occurs among the new registrations, since data for a precise measurement are not available. Any error margin in the estimates can be construed as negligible, for the percentage of withdrawals from the new registrations of the same period is less than 1%. Moreover, we confine this assumption to computing the number of common pensions each year. So, its use is not extended to the whole projection model.

$$C_t = NP_t - W_{t+1} \qquad [3.4]$$

Once the new registrations and the withdrawals have been projected and the common pensions computed (as is given by [3.4]), the relevant variable for the estimation, the number of pensions throughout the period (NPA), can be obtained using [3.2].

The average pension benefit for a given period is to be computed from the corresponding weighted average pension benefits of the different collectives (common, new registrations, and withdrawals). Denoting pmc_t, $pmnr_t$, and pmw_t the average pension benefits of the common, the new registrations, and the withdrawals, respectively, the average pension benefit can be obtained as:

$$pm_t = \frac{C_t\, pmc_t + 0.5NR_t\, pmnr_t + 0.5BW_t\, pmw_t}{C_t + 0.5NR_t + 0.5W_t} \qquad [3.5]$$

or alternatively,

$$pm_t = \delta_t\, pmc_t + \alpha_t\, pmnr_t + \beta_t\, pmw_t \qquad [3.6]$$

where δ_t, α_t, β_t represent each pension type as a proportion of NPA_t:

$$\delta_t = \frac{C_t}{C_t + 0.5NR_t + 0.5W_t}; \quad \alpha_t = \frac{0.5NR_t}{C_t + 0.5NR_t + 0.5W_t}; \quad \beta_t = \frac{0.5W_t}{C_t + 0.5NR_t + 0.5W_t} \qquad [3.7]$$

From here, the projection is disaggregated by pension category, contribution regime to Social Security, age, and sex. The key variable on which the model is based is the projection of the corresponding number of new registrations for each period, as well as the average pension. The projection of the withdrawals and their corresponding average pension benefit will depend greatly on the new registrations estimation, the number of existing pensions at the end of the previous period, as well as their respective average pension benefits. At the same time, the withdrawals and their corresponding average pension will determine the number of common pensions and their average pension benefit, along with the number of pensions at the end of the previous period and their respective average pension benefit.

3.1. Retirement

The projection of retirement pension expenditure derives from the distribution of the number of pension benefits by sex and age cohorts as of December 31st of 2003 (base year) for each contribution regime (MTAS, 2004).

a) *Projection of the number of pensions*

Starting from the distribution by sex and age cohorts of the pension benefits in the base year, the projection of the new registrations is implemented in accordance with the forecasted labour participation rate by sex and age cohorts in the macroeconomic scenario. In that manner, the evolution of the Social Security coverage ratio (the ratio of the number of retirement pensions to the population of more than 65 years of age) is linked to the evolution of the labour market participation rate. In the projection, it is necessary to discern the new registrations subject to a coefficient of correction when computing their pension benefit (anticipated or differed retirement).

To obtain the projection of the withdrawals, the expected mortality rates by sex and age cohorts as obtained from the demographic scenario are applied to the number of existing pension benefits at the beginning of the period (end of the previous period). They are also applied to the number of new registrations projected throughout the year.

Once the new registrations and withdrawals for the corresponding year have been projected, the projection of common pensions is made using [3.4]. The equivalent number of pensions throughout the period (NPA_t) is then estimated using [3.2]. Finally, using [3.3] the number of pension benefits at the end of the year (NP_t), which is necessary for the projection in the subsequent period, is obtained.

b) *Projection of the average pension*

The computation of the average pension of the new registrations is based on the legally warranted formula:

$$pmnr_t = \rho \cdot p(n) \cdot RB(CB_t, CB_{t-1}, ..., CB_{t-15}) \qquad [3.8]$$

where RB is the corresponding regulating base, computed as the average contribution bases (CB) of the last fifteen years of contribution[24], $p(n)$ is the percentage applied on the RB that depends on the number of years of contribution, and ρ is the applicable coefficient of correction in the event of anticipated or differed retirement.

We start the projection by estimating the number of years of contribution (*n*) for the retirement pensions from the data on the average years of contribution of the retirement pensioners. Since the objective is to obtain pensions projection by sex, the separate evolution of the contribution base for men and women is necessary. Because of the unavailability of such a disaggregation, the following strategy has been adopted. Firstly, it is considered that the gap

[24] As discussed in Section 2, the past contribution bases are updated from the third year; the previous two are considered at face value.

between average pensions of new registrations of men and women is the same as the one observed in the whole system. Secondly, it is assumed that the evolution of the gap will follow the same time trend as that of the participation gap. That is, the average retirement pension of female new registrations will approach that of their male counterparts as the rate of labour market participation of the former comes close to that of the latter during the projection period.

The average pensions of the withdrawals and the common pensions are obtained as a weighted average of the average pensions of the two possible collectives of origin in each case. That way, the withdrawals per year occur between the number of existing pensions at the end of the previous year and the new registrations for that year[25]. Consequently, the average pension of the withdrawals will be a weighted average of the average pension of the previous year (pm_{t-1}) and the average pension of the new registrations of the period:

$$pmw_t = \frac{NP_{t-1}}{NP_{t-1} + NR_t} pm_{t-1} + \frac{NR_t}{NP_{t-1} + NR_t} pmnr_t \qquad [3.9]$$

The common pensions in turn, as captured in [3.4], stem from the number of pensions at the end of the previous year and the withdrawals during the period. Accordingly, its average pension can be approximated as:

$$pmc_t = \frac{NP_{t-1}}{NP_{t-1} + W_t} pm_{t-1} + \frac{W_t}{NP_{t-1} + W_t} pmw_t \qquad [3.10]$$

Once the average pensions of the new registrations, the withdrawals and the common are obtained for a given period, the average retirement pension can be found using [3.5].

3.2. Permanent disability

As discussed in Section 2, the disability pensions system consists of different compensations and collectives depending on the cause and the degree of disability. Specifically, three degrees of permanent disability that initially give right to a life annuity are considered: total, absolute, and complete degree of disability. It was stressed in the description of the institutional framework that, since 1997, once accomplished 65 years of age, the disability pensioners are classified as retirement pensioners with no effect on their characteristics. New registrations of disability for people aged 65 year or more are not filed. Additionally, three possible causes of the disability that determine the corresponding regulating base are distinguished: common disease, non workplace

[25] Notice that, contrary to the computation of the common pensions, it is not necessary to assume that there exist no withdrawals among the new registrations.

accident, or causes attributable to the professional activity. Consequently, the projection of the disability pension expenditures requires projecting the pensioners and the average pension (according to the degree and the cause of the disability) alike. Again, the projection starts from the disability pensions as of december 31st of 2003 (MTAS, 2004) distributed by sex, the contribution regime, the degree and the cause of the disability[26].

a) *Projection of the number of pensions*

To project the new registrations for each level of disaggregation, we use the disability rates by age cohort, sex, contribution regime, degree and cause of disability that are obtained from the initial distribution of the new registrations. The disability rates are defined as the new registrations for every thousand of active worker in the base year. They are kept constant during the projection period, given their good behaviour in the last years, that has put them in acceptable levels when compared to those of the surrounding countries[27].

As to the projection of the withdrawals, in the case of disability pensions consideration of a second cause of withdrawals besides mortality is necessary, i.e., the loss of compensation rights after a diagnosis reassessment. The withdrawals for reassessment for each sex and age cohort are a percentage of the surviving pensioners in each group. This percentage is obtained by comparing the number of pensioners observed at the end of each year with the one that would be obtained if the unique cause of withdrawal from the system were the mortality rate[28].

From the new registrations and withdrawals in each period we obtain the number of common pensioners using [3.3] and [3.4]. Finally, the value of NPA for each projection year is derived from [3.2].

b) *Projection of the average pension*

To compute the average pension benefit for the new registrations we start with the legally established formula, which consists in applying a percentage (π)

[26] Disaggregated information is not available, so we had to have recourse to an imputation procedure. For instance, to disaggregate according to the cause of the disability we used the INE 'Encuesta Sobre Discapacidades, Deficiencias y Estado de Salud (1999) to obtain a proportion by sex and age cohort of the disabilities caused by common disease and non workplace accident.

[27] However, it is important to mention that substantial differences exist between contribution regimes to Social Security (Agrarian, Sea and Charcoal have the highest disability rates) and also by age cohorts (the rates are higher as the age comes close to retirement).

[28] The computation is done for the period 1999-2003, using for each age cohort the mean value throughout the period.

to the regulating base (RB). This percentage is determined by the degree of disability[29], while the RB is computed from the past contribution bases depending on the cause. Consequently, the average pension benefit of the new registrations for disability is obtained as a weighted average of the average pension benefits that correspond to each degree and cause of disability:

$$pmnr_t = \sum_{d=1}^{4} \sum_{c=1}^{3} \frac{NR_t^{dc}}{NR_t} \pi_d \, RB_t^c \qquad [3.11]$$

where the subscripts d (degree) and c (cause) refer to the degree and the cause of the disability, respectively. To differentiate the projection of the average pension benefit of the new registrations by sex, the same procedure used with retirement pensions is followed. Also, to project the average pensions of the withdrawals and the common pensioners, expressions [3.9] and [3.10] are used. Finally, the average pension benefit for disability is obtained from [3.5].

3.3. Survivors

As was pointed out in Section 2, survivor's benefits are designed to make up for the financial necessity that some individuals experience due to the death of others. Three categories of pensions are considered depending on the beneficiary: widowhood, orphanhood, and family benefits.

a) *Projection of the number of pensions*

In the case of survivors pensions, there exists no reason to link its evolution to the participation rate (as is the case for retirement pensions). On the contrary, in the case of widowhood, it can be assumed that this evolution will be correlated with the withdrawals that take place in the retirement and disability pensions, as well as in the active population. In that respect, the widowhood new registrations for each sex in every period are computed in relation to the withdrawals of the retired opposite sex, as well as to the withdrawals as a consequence of mortality of the active population and the withdrawals of disability pensions. For the base year, an adjustment factor between the result obtained via this method of projection and the one observed is computed. This adjustment factor will be applied for all the years of projection.

