Hacienda Pública Española / Revista de Economía Pública, 195-(4/2010): 37-64

Spanish pension system: Population aging and immigration policy

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Recibido: Enero, 2010
Aceptado: Octubre, 2010

Abstract

There is a widespread consensus in the literature that, as a consequence of the demographic transition, the current Spanish pension system will become unsustainable in the decades coming. In this article we evaluate the sustainability of the contributory pension sub-system, 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) an immigration policy, (ii) changes in the way of adjusting the pensions and (iii) increase of the legal age of retirement up to 68. The main results are the following. The current system will not incur deficits until 2022, from this point onwards deficits will begin to be accumulated. The expenditure on pensions in terms of GDP will increased from 8.3% in 2009 to 17.0% in 2049. An immigration policy –aimed at foreign young people– would help, but would not ensure the long-term sustainability of the current system. A policy that combines pension growth at a pace lower than productivity growth and extends the legal age of retirement up to 68 would give solvency to the system beyond 2028.

Keywords: Immigration policy; public pensions; fiscal sustainability.

JEL classification: E62, F22, H55, J61

1. Introduction

The population aging problem facing the majority of the developed countries, especially European ones, is widely acknowledged in policy and academic circles. The most important reasons for this phenomenon are the increase in life expectancy at birth and the decline in the fertility rate.

* I gratefully acknowledge the insightful comments and suggestions received by Miguel Ángel López García and Juan Francisco Jimeno and two anonymous referees. I also acknowledge the financial support of the Spanish Science and Technology System (project SEJ2006-04444) and the Catalan Government Science Network (project 2009 SGR 600 and *Xarxa de Referència d'R+D+I en Economia i Polítiques Públiques*).

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The European Commission (2009), forecasts that the older groups of the population will increase their weight in the coming decades in both Spain and Europe. One of the main implications of this aging process is the negative effect on the viability of the current pay-as-you-go pension systems. [1] In addition, public pension schemes have been severely affected by the current financial and economic crisis. High unemployment and lower earnings will reduce the contribution revenue of pension systems, worsening the long-term sustainability of pay-as-you-go schemes. In that sense, the crisis both highlights and exacerbates the long-term problems faced by many developed countrie's pension systems due to population aging. [2]

The effect of population aging on pensions has been, and continuous to be, a subject of intense research in Spain. Despite the differences in assumptions and methodologies, in general, the studies conclude that the demographic transition will make the current pensions system unsustainable in the long-term. Therefore, they conclude that it is essential carry out reforms regardless of the demographic and economic scenario considered (see Jimeno (2000), Alonso-Meseguer and Herce (2003), Da-Rocha and Lores (2005), Díaz-Giménez and Díaz-Saavedra (2006), Balmaseda del Campo *et al.* (2006), Gil *et al.* (2007) and Jimeno *et al.* (2008) among others). [3] The Spanish case has the particularity that the baby-boom happened ten years later than in most of European's developed countries (between the end of the 1950s and the end of the 1970s). Therefore, the negative effects on Spanish pensions, as a consequence of the aging of the baby-boomers, are expected to begin around the year 2025. In addition, the Spanish economy underwent an important contraction in 2009 and their labour market has been one of the most affected –between developed countries– by the current economic crisis.

On the other hand, immigration flows towards European countries have been increasing in recent decades, and this process is likely to continue. These immigration flows have been particularly intense in Spain, especially in the last ten years, generating a change in its socio-demographic profile. [4]

There are at least two elements that suggest 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 behaviour of foreigners, in their countries, is characterized by fertility rates that are higher than those of the native population. [5]

As a consequence of these effects, immigration has slowed down population aging in Spain. Nonetheless, the medium- and long-term Spanish population projections still continue to forecast a significant aging process. This problem can be expressed clearly through the old age dependency ratio. While in 2009 it was 0.26, the estimations for 2029 and 2049 suggest ratios of 0.40 and 0.65 respectively. [6]

On the contrary, other elements suggest that is not possible the solution of population aging through increasing immigration flows. Firstly, the number of immigrants is low in relation to the native population; secondly, the solution of immigration would be transitory due to the fact that the immigrants will generate rights to pensions themselves in the future; and finally, foreign people assimilate with the natives, for instance, by acquiring their reproductive behaviour.

In this context, various methodologies have been used to investigate the possibility of solving or, at least, mitigating the effects of population aging through a more liberal immigration policy involving the acceptance of higher number of immigrants. [7] These studies, which deal with the effects on the sustainability of pension systems, obtain similar conclusions: immigration flows can help, but not solve, the long-term solvency problems.

This paper has two main aims. First, we want to analyze the solvency of the current Spanish pension system in the light of the migratory shock of the last decade. In particular, we want to estimate how long the current contributory pension system will remain sustainable in this new context. Second, we will investigate the effects of different policies on the sustainability of the current Spanish pension system, in the medium and in the long-term. Specifically, an immigration policy is analyzed, individually and jointly, with other parametric policies such as raising in the legal age of retirement and different indexation formulas for pensions. [8]

The immigration policy is a novel step for the Spanish case, and it is probably the most interesting one in the sense that it differs from traditional policy reforms. The first paper using immigration as a policy instrument was Storesletten (2000). [9, 10] In our paper, immigration policy is understood as the action of granting visas or work permits to foreigners, and it is also "selective" in the sense that it focuses on individuals from 20 to 34 years old. We choose this kind of policy because our objective is to evaluate the possibility to achieve the long-term sustainability of the current pension system sustainable through an immigration policy. [11]

We employ a simple "Aggregate Accounting Model" (AAM) to evaluate the sustainability of the current contributory Spanish pension system. It is based on projections of the financial situation of the pension system under a certain set of assumptions on the demographic evolution as well as on some economic key variables. [12] Specifically, we extend the model developed by Blake and Mayhew (2006) which quantifies the deficit or surplus of the system in terms of contributors to the pension system. [13] The heterogeneity in this type of models could arise from agents with different age, employment rate, productivity, gender, origin, etc. In general, the inclusion of heterogeneity will give more accurate projections, but the complexity and data needs of the model is increasing (Jimeno *et al.* (2008)). We introduce heterogeneity in the productivity and in the participation in the labour market between natives and foreigners and also we consider three different age groups. Unlike previous projection exercises (for instance, Jimeno (2000), Alonso-Meseguer and Herce (2003), Da-Rocha and Lores (2005), Balmaseda del Campo *et al.* (2006), Gil *et al.* (2007)) that, between others, take into account heterogeneity in age (year by year), gender, type of pension, labour market outputs, etc., our model incorporates some of the particularities that the foreign labour force presents in the Spanish economy, such as lower productivity, as well as higher employment and unemployment rates. The differentiation between immigrants and natives, and the separate demography simulation of these two groups, allows us to capture the gap between these two collectives and quantify the impact of an immigration policy. A recent work by Gonzalez *et al.* (2009), using a general equilibrium model calibrated for Spain, simulate the revenues and

expenditures for the pension system, separately for natives and immigrants, and under different assimilation scenarios (in terms of contribution bases of social security). [14] Unlike our analysis, which simulate an immigration policy, Gonzalez *et al.* (2009) consider the net immigration flows of the INE demographic projections. In addition, they allocate these flows in ages between 0 and 40 years according to the observed distribution of immigration flows during the years 2005-2007.

Our main findings are the following. The current Spanish pension system will begin to generate deficits from the year 2022. 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 2027. An immigration policy will delay the appearance of the shortfalls by a time horizon ranging one to four years, depending on the scenario and on whether the immigration policy consists in an increase the INE assumptions in 100 thousands or 200 thousands the net immigration flows. [15] Finally, the adjustments of the pensions bellow the productivity growth would delay the appearance of the shortfalls, whereas the opposite measure would bring them forward.

