Spanish Pension System: Population Aging and Immigration Policy (Preliminary)

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Abstract

There is a widespread consensus, in the literature, that the current Spanish pension system will become unsustainable in the next decades as consequence of the demographic transition. In this article we evaluate the sustainability of the contributory pensions' subsystem, taking into account the demographic projections by the Spanish Statistical Office (INE). A baseline scenario is projected as well as several reforms are simulated, focusing on: (i) selective immigration policy, (ii) changes in the way of fitting the pensions and (iii) increase of the legal age of retirement up to 68. The main results are the following. The current system would not incur deficits until 2018, from then deficits will begin to be accumulated. The expenditure in pensions practically would double (from 8,3 % in 2005 to 17,2 % in 2050). A selective immigration policy -towards to foreign young people- would help, but does not solve the long-term sustainability of the current system. A policy that combines a pensions' growth less than productivity growth and extend the legal age of retirement up to 68 would give solvency to the system beyond 2029.

Keywords: Immigration policy; public pensions; sustainability.

JEL Codes: E62, F22, H55, J61.

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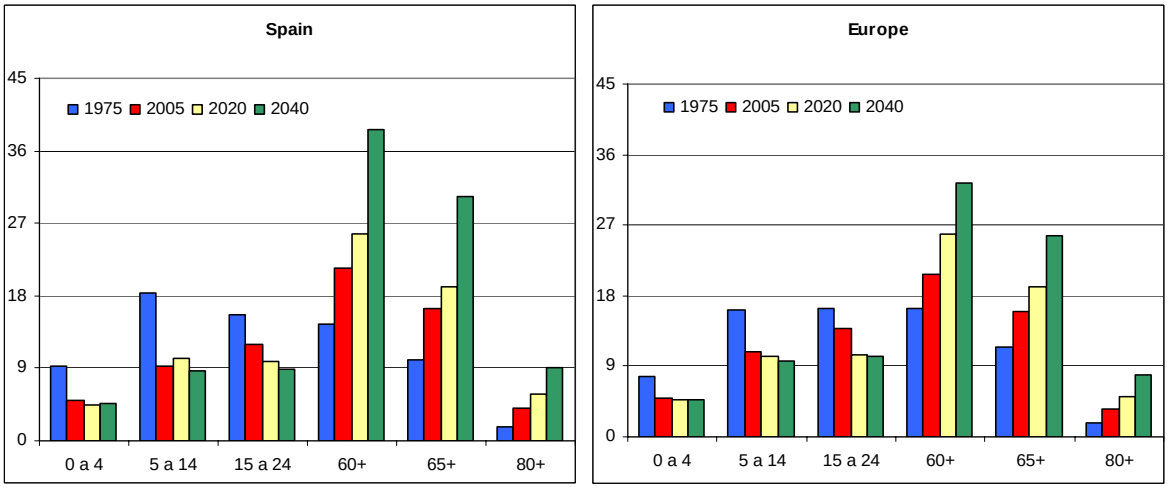
1 Introduction

The population aging problem that faces the majority of the developed countries, especially the Europeans has been well-known. The most important reasons behind of this phenomenon are the increase in life expectancy at birth and the decline in fertility rate. As can seen at Figure 1.1, both for Spain and Europe, it has been foreseen that the older groups of the population would increase their weight in the next decades. One of the main implications of this aging process are the negative effects on the viability of the current pay-as-you-go pensions systems. [1]

Figure 1.1: **Population projections by age groups 2005-2050**
en percentage of the total population



Source: Own elaboration from United Nations data.

The effect of the population aging on pensions has been an intense research topic in Spain. In general the studies conclude that the demographic transition will make the current pensions system unsustainable in long-run.[2] The Spanish case have the particularity that the baby-boom happened ten years later than in the most of European developed countries

[1] Most of European countries have pay-as-you-go defined benefit pensions systems.

[2] See Jimeno (2000), Alonso-Meseguer and Herce (2003), Da-Rocha and Lores (2005), Díaz-Gimenez and Díaz-Saavedra (2006), Gil, López-García, Onrubia, Patxot and Souto (2006), between others.

(between the end of the 1950 and the end of 1970). [3] Therefore, the effects on pensions, consequence of the aging of baby-boom, are expected to begin around the year 2025.

On the other hand, immigration flows towards developed countries has been increasing during the last decades and this process is likely to continue. These immigration flows have been more intense in Spain especially in the last ten years, generating a change in the sociodemographic profile of the society. [4]

There exist at least two elements that make think that immigration flows might attenuate the effects of population aging on pay-as-you-go pension systems. Firstly, immigration increases the working age population and secondly, the reproductive behavior of foreigners, in their countries, is characterized by higher fertility rates than the natives' ones. [5]

As a consequence of the effects mentioned before, the immigration has generated a slowdown of the population aging in Spain. However, the medium and long-term Spanish population projections still continue foreseeing a significant aging. This problem can be synthesized by the old age dependency ratio that in 2005 was $0,25$ and for 2025 and 2045 being estimated $0,32$ and $0,52$ respectively. [6] This is fundamentally a consequence of two facts; firstly, the persons live longer and secondly, the fertility rate will increase but will continue being relatively low.

In addition, it is important to highlight that migratory shock in Spain has been a conse-

[3] In the rest of European developed countries, as in USA the baby-boom happened after the second world war and lasted for the two following decades.

[4] In the period 2000-2005 Spain, between developed countries, was the second recipient economy of immigrants in absolute numbers (behind USA) and the first one in relation to the native population (United-Nations (2006)), with an annual average of 540 thousand immigrants.

[5] The immigrants in Spain are younger than the native population, with an average age of 33 and 41 years respectively. On the other hand, the total fertility rate for foreign women was 2,12 children compared with 1,19 children for Spanish women in 2002(Roig-Vila and Castro-Martín (2007)).

[6] The old age dependency ratio is defined as the number of persons older than 64 years old divided by the number of persons between 16 and 64 years old. The calculations were carried out using the INE population projections ("Hypothesis 1" published on May 16, 2005). These projections assume that the net immigration flows during the period 2006-2050 will be $12,7$ million persons. These the projections will be considered along this work.

quence of the high growth on employment. [7] Therefore, once the economy slows down the migration flows might decrease considerably. In spite of that, the existence of great economic and social disparities between sending and receiving immigration countries together with the accession of less developed economies to the European Union (EU), allows us to anticipate that immigration will continue being one of the most crucial social phenomenon of the 21st century in the European countries.

In this context, different methodologies have been used to investigate the possibility to solve or, at least, revert the effects of the population aging trough a more liberal immigration policy (the acceptance of more immigrants).[8] These works, dealing with the effects on the sustainability of the pensions systems, obtain similar conclusions. The immigration flows can help but not solve the long-term solvency problems. The main arguments that these authors raise are the following: the number of immigrants is reduced in relation to the native population, the solution of the immigration would be transitory due to the fact that the immigrants will generate rights to obtain a pension in the future and, finally, that foreign people assimilate with the native ones, for instance, acquiring their reproductive behavior.