In the case of orphanhood and family pensions, there exists an additional difficulty, since new registrations cannot be linked to the withdrawals in

[29] Since the absolute permanent disability can give place to two different percentages to be applicable to the *RB* (55% on general basis, and 75% when the beneficiary accomplish 55 years and is not working), the three possible degrees of disability considered are converted into four when estimating the average pension benefit.

retirement and disability or mortality of the active population by age cohorts. For that reason, the total number of new registrations in the base year is distributed by age cohort and sex following the available distribution pattern for total pensions. Then, the ratio of new registrations to total beneficiaries by age cohort and sex are obtained and are kept constant all through the projection period.

b) *Projection of the average pension*

The average pension benefit of widowhood new registrations is 52% of the regulating base that causes the benefit. For orphanhood and family pensions, except under special circumstances, this percentage goes down to 20%. Three possible causes of benefit are to be taken into consideration to obtain the regulating base: participant in the labour market, retired, or disabled. The regulating base is obtained as a weighted average of the respective regulating bases, the weights being the proportions of new registrations estimated for each of the three causes just mentioned. As to survivors new registrations due to labour-market participants' mortality, the regulating base can be obtained directly from the average contribution bases of the active population by age cohort. However, when the new registrations are the consequence of retired or disabled mortality, it is impossible to know the regulating base that caused the pension benefit. In these two cases, the ratio of the average pension of the retired and disabled new registrations to the average pension of survivors new registrations, computed for the base year, is used and is kept constant all through the period.

4. THE DATA

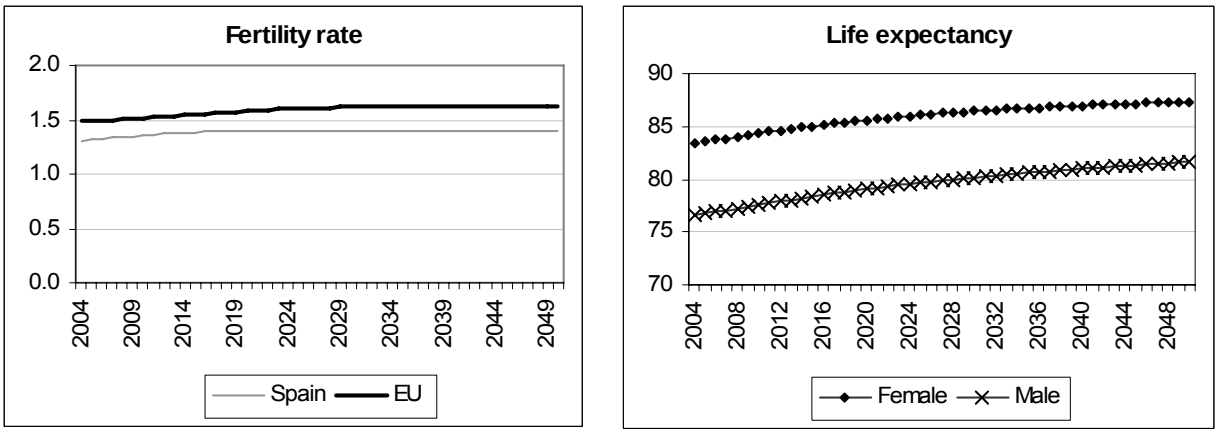
The projection model will produce results once introduced the evolution scenarios of the relevant demographic and macroeconomic variables. The scenarios adopted for the base projection are those elaborated for Spain by Eurostat (2005) (demographic scenario) and the Economic Policy Committee (EPC, 2006) (macroeconomic scenario). Their main traits are described next.

Demographic scenario

Population projections are carried out using three main hypotheses related to the evolution of the fertility rate, of life expectancy, and of the net migration flows. The projection implemented by Eurostat until 2050 is made by sex and age cohort, assuming that Spain will slightly recover its fertility rates during the period, although they will still be below the European Union average. As to the life expectancy, a gradual increase for both men and women is also expected.

Graph 4.1

DEMOGRAPHIC SCENARIO: EVOLUTION OF FERTILITY AND LIFE EXPECTANCY

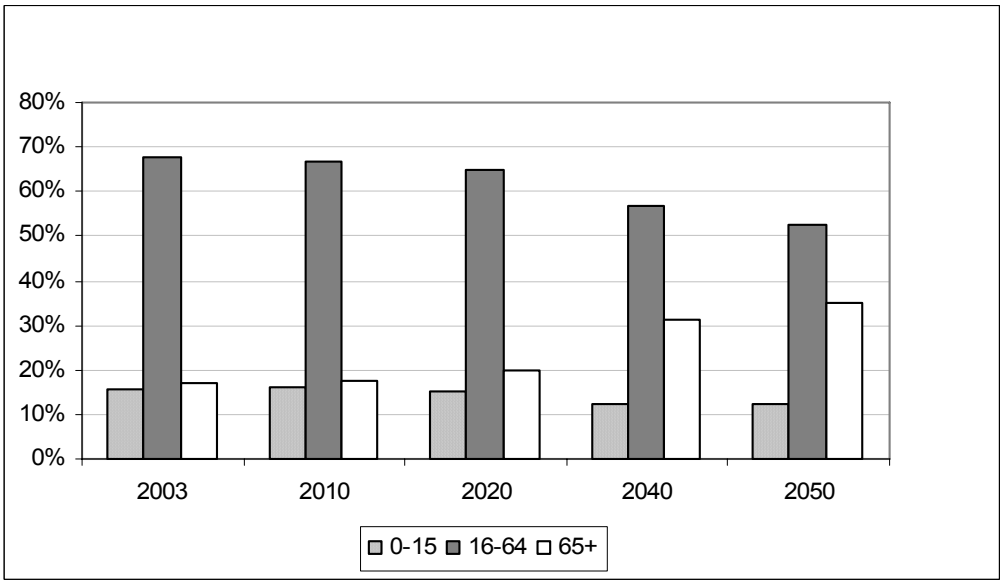


Source: Own elaboration from Eurostat (2005).

As far as migration is concerned, Eurostat's hypothesis is as follows: net migration flows will be stabilized at the end of this decade at a number slightly superior to 100,000 per year. This is a controversial hypothesis since during the last years net migration flows have been around 500,000 per year. In fact, Spain's Statistical Office (Instituto Nacional de Estadística, INE) has made alternative projections with net migration flows well above 250,000 per year.

Graph 4.2

DEMOGRAPHIC SCENARIO: EVOLUTION OF THE POPULATION COMPOSITION BY AGE



Source: Own elaboration from Eurostat (2005).

As can be observed in graph 4.2, Eurostat's projections exhibit a strong aging tendency of the Spanish population for the 2050 horizon. Specifically, after a

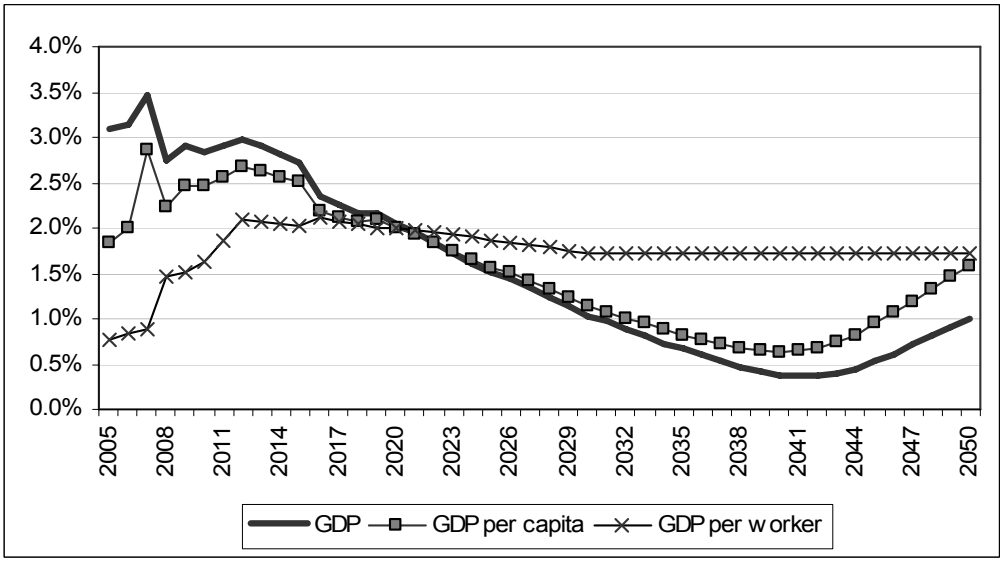
sustained increase from its original 24.6%, the dependency rate (ratio of population aged 65 years and more to potential labour-market participants between 16 and 64 years of age) will be superior to 65%.

Macroeconomic scenario

The main hypotheses of the macroeconomic scenario projected by the EPC for Spain are those that relate to the evolution of the GDP, the productivity growth rate, and the labour market variables (participation rates and unemployment rates). For the GDP, although with a slowdown between 2020 and 2040, a positive growth rate is expected for the whole projection period. A more stable evolution of productivity growth is expected, going from the present low rates (around 0.5%) to 2% until 2020. From there, it would decrease to remain at around 1.7% from 2030 on. This turns out to be a relevant assumption given that even a small recovery lasts for the whole projection period raising the GDP for each future year.

Graph 4.3

MACROECONOMIC SCENARIO: GDP EVOLUTION



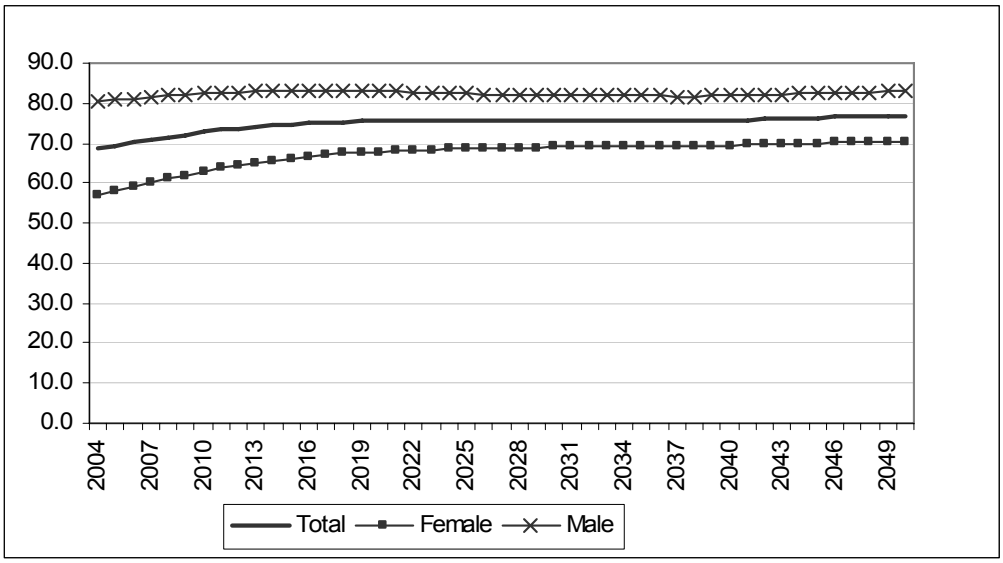
Source: Own elaboration from EPC (2006).