The paper is organized as follows. Section two describes the original model and presents our innovations. The third section analyzes the data, justifies the assumptions made and presents the parametrization of the model. Section four presents and comment 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 AAMs 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-term.

2.1. Blake and Mayhew Model

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

Blake and Mayhew (2006) propose the following model to analyze the sustainability of the United Kingdom state pension system:

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

where,

S_t = shortfall/surplus of contributors to the pension system;
p_0 = average value of the pensions in the first period, with $\dot{p}$ its growth rate;
c_0 = average contribution rate of the system in the first period, with $\dot{c}$ its growth rate;
y_0 = weighted average wage in the first period, with $\dot{y}$ its growth rate;
$N_{x,t}$ = number of people above of the age x and receiving a pension in period t;
$M_t^{a\text{-}b}$ = population aged between a and b years;
$a_0^{a\text{-}b}$ = activity rate of the people aged between a and b years in the first period and $\dot{a}^{a\text{-}b}$ its 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:

$$N_{x,t} = \frac{A_t}{2}\left[x_{m,t} - x\left(2 - \frac{x}{x_{m,t}}\right)\right], \qquad [2]$$

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. This should be interpreted as the maximum age to which a person lives for that projection year;

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

In addition, this model has a clear way to present the results, that is, it assesses shortfalls and surpluses of the pension system in contributor's terms. Concretely, the output is defined as the number of person-contributor years that would be needed or exists in excess in order to achieve solvency in the pension system.

2.2. Modifications to the Blake and Mayhew Model

Unlike the model developed in the previous subsection (2.1) our model allows for additional sources of heterogeneity among individuals. Specifically, we add their status as immigrants or natives. [16] The heterogeneity is expressed by means of differences in productivity and employment rates. [17] These modifications are carried out in order to adapt the model to the analysis of an immigration policy.

In the model we include the Reserve Fund of Social Security (*RF*), which can be seen as a reserve for facing the shortfalls of the system when necessary. The importance of the from the year 2000 onwards [18] is a consequence of the growth in the contributors to the system since then, which is itself related to the growth in employment and the successive immigration regularization processes. [19] The significant growth shown by the RF in recent years probably will not be repeated in the near future. The drop in the number of contributors and the contribution bases, as a consequence of the current economic crisis have considerably reduced the surpluses of the previous years. Unlike other founds (primarily private) [20] the Spanish RF has restricted the type of products in which can invest. It is mainly composed by sovereign debt. Therefore, the RF has not suffered significant losses because of falling investment values.

The modified model is as follows. Starting with the balance of the pension system and then, dividing it by the product of an average wage and the average contribution rate to the pension system, we obtain the contributor shortfall/surplus:

$$S_t = \frac{p_0 \left(1+\dot{p}\right)^t N_t}{c_0 \left(1+\dot{c}\right)^t y_0 \left(1+\dot{y}\right)^t} - \left\{ \sum_{i=1}^{2} \left[M_{t,i}^{20-34} e_{0,i}^{20-34} \left(1+\dot{e}_i^{20-34}\right)^t q_i^{20-34} + M_{t,i}^{35-49} e_{0,i}^{34-49} \left(1+\dot{e}_i^{35-49}\right)^t q_i^{35-49} + M_{t,i}^{50-64} e_{0,i}^{50-64} \left(1+\dot{e}_i^{50-64}\right)^t q_i^{50-64} \right] \right\}, \quad [3]$$

where,

S_t = represents the contributor shortfall/surplus of the pension system; [21]
i = [1,2] represents the natives and immigrants;
N_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) model we calculate the number of pensions –in terms of people employed– through an expression commonly used in AAM, [22]

$$\frac{N_t}{Oc_t} = Cov_t * \frac{M_t^{>64}}{M_t^{20-64}} * \frac{1}{a_t} * \frac{1}{1-\mu_t}, \quad [4]$$

where,

$Cov_t = N_t/M_t^{>64}$ = the coverage rate; [23]
$M_t^{>64}/M_t^{20\text{-}64}$ = the old age dependency ratio;
a_t = the activity rate;
μ_t = the unemployment rate;

As mentioned above, to obtain a complete idea of the sustainability of the current Spanish pension system, we include the *RF* in our simulations.

The *RF*, in contributor terms, for the period $T+1$ is calculated as follows:

$$RF_{T+1} = \sum_{t=0}^{t=T} \frac{RF_t (1+r)^{T-t}}{c_0 (1+\dot{c})^t \, y_0 (1+\dot{y})^t}, \quad [5]$$

where,

RF_t = the fund at each period t;
r = the rate of return;

A negative result in equations [3] and [5] indicates a contributor surplus, whereas a deficit is represented by a positive number.

3. Data

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

1. Population projections;
2. Economic projections;
3. Institutional factors relating of the pension system.

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

3.1. Population projections

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

The baseline scenario assumes the INE population projections "*Proyecciones de población a largo plazo"*, which suppose that net migratory flow to Spain will slow drastically as compared to the flows observed during recent years (117 thousands between 2010 and 2014). From 2015 to 2049 it will amount to approximately 72.5 thousand immigrants per year (an inflow of 2.5 million of immigrants in the period 2015-2049).

Spanish total fertility rate (TFR) showed a downward trend from 1975 until 1998, passing from 2.8 to 1.16 children per woman. Since then, it has grown slightly reaching 1.44 in 2009. This change can be basically explained by the increase of immigration flows. The INE population projections consider that the increasing in the fertility rate will continue in the coming years (until it reaches 1.7 children per woman). [24] We also assume

that all the children born in Spain are natives, even if their parents were foreigners (mother, father or both). [25]

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 0.13% and 0.16% for women and men respectively. Table 1 shows the main assumptions of INE population projections and the old-age dependency ratio resulting.

Table 1
SPANISH POPULATION PROJECTIONS 2009-2049
Main assumptions

	Population (thousands)	New inflows of immigrants	Life expentancy at birth (years)		Average Nº of children por women	Old-Age dependency ratio (percent)
			Men	*Women*		
2009	45,828	75,867	78.01	84.37	1.44	26.2
2015	46,567	49,834	79.16	85.36	1.52	29.2
2024	47,292	75,672	80.73	86.74	1.59	35.0
2029	47,518	74,637	81.54	87.46	1.62	40.0
2039	47,903	73,150	83.06	88.79	1.67	52.8
2049	47,967	72,451	83.06	88.79	1.71	65.2

Source: INE population projections.

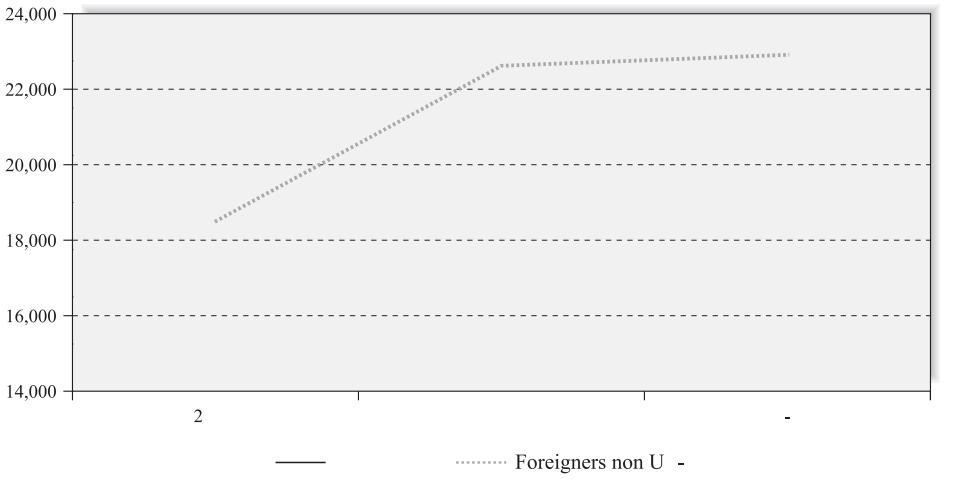
In order to project the population in the alternative immigration scenarios we use the cohort-component method. There are two main reasons to use this approach, first, is the methodology used by the INE in their projections, and second, it has an important analytical value understanding the relative contributions of population growth from different sources (cohorts, country of birth, gender, etc). Basically this method involves calculating the future sizes of the cohorts, taking into account the effects of fertility, mortality and migration. [26]

3.2. Economic projections

The economic projections (average labour productivity, economic activity rate and unemployment rate) represent the major uncertainty for the prediction of pension expenditure. Therefore in fifth section, we will carry out a sensitivity analysis to give robustness to the simulations.