This paper has two main aims. First, we want to analyze the solvency of the current Spanish pension system in light of the migratory shock of the last decade, in particular, until when the current pension system will be sustainable in this new context. Second, we will investigate the effect of different policies on the sustainability of the current Spanish pension system , in medium and long-run. Specially, a selective immigration policy is analyzed, individual and jointly, with a raise in the legal age of retirement and different indexation formulas for the pensions. We will realize a quantitative exercise of demographic projection

[7] More than six million employments were created in Spain between 1996 and 2005 (from 12,9 millions in 1996 to 19 millions in 2005).

[8] This is the main objective of the works like Auerbach and Oreopoulos (1999), United-Nations (2000), Bonin, Raffelhuschen and Walliser (2000), Collado, nigo Iturbe-Ormaetxe and Valera (2004) among others.

in order to analyze how a mix of these policies might affect in the long-run the solvency of the current contributory Spanish pension system keeping the solidarity unchanged.

The selective immigration policy is probably the most interesting one in the sense that it differs from the traditional economic policies. The first paper using a selective immigration as a policy instrument was Storesletten (2000). [9] In this paper by immigration policy is understood the action of granting visas or work permits for foreigners and the selective term implies that it concentrates on individuals with certain characteristics. [10]

The approach of this paper has been called by Jimeno, Rojas and Puente (2006) aggregate accounting models. It is based on projections of the financial situation of the pension system under certain set of assumptions on the demographic evolution as well as on some economic key variables. In this paper we will follow the methodology developed by Blake and Mayhew (2006) that, unlike the works of Jimeno (2000), Alonso-Meseguer and Herce (2003), Da-Rocha and Lores (2005), Gil et al. (2006), quantifies the deficit or surplus of the system in terms of contributors' to the pension system.

We modify the model developed by Blake and Mayhew (2006), introducing heterogeneity in the productivity and in the participation in the labor market between natives and foreigners. Specifically, our model incorporates some of the particularities that the foreigner labor force presents in the Spanish economy, like the minor productivity as well as a grater employment and unemployment rates. The differentiation between immigrants and natives and the simulation separately the demography of these two groups, will allows us to quantify the impact of a selective immigration policy. The calibration of the model is realized in order

[9] Using a OLG general equilibrium model, calibrated for the USA, the author estimated the changes in immigration policies that would make the current US fiscal policy feasible. His main finding was that a selective immigration policy towards individuals with high and medium skills and middle aged (between 35 and 44 years old) could solve the fiscal problems associated with the aging of the baby-boom.

[10] Generally, these policies have as an objective to attract foreigners with medium or high qualifications, as well as to cover the misalignments between supply and demand in the local labor market.

to reproduce some aggregate variables of the current contributory Spanish pension system.

The main findings are the following. The current Spanish pension system will begin to generate deficits from the year 2018. Extending the legal age of retirement up to 68 years and eliminating the possibility of early retirement (between the age of 60 and 65) will postpone the emergence of deficits until 2025. A selective immigration policy will delay the appearance of the shortfalls by a time horizon ranging from a few months up to twenty years, depending on the scenario and whether the immigration policy consists in an increase of 10% or 50 % the INE assumptions. Finally, the adjustments of the pensions above the productivity growth would advance the appearance of the shortfalls, whereas the opposite measure would delays them.

The paper is organized as follows: section two describes the original model and develops an alternative model in order to simulate a selective immigration policy; the third section analyzes the data, justifies the assumptions made and parametrizates the alternative model proposed. Section four presents and analyzes the main simulation results. Section five shows a sensitivity analysis and finally, section six concludes.

2 The Model

The models presented in this section share with other models of aggregate accounting, the concept that a pension system is sustainable as long as the income, obtained through the contributions, is enough to pay the totality of the pensions in the long-run.

2.1 Baseline Model

This model calculates the difference between income and expenditure of the pension system and expresses it in terms of contributors'. In other words, the model estimates the number of average contributors for year that would be needed or exceed (shortfall or surplus- to balance

the budget of the pension system).

Blake and Mayhew (2006) propose the following model to analyze a pay-as-you-go pension system sustainability:

$$S_t = \frac{p_0(1+\dot{p})^t N_{x,t}}{c_0(1+\dot{c})^t y_0(1+\dot{y})^t} - \{M_t^{20-34} a_0^{20-34}(1+\dot{a}^{20-34})^t + \\ M_t^{35-49} a_0^{35-49}(1+\dot{a}^{35-49})^t + M_t^{\geq 50} a_0^{\geq 50}(1+\dot{a}^{\geq 50})^t q_i^{\geq 50}]\} \tag{2.1}$$

Where:

- S_t - shortfall/surplus of contributors' to the pension system;
- p_0 - average value of the pensions in the first period and $\dot{p}$ is the growth rate;
- c_0 - average contribution rate of the system in the first period and $\dot{c}$ is the growth rate;
- y_0 - average wage in the first period and $\dot{y}$ is the growth rate;
- $N_{x,t}$ - number of people above of the age x and receiving a pension in period t;
- M_t^{a-b} - population aged between a and b years;
- a_0^{a-b} - activity rate of the people aged between a and b years in the first period and $\dot{a}^{a-b}$ is the growth rate;

For the initial period the authors use data from the official statistics and then make some assumptions about the growth rates. To obtain the number of people older than the age x (legal age of retirement) that are receiving a pension, the following formula is used:

$$N_{x,t} = \frac{A_t}{2}[x_{m,t} - x(2 - \frac{x}{x_{m,t}})] \tag{2.2}$$

Where:

- A_t - the intercept with the vertical axis from regression equation of the population aged between 50 and 89 against age for year of projection t;

- $x_{m,t}$ - the intercept with horizontal axis from regression equation of the population aged between 50 and 89 against age for year of the projection t, and it is interpreted as the maximum age to which anyone lives for that projection year;

One of the advantages of this approach is that it allows, trough a simple computation, to analyze the effect of different types of policies. The authors list some of them: real pensions amounts, number of pensioners, legal age of retirement, contribution rates, growth rate in real wages and activity rate.

In addition, the innovation and advantage of this model for our propose is that it assesses shortfalls and surpluses of the pensions system in contributors' terms. The output is defined as the number of person-contributor years that would be needed or exceed in order to achieve the solvency to the pension system.

