

# Evaluating the labor supply effects of alternative reforms of the spanish pension system\*

**Sergi Jiménez-Martín**  
Universitat Pompeu Fabra

## ABSTRACT

*In this paper we evaluate the short and medium term impact of a very drastic actuarial reform of the Spanish pension system on labor force behavior of the Spanish elderly. For comparison purposes the recent 1997 reform and two versions of the 2002 Amendment are also evaluated. We find that these reforms, jointly with the demographic changes in place, reduce the current hazard rates or conditional probability of exiting the labor force by a amount ranging from small (in the case of the R97, which more or less represents current system) to large, in the case of the Actuarial reform. Although the results should be taken with the natural caution, we provide an optimistic scenario of the evolution of retirement patterns in the forthcoming years and show the effectiveness of the actuarial evaluation in increasing average retirement ages. However, joining our evidence with the one obtained in Boldrin and Jiménez-Martín (2002, 2006) these changes are not likely to reverse the long run financial trend of the Spanish Social Security system.*

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## 1 INTRODUCTION

Recent developments of the Spanish labor market, in terms of increased participation and employment rates, have exacerbated the necessity of reevaluating the labor supply trends as well as the exit patterns of Spanish older people in the context of the current pension regulation as well as some hypothetical reforms. It is well established that any reform keeping individuals productive for longer periods is, even when we ignore the general equilibrium effects, likely to have positive short run consequences in the sustainability of the pension system. However, the long run consequences are less evident since the long run sustainability of any PAYG system is mostly driven by the demographics trends.

The Spanish literature projecting either the labor supply consequences or financial or both of hypothetical parametric pension reforms is abundant. They can be grouped in behavioral and non-behavioral. Amongst the behavioral we mention Conesa and Garriga (2000), Sánchez-Martín (2001), and Díaz-Saavedra (2005), who estimate general applied equilibrium models and Boldrin et al (2004) and Boldrin and Jiménez-Martín (2002, 2006) who consider reduced form models. There are many examples of non-behavioral projections, recent examples are Boldrin et al. (2001), Jimeno (2003), and Alonso and Herce (2003). Finally, Jimeno et al (2006), who review both methodologies, make a very interesting contribution to the understanding of the Spanish case. All of them are very pessimistic about the long run trends of the Spanish Social Security system even when an optimistic labor market scenario is considered.

In this paper our objectives are much more modest, since we only aim at evaluating the short and medium term impact that a number of alternative reform scenarios may have on the level of participation and employment of the Spanish elderly. Although we do not consider explicitly the financial consequences of the reform scenarios we keep, with the support of complementary research (Boldrin and Jiménez-Martín, 2002, 2006), an eye on them. A key feature that differentiates our research from any previous projection is the fact that we project from a sample of “real” contributive careers of Spanish workers enrolled in the Spanish Social Security system. So, our projections are based on the observed characteristics (wages, education, working histories, etcetera ...) of a sample of the workers that are expected to retire in the forthcoming years. Thus, our projection fully accounts for the heterogeneity of the Spanish population.

We consider four evaluation scenarios: the first is a drastic actuarial adjustment reform which implies a strong reduction in expected benefits and whose details will be described later on; the second corresponds to the 1997 (Law 24/1997) regime; the third to the 2002 amendment of the 1997 reform (Law 35/2002); and, finally, we also consider a minor modification of scenario created by the 2002 reform. All these reform are evaluated using 2003 as a benchmark year for projections. Thus, the 1997 reform can be thought as the system in place at the time of the evaluation, and the 2002-based and actuarial reforms can be thought as the alternative reforms.

Each reform scenario consists of changes to one or more of the constitutive elements of a public pension system: retirement age, replacement rate as a function of the number of contributive years, penalization for early retirement, contribution rate, floors and ceiling of both pensions and contributions. The kind of reforms considered here, similarly to those debated in many advanced countries, would have been politically unthinkable twenty or thirty years ago, when most of the current work force began its contributive careers. Hence, the changes considered, should they be implemented, would certainly take most contributors “off guard” and engender, for given contributive histories and wage profiles, substantial changes in their net position toward the social security administration. While, when a reform takes place, workers are likely to react to the change of rules by modifying their behavior, it is also clear that a completely satisfactory reaction is feasible only for workers that are at the very beginning of their contributive histories.

To accomplish this, we place some effort at modelling the behavioral response of different individuals to the changing incentives provided by each reform scenario. We use the results from previous microeconomic studies of Spanish retirement patterns (especially Boldrin et al. (2004)) to capture the behavioral responses of different individuals<sup>1</sup>. Such behavioral responses have been estimated by means of a family of reduced form models of retirement behavior in which various financial measures of the incentive to retire are used.

As noted above, in projecting labor supply scenarios we take into account the foreseeable variation of the characteristics of the popula-

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1. Other recent examples of econometric models of retirement are Blanco (2002), who estimates a duration models of transitions to early retirement, and Jiménez-Martín and Sanchez (2003), who estimated a structural retirement model.

tion in terms of expected level of education and contributions. As we shall illustrate later on, these are important factors in determining both the level of participation of cohorts approaching retirement and their rate of exit from the workforce. In order to estimate these quantities we combine data from the Spanish Labor force Survey carried out by the Spanish National Statistical office (INE), and a sample of the *Historiales Laborales de la Seguridad Social* (HLSS) from the Spanish Social Security administration. Both datasets are briefly described in the Appendix.

The remainder of the paper is organized as follows. Section 2 describes the labor market current situation. Section 3 describes the key traits of the Spanish pension systems and reforms. The simulation methodology is described in section 4. The effects of reforms on retirement patterns, and, hence, employment and participation are presented in section 5. Finally, section 6 offers some tentative conclusions.

## 2 CURRENT LABOR MARKET SITUATION AND TRENDS

Both participation and employment rates have been increasing continuously in recent years, specially for (educated) women. Figure 1 illustrates the trends in the 1985-2003 period of the employment level by gender (above left), the unemployment level (above right), the labor force participation rate (bottom left), and the unemployment rate (bottom right).

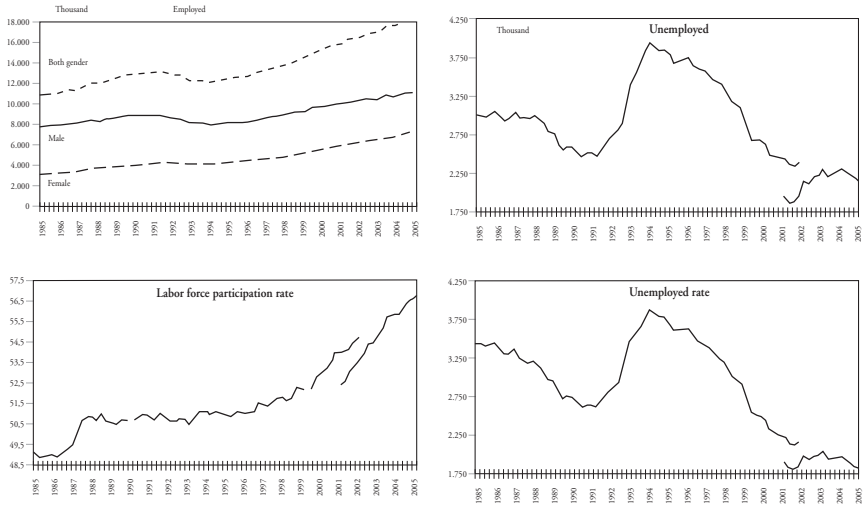
The level of employment and unemployment was originally estimated in the Spanish labor force survey, or EPA, at respectively 17241 and 2191 thousand in the second quarter of 2003. The implicit participation and unemployment rates<sup>2</sup> are 55.31 and 11.27 percent, respectively. In both cases they represent a significant improvement to the situation 10 years before (1993.III). In that period the participation and unemployment rates were 50.73 and 17.71 percent, respectively. The increase in the employment level has been relatively more important for women (53.1 percent) than it has been for men (28.6 percent).