We approximate the productivity through wages, since, at least in the medium term, the growth of labour productivity is transferred to wages. Due to the difference between wages and contribution bases, the calibration of the wages was made to reproduce the *RF* in 2009 (50,373 millon euros). [27]

The wage profiles for the different groups in the population were obtained from the Living Conditions Survey (*Encuesta de Condiciones de Vida*, INE) of 2005. [26] The monetary benefits of the wage earners and self-employed workers were considered. The gross incomes were obtained using the methodology developed in Levy and Mercader-Prats (2003). The results for the different population groups are summarized in Figure 1.



Source: Our own calculations based on data from Life Conditions Survey (2005).

Figure 1. Wage Profiles (Euros)

To project the average wage it is necessary to analyze the activity and unemployment rates of the different groups in the population.

We assume that there will be a slow convergence of the activity rate to the levels observed for the most developed European countries (common assumption in this type of models, for instance in Jimeno (2000), Alonso-Meseguer and Herce (2003) and Doménech and Melguizo (2009)). From the current 77% until 79%. [29] In addition, we assume that the unemployment rate will increase in 2010 and remain practically unchanged in 2011 and then decrease until to reach 5% in 2025, and thereafter remain at these levels. [30] The reduction in the unemployment rate until near full employment in 2025 is based on the following: first, on the recovery of the Spanish economy, and second, on the fact that with the retirement of baby-boom generation (beginning in the third decade of the current century) there will be a shortage of workers when the post baby-boom generations from the base will be the active population.

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

In a recent study, Feyrer (2007) analyzes the relation between demographic structure and productivity, concluding that demographic structure is closely related to productivity and economic growth. Along the same lines, Bloom *et al.* (2001) show that a country with a demographic structure in which the working age population has a high weight in the total population has an opportunity to capitalize on the "demographic dividend" if the right policy

environment is established. The most important policy areas are education, public health, family planning and other policies supporting labour market flexibility, openness to trade, and savings. At the same time, these studies present evidence that workers aged between 35 and 54 years are the most productive.

Productivity, which scarcely grown during the last decade, in 2009 grew at 3.3% as a consequence of the sharply collapse in labour input. For the coming years it is assumed that productivity will rise and then stabilize at growth rates of 1.5 % from 2025. [31] This assumption is based on the two following elements. Firstly, the demographic transition of the Spanish economy over the next 15 years will experience a substantial increase in the proportion of individuals at the most productive age. And secondly, public investment in education and Research, Development and Innovation (R+D+I) had increased in recent years and, probably, continue increasing in the future. In other words, this investment will create a good environment to capture the "demographic dividend".

The Gross Domestic Product (GDP) path is obtained from employment and labour productivity evolution. The GDP is expected to grow during the following years (after 2011), with growth rates over 2% until 2020; the growth rates are then expected to decrease to a minimum of 1% in 2039.

It is worth highlighting that the hypotheses adopted here do not claim to be an exact prediction of the evolution of the Spanish economy. Our results should be considered as a guide to the macroeconomic tendencies to construct different policy scenarios. Table 2 summarizes the main macroeconomic assumptions of our baseline scenario.

Table 2
MACROECONOMIC ASSUMPTIONS 2009-2049
In percentages

	Labour Productivity growth rate	GPD growth rate	Activity Rate			Unemployment Rate		
			Total	Natives	Immigrants	Total	Natives	Immigrants
2009	3.3	–3.6	77.3	76.1	84.8	16.6	14.9	27.1
2015	0.7	2.2	78.5	76.8	86.4	13.6	12.1	22.6
2024	1.4	1.5	77.7	75.5	86.2	5.8	5.0	9.5
2029	1.5	1.1	77.5	74.9	85.9	4.8	4.6	5.9
2039	1.5	0.8	78.5	75.7	85.8	5.0	4.8	5.9
2049	1.5	1.1	79.4	78.0	85.5	5.0	4.8	5.9

Source: Labour market ratios for 2009 were calculated by the author from the Spanish Labour Force Survey (INE).

3.3. Pension System

In this subsection we present the main characteristics of the current Spanish contributory pension system. [32]

The Contributory Pension System has what is known as a General Regime and five more Special Regimes (see Table 3). The General Regime includes most workers: the number of affiliates was 13,862,376 at the beginning of 2009, representing 75.7% of the total. There were 4,443,237 individuals affiliated in the special regimes at the beginning of 2009, [33] corresponding to 74.4% of the Special Regime of Self-Employed workers, reflecting the low weight of the other regimes (see Table 3).

Table 3
SOCIAL SECURITY AFFILIATES BY REGIME
In thousands and percentages, data 31/12/2008

	General Regime	Self-Employed	Agrarian	Sea Workers W.Ear. (1)	S-Emp. (1)	Coal	Domestic Workers	Total
Affiliated	13,862	3,310	776	49	15	8	286	18,306
Percentage	75.7	18.1	4.2	0.3	0.1	0.0	1.6	100.0

(1) Self-Employed (S-Emp.), wage earrners (W-Ear).
Source: Social Affairs and Labour Ministry (MTAS).

The system covers various types of contingencies: permanent disability, retirement, widow, orphan and family pensions. Each type of benefit has its eligibility rules (age, years of contribution, degree of disability, etc). Inside each regime, the retirement benefit is most important: at the beginning of 2009 retirement pensions represented 59.0% of the whole of the contributory system (see Table 4).

Table 4
TYPES OF PENSIONS AND AMOUNTS
Data 31/12/2008

Permanent Disability		Retirement		Widow	
Number (thousands)	Av. Pens (1) (euros)	Number (thousands)	Av. Pens (1) (euros)	Number (thousands)	Av. Pens (1) (euros)
916.3	806.5	4,995.7	822.2	2,263.3	531.5
Orphan		**Family Pensions**		**Total Numbre**	
Number (thousands)	Av. Pens (1) (euros)	Number (thousands)	Av. Pens (1) (euros)	Number (thousands)	Av. Pens (1) (euros)
261.0	326.3	37.7	432.1	8,473.9	725.9

(1) Average Pension (Av. Pens.).
Source: Social Affairs and Labour Ministry (MTAS).

The contributory ordinary retirement pension is obtained if the following conditions are fulfilled: [34]

- age 65;
- a minimum of 15 years of contributions, at least two years in the fifteen years prior to the year of retirement.