2.2 Modifications to the Baseline Model

Unlike the model developed in the previous subsection (2.1) the following model allows for an additional source of heterogeneity among individuals, concretely, we add their status as immigrants or natives. The heterogeneity is expressed by means of differences in rates of productivity, activity and employment. These modifications are carried out with the aim to build a model more suitable for analyze a selective immigration policy. [11]

On the other hand, in the model we include the Reserve Fund of Social Security (RF), which can be seen as a reserve at the moment to face the shortfalls of the system. The

[11] It is possible to insert additional sources of heterogeneity, but at the cost of addition data, which makes the implementation very difficult.

importance that the RF has gained [12] from 2000 is a consequence of the growth in the contributors to the system since then, which is itself related to the employment growth and the successive immigration regularization process. [13]

The modified model is as follows:

$$S_t = \frac{p_0(1+\dot{p})^t Pens_t}{c_0(1+\dot{c})^t y_0(1+\dot{y})^t} - \{\sum_{i=1}^{2}[M_{t,i}^{20-34} e_{0,i}^{20-34}(1+\dot{e}_i^{20-34})^t q_i^{20-34} + \\ M_{t,i}^{35-49} e_{0,i}^{35-49}(1+\dot{e}_i^{35-49})^t q_i^{35-49} + M_{t,i}^{50-64} e_{0,i}^{50-64}(1+\dot{e}_i^{50-64})^t q_i^{50-64}]\} \tag{2.3}$$

Where:

- i=[1,2] represents the natives y immigrants;
- $Pens_t$ - the number of pensions in t
- $e_{0,i}^{a-b}$ - the employment rate -for natives and immigrants- aged between a and b years and $\dot{e}_i^{a-b}$ are the respective growth rates;
- q_i^{a-b} - the productivity of the workers aged between a and b years;

Unlike the Blake and Mayhew (2006) we calculate the number of pensions -number of pensions in terms of occupied- through the following expression:

$$\frac{Pens_t}{Oc_t} = \frac{Pens_t}{M_t^{>64}} * \frac{M_t^{>64}}{M_t^{20-64}} * \frac{1}{a_t} * \frac{1}{1-\mu_t} \tag{2.4}$$

Where:

[12] The FR arises from one of the recommendations from the Agreement of Toledo in 1996, with the aim to smooth the effects of business cycle. This one began in the year 2000.

[13] The regularization of immigration took place in 1996, 2000, 2001 and 2005. The last regularization was the biggest with 640 thousand authorizations of residence and work granted to the immigrants.

- $\frac{Pens_t}{M_t^{>64}}$ - the coverage rate;

- $\frac{M_t^{>64}}{M_t^{20-64}}$ - the old age dependency ratio;

- a_t - the activity rate;

- μ_t - the unemployment rate;

As previously mentioned, to get a more complete idea of the sustainability of the current Spanish pension system, we include the RF in our simulations. [14]

RF) for the period $t+1$ is calculated as follows:

$$RF_{t+1} = \sum_{t=0}^{t=T} \frac{RF_t(1+r_t)^{t+1}}{c_0(1+\dot{c})^t y_0(1+\dot{y})^t} \tag{2.5}$$

Where:

- RF_t - the fund at the beginning of the period;

- r_t - the market interest rate;

A negative result in equations 2.3 and 2.5 indicates a contributors' surplus whereas a deficit is represented by a positive number.

One of the disadvantages that aggregate accounting models presents, is the increasing data needs as consequence of heterogeneity sources. Especially, the Spanish data for the foreign people still is not so good (probably by the novelty of the migratory phenomenon) which difficult enormously the simulation of selective immigration of policies.

[14]The amount of RF was 19.330,4 million Euros at the beginning of 2005, able to cover a little more than four months of the contributory pensions.

3 Data

For the projection of the expenditure of the Spanish pensions system we have made several assumptions regarding the following issues:

- Population projections;
- Economic projections, labor market and average productivity;
- Institutional factors, relating to the eligibility as a pensioner, the amount of pensions and the RF;

In this section we will firstly present in detail the data used and secondly, justify the assumptions made in the simulation exercises.

3.1 Population projections

Given the aims of this work and the characteristics of the contributory Spanish pension system (pay-as-you-go and defined benefit) the population projections are the key element of the analysis.

The baseline scenario assumes the INE population projections "Hipótesis del escenario 1", which suppose that net migratory flow to Spain will evolve according to the trend of last years until 2010 (2,2 millions between 2005 and 2010) and from 2011 and until 2050 will amount to approximately 275 thousand immigrants per year (inflow of 12,7 millions of immigrants in the period 2006-2050).

Spanish total fertility rate (TFR) has showed a descending trend from 1975 until 1998, passing from 2,8 to 1,16 children per woman. Since then, it has experienced a small growth reaching 1,35 in 2005. This change can be explained, basically, by the increase of immigration flows. The INE projections suppose that the increasing in fertility rate will continue in the

next years (until reaches 1,5 children per woman). [15] Also we assume that all the children that have been born in Spain are natives, despite their parents were foreigners (mother, father or both). [16]

Finally, the INE projections take into account a reduction in mortality rates, which is captured by an increase in the life expectancy at birth by 0,15% and 0,2% for women and men respectively.

The Table 3.1 shows the main assumptions of INE Population Projections.

Table 3.1: **Spanish Population Projections 2005-2050**
Main Assumptions

	Population (thousands)	Net inflows of immigrants (people)	Life expectancy at birth (years)		Average N^0 of children per women
			Men	Women	
2005	42.935	460.132	77,43	84,03	1,33
2006	43.484	417.449	77,62	84,20	1,34
2007	43.995	378.983	77,80	84,34	1,35
2010	45.312	284.874	78,34	84,79	1,40
2020	48.665	279.695	79,84	86,04	1,51
2030	50.878	274.517	80,89	86,92	1,53
2040	52.541	269.338	80,99	87,00	1,53
2050	53.160	264.159	80,99	87,00	1,53

Source: Own elaboration using INE population projections data.

3.2 Economic projections

The economic projections (average labor productivity and economic activity rate) represent the major uncertainty for the prediction of the pensions' expenditure. Therefore, we will carry out a sensibility analysis in the fifth section, to give support to the simulations.

[15] All these levels are very low. The reference TFR of 2,1 is considered as replacement level. This means that on average two children would replace all mothers and fathers, but this occurs only if all the children survive until the reproductive age. An extra 0,1 is needed to compensate the premature mortality and to balance the sex ratio of births.

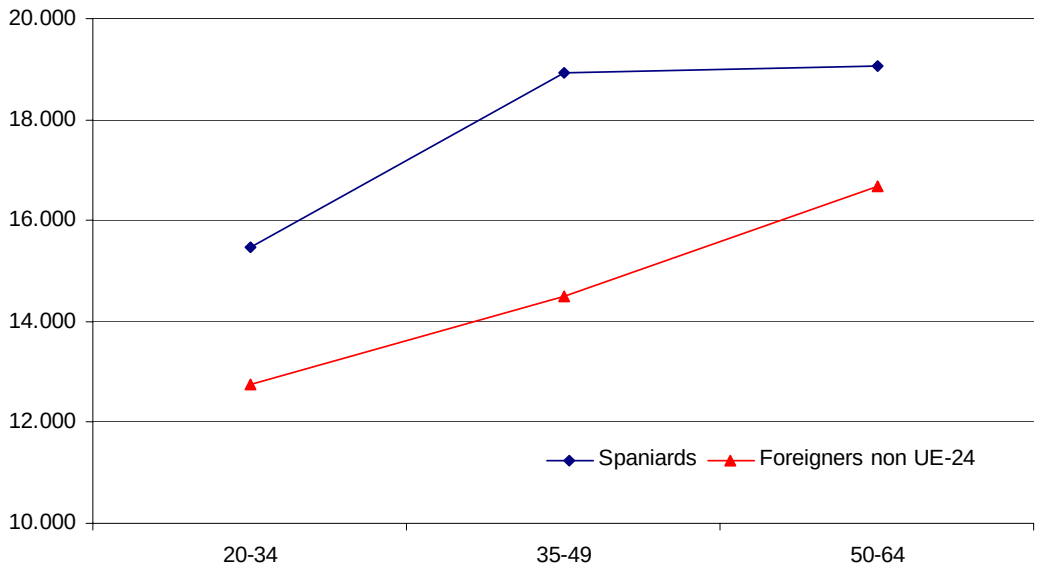
[16] Although the Spanish law derives from the *jus sanguis* principle -in contrast to *jus solis*- a children that has been born in Spain can under certain conditions obtain the Spanish nationality.