A more detailed figure by age is given in Table 1 which compares employment and unemployment rates (as a fraction of the popula-

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2. The participation rate is constructed as the ratio of active population to population 16+

**Figure 1:**  
**Trends in Spanish employment and unemployment. Source of the figures: INE, EPA**  
**periodical report 1st quarter of 2005 (ww.ine.es).**



**Table 1:**  
**Employment and unemployment by age (55-69) in 1993 and 2003**  
**(Source: EPA, 2nd quarter).**

age	1993						2003					
	male		female		pop	male		female		pop		
	e	u	e	u		e	u	e	u			
55	0.71	0.11	193094	0.23	0.03	199569	0.76	0.05	243340	0.34	0.04	250937
56	0.69	0.09	223622	0.23	0.02	244146	0.73	0.05	216745	0.28	0.04	212983
57	0.62	0.10	217243	0.24	0.02	244375	0.68	0.03	212423	0.29	0.04	229872
58	0.60	0.10	218890	0.20	0.03	235393	0.71	0.03	211897	0.26	0.03	224451
59	0.60	0.09	204624	0.21	0.02	245063	0.65	0.04	224616	0.25	0.03	244483
60	0.48	0.07	238966	0.18	0.02	246729	0.56	0.03	214537	0.23	0.01	228779
61	0.43	0.05	223450	0.16	0.01	234162	0.53	0.02	160347	0.19	0.01	183814
62	0.42	0.04	206503	0.14	0.01	251863	0.46	0.03	191417	0.18	0.01	205899
63	0.38	0.04	204849	0.15	0.01	246406	0.41	0.02	188210	0.14	0.01	197701
64	0.31	0.02	232281	0.13	0.00	242041	0.30	0.01	157348	0.11	0.01	173722
65	0.11	0.00	195606	0.08	0.00	232698	0.10	0.01	168150	0.04	0.00	201209
66	0.06	0.00	207241	0.05	0.00	216859	0.07	0.00	183602	0.04	0.00	209873
67	0.06	0.00	182807	0.03	0.00	223217	0.03	0.00	191115	0.02	0.00	235664
68	0.04	0.00	200476	0.03	0.00	215221	0.04	0.00	185600	0.02	0.00	219192
69	0.04	0.00	166439	0.02	0.00	206690	0.03	0.00	174235	0.01	0.00	233204

e: employment; u: unemployment; pop: population

tion) in the second quarter of 1993 and 2003 by age. Regardless of the gender, employment rates are higher in 2003 up to age 63. Above that age, employment rates are about the same in both periods.

Figure 2 shows the trends in older male employment and unemployment rates by age in the 1977-2003 period. While the employment rate of individuals 55-57 has decreased continuously, that of individuals 58-64 is u-shaped. So the tendency to early retire has been reversed in recent years.

Figure 3 shows the trends in older female employment and unemployment rates by age in the 1977-2003 period. The employment level of women at practically all ages is increasing in recent years, as a consequence (see the next section for a summary comment) of the substitution of low-educated older women by more-educated younger women.

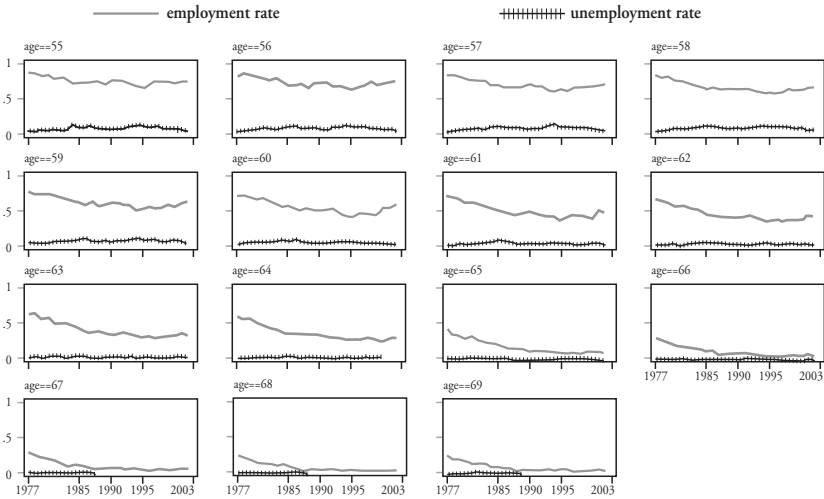
Figures 4 and 5 show the trend in respectively older male and older female hazard rates out of the labor force by age in the 1977-2003 period. Both hazard rates between 60 and 64 have increased during the period, being the recent years an exception. Much more clear is the continuous increase, which has not stopped in recent years, of the age 65 hazard in both cases.

## **2.1 The role of education in explaining labor force participation trends of older workers.**

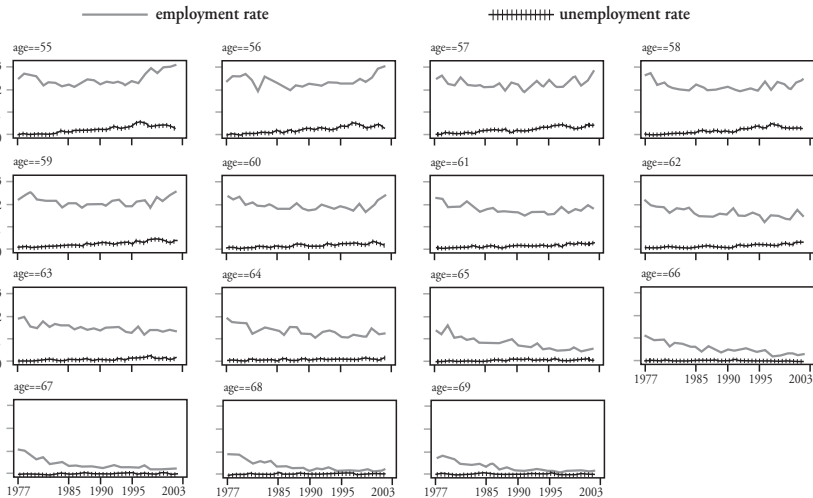
As commented in Boldrin et al. (2001) the distribution of the population by level of education for young cohorts (for instance, those aged 25-29 or 30-35 in 2003) is sensibly different from that of older cohorts (aged 45-69). Thus, the distribution of the population by education is far from being stationary. These differences will have a strong impact in the evolution of the LFP of older workers. For example, if the distribution of the group 45-69 by level of education were equal to that of group 30-35, male and female participation would increase in 9.36 and 16.72 percentage points, respectively.