There is also a possibility of obtaining a pension at 60 (early retirement or partial retirement) when complying with certain special requirements. To apply for early retirement, the worker must be at least 60 and must have contributed to a mutual employment before January 1967. [35, 36] As in the case of early retirement, the workers aged 60 by years or more may apply for partial retirement. This type of retirement is accompanied by a part time contract, with a lower wage. Depending on the worker's age (below or above 65) the new contract may or may not be related with a relief contract. [37] We should stress that our simulations do not take into account the effects of 2007 social security reform. [38]

The pension (P_t) is determined by applying the replacement rate to the Regulating Base (RB henceforth). The RB is calculated from the monthly contributions of the previous 15 years, as 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:

$$P_t = \alpha_n RB, \qquad [6]$$

where α_n represents the replacement rate, which depends on the years of contribution.

$$\alpha_n = \begin{cases} 0, & if\ n < 15, \\ 0.5 + 0.03 * (n - 15), & if\ 15 < 15, \\ 0.8 + 0.02 * (n - 25), & if\ 25 < n < 35, \\ 1, & if\ n \geq 35. \end{cases} \qquad [7]$$

The pension completes 100% of the *RB* with 35 years of contribution. People retiring with less than 35 years of contributions suffer a penalty that varies between 2% and 3% per year (see formula 7). In addition, there is an incentive for delayed 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 widow's pension varies from 52% to 70% of the *RB*; the orphan's pension is 20% of the *RB* for each child entitled to it.

The contributory pension system is financed through the worker's 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 worker's professional category). 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 study, we consider a weighted average of the rates of contribution in the different regimes, resulting in an average rate of contribution of 27% for the whole system.

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 scenarios, in this section, we present the results for the policies that show the outputs that are relevant to the objectives of this study.

First, we present the results of the simulation of the baseline scenario. Second, we add two hypotheses of immigration flows: a) net immigration flows higher than the INE's assumption in 100,000 immigrants, which are concentrated in ages between 20 and 34 years, b) net immigration flows higher than the INE's assumption in 200,000 immigrants which also are aged between 20 and 34 years. Table 5 summarizes the main results of the population projections considering the two immigration policies.

Table 5
POPULATION PROJECTIONS WITH ADDITIONAL IMMIGRATION FLOWS

	Increase in 100,000 net immigration flows			Increase in 200,000 net immigrants flows		
	Population (thousands)	Net inflows of immigrants (people)	Old-Age dependency Ratio (percent)	Population (thousands)	Net inflows of immigrants (people)	Old-Age dependency Ratio (percent)
2009	45,828	75,855	26.2	45,828	75,855	26.2
2015	46,567	149,834	29.2	46,567	249,834	29.2
2024	48,511	175,680	33.9	49,695	275,680	32.8
2029	49,458	174,638	38.1	51,362	274,638	36.2
2039	51,384	173,137	48.3	54,835	273,137	44.4
2049	53,058	172,446	57.0	58,137	272,446	50.2

Third, we assume that pension increase is 0.25 percentage points below productivity growth (i.e. a decrease pensioner's relative purchasing power). This indexation policy implies a 10.5% growth below productivity throughout the period. [39]

Finally, we add that the legal age of retirement will increase gradually from 2015, three months every year, until it reaches the age of 68 in 2026. We also assume that from 2015 the coverage rate begins to grow, reaching 1.1 in 2022, and then remains stable until the end of the period. [40]

A summary of the main assumptions in different scenarios are presented in Tables 6 and 7. The complete results of the simulated scenarios appear in the Tables in Annex A.

Figure 2 shows the results of contributor's shortfall/surplus and the evolution of the *RF* for the baseline scenario and when we add the two immigration policies and the pension's indexation below productivity growth.

The results of the baseline scenario simulation suggest that the current Spanish pension system will be sustainable until 2022. From that year on, the contributor shortfall will increase, reaching 17.7 million of contributors at the end of the period. This result shows a considerable demographic problem, but there is also time to discuss and elaborate a structural reform with the aim of achieving the long-term sustainability of the pension system.

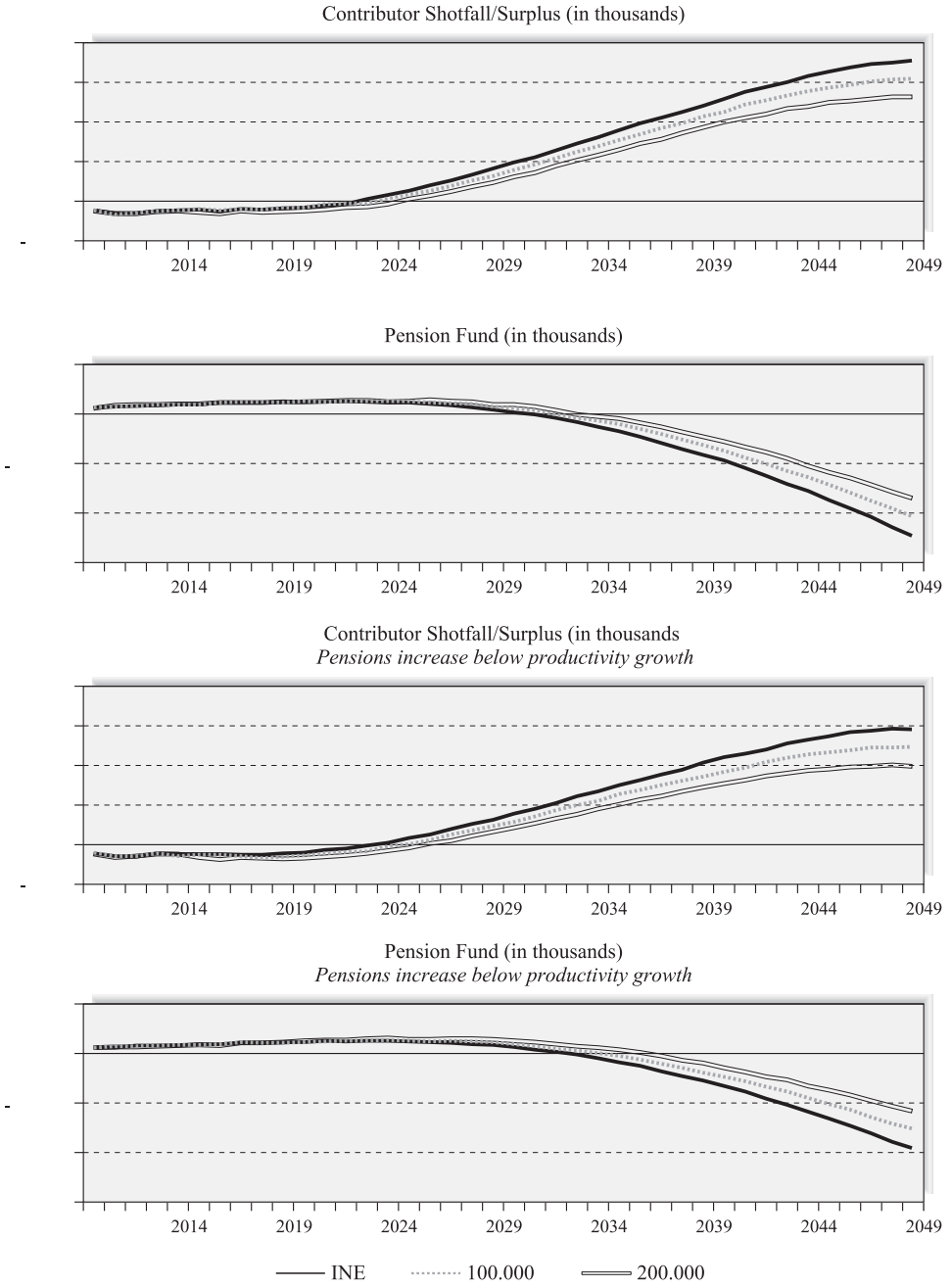
Table 6
PROJECTION ASSUMPTIONS

Baseline Scenario	
Macroeconomic assumptions	• Activity rate increases up to the average of most developed European Countries in 2040. • Unemployment rate decreases from 2012 until to reach 5 % in 2025. • Productivity growth increases until reach 1,5 % in 2025 and then remains at this level. • Years 2010 and 2011 we assume the macroeconomic scenario of the Spanish government. (see footnote 30)
Demographic assumptions	• INE (2010), long term population projections.
Institutional assumptions	• Pensions increase by productivity growth. • The coverage rate remains constant at the current level of 1.06 until the end of the period.
Reform Scenarios	
Demographic assumptions	• 100,000 more immigrants than INE's assumptions from 2015 concentrated in ages 20 - 34 years. • 200,000 more immigrants than INE's assumptions from 2015 concentrated in ages 20 - 34 years.
Institutional assumptions	• Pensions increse 0.25 p.p bellow productivity growth. • Reform in legal age of retirement until 68. • The coverage rate remains constant at the current level of 1.06 until 2014. Then it grows from 2015 reaching 1.1 in 2022 and then remains stable until the end of the period.