The salient feature of the labour market is the increase of the women participation rate, particularly until 2020. In turn, aggregate men participation rate in the labour market remains basically unchanged throughout the whole period. It is however important to mention some particular feature for the age cohorts. For instance, youth (both men and women less than 24 years of age) participation rate slightly declines during the first years of projection. Nevertheless, female participation rate for the remaining cohorts (up to 64 years) experiences a substantial increase. Meanwhile, only the 54-64 male age cohorts experience a

higher participation rate, but still lower than that of their female counterpart. It is important to put into relief that a higher participation rate for the superior age cohorts (between 65 and 71) is expected for both men and women alike. Their participation rate would be around 12%, compared with a 4% as of 2004.

Graph 4.4

MACROECONOMIC SCENARIO: EVOLUTION OF PARTICIPATION RATES

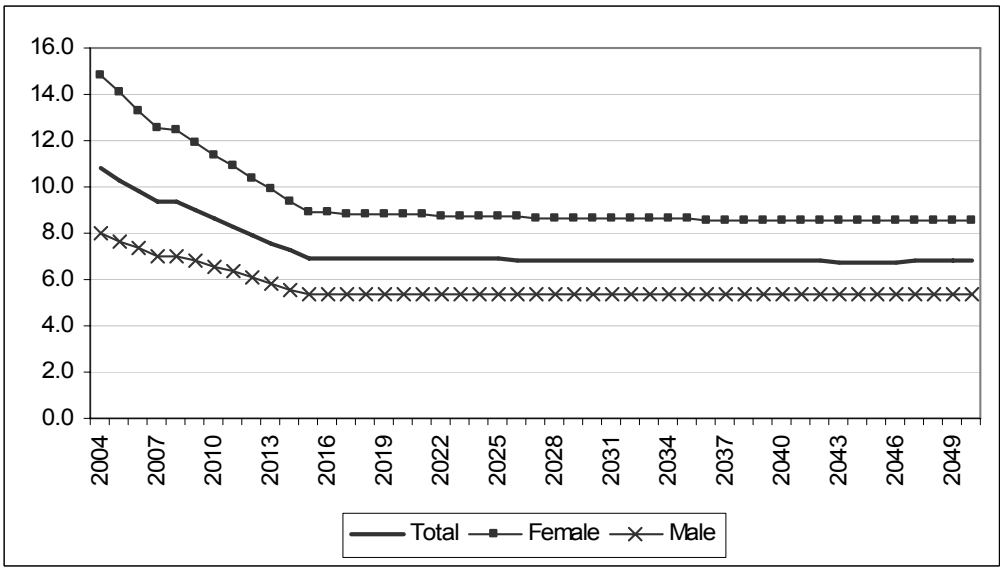


Source: Own elaboration from EPC (2006).

The expected evolution of unemployment for both men and women is a constant decline until it reaches an average value of 6.9% in 2015, which will basically remain unchanged until the end of the projection period.

Graph 4.5

MACROECONOMIC SCENARIO: EVOLUTION OF UNEMPLOYMENT RATES



Source: Own elaboration from EPC (2006).

5. RESULTS

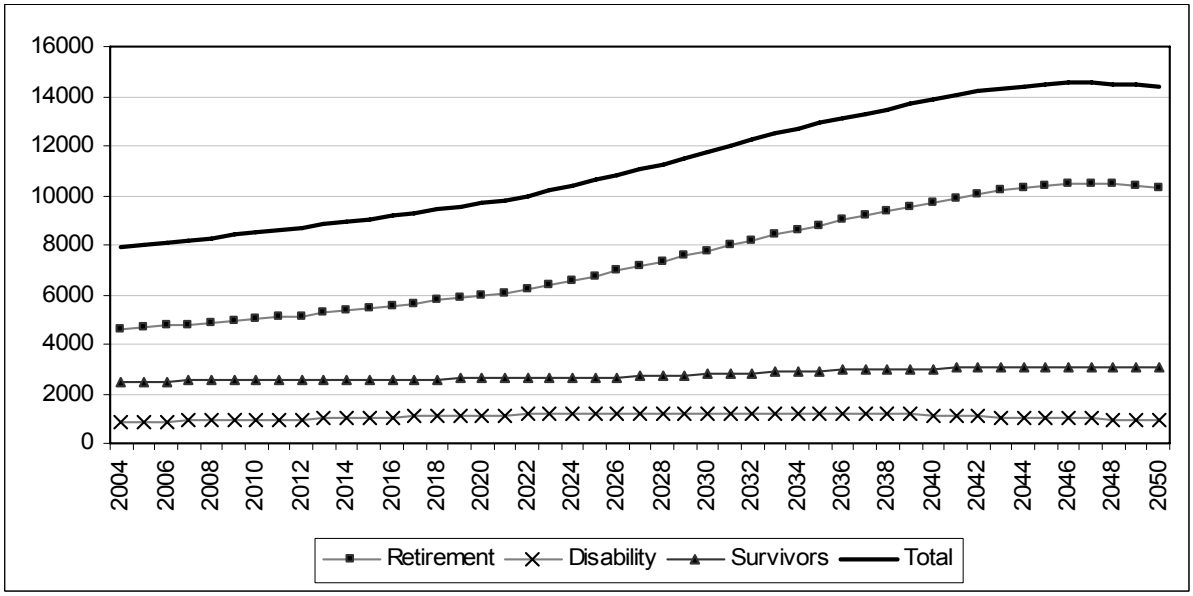
In this section the results of the projection model of contributory pension expenditure in Spain are presented.

5.1. Number of pensions

The evolution of the number of total pensions and pensions by category is illustrated in graph 5.1 and table 5.1. As is shown in graph 5.1, a sustained growth of contributory pensions is expected at an annual average cumulative rate of 1.3%. That way, in 2050 we would surpass the 14 million pension threshold, compared with barely 8 million in 2004. This evolution is nonetheless not lineal throughout the projection period. The number of pensions would grow at approximately 1% until the beginning of the 2020s. From that moment, with the retirement of the baby-boomers, the most populated cohorts, the rate of growth would double. From 2040 on, the rate of growth decreases to even become negative by 2047. From graph 5.1, it is straightforward to notice that retirement pensions are responsible for the observed tendency of total pensions, since the other benefits (disability and survivors) exhibit a much more stable tendency. In fact, as can be seen in table 5.1, the importance of the retirement pensions with respect to total contributory pensions exhibits a continuous growth in detriment of the other categories (in 2050 they represent more than 71%, against 58.6% in 2004).

Graph 5.1

EVOLUTION OF THE NUMBER OF CONTRIBUTORY PENSIONS BY CATEGORY



Note: Figures are expressed in thousand of beneficiaries.
Source: Own elaboration.

The projection analysis by sex allows drawing some interesting results. On the one hand, the total number of pensions accruing to both men and women is very similar in the base year, although a clearly differentiated structure can be observed by pension category. In that vein, male retirement pensions are substantially more numerous, while disability pensions rank second (respectively, 77.5% and 14.2% in 2004). Female widowhood pensions in turn outweigh those for retirement (more than 50% versus 39.3% in 2004).

The projection also shows differentiated tendencies in its future evolution. The total number of contributory pensions will grow proportionately more for men. Specifically, on average some 1.5% annual cumulative over the period, versus 1.1% for their female counterpart. As a consequence, the number of male pensions will be relatively more important and would represent 1.3 times those of female in 2050, which brings down the originally observed equality.

For both sexes, the retirement pensions are expected to be increasingly important, in particular for the women, who start off with a relatively inferior weight. For the first part of the projection, that is, until 2020, the average annual cumulative growth rate is about 1.6% for men and 1.5% for women. However, this trend is inverted between 2020 and 2050 to become 2% and 1.8% for women and men, respectively. So, by 2050 the number of retirement pensions accruing to women would represent approximately 53.2% that going to men, compared with the original 49.6%. Female retirement pensions from the total would grow more than 17 points with respect to the base year, while it would be a barely 6 points increment for their male counterpart.

The widowhood pensions exhibit the reverse trend. The number of male beneficiaries is expected to grow at approximately an annual cumulative average rate superior to 2.5%, while this figure would be 0.3% for the female. This result is in line with the assumptions made on the female labour market participation, which will give greater access to widowhood men pensions. However, at the end of the projection widowhood pensions would continue to be more important for women, representing 35.4% of the total female contributory pensions compared with 6.2% for men.

The growth of the number of pensioners for the remaining pension categories is expected to be negligible for both sexes and would be below 0.5% annual cumulative average. Both the disability pensions and the orphanhood and other family pension benefits lose importance with respect to total number of pensions for both sexes.