3.2.1 Productivity

We approximate the productivity through wages, because, at least in the medium term, the growth of labor productivity is transferred to wages. Consequently the relation between pensions and labor productivity becomes crucial in our analysis. [17]

The wage profiles for the different groups from the population were obtained from the Life Conditions Survey (Encuesta de Condiciones de Vida,INE) of 2005. The monetary benefit of the wage earners and self-employed workers were considered. The gross rents were obtained by means of the methodology developed in Levy and Mercader-Prats (2003). The results for the different population groups are summarized in the Figure 3.1.

Figure 3.1: **Wage Profiles**
Euros



Source: Own elaboration using data from ECV (2005).

To project wages it is necessary to take into account which has happened with activity

[17]The contribution base of the Social Security System is given by the wages bounded by a superior and inferior limit established by the government every period. Due to the difference between wages and contribution bases, the calibration of the wages was made to reproduce the evolution of the RF in 2005 and 2006.

and unemployment rates of the different groups of the population.

We assume that there will be a slow convergence of the activity rate up to the levels observed for the most developed European countries and, we assume that unemployment is reduced reaching the full employment at medium term (2020) (Jimeno (2000) and Alonso-Meseguer and Herce (2003)). The last assumption is based on the fact that, with the retirement of baby-boom generation (beginning of the third decade of the current century) there will be an insufficiency of workers, when the post baby-boom generations will be the base of the active population.

Taking into account the projections of active population and unemployment levels, the employment comes up automatically. As we mentioned before, the number of employees is one of the keys because they are also the contributors to the pension system.

In a recent work Feyrer (2007) studies the relation between demographic structure and productivity, concluding that demographic structure is closely related with productivity and economic growth. Similarly, Bloom, Canning and Sevilla (2001) show that a country with a demographic structure where the working age population has a considerable weight, has an opportunity to capitalize the "demographic dividend" if a right policy environment is established. The more important policy areas include, education, public health, family planning and others policies supporting labor market flexibility, openness to trade, and savings. At the same time, the previous studies present evidence that the workers aged between 35 and 54 years are the most productive.

We assume that the productivity rates will grow in the next years and then stabilize at growth rates of 1,0%. This assumption is based on two following elements. Firstly, the demographic transition of the Spanish economy over the next 15 years will consist in an important increase of proportion of individuals in the most productive age, and secondly,

there will be an increase of public investment in education and Research, Development and Innovation (R+D+i). In other words, the State will create a good environment to capture the "demographic dividend".

From employment and labor productivity evolution is obtained the GDP path. The GDP is expected to growth during the following decade, with growth rates above 2 % until 2020 and then the growth rates is expected to down to a minimum of 1,2 % in 2043.

It is worth to highlight, that the hypotheses adopted here do not aspire to be an exact prediction of the evolution of the Spanish economy. Therefore, our results should be considered as a guide of the macroeconomic tendencies to construct different policy scenarios. The Table 3.2 summarizes the main macroeconomic assumptions of our baseline scenario.

Table 3.2: **Macroeconomic Scenario 2005-2050**
Main Assumptions

	Labor Productivity growth rate	GDP growth rate	Activity Rate	Unemployment Rate
2005	0,3	3,4	73,8	8,8
2010	0,8	2,4	74,3	6,8
2020	1,0	2,4	76,3	4,1
2030	1,0	2,0	78,2	4,1
2040	1,0	1,3	79,4	4,1
2050	1,0	1,6	80,4	4,1

3.3 Pension System

In this section we present the main characteristics of the current Contributory Spanish Pension System. [18]

The Contributory Pension System has a General Regime and five more Special Regimes (see Table3.3). The General Regime includes the majority of workers, the number of affiliates was 12.947.234 at the beginning of 2005, representing 75,4 % of the total. There were

[18] A more detailed description of the System can be found in Jimeno (2000) and Gil et al. (2006).

4.214.686 individuals affiliated in the special regimes [19] by the beginning of 2005, corresponding to 66,7 % of the Special Regime of Self-Employed workers, which reflects the small weight of the others regimes (see Table3.3).

Table 3.3: **Social Security Affiliates be Regimen**

In thousands and percentage, data 31/12/2004

	Gral.Reg.	Self-Emp.	Agrarian		Sea Work.		Coal	Dom. Work.	Total
			w.-ear.	S-Emp.	w. ear.	S-Emp.			
Affiliated	12.947	2.881	790	279	53	16	11	184	17.162
Percentage	75,4	16,8	4,6	1,6	0,3	0,1	0,1	1,1	100,0

Source: Social Affairs and Labor Ministry (MTAS).

The System covers various types of contingencies: permanent disability, retirement, widow, orphan and family pensions. Each type of benefit has their eligibility rules (age, years of contribution, degree of disability, etc). Inside each regime, the retirement benefit is most important. The retirement pensions represented at the beginning of 2005 58,5% of the whole of the contributory system (see Table 3.4).

Table 3.4: **Types of Pensions and amounts**

In thousands and Euros, data 31/12/2004.

Permanent Disability		Retirement		Widow	
Number	Av.Pens.	Number	Av.Pens.	Number	Av.Pens.
828,1	671,2	4634,7	654,9	2153,6	434,3
Orphan		Family Pensions		Total	
Number	Av.Pens.	Number	Av.Pens.	Number	Av.Pens.
263,9	252,3	40,5	331,4	7920,7	581,6

Source: Social Affairs and Labor Ministry (MTAS).

The contributory ordinary retirement pension is obtained if the following conditions are

[19] Self-Employed, Agrarian (Self-Employed and wage earners workers), Sea workers (Self-Employed and wage earners workers), Coal and Mining and Domestic Employees.

fulfilled:[20]

- 65 years old
- a minimum of 15 years of contribution, at least two years in fifteen years prior to the year of retirement.

Also, there is a possibility to obtain a pension at age of 60 (early retirement or partial retirement) when complying with certain special requirements.

The pension (P_t) is determined applying the replacement rate [21]to the Regulating Base (RB henceforth). The RB is calculated from the monthly contributions of the previous 15 years. Concretely, from the quotient of the contributions of the 180 months immediately prior to retirement by 210 (15 years multiplied by 14 payments per year). In order to calculate the ordinary pension retirement the following formula is used:

$$P_t = \alpha_n RB \tag{3.1}$$

Where α_n represents the replacement rate, that depends on the contribution years.

$$\alpha_n = \begin{cases} 0, & \text{if n} < 15 \\ 0.5 + 0.03 * (n - 15), & \text{if } 15 \leq \text{n} < 25 \\ 0.8 + 0.02 * (n - 25), & \text{if } 25 < \text{n} < 35 \\ 1, & \text{if n} \geq 35 \end{cases} \tag{3.2}$$

The pension completes 100 % of the RB with 35 years of contribution. The people retiring with less than 35 years of contributions suffer a penalty that varies between 2 and 3 % per

[20]Special Regimes has different requirements and benefits that could vary depending on the socioeconomic activity.