Table 7
MACROECONOMIC ASSUMPTIONS 2009-2049
UNDER REFORM SCENARIOS

	Activity Rate			Unemployment Rate		
	Total	**Natives**	**Immigrants**	**Total**	**Natives**	**Immigrants**
2009	77.3	76.4	85.3	16.6	14.9	27.1
2015	78.2	76.4	86.2	13.6	12.1	22.6
2024	75.4	73.5	84.0	5.9	5.1	9.7
2029	74.9	72.9	83.8	4.9	4.7	6.0
2039	76.3	74.8	84.6	5.1	4.9	6.0
2049	78.1	76.8	84.1	5.1	4.9	6.0

Souce: The ratios for 2009 were calculated by the author from the Spanish Labour Force Survey (INE).



Source: Own elaboration.

Figure 2. Contributor Shortfall/Surplus Projections and Reserve Fund 2009-2049: Baseline scenario

On the other hand, an immigration policy towards young people (between 20 and 34 years) would improve sustainability by delaying the appearance of the shortfalls by one or two years, depending on the increase in immigration (100,000 or 200,000). [41]

When we simulate an increase of the pensions lower than the productivity growth, the emergence of the contributor shortfall is delayed by one, two and two years, in each scenario (INE assumptions, and the two higher immigration scenarios). From 2025 the baby-boomers will start to retire, increasing the number of pensions. [42] The increase in the amount of pensions below the productivity growth will reduce the pressure on the pension system accounts. Figure 3 shows the scenarios with a reform in the legal age of retirement. In all the cases the effects of the reform are positive for the pension system. In particular, the reform in the baseline model delays the appearance of the shortfall by five years, and when an immigration policy is assumed the insufficiency of contributors does not appear until 2028 and 2029, depending on the increase in immigration (by 100,000 or 200,000 more immigrants than the INE assumptions).

The decrease in the relative purchasing power of the pensioners (in addition to the reform in legal age of retirement) has a stronger effect on the social security accounts than in the case without reform. The system would begin to generate deficits from 2028; when an immigration policy is simulated solvency would be ensured until 2029 and 2031, for 100,000 and 200,000 increases in immigration flows respectively.

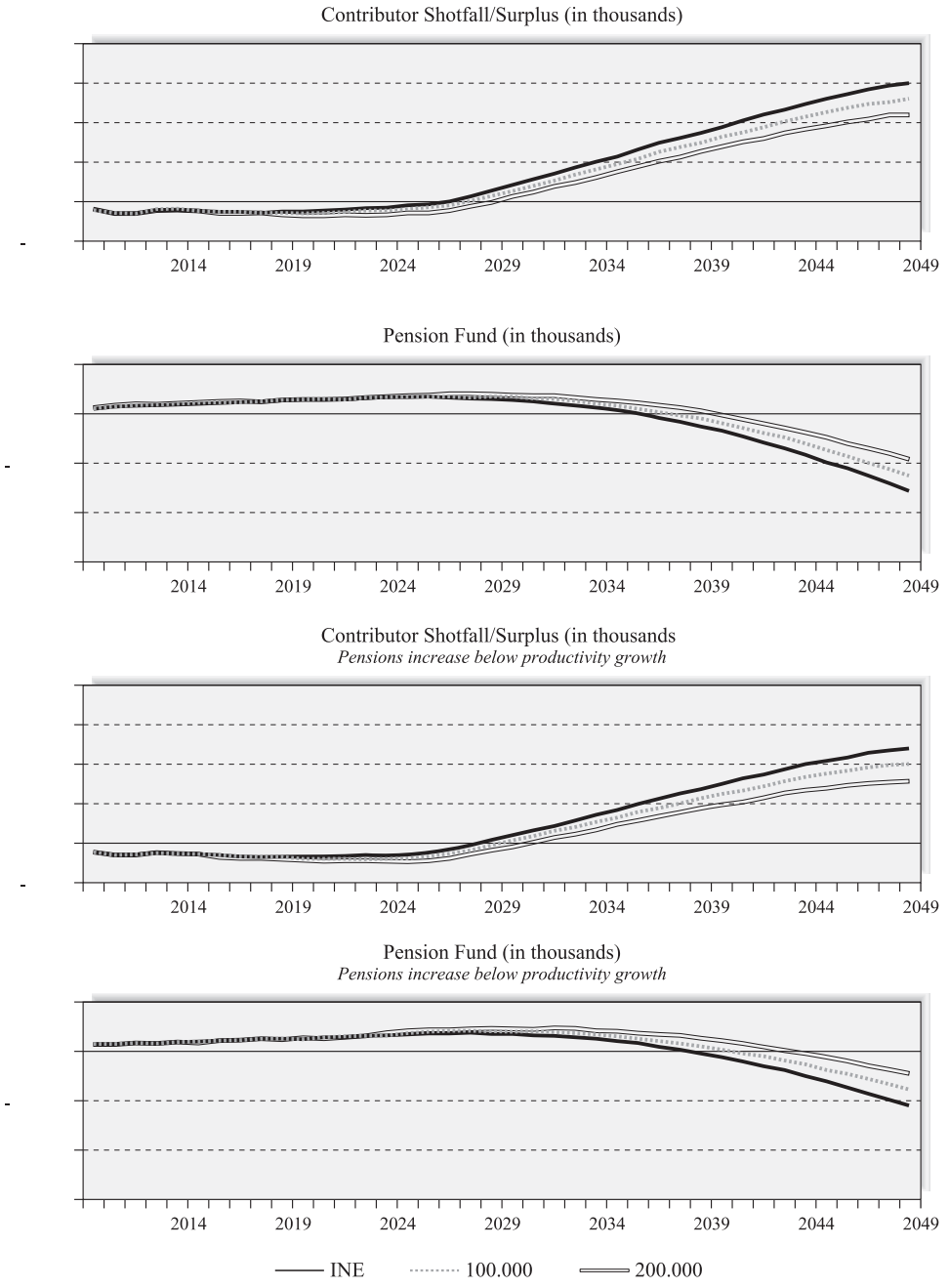
We have also simulated the *RF*, we consider that all the surpluses of the contributory system are accumulated and capitalized at 3%. [43] Figures 2 and 3 also show a *RF* simulation for each scenario. All the graphs confirm that *RF* will grow in the coming years.

For instance, in the baseline scenario the *RF* accumulated during the surplus period will be enough to finance the pensions for nine more years once the shortfall appears. Consequently, a debt will begin to accumulate. With an immigration policy the *RF* accumulated allows for financing the deficits until 2031 (100,000) and 2033 (200,000). In all immigration scenarios with reform in legal age of retirement the fund increase, ensuring the sustainability of the system few more years. In particular, the scenario that considers the reform in the legal age of retirement, an increase in net immigration flows in 200,000 and the decline in the relative purchasing power of the pensioners, the *RF* will be enough to finance the pensions until 2044.