Table 5.1

EVOLUTION OF THE NUMBER OF PENSIONS BY GENDER AND CLASS (IN NUMBER AND AS PERCENTAGE OF TOTAL)

BOTH SEXES									
	Retirement		Disability		Widow		Other		TOTAL
2004	4,625,846	58.6%	817,392	10.4%	2,135,325	27.0%	318,708	4.0%	7,897,270
2005	4,677,186	58.2%	861,993	10.7%	2,166,665	27.0%	324,167	4.0%	8,030,012
2010	4,985,975	58.7%	951,648	11.2%	2,207,785	26.0%	342,866	4.0%	8,488,274
2015	5,430,056	60.1%	1,028,599	11.4%	2,239,406	24.8%	343,637	3.8%	9,041,698
2020	5,963,505	61.5%	1,124,639	11.6%	2,244,018	23.2%	357,601	3.7%	9,689,762
2025	6,750,004	63.7%	1,193,017	11.2%	2,285,842	21.6%	376,000	3.5%	10,604,864
2030	7,772,770	66.0%	1,223,497	10.4%	2,395,419	20.3%	385,036	3.3%	11,776,722
2035	8,805,681	68.1%	1,208,128	9.3%	2,533,406	19.6%	383,106	3.0%	12,930,320
2040	9,737,186	70.2%	1,130,660	8.2%	2,626,274	18.9%	376,495	2.7%	13,870,616
2045	10,391,688	71.7%	1,015,547	7.0%	2,715,873	18.7%	370,930	2.6%	14,494,038
2050	10,322,379	71.9%	944,581	6.6%	2,721,686	19.0%	366,625	2.6%	14,355,270
MALE									
	Retirement		Disability		Widow		Other		TOTAL
2004	3,092,548	77.5%	566,647	14.2%	159,953	4.0%	172,204	4.3%	3,991,351
2005	3,135,543	77.0%	595,107	14.6%	169,456	4.2%	174,062	4.3%	4,074,168
2010	3,368,448	76.4%	646,954	14.7%	210,653	4.8%	183,260	4.2%	4,409,315
2015	3,669,950	76.4%	692,149	14.4%	257,922	5.4%	184,043	3.8%	4,804,064
2020	4,007,087	76.2%	756,304	14.4%	306,387	5.8%	190,928	3.6%	5,260,707
2025	4,475,686	76.7%	803,703	13.8%	356,852	6.1%	200,074	3.4%	5,836,314
2030	5,101,900	78.0%	825,514	12.6%	406,384	6.2%	205,008	3.1%	6,538,806
2035	5,745,454	79.6%	814,274	11.3%	450,137	6.2%	204,901	2.8%	7,214,766
2040	6,352,639	81.5%	760,518	9.8%	478,374	6.1%	203,012	2.6%	7,794,544
2045	6,777,855	83.1%	679,495	8.3%	498,160	6.1%	201,935	2.5%	8,157,444
2050	6,739,224	83.5%	629,827	7.8%	498,543	6.2%	201,079	2.5%	8,068,672
FEMALE									
	Retirement		Disability		Widow		Other		TOTAL
2004	1,533,297	39.3%	250,745	6.4%	1,975,372	50.6%	146,504	3.8%	3,905,919
2005	1,541,643	39.0%	266,887	6.7%	1,997,209	50.5%	150,105	3.8%	3,955,844
2010	1,617,526	39.7%	304,694	7.5%	1,997,132	49.0%	159,606	3.9%	4,078,959
2015	1,760,105	41.5%	336,450	7.9%	1,981,484	46.8%	159,594	3.8%	4,237,633
2020	1,956,417	44.2%	368,334	8.3%	1,937,631	43.7%	166,672	3.8%	4,429,054
2025	2,274,319	47.7%	389,314	8.2%	1,928,991	40.5%	175,927	3.7%	4,768,550
2030	2,670,870	51.0%	397,982	7.6%	1,989,035	38.0%	180,028	3.4%	5,237,916
2035	3,060,227	53.5%	393,854	6.9%	2,083,270	36.4%	178,204	3.1%	5,715,554
2040	3,384,547	55.7%	370,142	6.1%	2,147,900	35.4%	173,483	2.9%	6,076,072
2045	3,613,834	57.0%	336,052	5.3%	2,217,713	35.0%	168,995	2.7%	6,336,594
2050	3,583,155	57.0%	314,753	5.0%	2,223,144	35.4%	165,546	2.6%	6,286,598

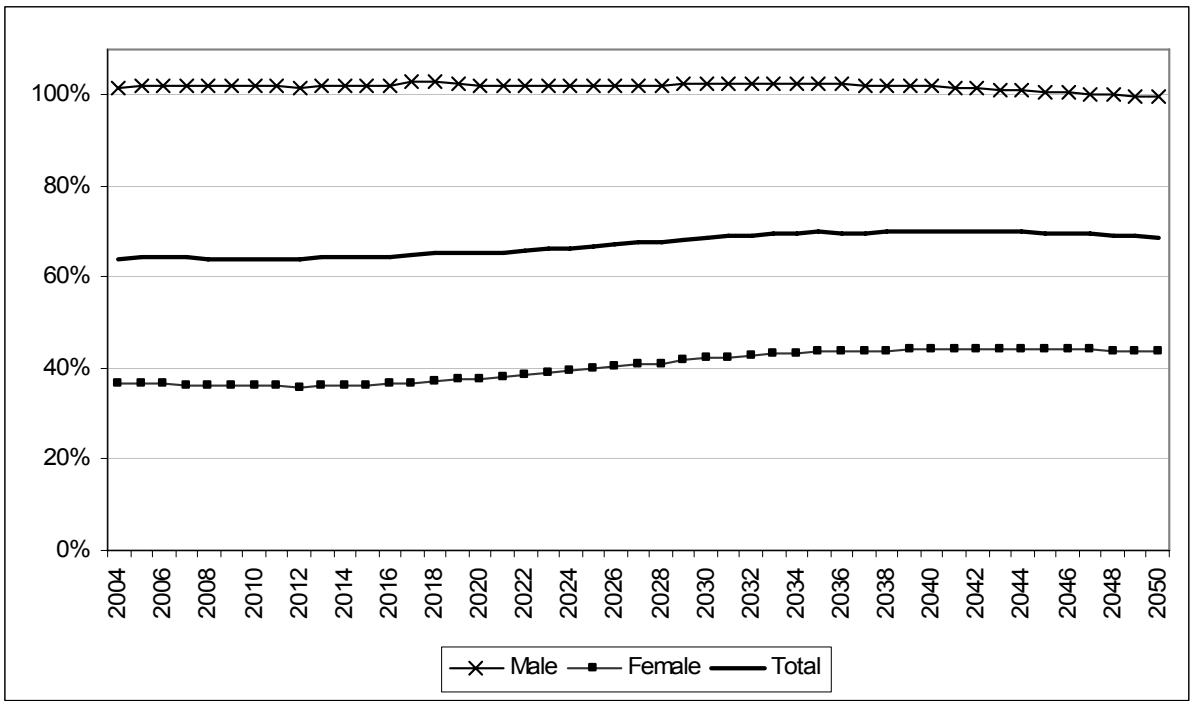
Source: Own elaboration.

Finally, it is important to notice that this expected evolution for the number of pensions appears to be a corollary of the starting demographic scenario, where a clear tendency of population ageing is observed, as well as the

assumptions on the evolution of the labour market. In effect, the increase in participation rates has a direct impact on the increase of the retirement pension coverage rate (ratio of the number of pensions to the population over 65 years), which in fact goes from 64.1% in 2004 to about 70% around 2040 (graph 5.2).

Graph 5.2

EVOLUTION OF RETIREMENT PENSION COVERAGE RATE



Source: Own elaboration.

Note: The coverage rate is obtained as the number of pensions divided by the population aged 65 and more. The coverage rate can be over 100% due to the existence of retirement pensioners under 65 years.

5.2. Average pension benefit

The estimated evolution of the average pension benefit in real terms by sex and category, as well as the expected annual growth rates, are shown in table 5.2.

Table 5.2

PROJECTED EVOLUTION OF THE AVERAGE PENSION BENEFIT AND ITS GROWTH RATE BY GENDER AND CLASS (AVERAGE ANNUAL GROWTH RATES)

BOTH SEXES								
	Retirement		Disability		Widow		Other	
2004	673		663		439		247	
2005	679	0.8%	679	2.4%	452	2.8%	259	4.7%
2010	751	2.0%	756	2.2%	506	2.3%	313	3.8%
2015	781	0.8%	824	1.7%	519	0.5%	395	4.8%
2020	847	1.6%	900	1.8%	540	0.8%	453	2.8%
2025	946	2.2%	980	1.7%	568	1.0%	496	1.8%
2030	1,053	2.2%	1,062	1.6%	595	0.9%	526	1.2%
2035	1,149	1.8%	1,149	1.6%	618	0.7%	548	0.8%
2040	1,267	2.0%	1,235	1.5%	640	0.7%	571	0.8%
2045	1,343	1.2%	1,323	1.4%	650	0.3%	600	1.0%
2050	1,379	0.5%	1,420	1.4%	658	0.2%	635	1.1%
MALE								
	Retirement		Disability		Widow		Other	
2004	768		715		390		232	
2005	771	0.5%	729	2.0%	413	5.6%	242	4.1%
2010	834	1.6%	798	1.8%	499	3.9%	315	5.4%
2015	857	0.5%	862	1.5%	532	1.3%	417	5.8%
2020	917	1.4%	935	1.6%	564	1.2%	487	3.2%
2025	1,017	2.1%	1,013	1.6%	594	1.0%	535	1.9%
2030	1,137	2.2%	1,093	1.5%	617	0.8%	569	1.2%
2035	1,248	1.9%	1,180	1.5%	633	0.5%	594	0.9%
2040	1,380	2.0%	1,269	1.5%	648	0.5%	622	0.9%
2045	1,463	1.2%	1,360	1.4%	654	0.2%	656	1.1%
2050	1,504	0.6%	1,460	1.4%	659	0.2%	696	1.2%
FEMALE								
	Retirement		Disability		Widow		Other	
2004	483		546		443		257	
2005	492	1.7%	569	4.0%	455	2.7%	270	4.9%
2010	578	3.3%	666	3.2%	506	2.2%	314	3.0%
2015	624	1.6%	746	2.3%	517	0.4%	387	4.3%
2020	705	2.5%	828	2.1%	537	0.8%	441	2.7%
2025	805	2.7%	912	1.9%	564	1.0%	483	1.8%
2030	893	2.1%	997	1.8%	591	1.0%	514	1.2%
2035	964	1.5%	1,083	1.7%	614	0.8%	537	0.9%
2040	1,057	1.9%	1,165	1.5%	638	0.8%	560	0.8%
2045	1,117	1.1%	1,247	1.4%	650	0.4%	587	1.0%
2050	1,143	0.5%	1,340	1.4%	658	0.3%	620	1.1%

Note: Figures are expressed in constant euros of 2004 per month without including extraordinary payments.