In order to show the relevance that will have in the forthcoming years these composition effects we have carried out the following experiment. We have combined the projections of the Spanish population by sex and age from 2003-2020 (INE (1995)) with the distribution by sex, age and education (without studies or primary, secondary, university) from the EPA in 1993-1997 to obtain the projections of the Spanish population by sex, age and level of edu-

**Figure 2:**  
Trends in male employment and unemployment by age



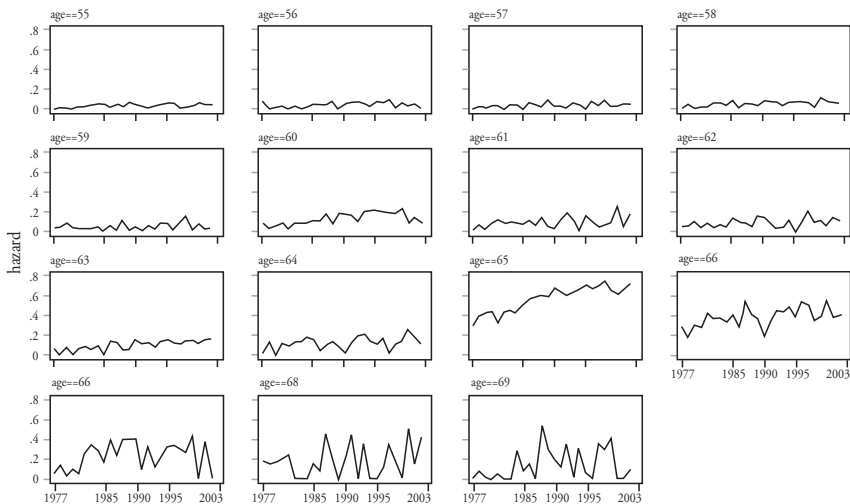
**Figure 3:**  
Trends in female employment and unemployment by age



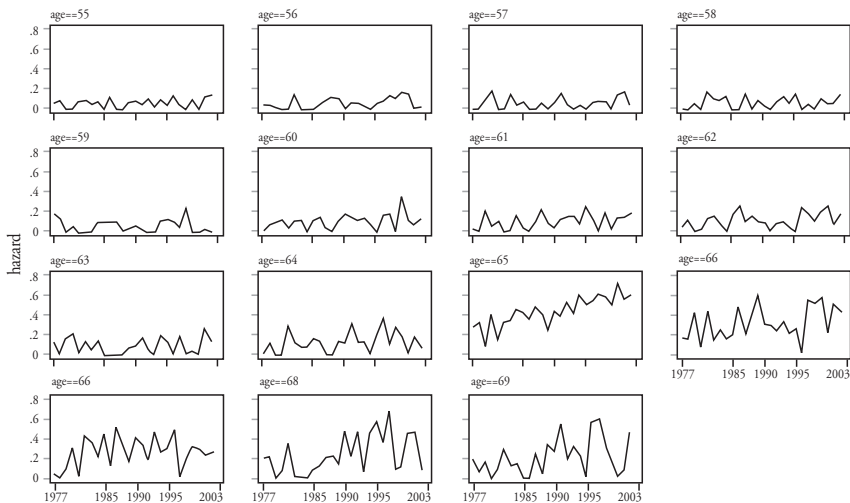
cation. To obtain the projections of the LFP rate by age group (45-54, 55-59, 60-64, 65-69) we assume (conservatively) that the current (2003) LFP rates by sex, age and education group remain constant in 2003-2020.

The results are striking. We found a positive composition effect at all age groups for both men and women (see Figure 6 and 7, respectively). However the effect is much more important for female than

**Figure 4:**  
Trends in male hazard out of the labor force by age



**Figure 5:**  
Trends in female hazard out of the labor force by age



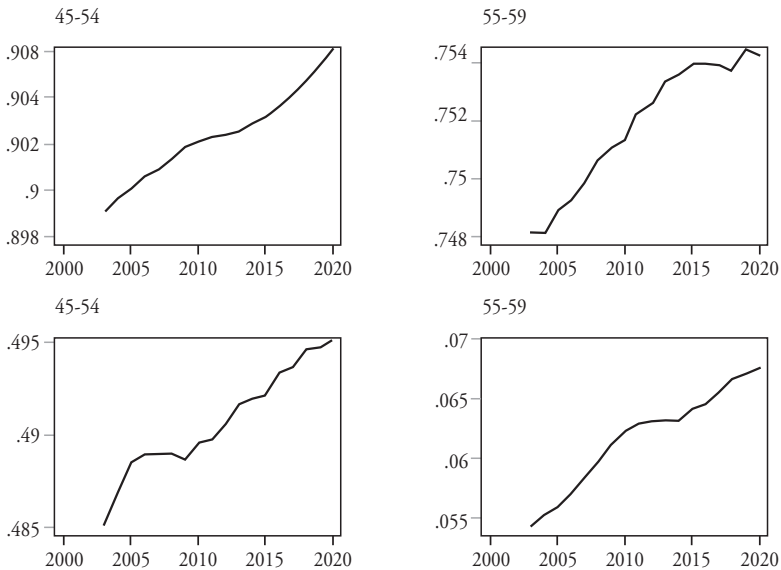
for male groups. The LFP of male aged 45-54 and aged 55-59 increases remain practically constant. For older male groups the increase is about one percentage point. The increase in relative terms is specially relevant for male 65-69 (25 percent in relative terms).

As noted above, the composition effect is much more important for women. The LFP of female aged 45-54 increase from 52.5 per-

cent in 2003 to 60.3 in 2020. That is, a 7.8 basis percentage point increase, which is attributable to the change in the structure of the population by level of education. Likewise, the LFP of female aged 55-59 and aged 60-64 increases 6.7 and 4.8 basis percentage points (22.7 and 26.2 percent in relative terms), respectively. Finally, the composition effect in female aged 65-69 is also important, 0.8 percentage points, specially in relative terms (30.8).

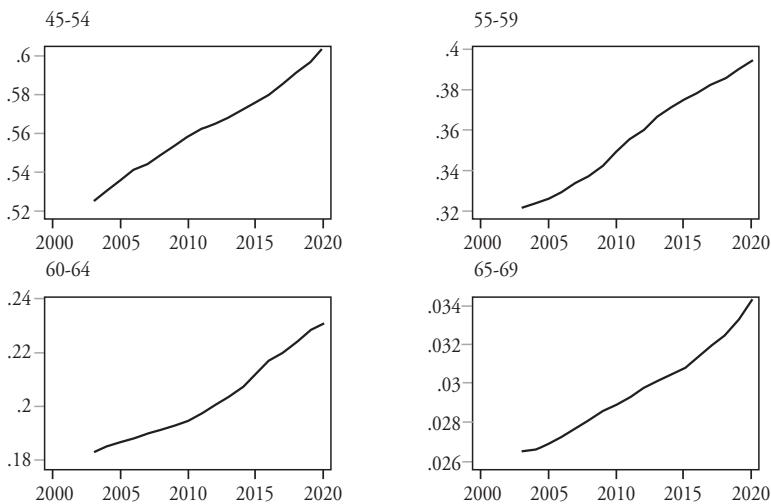
In summary, because of the change in the composition by educational levels of the population, by year 2010 male participation 45-69 would increase by 1.60 basis points (from 65.92 to 67.53 percent). Female participation 45-69 is expected to increase from 33.18

**Figure 6:**  
**The effect of educational composition in the projection of LFP of older male workers: 2003-2020**



to 38.03 percent!. Thus, the important composition effect that has been found should not be ignored when projecting, for instance, the retirement behavior of Spanish workers, specially female workers.