[21]The quotient between the pension and the earnings before retirement.

year (see formula 3.2). In addition, there is an incentive for later retirement. People aged at least 65 years and contributing for at least 35 years receive an additional 2 % for every complete year of contribution.

The calculation of the other benefits of the system is quite different. The widows' pension vary from the 52 % until 70% of the RB; the orphans' pension is 20 % of the RB for each child with right to perceive it.

In addition to have reached 60 years, in order to apply for the early retirement, the worker must have been contributor in an mutual employment before January 1^{st} of 1967. [22]

As in the early retirement case the workers with 60 years or more may apply for the partial retirement. This type of retirement is accompanied with a part time contract, with a smaller wage. Depending on the age of the worker (less or more than 65) the new contract may be or may not be related with a relief contract. [23]

Financing of the contributory pension system is made through the workers' contributions. These contributions are a fixed proportion of the contribution base (the total wages except the amount of extra hours, between a minimum and a maximum that depends on the professional category to which the worker belongs). The rate of contribution varies according to the regimes. The rate is 28,3% in the General Regimen (consisting of 23.6 % paid by the employer and a 4,7% by the worker. In our work, we consider a weighted average of the different regimes rates of contribution, resulting in an average rate of contribution of 27 % for the whole system.

[22]Workers who decide for this option, have the pension reduced by 8% per each year below 65. The coefficient of the penalty gradually decreases if the worker has contributed fore more than 30 years until a maximum of the 6% when he has contributed for more than 40 years of contributions.

[23]For details on the requirements to obtain pension see INSS (2006).

4 Simulation Results

Having presented the main characteristics of the contributory Spanish pension system and having discussed the main assumptions about the macroeconomic and demographic variables, we are now ready to present the simulation results.

We present only the results for the policies that showed the more interesting outputs according the objectives of this study, the effects of a selective immigration policy.

The results are presented in two blocks, each of one was simulated under three hypotheses of immigration flows and three hypotheses of pensions adjustments, obtaining in total eighteen scenarios. Both blocks have differences in the legal age of the retirement, then we will simulate one block without a reform and another one with a reform in the legal age of retirement.

The model with the INE immigration assumptions was simulated and it was also assumed an immigration flow 10 % and 50% greater than the INE assumption. The selective component of the policy refers to the age of immigration, cohorts concentrated in ages between 20 and 35 years old. Three variants was simulated with regard to the pensions indexation. First, consist in pension increase equal to the productivity growth, and the other two scenarios assume that the pensions increase 0,25% above and below productivity growth. The complete results of the simulated scenarios appear in the Tables in Annex A.

Block without Reform The simulations were made under the following assumptions: the economy reaches the full employment in 2020 (unemployment rate around 4%) and then remains at this rate until the end of the period; the activity rate grows from 74% in 2005 up to 80 % in 2050, which implies an increase in the active population from 20 millions in 2005 until a maximum of 23,4 millions in 2030 and then fall down to 22

millions in 2050; [24] the productivity, that at the moment scarcely grow, will increase from 0,3% in 2005 until 1,0 % in 2015 and then remains constant until end of the period; the coverage rate (number of pensions divided by population over 64) remains constant at the current level of 1,1 until 2015 and from 2016 it begins to grow until reaching 1,15 in 2020, after that remains stable until the end of the period.

Block with Reform We add the following assumptions to the previous ones. The legal age of retirement will increase gradually from 2015, three months every year, until reaching the age of 68 in 2027. Also, we assume that, from 2021, the coverage rate will start growing linearly from 1,15 until 1,18 in 2027.

The Figure 4.1 shows the results of contributors' shortfall/surplus and the evolution of the RF for the nine scenarios without reform.

The results of the baseline scenario simulation (block without reform, selective immigration policy and with pensions adjustments equal to the productivity growth) suggest that the current Spanish pension system will be sustainable until 2018. From this year there would be an increasing contributor shortfall, reaching 13,6 millions of contributors at the end of the period. This result is not contradicted with the existence of a considerable demographic problem, but it implies that there is time to process the changes caused by the migratory *shock* of the last ten years. For instance, to update the population projections and design a reform in order to give sustainability to the pension system.

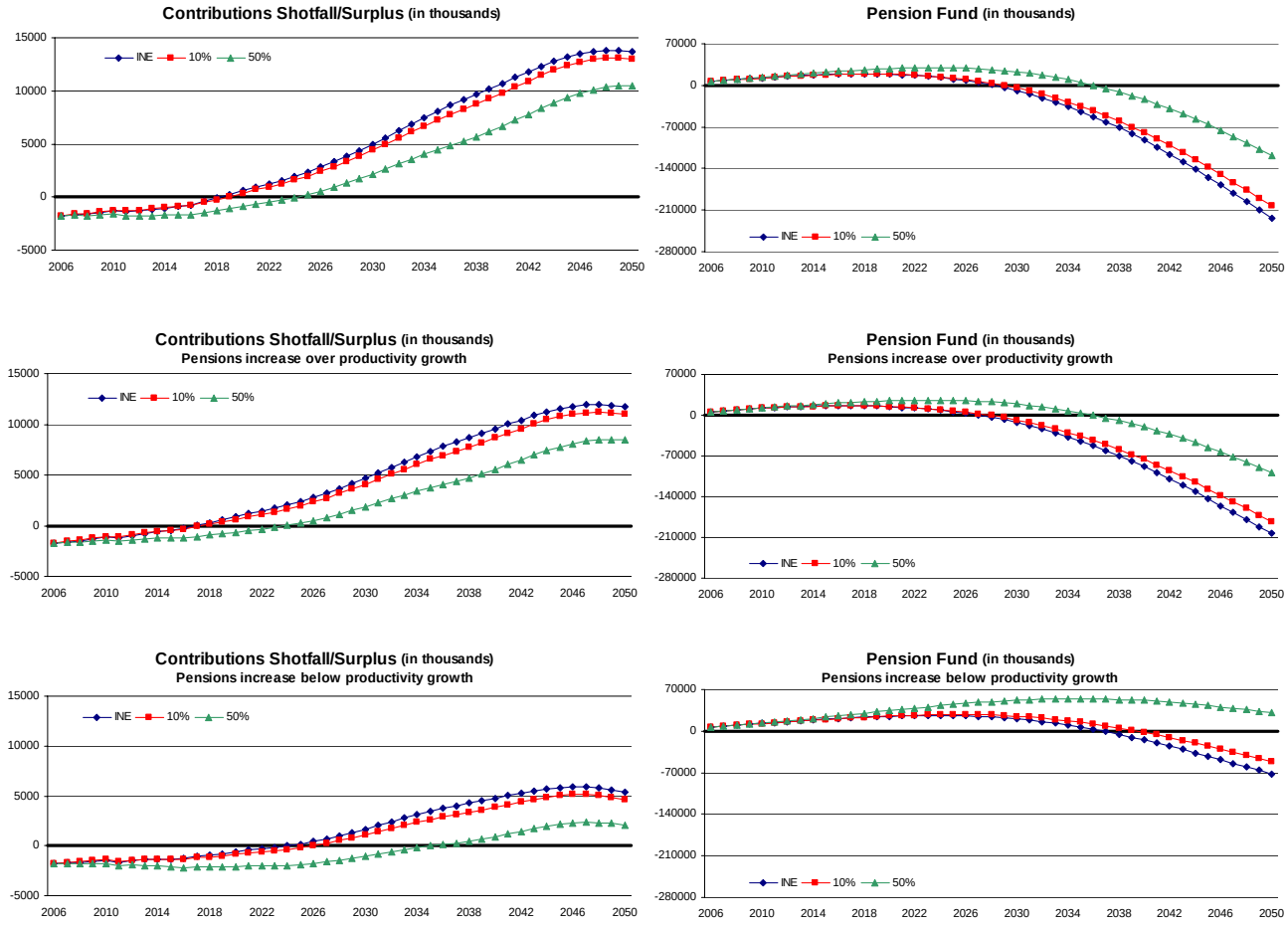
On the other hand, a selective immigration policy of young people (between 20 and 34 years) would improve the sustainability, delaying the appearance of the shortfalls some months and six years, depending on the increase on immigration, 10 or 50 %.[25]