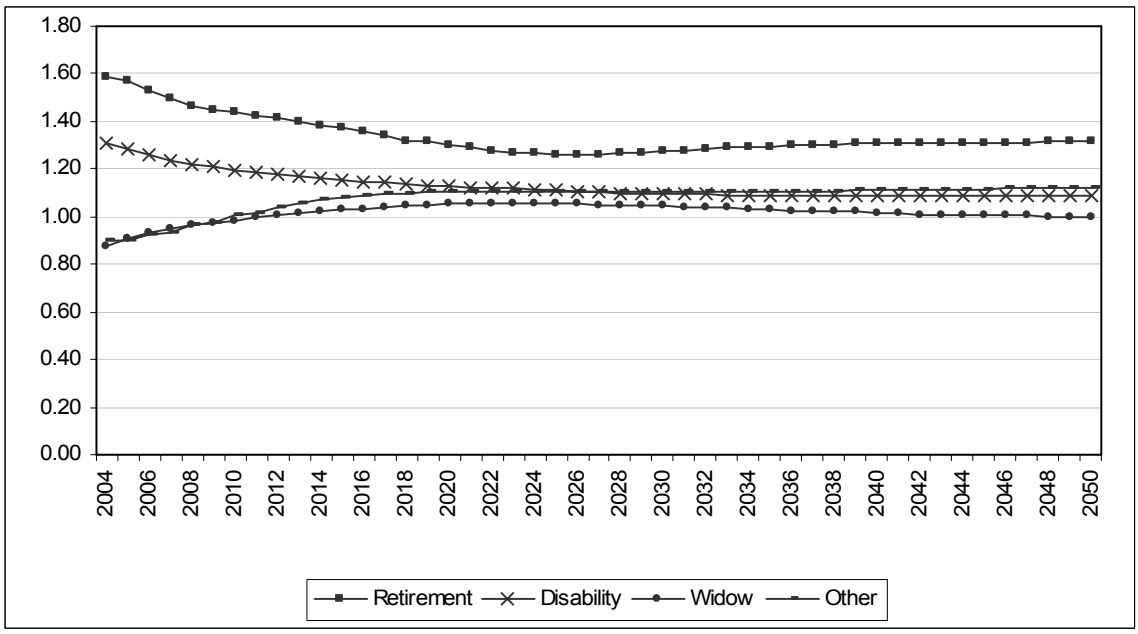
Source: Own elaboration.

The evolution of the average pension is differentiated for both pension category and sex (see graph 5.3). The behaviour of the average pension for the new registrations and the proportion of new registrations with respect to yearly

total pensions are of central salience in that evolution. This can be seen from [3.5]-[3.7], for the benefits accruing to common pensions and withdrawals are only indexed by the annual inflation rate (applicable to all pension categories and both sexes). On graph 5.4, the number of new registrations in relation to total number of pensions by sex and category are presented for the base year (2004).

Graph 5.3

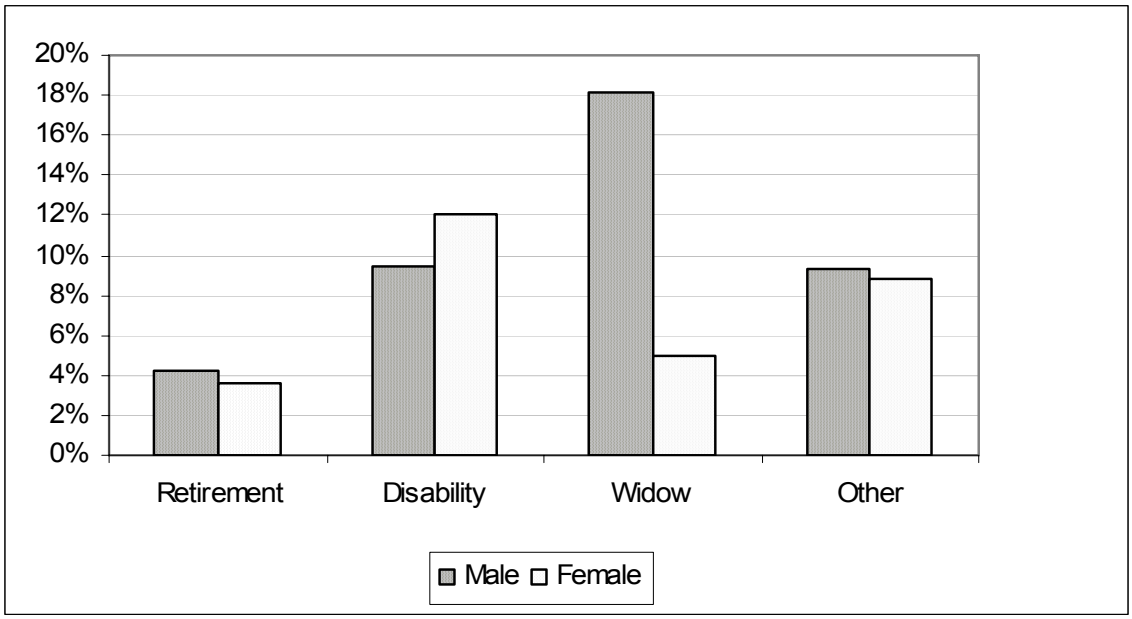
EVOLUTION OF THE 'SEX GAP' FOR AVERAGE PENSION BENEFIT BY CATEGORY



Source: Own elaboration.

Graph 5.4

NEW REGISTRATIONS RELATED TO THE TOTAL NUMBER OF PENSIONS BY SEX AND CATEGORY IN 2004

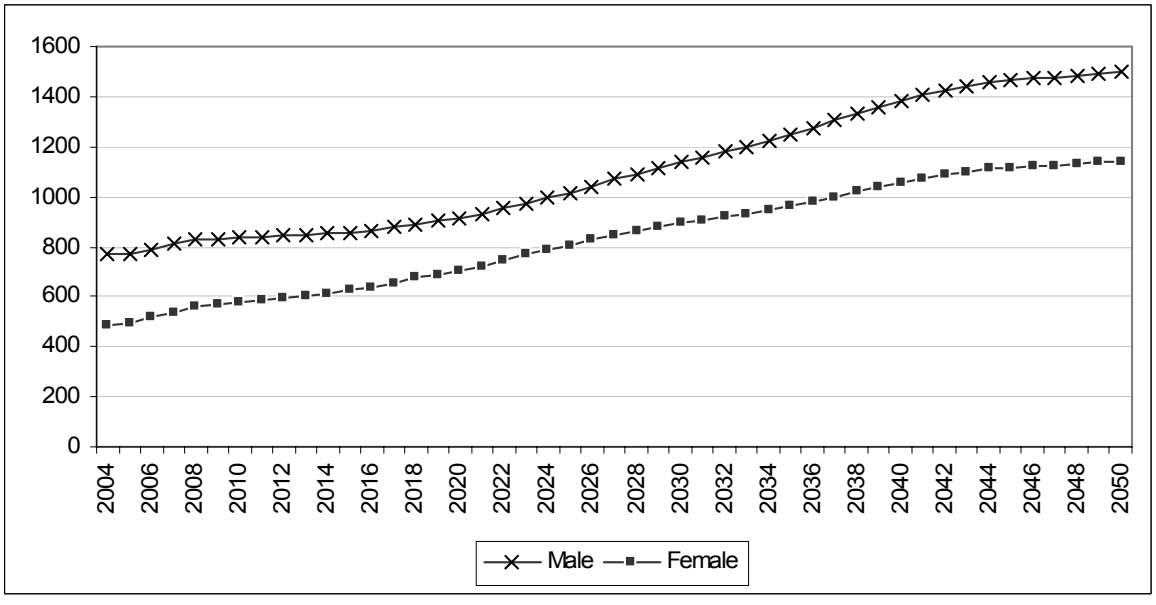


Source: Own elaboration from MTAS (2005).

With respect to retirement, the average pension for men starts 1.6 times that of women. This gap would be reduced to 1.3 in 2050. The greater access of women into the labour market, along with the wage equality tendency, are the key factors explaining the breaching of the gap. Nevertheless, it is important to note that, although a clear tendency of convergence between men and women average retirement pensions can be observed until 2025, from that moment this trend is inverted and the gap starts to widen again (see graph 5.5). Mainly, the explanation for this evolution lies in the fact that the proportion of new registrations with respect to total pensions each year is greater for men (see graph 5.4). This is because women have higher life expectancy and consequently on average they collect pension benefits for more years than men. And, since the average pension benefit for the new registrations has less weight when computing the average pension benefit (see [3.6]), this makes the female retirement average pension benefit grow at a rate below that of their male counterpart. As is explained in subsection 3.1, this effect is temporarily counterbalanced to the extent that the model diminishes the gap between the average pension benefit of the new registrations for men and women as the participation rates of the macroeconomic scenario become closer. But even though the participation rates gap is breached substantially between 2004 and 2020, from that moment the closing rate is quite inferior. All this provokes a renewed increase of the total gap between sexes for all the beneficiaries, besides the fact that the gap for average pension benefits that correspond to the new registrations in the system remains unchanged.