**Figure 7:**  
**The effect of educational composition in the projection of LFP of older female workers:**  
**2003-2020**



### 3 BACKGROUND OF THE SYSTEM

#### 3.1 Public programs for old-age workers

As customary, we provide a brief description of the system pre-1997 reform. Changes introduced by the reform and the amendment are noted latter. For more details on the Spanish social security system, we refer the reader to Boldrin et al. (1999, 2001).

Table 2 summarizes the programs available after age 50. Leaving aside private pensions, there are three public programs that affect the behavior of old age workers: unemployment benefits, disability benefits, and retirement pensions.

Unemployment benefits are generally conditional on previous spells of contributions and are available only for workers in the General Regime (RGSS) of the Spanish Social Security (S3) system.<sup>3</sup> There are two continuation programs for those who have exhausted their entitlement to contributory unemployment benefits: one for those aged 45+ (UB45+ program) and the other for those aged 52+ (UB52+ program).

3. People enrolled in any of the Special Regimes (RESS) either have no access to unemployment benefits (selfemployed and household employees) or have special unemployment programs (farmers and fishermen).

The latter is a special subsidy for unemployed people that are older than 52, lack other income sources, have contributed to unemployment insurance for at least 6 years in their life and, except for age, satisfy all requirements for an old-age pension.

The Spanish Social Security system provides insurance against both temporary and permanent illness or disability. Contributory disability (DI) benefits are far more generous than any other old-age program, since they are not subject to penalties for young age or insufficient years of contribution.<sup>4</sup> DI benefits are subject to approval by a medical examiner (notoriously, the tightness of the admissibility criteria used by examiners varies both over time and across regions) and, since the early 1990s, they have become harder to obtain at older ages. In fact, and contrary to the practice prevailing during the 1980s, it is now uncommon to access permanent DI benefits after age 55. This has been achieved mainly by tightening the disability evaluation process for the temporary illness program (Incapacidad Laboral Transitoria) which, in the past, was most often used as a bridge to retirement.

Both the unemployment and the disability plans offer, as we will argue momentarily, a “pathway to early retirement” alternative to the “official” one (the latter consisting of early retirement at 60 and of normal retirement at 65). Such alternative pathways are taken in due account in our estimation and simulation procedures.

The retirement program we label official (or regular) offers two options: early retirement and normal retirement. Early retirement is

**Table 2:**  
**Public programs at older ages. (1)**

	Unemployment insurance	Disability Insurance	Private pension plan	Social security benefits
50	cont. from 45+	cont. /non-cont.	yes	(2)
52	cont. from 52+	cont. /non-cont.	yes	(2)
55	cont. from 52+	cont. /non-cont.	yes	(2)
60	cont.	cont. /non-cont.	yes	ER: cont.
65	–	–	yes	NR: cont./non-cont.

Keys: cont.: contributory; non-cont.: non contributory;  
45+ and 52+: Special UI program for 45+ and 52+ workers enrolled in the RGSS.  
ER: early retirement, NR: normal retirement.

Notes: (1) All public programs provide benefits for dependants.  
(2). There are age bonuses for certain professions, allowing for retirement before 60.

4. For a discussion of non-contributory disability pensions and other marginal insurance schemes (which are not relevant to the following analysis and have little or no impact on the retirement decisions of the workers we are considering) see Boldrin et al. (1999).

possible from age 60 but it only applies to workers who started their contributive career before 1967. The normal retirement age is 65, although some professional groups have lower normal retirement ages (miners, military personnel, policemen and fishermen are the main ones). Collective wage settlements often impose mandatory retirement at age 65, facilitate retirement at 64 with full benefits, or encourage retirement between 60 and 63 through lump sum payments.

### 3.2 Social Security regimes and their rules

Under current legislation, public contributory pensions are provided by the following programs.

- The “General Social Security Scheme” (*Régimen General de la Seguridad Social*, or RGSS) and the “Special Social Security Schemes” (*Regímenes Especiales de la Seguridad Social*, or RESS) cover, respectively, the private sector employees and the self-employed workers and professionals. The RGSS covers also the members of cooperative firms, the employees of most public administrations other than the central governments and all unemployed individuals complying with the minimum number of contributory years when reaching 65. The RESS include five special schemes:
    1. Self-employed, *Regimen Especial de Trabajadores Autónomos* or RETA.
    2. Agricultural workers and small farmers, *Régimen Especial Agrario* or REA.
    3. Domestic workers, *Régimen Especial de Empleados de Hogar* or REEH.
    4. Sailors, *Régimen Especial de Trabajadores del Mar* or RETM.
    5. Coal miners, *Régimen Especial de la Minería del Carbón* or REMC.
  - The scheme for government employees (*Régimen de Clases Pasivas*, or RCP) includes public servants employed by the central government and its local branches. In this study we do not consider this regime.
- Legislation approved by Parliament in 1997 established the progressive elimination of all the special regimes but RETA by the end of year 2001. At the moment, however, this piece of legislation has not been implemented, and the special regimes are still active.

### 3.3 Rules of the RGSS

This subsection describes the rules governing, since 1985, the old-age and survivors pensions in the RGSS. The changes introduced by the 1997 reform (R97) and the 2002 (A02) amendment will be illustrated as we go along. A summary of the basic technical aspects of the pre-and post-1997 systems can be found in Table 3.

#### *Financing and Eligibility*

The RGSS is a pure pay-as-you-go scheme. Contributions are a fixed proportion of covered earnings, defined as total earnings, excluding payments for overtime work, between a floor and a ceiling that vary by broadly defined professional categories. Currently, eleven categories are distinguished, but the effective number of ceilings and floors for covered earnings is only four.

The current RGSS contribution rate is 28.3 percent, of which 23.6 percent is attributed to the employer and the remaining 4.7 percent to the employee. A tax rate of 14 percent is levied on earnings from overtime work.

Entitlement to an old-age pension requires at least 15 years of contributions. As a general rule, reciprocity is conditional on having reached age 65 and is incompatible with income from any kind of employment requiring affiliation to the Social Security system.

#### *Benefit computation*

When eligibility conditions are met, a retiring worker receives an initial monthly pension  $P_t$  equal to

$$P_t = \alpha_n \text{BR}_t,$$

where the benefit base (*base reguladora*)  $\text{BR}_t$  is a weighted average of covered monthly earnings over a reference period that consists of the last 8 years before retirement

$$\text{BR}_t = \frac{1}{112} \left( \sum_{j=1}^{24} W_{t-j} + \sum_{j=25}^{96} W_{t-j} \frac{I_{t-25}}{I_{t-j}} \right),$$

where  $W_{t-j}$  and  $I_{t-j}$  are earnings and the consumer price index in the  $j$ -th month before retirement. Pensions are paid in fourteen annual installments, hence the division by 112 in the previous formula.

The replacement rate  $\alpha_n$  depends on the age of the retirees and on the number of years of contribution. When age is below 60,  $\alpha_n = 0$  for all  $n$ . For age equal or larger than 65,  $\alpha_n$  is equal to

$$\alpha_n = \begin{cases} 0, & \text{if } n < 15, \\ .6 + .02(n - 15), & \text{if } 15 \leq n < 35, \\ 1, & \text{if } 35 \leq n. \end{cases}$$

In the case of early retirement, i.e. for ages between 60 and 65,  $\alpha_n$  is determined by the previous formula multiplied a penalization factor. The latter is equal to .60 at 60, and increases of .08 each year, until reaching the value of 1.0 at age 65.