[24] We allow for unemployment and specific activity rates for individuals aged between 20 and 64.

[25] At least two elements must be taken into account when assuming an entrance of immigration 50 % higher

Figure 4.1: **Contributors' Shortfall/Surplus Projections and Reserve Fund 2005-2050**

In thousands



Source: Own elaboration.

When we simulate that the pensions increase over the productivity growth, the shortfalls appear even before. Concretely, two years for the simulations with the INE assumptions and one year in both 10% and 50 % greater immigration.

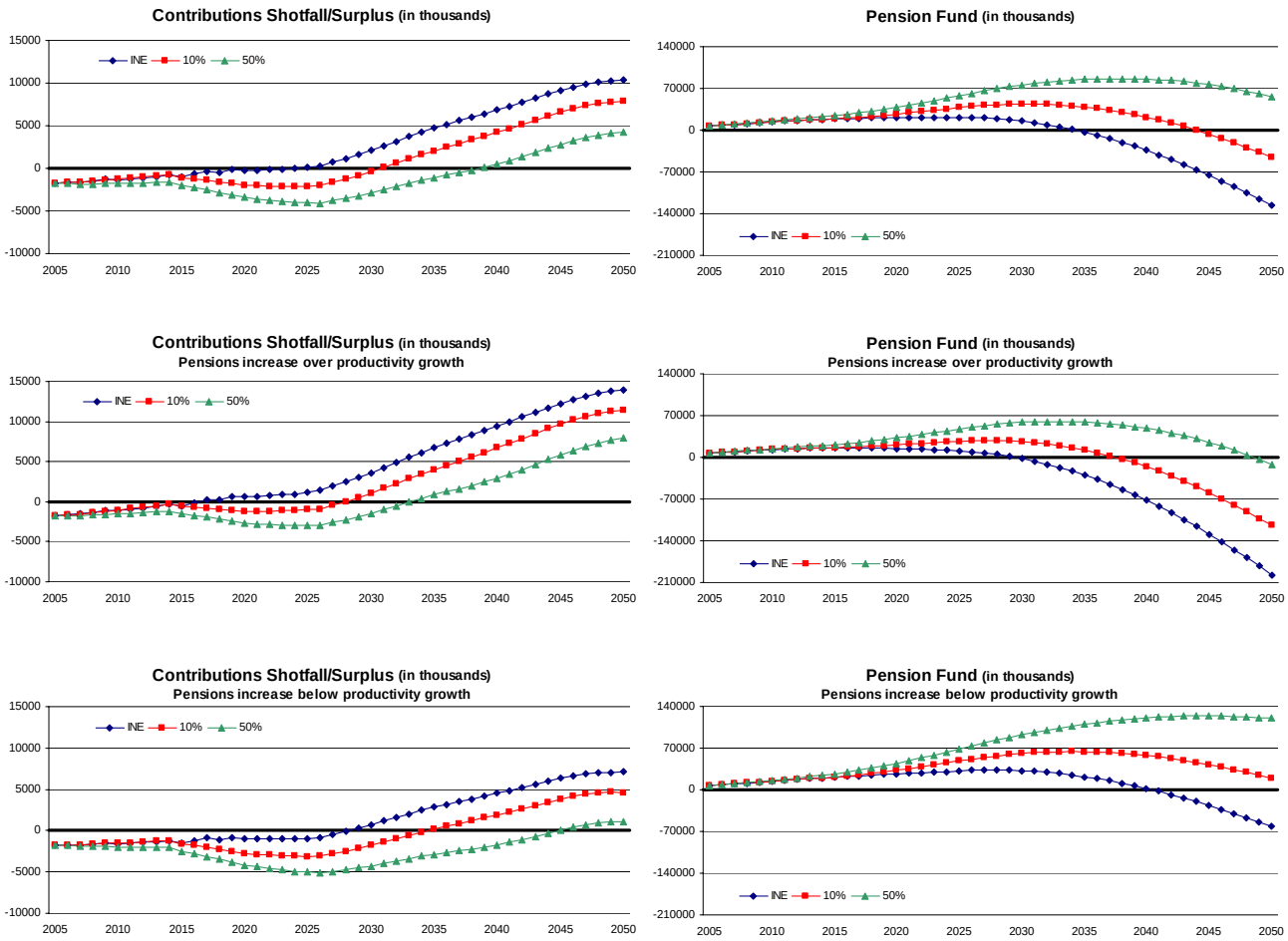
The results change drastically in the scenario assuming a decrease in relative purchase power parity of the pensioners. The emergence of the contributor shortfall is delayed by five, seven and eleven years, for the three cases mentioned before, respectively. From 2025 the baby-boomers will start to retire incrementing the number of pensions.[26] The increase of the

than the INE assumption. Firstly, the unemployment rate is about 5% in long-run. Secondly, this model does not allow for general equilibrium effects, specifically over wages.

[26]Between 2025 and 2040 the number of pensions el increase from 12 to 16,9 million, whereas in 2010 the

Figure 4.2: **Contributors' Shortfall/Surplus Projections and Reserve Fund 2005-2050 (Legal age of retirement 68)**

In thousands



Source: Own elaboration.

pensions under the productivity growth will diminish the pressures on the pension system accounts. Whereas, increase the pensions over the wage growth produces the opposite effect.

Figure 4.2 shows the scenarios with a reform in the legal age of retirement. In all the cases the effects of the reform are positive to give solvency to the pension system. In particular, the reform in the baseline model delays the appearance of the shortfall by seven years and when a selective immigration policy is assumed the insufficiency of contributors does not appear until 2031 and 2039, depending on the increase of immigration by 10% or 50 % more than the INE assumptions.

pensions will be around 8,5 million.