The pattern of the evolution of the pension expenditure as a percentage of GDP, with an explosion from 2025, is similar in all the scenarios. In particular, the increase in pension expenditure would be 2.4 percentage points between 2009 and 2029 on the baseline scenario simulation, whereas in the later twenty years (period 2030-2049) the increase would be 6.3 percentage points.

5. Sensitivity Analysis

In this section we show the results of a sensitivity analysis of assumptions made in the baseline scenario. We simulate the model varying the assumptions over the coverage rate and



Source: Own elaboration.

Figure 3. Contributor Shortfall/Surplus Projections and Reserve Fund 2009-2049: Reform scenario

considering different assumptions about the short-term macroeconomic scenario. Six alternative scenarios for each case will be shown, taking into account the immigration policies. The main results are summarized in Table 8.

Table 8
SENSITIVITY ANALYSIS

	Deficit from year	2049 deficit thousands	Pens. Expenditure/GPD percentage
Baseline	2022	17,695	17.0
Baseline 100,000	2023	15,474	14.0
Baseline 200,000	2024	13,251	12.1
Low coverage rate	2025	15,649	16.0
Low coverage rate 100,000	2026	13,380	13.2
Low coverage rate 200,000	2027	11,118	11.4
High coverage rate	2020	19,489	17.9
High coverage rate 100,000	2021	17,310	14.7
High coverage rate 200,000	2022	15,122	12.8
Slow macroeconomic recovery	2021	17,855	17.2
Slow macroeconomic recovery 100,000	2022	15,668	14.2
Slow macroeconomic recovery 200,000	2024	13,478	12.3
Quick macroeconomic recovery	2023	17,538	16.9
Quick macroeconomic recovery 100,000	2024	15,300	13.9
Quick macroeconomic recovery 200,000	2025	13,066	12.1

5.1. Coverage Rate

The baseline scenario presupposes that the coverage remains constant until 2049 at the current level (1.06). The two alternative scenarios proposed here are the following: one with low and the other with high coverage rate. The first one considers that the coverage rate decrease from 2015 until 1 in 2024, and then remain at this level until 2049. The second one assumes that the coverage rate growth from 2015, reaching 1.12 in 2024, and then remain at this level. The results are consistent in all the scenarios. In particular, the shortfalls appear earlier or later with a higher or a lower coverage rate respectively. These results are consistent with an increase or a decrease in the pension expenditure and with bigger or smaller deficit at the end of the period.

5.2. Short-term Macroeconomic Scenario

For the sensitivity analysis of the short-term macroeconomic evolution we also assumed two alternative scenarios, one with slow economic recovery and the other with a quick economic recovery. Instead of consider that the economic recovery begins in 2012 (baseline scenario) the first alternative scenario considers that the current situation of the labour market

(unemployment rate around 18%) remains practically unchanged until 2014 and from 2015 the economy begins to recover. Concretely, we assume that the unemployment rate will decrease until to reach 6% in 2025, and thereafter remain at these levels. The second alternative scenario assumes a quick recovery, that means the economic recovery starts in 2011 and the unemployment rate will decrease until to reach 4.5% in 2020. Both scenarios again show consistent results. In the slow recovery scenario the financing needs appear earlier, and later in the case of quick economic recovery. The results also show both, greater deficits at the end of the period and a higher pensions expenditure in the slow recovery scenario and the opposite results are observed when a quick economic recovery is simulated.

6. Final Comments

The demographic evolution in developed countries has been marked by low fertility rates and an increase in life expectancy at birth. At the same time, the increasing migratory flows in recent years have become an issue of intense debate in these countries. The unsustainability of pay-as-you-go pension systems has led many policy makers and institutions to propose that governments should implement more liberal migratory policies as an alternative to parametric or structural reforms of the pension systems. In this context, we contribute to the analysis of the long-term sustainability of the current Spanish pension system by evaluating the effects of an immigration policy, and comparing then with the effects of other traditional parametric reforms in a simple accounting framework.

All the simulated scenarios confirm that the current pension system is unsustainable in the long-term. Our projections indicate an explosion of the ratio of pension expenditure to GDP from the middle of the 2020's, which will coincide with the retirement of the baby-boom generation.

A reform in the current Spanish pension system in the coming years is necessary. However, there is time to discuss and develop a structural reform for the next 20 years, instead of continue the with partial reforms to the system every few years. Because pension reforms are indeed challenging and controversial –it involves long-term decisions in the face of many short-term pressures– another objective of the reform must be to achieve the support of all the agents involved.

An immigration policy substantially improves the sustainability of current contributory pension system. Although this policy does not provide a long-term solution, it will delay the emergence of the shortfalls. Significantly, increasing the pensions below productivity growth –which would be likely to meet greater resistance at the moment of its implementation– have similar effects in terms of sustainability. In other words, this policy individually considered is not a long-term solution. Better results (in terms of sustainability) are obtained by extending the legal age of retirement to 68 years.[44] For these reasons, and with the decrease in the working age population, the immigration policy could be considered as a real alternative to the traditional pension policy reforms.

However, a reform that combines a delay in legal age of retirement with a growth of pensions 0.25 percentage points below productivity growth and an immigration policy (of

200,000 immigrants a year) is the scenario analyzed that almost guarantees the long-term sustainability of the current pension system.

Finally, we should mention some limitations of our simulation results. Due to the assumptions on the long-term projections, the results presented in this paper should not be taken as precise estimations but rather tendency indicators. Moreover, this methodology does not take into account both general equilibrium effects (in particular the effects of immigration on wages) and the responses of agents to changes in the pension system. In addition, in order to present the model we have made some simplifications of the Spain's current contributory pension system.

Notes

1. Most European countries have pay-as-you-go defined benefit pension systems. See Borgmann (2005) for a detailed analysis of the characteristics of the public pension schemes in Europe.
2. For a detailed analysis of the effects of the current financial and economic crisis on pension systems see OECD (2009).
3. Some projections of pension expenditure, under different scenarios, are presented in Table A5 in Annex A.
4. Foreign-born population has increased from 0.64 million in 1998 (1.6% of the total population) to 5.65 million in 2009 (12.1% of the total population). Specifically, during the period 2000-2005, among developed countries, Spain was the second recipient of immigrants in absolute terms (only behind USA) and had the highest level of all in relation to the native population, with an annual average of 540 thousand immigrants. (United-Nations (2006), OECD (2007))
5. Immigrants in Spain are younger than the native population (mean ages 33 and 41 years respectively). In 2002, the total fertility rate for foreign women was 2.12 children compared with 1.19 for Spanish women (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 20 and 64 years old. The calculations were carried out using the INE population projections (*Proyecciones de población a largo plazo* posted on the INE website on January 28, 2010). These projections assume that net immigration flows during the period 2009-2049 will be 2.7 million persons. These projections will be considered throughout this study.
7. This is the main objective of studies like Auerbach and Oreopoulos (1999), United-Nations (2000), Bonin *et al.* (2000), Collado *et al.* (2004) among others.
8. These parametric reforms are two of the most common features of recent reform packages in OECD countries (for more details on recent pension reforms in OECD countries, see Martin and Whitehouse (2008)).
9. Using an Overlapping-Generation (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 immigration policy aimed at 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. Using a general equilibrium model for the Danish economy Schou (2006) obtains that an increase in immigration flows does not solve the fiscal problems. However, if the foreign workers experience an economic assimilation with natives, an immigration policy might be a relevant tool to solve fiscal problems.
11. Among other objectives, these policies aim to attract foreigners with medium or high qualifications, to cover the misalignments between supply and demand in the local labour market, as well as reunify the immigrant's families. For a discussion on design an immigration policy see the chapter one of Borjas (1999).