Beginning in 1997, the number of reference years used for computing  $BR_t$  has been increased by one every year until 2003, to reach a total of 15 years. The formula for computing  $\alpha_n$  has been changed to the following

$$\alpha_n = \begin{cases} 0, & \text{if } n < 15, \\ .5 + .03(n - 15), & \text{if } 15 \leq n < 25, \\ .8 + .02(n - 25), & \text{if } 25 \leq n < 35, \\ 1, & \text{if } 35 \leq n. \end{cases}$$

The penalization factors have, basically, remained the same, exception made for workers with 40 or more years of contributions (details in the next subsection).

The A02 amendment allows for the possibility of  $\alpha_n$  being greater than one when people are above 65 years of age, that is

$$\alpha_n = 1 + .02(a - 65), \quad \text{if } 65 \leq a \quad \text{and} \quad n \geq 35,$$

In all of our simulations we use the pre-1997 formula, which was in place over the relevant sample period. We consider the impact of the 1997 reform and the 2002 amendment when examining alternative policies (see respectively R97 and A02 in Section 7).

Outstanding pensions are fully indexed to price inflation, as measured by the consumer price index. Until 1986, pensions were also indexed to real wage growth.

### *Early retirement*

The normal retirement age is 65 but early retirement at age 60 is permitted as a general rule for those who became affiliated to the Social Security system (*Mutualidades Laborales*) before 1967. The replacement rate for early retirees is reduced by 8 percentage points for each year under age 65. Starting from 1997, workers who retires after the

age of 60 with 40 or more contributive years are charged a penalty of only 7 percent for each year under age 65. The 2002 amendment has modified further the rules determining the replacement rate. It now reads as follows

$$\alpha_n = \begin{cases} 0, & \text{if } a < 61, \\ 1 - \kappa(a - 61), & \text{if } 61 \leq a < 65, \\ 1, & \text{if } 65 \leq a. \end{cases}$$

where,

$$\kappa = \begin{cases} 0.080 & \text{if } n = 30, \\ 0.075 & \text{if } 31 \leq n \leq 34, \\ 0.070 & \text{if } 35 \leq n \leq 37, \\ 0.065 & \text{if } 38 \leq n \leq 39, \\ 0.060 & \text{if } 40 \leq n. \end{cases}$$

However, there is a long transitory period since most workers can still retire under the former regulation.

Unless a collective labor agreement prescribes mandatory retirement, individuals may continue working after age 65. Before 2002 there were no incentives to work past age 65. As mentioned, the 2002 legislation now allows for

$$\alpha_n = 1 + .02(a - 65), \quad \text{if } 65 \leq a \quad \text{and} \quad n \geq 35,$$

and eliminates social security contributions for workers meeting the eligibility criteria for full normal retirement ( $a \geq 65$  and  $n \geq 35$ ) who continue working.

About ten percent of the workers enrolled in the RGSS is actually exempt from reduction in the replacement rate in case of early retirement. This applies to a number of privileged categories (bullfighters, employees of railroads, airlines, and public transportation, for example), or to workers who were laid off during cases of industrial restructuring regulated by special legislation. These exemption rights are “portable” in proportion to the number of years spent working in the privileged sector.

### ***Maximum and minimum pension***

Pensions are subject to a ceiling, legislated annually and roughly equal to the ceiling on covered earnings. The 2000 ceiling corresponds to about 4.3 times the minimum wage (*salario mínimo interprofesional*, or SMI) and about 1.6 times the average monthly earnings in the manufacturing and service sectors. If the initial old-age pension, computed as above, is below a minimum, then the mini-

imum pension is paid. The latter is also legislated annually. Other things being equal, minimum pensions are higher for those who are older than 65 or have a dependent spouse.

In the last decade, minimum pensions grew at about the same rate as nominal wages, whereas maximum pensions grew at the rate of inflation. The ratio between the minimum old-age pension and the minimum wage has been increasing steadily from the late 1970s (it was 75 percent in 1975) until reaching almost 100 percent in the early 1990s. The percentage of RGSS retirees receiving a minimum pension has been declining steadily, from over 75 percent in the late 1970s to 27 percent in 1995.

### *Family considerations*

A pensioner receives a fixed annual allowance for each dependent child that is younger than 18 or disabled. In 2000, this allowance was equal to 48,420 pesetas for each child under 18, and to 468,720 pesetas (45 percent of the annualized minimum wage) for each disabled child.

Survivors (spouse, children, other relatives) may receive a fraction of the benefit base of the deceased if the latter was a pensioner or died before retirement after contributing for at least 500 days in the last 5 years. The benefit base is computed differently in the two cases. If the deceased was a pensioner, the benefit base coincides with the pension. If the deceased was working, it is computed as an average of covered earnings over an uninterrupted period of 2 years chosen by the beneficiary among the last 7 years immediately before death. If death occurred because of a work accident or a professional illness, then the benefit base coincides with the last earnings.

The surviving spouse gets 45 percent of the benefit base of the deceased (46 percent after the 2002 amendment, fraction that will be increased further in the forthcoming years). In case of divorce, the pension is divided between the various spouses according to the length of their marriage with the deceased. Such a pension is compatible with labor income and any other old-age or disability pension, but is lost if the spouse remarries.

Each of the surviving children gets 20 percent of the benefit base until the age of 18 (amount raised to 23 per cent in 1997). An orphan who is the sole beneficiary may receive up to 65 percent of the benefit base. If there are several surviving children, the sum of the pensions to the surviving spouse (if any) and the children cannot exceed 100 percent of the benefit base.

A Spanish peculiarity is the “pension in favor of family members”. This pension entitles other surviving relatives (e.g. parents, grandparents, siblings, nephews, etc.) to 20 percent of the benefit base of the principal if they satisfy certain eligibility conditions (older than 45, do not have a spouse, do not have other means of subsistence, have been living with and depending economically upon the deceased for the last two years). To this pension, one may add the 45 percent survivors pension if there is no surviving spouse or eligible surviving children.

### 3.4 Special schemes

In this section we sketch the main differences between the general and the special schemes. Whereas rules and regulations for sailors and coal miners are very similar to the ones for the general scheme, special rules apply to self-employed, farmers, agricultural workers, domestic helpers and a few other categories not discussed here, such as part-time workers, artists, travelling salespeople, and bullfighters. Beside differences in the SS tax rate and the definition of covered earnings, an important difference is the fact that the affiliates to the special schemes have no early retirement option (exception made for miners and sailors).

The rest of this section focuses on the special schemes for self-employed workers (RETA) and farmers (REA), which together represent 93 percent of the affiliates to the special schemes, and 86 percent of the pensions they pay out.

#### *Self-employed*

While the SS tax rate is the same for the RETA and the general scheme (28.3 percent in 2000), covered earnings are computed differently, as the self-employed are essentially free to choose their covered earnings between a floor and a ceiling legislated annually. Not surprisingly in the light of the strong progressivity of Spanish personal income taxes, a suspiciously large proportion of self-employed workers report earnings equal to the legislated floor until they reach age 50. After that age one observes a sudden increase in reported covered earnings. This behavior exploits the “finite memory” in the formula for the calculation of the initial pension.