The decrease of the relative purchasing power parity of the pensioners (in addition to the reform) have stronger effect on the social security accounts than in the case without reform. Concretely, the system would begin to generate deficits from 2029 and when a selective immigration policy is simulated the solvency would be assured until 2035 and 2045, for 10 and 50 %, respectively.

The Figures 4.1 and 4.2 also shows a RF simulation for each scenario. All the graphics confirm that it will grow in the next years. For instance, in the baseline scenario the RF accumulated during the surplus period will be enough to finance the pensions ten more years since the shortfall appears. Consequently, a debt would begin to be accumulated. With a selective immigration policy the RF accumulated allows for financing of deficits until 2028 and 2036 in the 10 % and 50 % cases. In the scenarios with reform, the fund will be enough to finance the pensions until 2035. When a selective immigration policy is considered, the RF will be enough to finance the pensions until 2044 and the end of the period of analysis in the two cases mentioned before.

The pattern of the evolution of the pensions' expenditure as a percentage of GDP, with an explosion from 2025, is similar in all the scenarios. In particular, the increase in pensions' expenditure would be 2,1 percentage points between 2005 and 2025 on the baseline scenario simulation, whereas in the later twenty years (period 2026-2045) the increase would be 5,8 percentage points.

5 Sensibility Analysis

In this section we show the results of a sensitivity analysis of assumptions made on two of the main parameters of the baseline scenario; the coverage rate and the labor productivity growth. Six alternative scenarios for each case will be showed, taking into account the

selective immigration policies. The main results are summarized in the Table 5.1.

5.1 Coverage Rate

The Baseline scenario presupposes that the coverage rate grows from 1,1 in 2016 until 1,15 in 2020 and then remaining constant until 2050. The two alternative scenarios proposed here are the followings, one with low and other with high coverage rate. The first one considers that the coverage rate remains constant at 1,1 throughout the whole period. The second one assumes that the growth of the baseline scenario will continue until reaching 1,2 in 2025 and then remains at this level. The results are consistent in all the scenarios. In particular, the shortfalls appear earlier or later which a higher or a lower or a higher coverage rate respectively. These results are coherent with a decrease or an increase in the pensions expenditure and with a deficit at the end of the period.

Table 5.1: **Sensibility Analysis**

	Deficit from year	2050 deficit thousands	Pens. Expenditure/GDP percentage
Base	2018	13.569	17,2
Base 10%	2018	12.807	16,6
Base 50%	2024	10.484	14,9
Low coverage rate	2020	12.094	16,4
Low coverage rate 10%	2022	11.326	15,8
Low coverage rate 50%	2027	8.987	14,2
High coverage rate	2018	15.043	17,9
High coverage rate 10%	2018	14.288	17,3
High coverage rate 50%	2022	11.980	15,5
Low productivity growth	2016	20.943	17,1
Low productivity growth 10%	2016	20.215	16,5
Low productivity growth 50%	2019	17.970	14,7
High productivity growth	2020	7.679	17,3
High productivity growth 10%	2022	6.891	16,6
High productivity growth 50%	2029	4.506	14,9

Source: Own elaboration.

5.2 Labor Productivity Growth

For the sensitivity analysis of the labor productivity growth we also assumed two alternative scenarios, one with lower and other with higher growth with respect to the baseline assumptions. The baseline scenario supposes that productivity will grow progressively from the current 0,3 % until reaching 1,0 % in 2015 and then would remain stable until 2050. In the low growth scenario we assume a growth rate reaching 0,5 % in 2015 and remaining at that level until the end of the period. The second scenario deems a more rapid growth reaching 1,5 % in 2015 and remaining constant from 2015 until 2050. Both scenarios again show coherent results. In the low growth scenario the financing necessities appears earlier and later in the case of high growth. These results are compatible with greater or smaller deficits at the end of the period respectively. The pensions' expenditure, was inferior in the low growth simulation than in the baseline scenario and superior in the high growth one.

6 Final Comments

The increasing migratory flows during the last years have become in developed countries an issue of intense debate. At the same time, the demographic evolution in these countries have been marked by low fertility rates and an increase in life expectancy at birth. The sustainability of pay-as-you-go pension systems led many countries to propose more liberal migratory policies as an alternative to parametric or structural reforms of the pension systems. Given the previous fact, our analysis has focused on the effects of a selective immigration policy and parametric reforms on the long-term sustainability of the contributory pension system that currently exists in Spain.

All the simulated scenarios confirm that the current pension system is unsustainable in the long-run. Concretely, our projections indicate an explosion of the ratio of pensions' expendi-

ture to GDP from 2025, which coincide with the retirement of baby-boom the generation.

In spite of the long-run unsustainability, the problems are not immediate, and a structural reform would not have to be urgent. It would be perhaps prudent to wait for more stable demographic scenario, especially with regard to the migratory flows, to implement some partial or structural reforms.

A selective immigration policy improves considerably the sustainability of current contributory pension system in Spain. Although this policy does not provide a long-term solution, it will delay the emergence of the shortfalls. It is important to notice that increasing the pensions bellow productivity growth, which surely would offer a greater resistance at the moment of it implementation, have similar effects in terms of sustainability. In other words, this policy individually considered is not a long-term solution. Similar results were obtained by extending the legal age of retirement until 68 years. For the previous reasons, the migration policy must be considered as a real alternative to the traditional economic policies.

However, a reform that combines a delay in legal age of retirement with a growth of pensions 0,25% under productivity growth and a selective immigration policy (of 50 %) is the only one scenario analyzed that guarantees the long-term sustainability of the current pension system.

The sensitivity analysis shows coherency with the results assuming a greater robustness of the results of the simulated model.

Finally, it is important to stress some of the limitations inherent to our methodology. Due to the assumptions on the long-term projections, the results presented in this paper shall not be taken as precise estimations but rather tendency indicators. Moreover, this methodology does not take into account the general equilibrium effects, in particular, the effects of immigration on wages. Last not the least, in order to present the model we have made

some simplifications, considering some of the main characteristics of the current contributory pension system.