12. More details on this and other approaches to evaluate the effects of population aging on pension expenditures can be found in Jimeno *et al.* (2008).
13. The number of average contributors per year that would be needed or would exceed to balance the budget of the pension system.
14. Their main finding is that immigration delay the entrance into deficits but does not solve the unsustainability problem even if immigration reaches total assimilation in the labour market.
15. These increases in immigration, of 100 and 200 thousand from 2015, imply that net immigration flows from 2015 to 2049 reach, on average, 0.25% and 0.43% of total population a year in each case respectively. Between 1999 and 2008 the net immigration flows over total population was, on average, 1.1% a year (*Padrón Municipal*, INE).
16. Education could be another source of heterogeneity. Using an OLG general equilibrium model, Díaz-Giménez and Díaz-Saavedra (2006) study the implications of educational transition on the sustainability of the current Spanish pension system.
17. Unlike the Blake and Mayhew (2006) model, we consider the working age population from 20 to 64 years old and employment rate instead of economic activity rate.
18. The *RF* arose from one of the recommendations of the Toledo agreement in 1996, in order to smoothen the effects of the business cycle. The current fund began in the year 2000 and at the beginning of 2009 the *RF* contained 50,373 million euros.
19. Regularizations of immigration took place in 1996, 2000, 2001 and 2005. The last was the biggest, with 640 thousand residence and work authorizations granted to immigrants.
20. In most of OECD countries the real investment return of private pension founds in 2008 was negative (OECD (2009)).
21. One limitations of the model structure is that the y_0 does not fully capture the differences in the growth rates of productivity between immigrants and natives, just the part corresponding to the share of each group of workers.
22. Between others, see Balmaseda del Campo *et al.* (2006), Jimeno *et al.* (2008) and Doménech and Melguizo (2009) use a similar formula to obtain the number of pensions.
23. Due to a limitation of the model, we will consider the evolution of the coverage rate *ad hoc* according to the expected trends.
24. All these levels are very low. The reference TFR of 2.1 is considered as the 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 reproductive age. An extra 0.1 is needed to compensate premature mortality and to balance the sex ratio of births.
25. Although Spanish law derives from the *jus sanguis* principle –in contrast to *jus solis*– a child born in Spain can, under certain conditions, obtain Spanish nationality.
26. For more details in population projection methodologies see Rowland (2003).
27. The contribution base of the Social Security System is given by the wages bounded by an upper and lower limit established by the government every period.
28. These data were adjusted through the average variation in wage costs.
29. The average activity rate in UK, Germany and France in 2009 was 78.8%. Recall that we are considering the population between 20 and 64 years old.
30. For the years 2010 to 2011 we use the macroeconomic scenario of the Spanish government. Posted on http://serviciosweb.meh.es/APPS/DGPE/textos/Previsiones/prevesp.pdf.
31. This rise in the productivity growth rate is also found in other studies, see Balmaseda del Campo *et al.* (2006), Gil *et al.* (2007) and Doménech and Melguizo (2009).

32. A more detailed description of the system can be found in Jimeno (2000) and Gil *et al.* (2007).
33. Self-Employed, Agrarian (Self-Employed and wage earners), Sea workers (Self-Employed and wage earners workers), Coal and Mining and Domestic Employees.
34. Special Regimes have different requirements and benefits that vary depending on the socioeconomic activity.
35. If the worker does not contributed to a mutual employment before January 1st 1967 the earlier retirement age is 61 years.
36. Workers who decide for this option have their pension reduced by 8% per each year below 65. The coefficient of the penalty gradually decreases if the worker has contributed for more than 30 years until a maximum of 6% if when he/she has contributed for more than 40 years.
37. For details on the requirements to obtain pensions see INSS (2006).
38. The Law 40/2007 (*Ley de medidas en materia de Seguridad Social*) in force since January 2008, has changed some of the conditions for early and partial retirement. In particular, increasing the minimum number of years of contributions and the minimum age required. The Law has also strengthened the incentives to work over 65 years. There is a transition period that, depending on the measure, finishes between the end of 2012 and 2014.
39. Although since the 1980s, pensions are adjusted for expected changes in prices, in our simulations we will analyze adjustments above and below the productivity growth. Many OECD countries have changed the indexation policy from adjusting pension benefits to earnings towards indexation to prices (e.g. Austria, Italy, Finland and Portugal). This maintains the purchasing power of pensions, but pensions increase less than workers' earnings and reduce the fiscal burden of pensions. See Martin and Whitehouse (2008) for a detailed analysis of pension reforms in OECD countries.
40. In spite the average age of retirement in Spain is lower than the legal age of retirement (64.7 and 63.2 years for females and males respectively, see Moral-Arce *et al.* (2010)) we do not take into account explicitly the early retirement. In spite of that, our results are in line with the models that simulate parametric reforms and consider agent's behavior. Using a general equilibrium model and considering an endogenous early retirement, Díaz-Giménez and Díaz-Saavedra (2009) shows that an increase in legal age of retirement delays the appearance of the deficits. Concretely, they find that increasing three years the statutory age of retirement, the pension system fund will increase and will be sufficient to finance the pensions until 2050 instead of 2028 which is when it would run out under the current rules.
41. At least two elements must be taken into account when assuming an entrance of immigration 200,000 higher than the INE assumption. Firstly, the unemployment rate is higher (around 5.3%) in the long-term. Secondly, this model does not allow for general equilibrium effects, specifically over wages.
42. Between 2025 and 2049 the number of pensions will increase from 10.7 to 16.5 million, compared with a figure of around 8.5 million in 2010.
43. We do not consider that a small part of the surpluses –until 2011– must be dedicated to finance the minimum pensions. On the other hand, we assume a rate of return equal 3% in real terms which is in line with assumptions made by the European Commission (European Commission (2009)) and other studies like Doménech and Melguizo (2009).
44. Moral-Arce *et al.* (2010) show that an increase in the legal age of retirement seems to be the most secure way to delay retirement.

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Resumen

Existe consenso en la literatura que, como consecuencia del envejecimiento poblacional, el actual sistema de pensiones en España será insostenible en las próximas décadas. En este artículo, se evalúa la sostenibilidad del sub-sistema de pensiones contributivas en base a las proyecciones demográficas realizadas por el Instituto Nacional de Estdística (INE). A partir de un escenario base, se simulan varias reformas del sistema, en particular: (i) una política de inmigración, (ii) diferentes mecanismos

de ajuste de las pensiones (iii) una extensión en la edad legal de jubilación hasta los 68 años. Los principales resultados son los siguientes. El actual sistema no incurrirá en déficits hasta 2022, a partir de cuando los déficits comenzarán a acumularse. El gasto en las pensiones en términos de PIB crecerá desde el 8.3% en 2009 hasta el 17.0% en 2049. La política de inmigración –dirigida a jóvenes extranjeros– puede ayudar, pero no resolver los problemas de la sostenibilidad de largo plazo del actual sistema. Una política que combine un ajuste de las pensiones por debajo del crecimiento de la productividad y que extienda la edad legal de retiro hasta los 68 años podría otorgar solvencia al sistema hasta 2028.

Palabras clave: Política de inmigración; pensiones públicas; sostenibilidad fiscal.