Graph 5.5

EVOLUTION OF AVERAGE RETIREMENT BENEFIT PENSION BY SEX

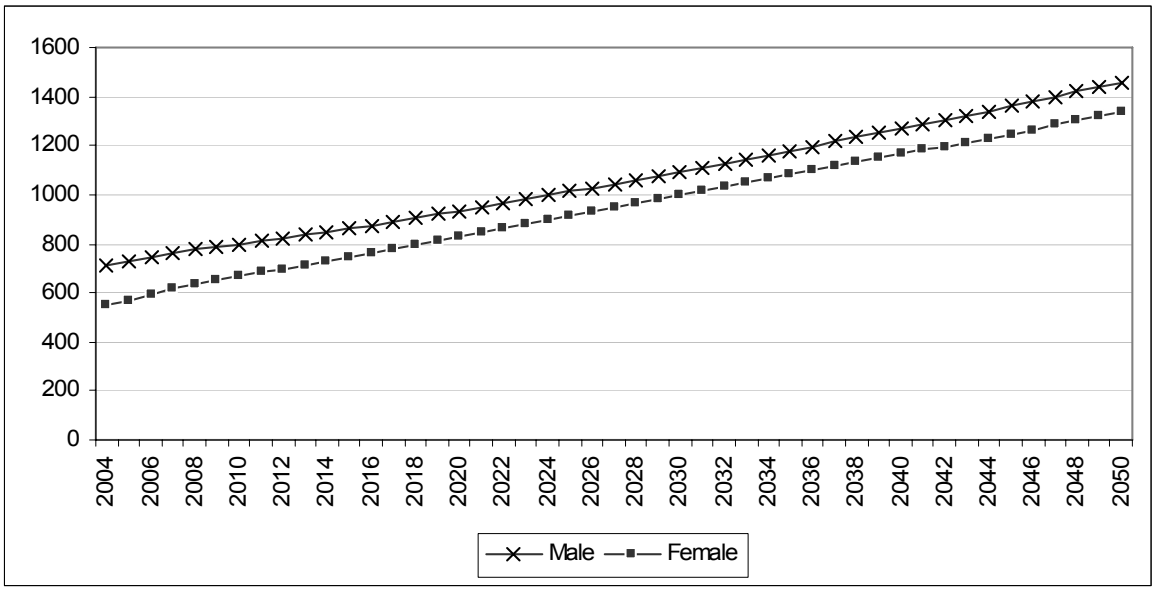


Note: Figures expressed in constant € of 2004 per month (without extraordinary payments).
Source: Own elaboration.

Concerning disability pensions, they are initially higher for men than for women, although the gap is less important than in the case of retirement benefits. As is shown in graph 5.6, the temporal evolution depicts a clear trend toward reducing the gap in the average benefit by sex: in the base year male average pension benefit represented 1.3 that of their women counterpart, while in 2050 this proportion declines to 1.1. It is important to mention that just for disability pensions the women have initially a higher proportion of new registrations to total pensions than men. But that difference would decrease gradually and both proportions would become equal around 2030. This evolution of the proportion of new registrations is the key explanatory factor for the considerable decline of the 'sex gap' in the average pensions until 2030. From that moment, this gap would tend remain constant (see graph 5.3).

Graph 5.6

EVOLUTION OF AVERAGE DISABILITY BENEFIT PENSION BY SEX



Note: Figures expressed in constant € of 2004 per month (without extraordinary payments).

Source: Own elaboration.

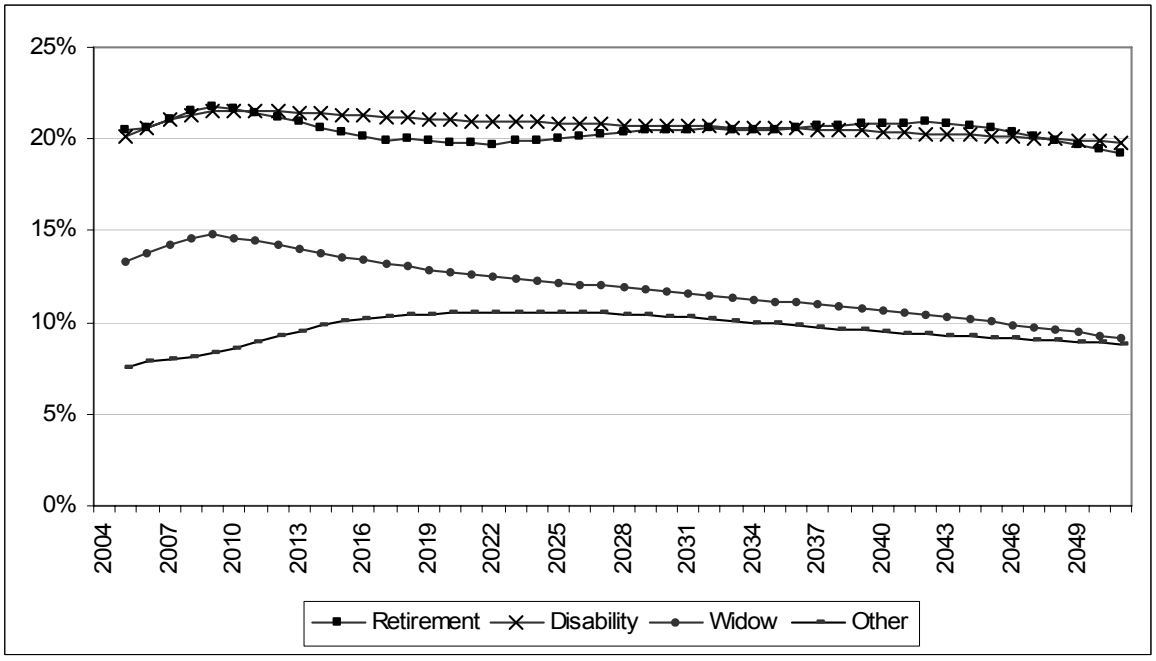
As for widowhood pensions, the ratio of new registrations to total pensions is quite higher for men than for women (se graph 5.4). The main reason for this result is that total number of female pensions is superior to the male ones (in 2004 widowhood pension benefits accruing to men represented about 7% of the total). The expected evolution of labour market, with a considerable increase of women participation rates and employment, leads one to believe in a considerable increase of male widowhood pension benefits. As the projection results show, the latter's relative importance is superior to that of the former. Despite the fact that men average pension benefit is initially slightly inferior to

that of women, because of their higher rates of new registrations, widowhood average pension benefit for the former grows at a faster rate than that of the latter during great part of the projection period. Something similar occurs to the rest of pensions accruing to survivors, where the ratio of new registrations is also inferior for men and tends to become more important during the projection period. So, even though initially the pension benefit is slightly superior for women, men pension benefits would surpass it around 2010 and keep that position during the remaining projection period.

An interesting result is obtained by comparing the evolution of the average pension benefit with respect to productivity ratio (GDP per worker). From graph 5.7, one can deduct that no important fluctuations of the disability and retirement pension benefits are to be expected during the projection period. As to widowhood pension benefit, a slight increase is observed during the first years. This would start decreasing steadily afterwards to eventually reach, by 2050, an average pension benefit below 10% the average productivity versus the 15% maximum that it would reach in 2010. For the rest of the survivors pensions an initial increase is also observed. This would continue until 2025 but would begin to decline after, yet at a lower rate than that observed for widowhood.

Graph 5.7

EVOLUTION OF AVERAGE PENSION BENEFIT AS A PERCENTAGE OF THE PRODUCTIVITY RATIO (GDP PER WORKER)



Source: Own elaboration.

5.3. Total pension expenditure

The results for the projection of contributory pension's total expenditure for the spell 2004-2050 are shown in table 5.3. Their evolution with respect to GDP can be captured in graph 5.8. It is expected that total pension expenditure in real terms will increase significantly, at an average annual cumulative rate close to 3%. The important increase of the retirement pensions stands out. These grow at a 3.4% annual rate and, given their relative importance, they determine the evolution of total expenditure (they represent 66% at the beginning and are above 80% of total expenditure in 2050).

Table 5.3

EVOLUTION OF CONTRIBUTORY PENSION EXPENDITURE BY CATEGORY

	Retirement		Disability		Widow		Other		TOTAL
2004	42,546	66.2%	7,532	11.7%	13,125	20.4%	1,104	1.7%	64,307
2005	44,472	65.8%	8,199	12.1%	13,705	20.3%	1,178	1.7%	67,554
2010	52,414	65.8%	10,070	12.6%	15,631	19.6%	1,501	1.9%	79,617
2015	59,400	66.4%	11,863	13.3%	16,249	18.2%	1,898	2.1%	89,411
2020	70,732	67.9%	14,170	13.6%	16,956	16.3%	2,265	2.2%	104,124
2025	89,369	70.7%	16,364	12.9%	18,156	14.4%	2,604	2.1%	126,495
2030	114,581	73.7%	18,190	11.7%	19,925	12.8%	2,829	1.8%	155,527
2035	141,651	76.2%	19,426	10.5%	21,857	11.8%	2,935	1.6%	185,869
2040	172,763	79.0%	19,546	8.9%	23,483	10.7%	3,008	1.4%	218,800
2045	195,330	80.7%	18,809	7.8%	24,709	10.2%	3,112	1.3%	241,960
2050	199,223	80.9%	18,780	7.6%	25,068	10.2%	3,254	1.3%	246,326

Note: Figures are expressed in millions of constant € of 2004, and as percentage of total.
Source: Own elaboration

It is however important to mention that the evolution of expenditure is non lineal during the projection period. On the contrary, looking at the growth rate, different stages can be discerned. During the first part, approximately until 2020, the average annual cumulative rate of growth is about 3% and would intensify to reach 3.8% after that year. During the last part of the projection period, more or less from 2040, an inflection point can be observed in the variation rate, which would exhibit from that moment less significant values (some 1.2% between 2040 and 2050) or even becomes negative for some pension categories during specific periods.

Once again, the evolution of retirement pensions determines the trend of global expenditure. Until 2020 its growth is about 3.2% annually, compared with an average of 4.6% between 2020 and 2040. This is without doubt due to the baby-boomers retirement (this was shown in graph 5.1). In the last years, it can be clearly observed that their decline starts to have an echo on the rate of growth of the expenditure, that is reduced to 1.4% on average between 2040

and 2050 (this rate is only 0.5% in the last five years). In the case of disability pensions, expenditure grows significantly (around 4% annually) until 2020. From that moment the rate of growth slows (around 1.6% between 2020 and 2040) and becomes negative by 2039 (only in the last two years a slight positive growth rate, inferior to 0.5%, is observed). The expenditure in survivor pensions to orphans and other family members exhibits an evolution similar to that of disability. Only in the first half of the projection period one can observe significant rates of growth, exhibiting on average some 4.6% annual cumulative rate between 2004 and 2020. After that period, the values are lower, although the variation rates are not negative. Finally, expenditure in widowhood pensions grows less rapidly than the rest of the categories. The average annual cumulative rate is 1.6% between 2004 and 2020 (to remain basically unchanged between 2020 and 2040), while it goes down to 0.7% in the last ten years.