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A Annex

Table A.1: **Projections 2005-2050: Spanish Contributory Pension System**

Baseline Scenario

INE Projections								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.564	9.401	10.748	13.437	16.755	18.846
Pensions' Expenditure/GDP	8,3	8,3	8,2	8,6	9,5	11,6	14,8	17,3
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.659	-1.429	-740	978	4.382	8.348	9.044
accumulated (*)	-6.247	-7.933	-13.892	-19.161	-17.840	8.870	76.945	171.801
10% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.138	8.673	9.512	10.828	13.488	16.754	18.958
Pensions' Expenditure/GDP	8,3	8,3	8,3	8,6	9,4	11,3	14,3	16,7
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.601	-1.318	-799	705	3.772	7.457	8.262
accumulated (*)	-6.247	-7.875	-13.450	-18.621	-18.264	3.926	63.412	150.241
50% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.138	8.673	9.512	10.828	13.488	16.914	20.032
Pensions' Expenditure/GDP	8,3	8,3	8,1	8,3	8,8	10,2	12,5	14,9
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.701	-1.767	-1.679	-648	1.460	4.398	5.891
accumulated (*)	-6.247	-7.975	-14.864	-23.601	-29.132	-25.863	4.994	63.497

Note: (*) These values are expressed in thousands

Table A.2: **Projections 2005-2050: Spanish Contributory Pension System**

Baseline Scenario with pensions growth $0,25\%$ above productivity growth

INE Projections								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.564	9.401	10.748	13.437	16.755	18.846
Pensions' Expenditure/GDP	8,3	8,3	8,3	8,9	9,9	12,3	16,1	19,3
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.618	-1.203	-302	1.196	5.172	10.008	11.484
accumulated (*)	-6.247	-7.891	-13.227	-16.317	-13.416	17.979	98.834	215.247
10% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.138	8.673	9.512	10.828	13.488	16.754	18.958
Pensions' Expenditure/GDP	8,3	8,3	8,4	8,9	9,8	12,0	15,5	18,6
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.560	-1.090	-356	924	4.564	9.113	10.713
accumulated (*)	-6.247	-7.834	-12.778	-15.744	-13.794	13.100	85.330	193.781
50% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.138	8.673	9.512	10.828	13.488	16.914	20.032
Pensions' Expenditure/GDP	8,3	8,3	8,2	8,5	9,2	10,9	13,6	16,7
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.660	-1.541	-1.242	-433	2.229	6.011	8.368
accumulated (*)	-6.247	-7.934	-14.195	-20.751	-24.715	-16.860	26.360	106.328

Note: (*) These values are expressed in thousands

Table A.3: **Projections 2005-2050: Spanish Contributory Pension System**

Baseline Scenario with pensions growth $0,25\%$ below productivity growth

INE Projections								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.564	9.401	10.748	13.437	16.755	18.846
Pensions' Expenditure/GDP	8,3	8,2	8,1	8,5	9,2	10,9	13,5	15,4
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.700	-1.651	-1.283	-418	2.014	5.012	5.071
accumulated (*)	-6.247	-7.974	-14.554	-21.514	-25.473	-18.545	20.026	76.786
10% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.138	8.673	9.512	10.828	13.488	16.754	18.958
Pensions' Expenditure/GDP	8,3	8,3	8,2	8,4	9,1	10,6	13,0	14,9
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.643	-1.543	-1.348	-701	1.400	4.127	4.272
accumulated (*)	-6.247	-7.917	-14.118	-21.001	-25.966	-23.645	6.415	55.042
50% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.138	8.673	9.512	10.828	13.488	16.914	20.032
Pensions' Expenditure/GDP	8,3	8,2	8,0	8,1	8,5	9,6	11,4	13,3
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.743	-1.991	-2.221	-2.027	-846	1.155	1.859
accumulated (*)	-6.247	-8.016	-15.528	-25.957	-36.722	-52.838	-50.528	-29.925

Note: (*) These values are expressed in thousands

Table A.4: **Projections 2005-2050: Spanish Contributory Pension System**

From 2015 the legal age of retirement increase until 68 years (three months per year)

INE Projections								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.564	9.269	9.856	11.429	14.438	16.918
Pensions' Expenditure/GDP	8,3	8,3	8,2	8,5	8,9	10,0	12,5	15,4
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.651	-1.374	-1.029	-203	1.104	4.366	6.258
accumulated (*)	-6.247	-7.924	-13.741	-18.923	-20.665	-20.095	10.654	68.810
10% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.673	9.378	9.914	11.394	14.255	16.846
Pensions' Expenditure/GDP	8,3	8,3	8,3	8,4	8,3	9,0	11,3	13,9
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.670	-1.265	-1.094	-1.994	-1.402	1.745	3.815
accumulated (*)	-6.247	-7.944	-13.851	-18.948	-27.110	-48.886	-44.616	-11.748
50% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.673	9.378	9.914	11.394	14.291	17.564
Pensions' Expenditure/GDP	8,3	8,2	8,1	8,1	7,8	8,2	10,0	12,3
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.774	-1.735	-2.020	-3.424	-3.887	-1.871	272
accumulated (*)	-6.247	-8.047	-15.321	-24.164	-38.530	-80.509	-107.989	-112.523

Note: (*) These values are expressed in thousands

Table A.5: **Projections 2005-2050: Spanish Contributory Pension System**

From 2015 the legal age of retirement increase until 68 years with pensions growth $0,25\%$ above productivity growth

INE Projections								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.564	9.269	9.856	11.429	14.438	16.918
Pensions' Expenditure/GDP	8,3	8,3	8,3	8,7	9,2	10,6	13,7	17,2
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.609	-1.149	-539	572	2.536	6.686	9.401
accumulated (*)	-6.247	-7.883	-13.075	-16.316	-14.710	-2.927	47.288	133.867
10% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.673	9.378	9.914	11.394	14.255	16.846
Pensions' Expenditure/GDP	8,3	8,3	8,4	8,6	8,6	9,6	12,4	15,6
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.629	-1.037	-599	-1.218	14	4.018	6.922
accumulated (*)	-6.247	-7.903	-13.182	-16.314	-21.116	-31.747	-8.372	52.503
50% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.673	9.378	9.914	11.394	14.291	17.564
Pensions' Expenditure/GDP	8,3	8,2	8,2	8,3	8,1	8,8	10,9	13,8
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.732	-1.508	-1.529	-2.659	-2.503	337	3.383
accumulated (*)	-6.247	-8.006	-14.654	-21.546	-32.590	-63.642	-72.545	-49.461

Note: (*) These values are expressed in thousands

Table A.6: **Projections 2005-2050: Spanish Contributory Pension System**

From 2015 the legal age of retirement increase until 68 years with pensions growth $0,25\%$ below productivity growth

INE Projections								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.564	9.269	9.856	11.429	14.438	16.918
Pensions' Expenditure/GDP	8,3	8,3	8,1	8,2	8,6	9,4	11,5	13,7
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.692	-1.597	-1.508	-952	-245	2.235	3.442
accumulated (*)	-6.247	-7.965	-14.402	-21.491	-26.481	-36.577	-23.895	8.526
10% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.673	9.378	9.914	11.394	14.255	16.846
Pensions' Expenditure/GDP	8,3	8,2	8,2	8,2	8,0	8,5	10,4	12,4
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.711	-1.491	-1.579	-2.743	-2.736	-343	1.032
accumulated (*)	-6.247	-7.985	-14.515	-21.542	-32.964	-65.342	-78.803	-71.294
50% Increase in immigration aged between 20 and 35								
	2005	2006	2010	2015	2020	2030	2040	2050
Number of pensions (*)	7.913	8.100	8.673	9.378	9.914	11.394	14.291	17.564
Pensions' Expenditure/GDP	8,3	8,2	8,0	7,9	7,5	7,7	9,1	11,0
Contributors' Shortfall/Surplus								
annual (*)	-1.774	-1.815	-1.959	-2.501	-4.163	-5.190	-3.899	-2.515
accumulated (*)	-6.247	-8.088	-15.983	-26.742	-44.331	-96.705	-141.428	-170.967

Note: (*) These values are expressed in thousands