Clasificación JEL: E62, F22, H55, J61

Annex A

Table A1
PROJECTIONS 2009-2049: SPANISH CONTRIBUTORY PENSION SYSTEM
Baseline Scenario

	2009	2015	2024	2029	2039	2049
Number of Pensions (*)	8,532	8,936	10,476	11,737	14,509	16,492
Pension Expenditure/GDP	8.3	8.4	9.4	10.7	14.0	17.0
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,097	1,110	4,456	12,257	17,695
accumulated (*)	–11,265	–18,899	–21,343	–5,711	84,283	246,661
100,000 increase in immigration aged between 20 and 34						
Number of Pensions (*)	8,532	8,935	10,482	11,756	14,550	16,607
Pension Expenditure/GDP	8.3	8.2	8.8	9.8	12.2	14.0
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,130	587	3,619	10,771	15,474
accumulated (*)	–11,265	–18,931	–23,983	–12,005	65,832	208,387
200,000 increase in immigration aged between 20 and 34						
Number of Pensions (*)	8,532	8,760	10,488	11,777	14,595	16,720
Pension Expenditure/GDP	8.3	8.0	8.5	9.2	11.1	12.1
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,512	96	2,831	9,337	13,251
accumulated (*)	–11,265	–19,467	–27,034	–18,487	47,764	170,728

(*) These values are expressed in thousands.

Table A2
PROJECTIONS 2009-2049: SPANISH CONTRIBUTORY PENSION SYSTEM
Baseline Scenario with pension growth 0.25 p.p. below wage growth

	2009	2015	2024	2029	2039	2049
Number of Pensions (*)	8,532	8,936	10,476	11,737	14,509	16,492
Pension Expenditure/GDP	8.3	8.3	9.0	10.2	13.0	15.4
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,275	438	3,404	10,198	14,545
accumulated (*)	–11,265	–19,345	–25,826	–14,784	58,941	193,755
100,000 increase in immigration aged between 20 and 34						
Number of Pensions (*)	8,532	8,935	10,482	11,756	14,550	16,607
Pension Expenditure/GDP	8.3	8.1	8.5	9.3	11.3	12.7
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,307	–89	2,555	8,679	12,252
accumulated (*)	–11,265	–19,377	–28,484	–21,140	40,191	154,666
200,000 increase in immigration aged between 20 and 34						
Number of Pensions (*)	8,532	8,760	10,488	11,777	14,595	16,720
Pension Expenditure/GDP	8.3	7.9	8.2	8.8	10.3	11.0
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,687	–585	1,756	7,216	9,969
accumulated (*)	–11,265	–19,908	–31,546	–27,677	21,854	116,302

(*) These values are expressed in thousands.

Table A3
PROJECTIONS 2009-2049: SPANISH CONTRIBUTORY PENSION SYSTEM
Reform Scenario: from 2015 the legal age of retirement increase until 68 years (three months per year)

	2009	2015	2024	2029	2039	2049
Number of Pensions (*)	8,532	8,849	9,302	10,091	12,721	15,039
Pension Expenditure/GDP	8.3	8.1	8.4	9.3	12.3	15.5
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,269	–750	1,602	8,812	14,904
accumulated (*)	–11,265	–19,071	–29,724	–27,692	29,309	157,575
100,000 increase in immigration aged between 20 and 34						
Number of Pensions (*)	8,532	8,849	9,307	10,107	12,757	15,089
Pension Expenditure/GDP	8.3	8.1	8.1	8.7	11.1	13.2
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,302	–1,173	928	7,615	13,003
accumulated (*)	–11,265	–19,104	–31,947	–32,867	14,366	126,327

Table A3
PROJECTIONS 2009-2049: SPANISH CONTRIBUTORY PENSION SYSTEM
Reform Scenario: from 2015 the legal age of retirement increase until 68 years (three months per year) ***(continuation)***

200,000 increase in immigration aged between 20 and 34						
Number of Pensions (*)	8,532	8,760	9,312	10,125	12,797	15,138
Pension Expenditure/GDP	8.3	8.0	7.8	8.3	10.1	11.6
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,512	–1,603	238	6,366	10,980
accumulated (*)	–11,265	–19,467	–34,531	–38,462	–1,327	93,422

(*) These values are expressed in thousands.

Table A4
PROJECTIONS 2009-2049: SPANISH CONTRIBUTORY PENSION SYSTEM
Reform Scenario (from 2015 the legal age of retirement increase until 68 years) with pension growth 0.25 p.p. below productivity growth

	2009	**2015**	**2024**	**2029**	**2039**	**2049**
Number of Pensions (*)	8,532	8,849	9,302	10,091	12,721	15,039
Pension Expenditure/GDP	8.3	8.0	8.1	8.8	11.4	14.0
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,446	–1,347	698	7,008	12,031
accumulated (*)	–11,265	–19,515	–33,920	–35,841	7,014	110,668
100,000 increase in immigration aged between 20 and 34						
Number of Pensions (*)	8,532	8,849	9,307	10,107	12,757	15,089
Pension Expenditure/GDP	8.3	8.0	7.8	8.3	10.3	12.0
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,478	–1,774	13	5,781	10,075
accumulated (*)	–11,265	–19,548	–36,159	–41,069	–8,189	78,721
200,000 increase in immigration aged between 20 and 34						
Number of Pensions (*)	8,532	8,760	9,312	10,125	12,797	15,138
Pension Expenditure/GDP	8.3	7.9	7.5	7.9	9.4	10.5
Contributor Shortfall/Surplus						
annual (*)	–1,175	–1,687	–2,207	–687	4,506	8,008
accumulated (*)	–11,265	–19,908	–38,755	–46,713	–24,119	45,213

(*) These values are expressed in thousands.

Table A5
PENSION EXPENDITURE/GDP: PROJECTIONS UNDER DIFFERENT ASSUMPTIONS AND METHODOLOGIES
In Percentage

	Without reform	Legal age of retirement 70	35 years to computa the pensions
Jimeno (2000) (a)			
2000	8.9		
2050	16.8	10.7	
Alonso-Meseguer and Herce (2003) (b)			
2003	9.8		
2040	15.9		14.3
Da-Rocha and Lores (2005) ©			
2003	8.0		
2040	19.8	14.1	17.1
Balmaseda del Campo *et al.* (2006) (d)		pensions increase below IPC (0.5%)	
2004	7.7		
2045	18	12.8	14.8
Gil *et al.* (2007)			
2004	7.6		
2040	13.7		
Jimeno *et al.* (2008) (f)			
2005	9.0		
2050	19.6		
General Equilibrium Models			
Gonzalez *et al.* (2009)			
2006	6.5		
2051	19.1		
Jimeno *et al.* (2008)			
2000	7.9		
2050	19.4		
Díaz-Giménez and Díaz-Saavedra (2006)			
1997	10.4		
2040	16.1		

Note: Main Assumptions: *a*) The employment rate increases from 54.9% to 65%; the number of pensions in relation to working age population rises from 29% to 64.8%; the ratio of average pension per retiree to average labour productivity increases from 16.8% to 32.1%. *b*) Including retirement pensions, temporal disability pensions and management costs. The activity rate increases from 67% to 73%; INE population projections (2001); unemployment rate falls to 4.5% in 2015 and then remains at this rate until 2040; the productivity rate increase until 2% in 2020. *c*) The employment rate increases from 60.9% to 68.3%; the old age dependency ratio rise from 25% to 48.6%; the coverage rate decreases from 108.7% to 89.3%; the ratio of average pension per retiree to average labour productivity increases from 18% to 31.2%. *d*) The activity rate increases from 70.4% to 78.1%; the old age dependency ratio rises from 24% to 54%; the coverage rate increases from 112% to 118%; unemployment rate decreases until 3.8% in 2045; the ratio of average pension per retiree to average labour productivity increases from 18% to 21%. *e*) Demographic scenario from Eurostat and macroeconomic scenario from Economic Policy Committee (2006). *f*) The scenario with the lowest rise in the ratio of older population to the working age population from INE, resulting in an increase in the old age dependency ratio from 25.1% to 56%; the employment rate increases until 64.5% in 2050; the ratio of average pension per retiree to average labour productivity remains constant(22%).