In 2000, the RETA contributive floor and ceiling were equal to 116,160 pta and 407,790 pta per month respectively, corresponding

to 1.4 and 5 times the minimum wage, and to .5 and 1.9 times the average earnings in manufacturing and services. To reduce misreporting of earnings on the part of the self-employed, a different ceiling applies to self-employed aged 50+ who had not reported higher earnings in previous years. In 2000 the latter was only 219,000 pta per month, roughly equal to average monthly earnings.

A crucial difference with respect to the general scheme is that, under the RETA, reciprocity of an old-age pension is compatible with maintaining the self-employed status. The implications of this provision for the retirement behavior of self-employed workers are discussed later on.

Other important provisions are the following: RETA only requires 5 years of contributions in the 10 years immediately before the death of the principal in order to qualify for survivors pensions. Under RETA, the latter is 50 percent of the benefit base. If the principal was not a pensioner at the time of death, the benefit base is computed as the average of covered earnings over an uninterrupted period of 5 years chosen by the beneficiary among the last 10 years before the death of the principal.

### *Farmers*

In this case, both the SS tax rate and the covered earnings differ with respect to the general scheme. Self-employed farmers pay 19.75 percent of a tax base that is legislated annually and is only weakly related to average earnings. In 2000, this was equal to 91,740 pta per month, corresponding to 1.24 times the minimum wage and about 40 percent the average monthly earnings in the manufacturing and service sectors.

Farm employees, instead, pay 11.5 percent of a monthly base that depends on their professional category and is also legislated yearly. In addition, for each day of work, their employer must pay 15.5 percent of a daily base that also varies by professional category and is legislated annually.

## 4 SIMULATION METHODOLOGY

Our simulation methodology follows partially the estimation and simulation methodology described in Boldrin and Jiménez-Martín (2002, 2006),<sup>5</sup> to which the reader is referred for all relevant details.

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5. Available in working paper format: <http://www.econ.upf.edu/docs/papers/downloads/652.pdf>.

In short, our simulations involve the following steps:

1. Definition of the estimation and simulation samples.
2. Definition of the incentive measures
3. Retirement model
4. Description of Policies
5. Results

The Appendix present a brief description of the data sources employed in this study.

#### 4.1 Key ingredients of the retirement models

In this section we review the main steps taken in order to estimate reduced form retirement models. First we describe the sample and the characteristics of the earning processes. Then we construct the various measures of Social Security incentives. In the last part we review the results from the estimated models.

##### 4.1.1 *Estimation and simulation samples*

*Estimation sample:* We use the sample of workers continuously active during the 1986-1995 period and considering exit from the labor force in 1995. We consider four groups of workers: male and female, and RGSS and RETA workers. The respective sample sizes are: male RGSS (16191 observations), female RGSS (3852 obs.), male RETA (4355 obs.), female RETA (2051 obs.).

*simulation sample:* We use individuals born between 1933 (aged 70 in 2003) and 1955 (aged 55 in 2010) extracted from the HLSS sample described in the appendix. We have concentrated on workers enrolled in either the General Regime (RGSS) and the Self-employed regime (RETA), because of we have not wage data for the rest. These two groups cover practically 90 percent of the affiliates to the Spanish Social Security. Finally, in order to perform our simulation we assume that the behavior of those workers not directly covered by our sample (mainly agricultural workers and central government employees) are well represented by it.

**Table 3:**  
**Pension provisions, institutions and systems**

Institutions	RGSS System 1985-1996	RGSS System after 1997
<b>Provisions affecting all individuals</b>		
A. Basic ingredients		
A1. The benefit base formula	$\frac{1}{96} \left( \sum_{j=1}^{24} BC_{t-j} + \sum_{j=25}^{96} BC_{t-j} \frac{t-25}{t-j} \right)$	$\frac{1}{180} \left( \sum_{j=1}^{24} BC_{t-j} + \sum_{j=25}^{180} BC_{t-j} \frac{t-25}{t-j} \right)$
-Contribution period	8 years	15
-Fraction actualized	6 years	13
A2. Fiscal system		
-Income tax	[progressive]	id.
-labor tax	linear (regime and group specific)	id.
B. Replacement rates		
-Function of contributive years	$\begin{cases} 0, & \text{if } n < 15, \\ .6 + .02(n - 15), & \text{if } 15 \leq n < 35, \\ 1, & \text{if } 35 \leq n. \end{cases}$	$\begin{cases} 0, & \text{if } n < 15, \\ .5 + .03(n - 15), & \text{if } 15 \leq n < 25, \\ .8 + .02(n - 25), & \text{if } 25 \leq n < 35, \\ 1, & \text{if } 35 \leq n. \end{cases}$
-Function of age	$\begin{cases} 0, & \text{if } a < 60, \\ .6 + .8(a - 60), & \text{if } 60 \leq a < 65, \\ 1, & \text{if } 65 \leq a. \end{cases}$	$\begin{cases} 0, & \text{exception for } n \geq 40: \\ & \text{if } a < 60, \\ .65 + .07(a - 60), & \text{if } 60 \leq a < 65, \\ 1, & \text{if } 65 \leq a. \end{cases}$
<b>Provisions affecting particular individuals</b>		
C. Income tax exemptions		
-Max pension exempted	$\infty$ Minimum wages	id.
-Max income exempted	$\infty$ Minimum wages	id.
D. Min/Max contributions		
-Min level of contribution	(specific for 12 group)	id.
-Max level of contribution	(specific for 12 group)	id.
E. Min. and Max. pensions		
-Min pension	$\infty$ minimum wages and family specific	id.
-Max pension	4.3 minimum wage (in 1995)	id.
F. Age bonuses	YES (occupation specific)	id
G. Survivor benefits	0.45 X (benefit base)	id
H. Dependant benefits	18, 22 (means tested)	18, 23 (means tested)
<b>Eligibility</b>	2 years contrib. last 10 years	2 out of last 15 years
<b>Pension computation</b>	$b_t = \max\{\min\{\bar{b}_t[n, e, BR(BC, I)], \bar{b}_t\}, \underline{b}_t\}$ where $\bar{b}_t$ is the pension in A+B and $\bar{b}_t$ and $\underline{b}_t$ are respectively the maximum and minimum pension.	
<b>2002 Amendment</b>		
-Scheme for early retirement,	$\alpha_n = \begin{cases} 0, & \text{if } a < 61, \\ 1 - \kappa(a - 60) & \text{if } 61 \leq a < 65, \\ 1 & \text{if } 65 \leq a. \end{cases}$	where $\kappa = \begin{cases} 0.08 & \text{if } n = 30 \\ 0.075 & \text{if } 31 \leq n \leq 34 \\ 0.07 & \text{if } 35 \leq n \leq 37 \\ 0.065 & \text{if } 38 \leq n \leq 39 \\ 0.06 & \text{if } 40 \leq n. \end{cases}$
-Premium for late retirement	$\alpha_n = 1 + 0.02(a-65)$ iff $n \geq 30$	
-Social Security contributions:	No contributions for workers 65+, provided $n \geq 35$	
-Survivor benefits	0.46 X (benefit base)	

### 4.1.2 *Evaluation of Social Security incentives*

#### *Assumptions*

For every male worker in the “wage sample” who is enrolled either in the RGSS or in the RETA we assume that: (i) he is married to a non-working spouse, (ii) his wife is three years younger, and (iii) his mortality corresponds to the baseline male mortality from the most recent available life tables (INE, 1995).