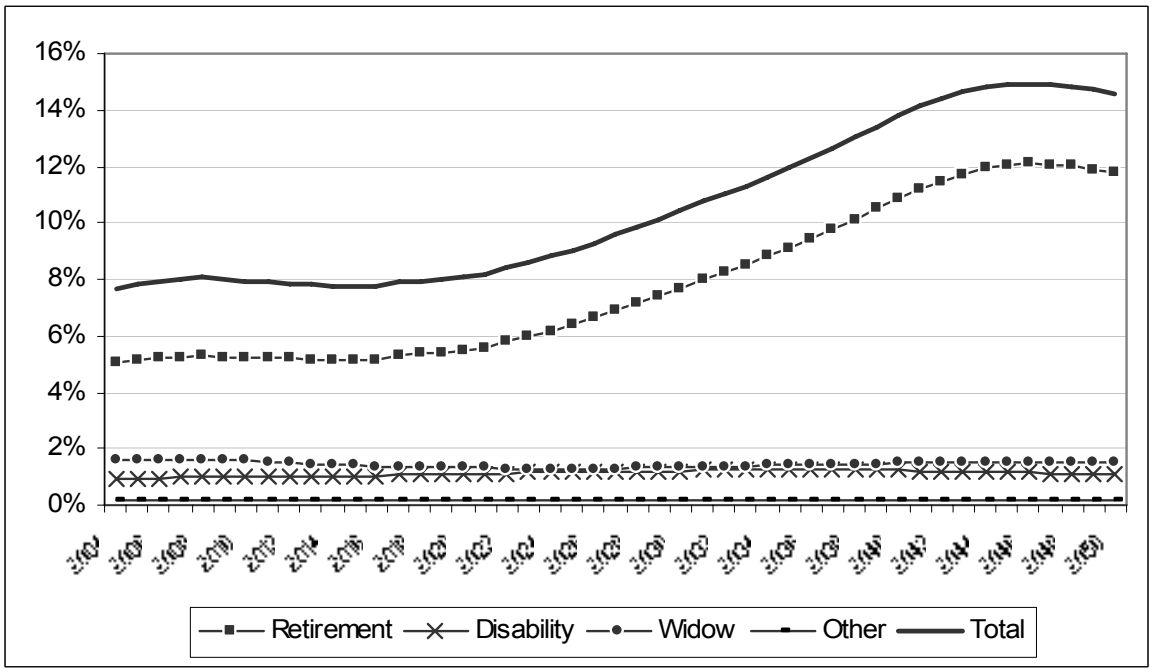
With respect to GDP, the total expenditure in contributory pensions will remain basically constant until 2017 at a level about 8%, and will begin a sustained growth afterwards to reach a maximum value of about 15% of GDP around 2045 (graph 5.8). This figure is quite substantial given that the baseline scenario incorporates a recovery of employment and female participation rates which increase the denominator, the GDP. Our results are in line with those obtained by other authors or in official estimations. When sizable differences remain, they can be explained by the set of assumptions or by the modelling strategy[30].

Overall, the increase in pension expenditure is a clear consequence of the evolution of the expenditure in retirement pensions, since the expected variations in disability and survivor pensions are small.

[30] Indeed results might be sensitive to assumptions of demographic parameters, macroeconomic and labour marker performance, though the clarity of the model strategy does not always allow making it clear. On the two opposite extremes Ahn et al. (2005) obtain a total expenditure on pensions reaching a 20% of GDP while MTAS (2005) obtain a 14,51%. The former focus on the need to introduce stochastic demographic projections, which turn out to be a recent methodological proposal that amplify to great extent the variability of results. In fact they give the 20% as an intermediate scenario. The later, the figure of 14,51% of GDP, is probably due to assumptions on participation and unemployment.

Graph 5.8

EVOLUTION OF CONTRIBUTORY PENSION EXPENDITURE AS A PERCENTAGE OF GDP



Source: Own elaboration.

A synthetic indicator commonly used in Generational Accounting, and that gives a long term vision on the evolution of the expenditure, consists in measuring the present value of the expenditure with respect to the present value of GDP for the whole projection period. The value of this indicator (which we will call *sustainability indicator* SI), may be interpreted as the percentage of GDP that, on average and during the period of projection, is to be allocated annually to the payment of contributory pensions. If we denote the discount rate d, the SI may be defined as follows:

$$SI = \frac{\sum_{t=1}^{n} \frac{TE_t}{(1+d)^t}}{\sum_{t=1}^{n} \frac{GDP_t}{(1+d)^t}} \qquad [5.1]$$

where TE is total expenditure, n is the final projection period (2050), and t represents the year $(t = 1,\ldots,N)$. The comparison of the *SI* with the ratio of expected Social Security revenues to GDP allows studying how sustainable is the pay-as-you-go system. In table 5.4, the value of *the* SI of the base scenario projection for two different discount rates (3% and 5%) is provided.

Table 5.4

BASELINE RESULTS FOR THE *SI* PARAMETER

	Retirement	Disability	Widow	Other Survivors	TOTAL
$d = 3\%$	7.896	1.133	1.430	0.178	10.638
$d = 5\%$	7.284	1.114	1.434	0.174	10.005

Source: Own elaboration.

Insofar as the discount rate reflects the decline of the value of flows throughout time, the higher this is the lower the weight given to future flows. This entails that a scenario for which the projection of future expenditure is characterized by sharp increments will have a value of *the SI* that decreases as the discount rate increases. This applies to all pension categories but widowhood benefits. The reason is the low projected growth for this specific category, which is substantially less than that for the other categories.

As can be observed, the expenditure in retirement pensions would require, according to the simulations, an annual *average* collection for its complete funding of 7.9% of GDP (for $d = 3\%$) or of 7.3% of GDP (for $d = 5\%$), while in fact the effort currently exerted is significantly less, some 5.1% of GDP. If we add the remaining expenditure categories, the need for funding of the contributory pension system would on average be more than 10% of GDP during the projection period (while it is currently 7.7% of GDP). Additionally, this indicator also proves to be very useful when comparing the results of the different sensitivity analyses proposed.

6. SENSITIVITY ANALYSIS

With the aim of studying how sensitive are the results of the base projection scenario to changes in some of the key demographic and macroeconomic variables, four scenarios of sensitivity analysis are established. Firstly, a projection using two alternative hypotheses on productivity growth (higher and lower than that in the base scenario) is implemented. Secondly, a projection under an alternative demographic scenario that makes a zero migration hypothesis, which allows analysing the impacts of migration on the expenditure, is carried out. Thirdly, we propose the projection under a scenario of greater labour market participation and employment of individuals older than 55 years.

6.1. Productivity growth

The hypothesis on productivity used in the base scenario (see graph 4.3) assumed a steadily increasing evolution until 2012 where it would reach annual

growth values superior to 2% to later stabilize around 1.7%. In this exercise the sensitivity of the projection results to two alternative productivity growth hypotheses is analyzed. Under the high productivity hypothesis, the maximum value would reach a 2.4% rate to stabilize around 2%. Under the low productivity hypothesis, the maximum value would be below 2% and remain stable below 1.5%.

Changing the productivity hypothesis affects the evolution of expenditure just for the average pension benefit. More specifically, it affects the evolution of the average pension benefit of the new registrations but leaves invariable the number of pensions. Graph 6.1 presents the evolution of the ratio of total expenditure to GDP under the two alternative hypotheses. The effects of a higher or a lower evolution of productivity cannot be judged until after 2020, which is the necessary delay for the productivity changes to be reflected in the regulating bases for the new pensioners entering the system. As can be observed from the synthetic indicator *SI* in table 6.2, the effects of the changes in productivity are mirrored particularly in the retirement pension expenditure, whereas these effects are a lot less significant for disability and survivors benefits.

6.2. Zero migration

The effects of the migration hypothesis are analysed by projecting the model under the alternative scenario of zero migration. The effects of migration on pension expenditure would be produced both on the number of pensioners and the average pension benefit alike. But, as can be observed in graph 6.1 and Table 6.2, which give the evolution of the expenditure and the results for the *SI* respectively, these effects are surprisingly very limited.

6.3. Greater labour market participation and higher employment of workers older than 55 years

An experiment considering a possible increase in the labour market participation and higher employment of the workers older than 55 years is proposed. This way we pretend to mirror one of the possible effects of an increase in life expectancy along with the impact of a greater quality of life, which would make the expansion of the effective working time viable. Although the retirement age in Spain is 65 years, it is in this respect important to mention that the effective retirement age is on average 62. As is shown in graph 6.1 however, the effect of this hypothesis is also very limited since it hardly alters the course of the events described in the base scenario.

Table 6.1

SENSITIVITY ANALYSIS (*SI* VALUES)

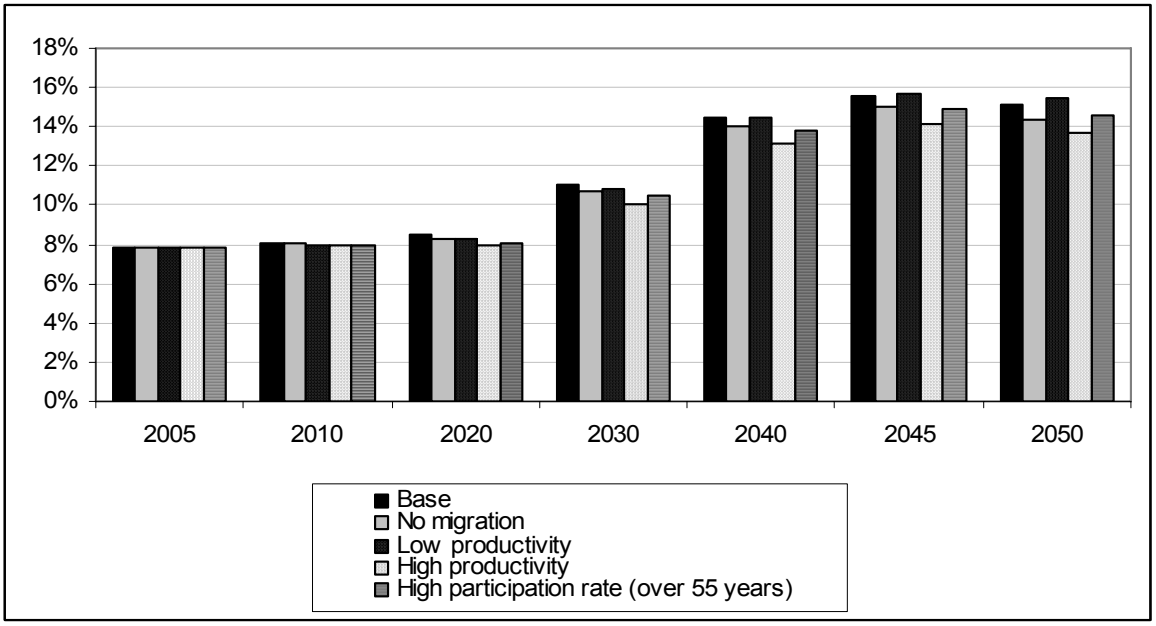
	Retirement	Disability	Widow	Other survivors	TOTAL
Base	7.896	1.133	1.430	0.178	10.638
Low productivity	8.110	1.153	1.475	0.181	10.920
High productivity	7.677	1.113	1.385	0.175	10.350
No migration	7.925	1.114	1.430	0.178	10.647
High participation (over 55 years)	7.843	1.125	1.434	0.177	10.578

Note: The results are obtained assuming a 3% discount rate.

Source: Own elaboration.

Graph 6.1

PENSION SPENDING AS A PERCENTAGE OF GDP UNDER ALTERNATIVE SCENARIOS



Source: Own elaboration.

7. CONCLUSIONS

The need for long-term fiscal projections is self evident. Of these projections, pension expenditures are one of the most important because firstly they represent a large share of total expenditure, and secondly because of the close relationship between this variable and demographic change. In this paper, after a state of the arts exposé, we develop a model to project contributory pensions

expenditures if the Spain Social Security System until 2050. For that purpose we used the last demographic and macroeconomic scenarios developed by Eurostat (2005). The model starts with a decomposition of total expenditure as a product of the number of pensions and the average pension benefit. Later, we undertake a disaggregation by pension category, contribution regime to Social Security, sex, and age cohort.

Among the results obtained, one is of central importance: a substantial increase in total expenditure for contributory pensions is to be expected. This would reach some 15% of GDP around 2050 compared to a barely 8% in 2004. However, three stages are to be differentiated in change. Thus, from 2004 until 2018-2020 approximately, total expenditure as a percentage of GDP would remain basically unchanged, but afterwards we would observe a steady increase until it reaches maximum values around 2045. From that year a gradual downward tendency would set in. Taking into account the fact that important changes in the ratio of average pension benefit to GDP per worker are not foreseen during the projection period, the increase in expenditure would mainly be attributed to the growth of the number of beneficiaries. In fact, the results show clearly that by 2050 the number of pensions would be more than 14 million, compared to barely 8 million in 2004. This important increase is due principally to the expected demographic evolution by age cohorts (in 2050 more than 35% of the population would be 65 years old or more, compared to 16.8% in 2004).

By pension categories, as the projection results show, the evolution of total expenditure is driven by the evolution of retirement pensions. For instance, the coverage rate of retirement pensions (the ratio of the number of pensions to the population 65 years old or more) would increase by more than five percentage points during the projection period and would be around 70% in 2050. Although an increase in the number of beneficiaries for the rest of the pension categories is also expected, this increase, in each and every case, is not important enough so as to make them gain more importance with respect to total expenditure. Retirement pensions in turn gain weight since they would represent almost 72% of total number of pension benefits in 2050, against 58.6% in 2004. Consequently, the expenditure in retirement pensions would be almost 81% of total contributory pensions in 2050, against 66% originally. Meanwhile, total expenditure in all the other categories of pensions would lose weight.

Interesting conclusions are also reached from the analysis of the results by sex. We are referring to both the number of pensions and the average pension benefit. For instance, concerning the total number of pensions (including all categories), contrary to what one would expect, the projection shows a greater increase of the men pensions. Being basically equal at the beginning (with 4 million pensions for both men and women), the number of benefits allocated to men pensions would

be 8 million against 6 million for women in 2050. If we look at each pension type we can see that the initial women retirement pensions, which represented only one third of the total, would grow more than men pensions, yielding an average annual growth rate of 1.86% versus 1.71%, due to the increase in female participation. Nevertheless as an indirect effect of this trend, it is expected that widowhood men pensions grow relatively more (an average annual growth rate of 2.5% is estimated for the number of men pensions, compared to a barely 0.3% for women pensions). Consequently, the absolute increases that are observed in the number of female beneficiaries in all the pension categories would not suffice to inhibit a relative increase of the men pensions. The future entitlement conditions of widow pensions will probably change this result but the projection model needs to stick to constant legislation assumption.

As far as the size of pension benefits is concerned, the model projects important changes in the original differences that exist in the various pension categories by sex. For the widowhood pensions and the rest of pensions to survivors, the 'sex gap' (the difference between the average pension benefit for men and women) is initially favourable to women, whose average pension starts at a level that is 10% superior to that of men. Nonetheless, that gap would disappear before 2012. From that moment average pension benefits by sex would remain very similar, and even the men pensions would be slightly above. This is mainly attributable to the greater proportion of new registrations of men with respect to total number of pensions. This brings the size of the of pension benefit closer to the growth of the contributory bases. For retirement pensions however, the average benefit allocated to men starts by being 60% more than that allocated to women, but at the end of the projection the excess is only 30%. The greater labour market participation of women along with the tendency to wage equality would not be sufficient to bring the size of the benefits by sex closer. The proportion of new registrations to total retirement pension beneficiaries is superior for men (due basically to higher life expectancy of women which keeps them longer time in the system), which, despite a hypothetical equality in the contributory bases, provokes a greater increase of the size of average benefits to men.

The ratio of the present value of the flows of total pension expenditure to the present value of GDP (the value of *kappa*) is frequently used as an indicator to assess the sustainability of public finances. This index is very useful as a synthetic indicator of sustainability as well as to capture variations between the different sensitivity scenarios. In our base scenario (and for discount rates between 3% and 5%), the model forecasts a value for SI superior to 10%.

Regarding the sensitivity analysis, in this paper we have considered how the simulation results vary under changes in: (1) productivity growth, (2) migration, and (3) the labour market participation of individuals of 55 years old or older.

With respect to (1), a greater or lower productivity growth rate hardly has any influence on the results until after 2020. This is due to the fact that the increases in the contributory bases require some time before they have any effect on the new registrations pensions. Assuming a 3% discount rate, a greater (lesser) productivity growth rate reduces (increases) the value of the S_I from 10.6 to 10.3 (10.9). In fact, this is the variable that has the greatest impact on the projection results. As a matter of fact, the hypotheses of no migration and of a greater labour-market participation of the individuals of 55 years old or more hardly influence the value of S_I.

The availability of long-term fiscal projections is a necessary condition for the introduction of reforms in the areas of public action. On the contrary, the lack of these projections can allow necessary reforms to be avoided or deferred. This paper tries to palliate the need to have long-term projections specifically for contributory pension expenditure, which is in absolute term one of the most important rubric of public expenditure in welfare.

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SÍNTESIS

PRINCIPALES IMPLICACIONES DE POLÍTICA ECONÓMICA

The availability of long-term fiscal projections is a necessary condition for the introduction of reforms in the areas of public action. Of these projections, pension expenditures are one of the most important because firstly they represent a large share of total expenditure, and secondly owing to their close relationship with demographic change. In this paper, a model to project contributory pensions expenditures in the Spain Social Security System until 2050 is developed.

A central result emerging from the analysis is that a substantial increase in total expenditure for contributory pensions is to be expected. This would reach some 15% of GDP around 2050 compared to a barely 8% in 2004. However, three stages are to be differentiated. From 2004 until 2018-2020 approximately, total expenditure as a percentage of GDP would remain basically unchanged, but afterwards a steady increase is observed until it reaches maximum values around 2045. From that year a gradual downward tendency would set in. Taking into account the fact that important changes in the ratio of average pension benefit to GDP per worker are not foreseen during the projection period, the increase in expenditure would mainly be attributed to the growth of the number of beneficiaries. In fact, the results show clearly that by 2050 the number of pensions would be more than 14 million, compared to barely 8 million in 2004. This important increase is due principally to the expected demographic evolution by age cohorts (in 2050 more than 35% of the population would be 65 years old or more, compared to 16.8% in 2004).

By pension categories, the evolution of total expenditure is driven by the evolution of retirement pensions. In particular, the coverage rate of retirement pensions (the ratio of the number of pensions to the population 65 years old or more) would increase by more than five percentage points during the projection period and would be around 70% in 2050. Although an increase in the number of beneficiaries for the rest of the pension categories is also expected, this increase, in each and every case, is not important enough so as to make them gain more importance with respect to total expenditure. Retirement pensions in turn gain weight since they would represent almost 72% of total number of pension benefits in 2050, against 58.6% in 2004. Consequently, the expenditure in retirement pensions would be almost 81% of total contributory pensions in 2050, against 66% originally. Meanwhile, total expenditure in all the other categories of pensions would lose weight.

The results may also be used to assess the sustainability of the pension system. An indicator frequently used is the ratio of the present value of the flows of total pension expenditure to the present value of GDP. This indicator is very helpful to analyse the evolution as well as the variations between the different sensitivity scenarios. In the base scenario (and for discount rates between 3% and 5%), the model forecasts a value for the above-mentioned indicator superior to 10%.

Regarding the sensitivity analysis, the paper considers how the simulation results vary under changes in productivity growth, in migration, and in the labour market participation of individuals of 55 years old or older. With respect to changes in productivity growth, a greater or less growth rate hardly has any influence on the results until after 2020. This can be attributed to the fact that the increases in the contributory bases require some time before they have any effect on the new registration pensions. Assuming a 3% discount rate, a greater (lesser) productivity growth rate reduces (increases) the value of the sustainability indicator from 10.6 to 10.3 (10.9). In fact, this is the variable that has the greatest impact on the projection results. As a matter of fact, the hypothesis of no migration and that of a greater labour-market participation of the individuals of 55 years old or more hardly influence the value of the sustainability indicator.

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Junto al original del Papel de Trabajo se entregará también un resumen de un máximo de dos folios que contenga las principales implicaciones de política económica que se deriven de la investigación realizada.

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