For every female in the “wage sample” we assume that: (i) she is married to either a retiree or a worker entitled to retirement benefits, (ii) her husband is four years older, and (iii) her mortality is the baseline female mortality from the most recent available life tables (INE, 1995).

For both men and women we further assume that: (iv) starting at age 55 and until age 65, there are three pathways to retirement: the UB52+ program, DI benefits and early retirement. At each age, an individual has an age-specific probability of entering retirement using any of these three programs. However the following restrictions are important in characterizing the actual usage of the three pathways to retirement:

1. No person has access to early retirement before age 60.
2. After age 60, a person cannot claim UB52+ and can only claim early retirement or DI benefits.
3. A self-employed person enrolled in RETA can never claim UB52+ benefits.

This implies that, in practice, pathways for retirement are relatively simple. For people in the RGSS either they retire before 60 via the UB52+ or the DI benefits program or they retire after 60 via the DI (most unlikely, though, since 1992) or the R program. People in the RESS either go via the DI benefits or the R program, with the likelihood of the former being low and decreasing from age 60 onward.

#### *Family assumptions*

1. Marital status assumptions

We have used family data from the Spanish Labor Force Survey (EPA) to obtain information on the marital status of individuals born in 1940 (55 in 1995 and 70 by 2010). The main findings, which we try to replicate in our simulations, are the following:

- (a) **Male:** 95 percent married and 5 percent single. Among those married, 75.2 percent have a non-working spouse and the rest a working spouse. In both cases the (average) spouse is born in three years later (aged 52).
- (b) **Female:** 74 percent married and 26 percent single. Among those married, 34.5 have a non-working spouse (presumably retired) and the rest a working spouse. In both cases the (average) spouse was born three years earlier.

2. Since survivor and retirement benefits are fully compatible (up to the amount of the maximum pension) there is no necessity to correct for double counting in the Spanish case. Whenever the maximum pension ceiling is supposed to take effect, this is applied to the total pension payments accruing to the survivor.

### *Calculating SS incentives*

For a worker of age  $a$ , we define social security wealth (SSW) in case of retirement at age  $h \geq a$  as the expected present value of future pension benefits

$$SSW_h = \sum_{s=h+1}^S \rho_s B_s(h)$$

Here  $S$  is the age of certain death,  $\rho_s = \beta^{s-a} \pi_s$ , with  $\beta$  denoting the pure time discount factor and  $\pi_s$  the conditional survival probability at age  $s$  for an individual alive at age  $a$ , and  $B_s(h)$  the pension expected at age  $s \geq h + 1$  in case of retirement at age  $h$ . Given SSW, we define three incentive variables for a worker of age  $a$ :

1. *Social security accrual* (SSA) is the difference in SSW from postponing retirement from age  $a$  to age  $a + 1$ .

$$SSA_a = SSW_{a+1} - SSW_a = \sum_{s=a+2}^S \rho_s [B_s(a+1) - B_s(a)] - \rho_{a+1} B_{a+1}(a).$$

The SSA is positive if the expected present value  $\sum_{s=a+2}^S \rho_s [B_s(a+1) - B_s(a)]$  of the increment in the flow of pension benefits is greater than the expected present value  $\rho_{a+1} B_{a+1}(a)$  of the pension benefit foregone by postponing retirement. If the increments  $B_s(a+1) - B_s(a)$  are small, as it is usually the case, then the SSA is negative. The re-scaled negative accrual  $\tau_a = -SSA_a / W_{a+1}$ , where  $W_{a+1}$  equals expected net earnings at age  $a + 1$  based on the information available up to age  $a$ , is called the implicit tax/subsidy on postponing retirement from age  $a$  to age  $a + 1$ .

2. *Peak value* (Coile and Gruber, 2000)  $PV_a = \max_h \{SSW_h - SSW_a\}$ ,  $h = a + 1, \dots, R$ , where  $R$  is a mandatory retirement age (which does not exist in Spain, but given the retirement evidence we find it reasonable to assume  $R = 70$ ). Thus, the peak value is the maximum difference in SSW between retiring at any future age and retiring at age  $a$ .
3. *Option value*  $OV_a = \max_h \{V_h - V_a\}$ ,  $h = a + 1, \dots, R$ , where

$$V_a = \sum_{s=a+1}^S \rho_s [kB_s(h)]^\gamma$$

is the total expected utility of retiring at age  $a$ , and

$$V_h = \sum_{s=a+1}^h \rho_s W_s^\gamma + \sum_{s=h+1}^S \rho_s [kB_s(h)]^\gamma$$

is the total expected utility of retiring at age  $h > a$ . Thus, the option value (Stock and Wise, 1990) is the maximum utility difference between retiring at any future age and retiring at age  $a$ . We parameterize the model by assuming  $\beta = .97$ ,  $\gamma = 1$  and  $k = 1.25$ .

4. Further, we estimate conditional survival probabilities from INE (1995) survival tables. Under our assumptions,  $V_a = 1.25 SSW_a$  and

$$V_h = \sum_{s=a+1}^h \rho_s W_s + 1.25 SSW_h.$$

If expected earnings are constant at  $W_a$  (as assumed by our earnings model), then

$$V_h - V_a = W_a \sum_{s=a+1}^h \rho_s + 1.25(SSW_h - SSW_a),$$

that is, the peak value and the option value are proportional to each other except for the effect due to the term  $\sum_{s=a+1}^h \rho_s$ .

### 4.1.3 The reduced form retirement model

This section briefly illustrates the explanatory power of our incentive measures (accrual, peak value, and option value) for retirement behavior. The results reported here are distilled from the extensive econometric analysis conducted in Boldrin et al. (2004), to which the reader is referred for all relevant details.

We follow a regression based approach to model the effect of Social Security wealth, incentive measure (either accrual, peak or option value) and individual demographic characteristics on the

decision to retire in year 1995 conditional on being active at the end of 1994. Retirement probabilities are assumed to have the probit form

$$\Pr\{R_i = 1\} = \Phi(\delta_1 \text{SSW}_i + \delta_2 I_i + \delta_3' X_i),$$

where  $R$  is a binary indicator of retirement,  $\Phi$  is the distribution function of a standard normal,  $I$  denotes the incentive measure, and  $X$  is a vector of predictors which include individual earnings and socio-demographic characteristics. The socioeconomic and earnings information is richer for the RGSS than for the RETA. This, coupled with the widespread misreporting of earnings that characterizes the affiliates to RETA, makes a quantitative analysis of their retirement patterns a very difficult task. Regression results for RETA, in fact, are much poorer than those for RGSS and, in any case, should be taken with caution.

For each one of the three incentive measures (accrual, peak and OV) we have used the following specification for the set of predictors  $X$ : an eligibility dummy for attainment of a minimum of 15 years of contributions; three industry-specific variables: the fraction of collective wage settlements having a clause favoring early retirement, the presence of rules permitting retirement at age 64 without penalty, and the existence of mandatory retirement at age 65; different measures of seniority on the job and in the labor market (length of the current employment spell and its square, number of years of contribution and its square, number of years since first employment); dummies for schooling level and contributive group (only for people in the RGSS); dummies for part-time work and sector of occupation (only for people in the RGSS); the expected wage and our estimate of the lifetime earnings net present value, and their squares; the net present value of expected wages until the year in which either the peak value or the option value reach their maximum.

A summary of the estimation results obtained for each incentive measure are presented, separately by sex and Social Security regime, in Table 4. In each case we have considered agespecific dummies. The models have been fit to the observed transitions between 1994 and 1995. We show, for each combination of sex and regime, the estimates of the probit coefficients, their estimated standard errors and the implied probability effect. Since we report the results from a large number of models, we concentrate on the variables of

interest. The complete set of results is available from the authors upon request.

## 4.2 Description of the policies and simulation exercise

In the simulations we consider up to four policies:

- AR: Actuarial reform. This reform implies the following changes to the base system: (i) early retirement age at 60, (ii) normal retirement age at 65, (iii) a replacement rate at the normal retirement age equal to 60 percent of the gross (but net of the employers contributions) average lifetime earnings (on the best 40 earnings years before retirement or the first age of eligibility, whatever comes first), and an actuarial adjustment of 3.6 percent per year (or 6 percent with respect to the replacement rate at the normal retirement age) from age 60 to age 70 (this implies a replacement rate of 42 percent at age 60 and 78 percent at age 70). Notice that (i) and (ii) correspond to the current Spanish system, whereas the actuarial adjustment for retirement before age 65 is less favorable than the one currently used in Spain. Also, the current Spanish system is more generous for retirement at age 65 and has no actuarial adjustment for postponing retirement after that age.
- R97: 1997 Reform. The regime created by the 1997 Spanish reform and currently in place.
- A02: 2002 Amendment of the 1997 reform. The 1997 regime as altered by the amendment introduced in 2002.
- A02C: 2002 Amendment + reform of the eligibility rules for the minimum (contributive) pension. This simulation is based in the 2002 amendment plus the fact that the minimum pension is not available until age 65.

We recall that the 1997 reform implies the following changes in the basic benefit formula and in the penalties related to age and contributive history: (i) the number of years of contribution used to construct the benefit base is increased from 8, as prescribed by the 1985 legislation, to 15, (ii) workers retiring after the age of 60 with 40 or more contributive years are charged an actuarial adjustment of only 7 percent (instead of 8 percent) for each year under age 65, (iii)

**Table 4:**  
**Probit models of the 1995 retirement rates.**

	ACCRUAL		PEAK		OV	
	coef.	s.e.	coef.	s.e.	coef.	s.e.
Male RGSS: 16191 obs.						
SSW	.00749	.00152	.01387	.00170	.01627	.00186
(m.e.)	.00071	.00014	.00136	.00017	.00161	.00018
Incent.	-.00130	.00489	.00448	.00254	.01032	.00115
(m.e.)	-.00012	.00046	.00044	.00025	.00102	.00011
Cons.	-1.197	.53053	-1.273	.52863	-1.262	.53657
	$R^2$	log-l	$R^2$	log-l	$R^2$	log-l
	.373	-3579.	.380	-3544.	.381	-3534.
Female RGSS: 3852 obs.						
SSW	.01812	.00419	.02022	.00438	.02175	.00477
(m.e.)	.00162	.00038	.00185	.00040	.00199	.00044
Incent.	-.00580	.00755	.00393	.00527	.00361	.00210
(m.e.)	-.00053	.00068	.00036	.00048	.00033	.00019
Cons.	-.2204	.74217	-.2072	.74880	-.3375	.75922
	$R^2$	log-l	$R^2$	log-l	$R^2$	log-l
	.355	-860.1	.356	-858.5	.356	-858.5
Male RETA 4355 obs.						
SSW	.00726	.01174	.00992	.01238	.00501	.01451
(m.e.)	.00096	.00155	.00131	.00163	.00066	.00191
Incent.	.01050	.01440	.01432	.01056	.00187	.00758
(m.e.)	.00138	.00190	.00188	.00139	.00025	.00100
Cons.	-1.542	1.2772	-1.6444	1.2819	-1.324	1.283
	$R^2$	log-l	$R^2$	log-l	$R^2$	log-l
	.252	-1079.	.253	-1078.	.253	-1079.
Female RETA 2051 obs.						
SSW	-.00176	.01113	-.00248	.01119	-.01475	.01781
(m.e.)	-.00025	.00156	-.00035	.00157	-.00207	.00250
Incent.	.02538	.01207	.01824	.01039	.00739	.01736
(m.e.)	.00355	.00169	.00256	.00146	.00104	.00244
Cons.	-3.678	3.7786	-2.4574	3.8070	-1.876	3.9571
	$R^2$	log-l	$R^2$	log-l	$R^2$	log-l
	.197	-597.9	.196	-598.5	.195	-598.9

note: m.e. stands for marginal effect

the penalty for insufficient contributions is changed to

$$\alpha_n = \begin{cases} 0, & \text{if } n < 15, \\ .5 + .03(n - 15), & \text{if } 15 \leq n < 25, \\ .8 + .02(n - 25), & \text{if } 25 \leq n < 35, \\ 1, & \text{if } 35 \leq n, \end{cases}$$

The 2002 amendment has introduced the following changes, which were also illustrated in Section 2: (i) a generalized penalization rule for early retirement, starting at age 61; (ii) a new incentive scheme for those retiring after the age 65 with, at least, 35 years of contributions; (iii) a mild increase in survivor benefits.

### 4.3 Description of the simulation exercise

For each of the policies, given the estimated conditional retirement (hazard) models, we carry out the following simulation exercise:

1. For each individual in sample we compute the SSW and incentive measures according to the assumed policy changes.
2. Then, for each individual in sample, we compute predicted conditional retirement probabilities, conditional on both observed individual characteristics and predicted incentive variables.
3. Given the individual-specific conditional retirement probabilities or hazard, we obtain, for each year in {2005,2010}, average retirement hazard profiles.
4. Finally, combining the average retirement hazard profiles and the projected (at age 54) participation rates we obtain the projected participation profiles.

In order to simplify our presentation we only show results with the OV incentive measure. The rest of the results are available on request. We refer to Boldrin and Jiménez-Martín (2002, 2006) for a review of the financial implications of the results using OV as well as other incentive measures.

## 5 PARTICIPATION AND EMPLOYMENT EFFECTS OF THE REFORMS

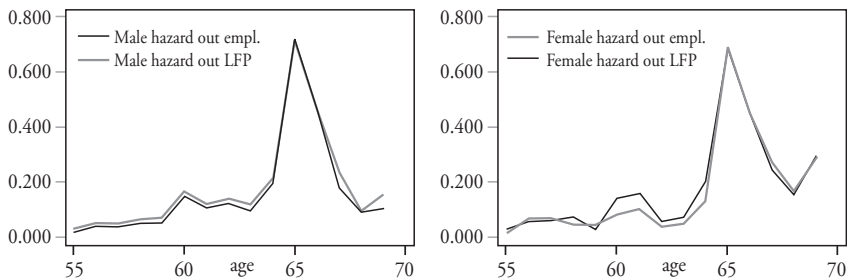
In this section we perform two main tasks. Firstly, we show the current (2nd quarter of 2003) hazard rate out of the labor force and out of employment in order to have a benchmark for comparison. Secondly, we simulate the effect of the recent Spanish reforms (1997 and 2002) and an actuarial reform described above in the employment level by age in 2005 and 2010.

### 5.1 Current average probability of leaving work from the labor force survey (2/03).

Table 5 and figure 8 present the conditional probabilities of leaving work and activity by gender and age in the second quarter of 2003. These transition probabilities have been constructed using the retrospective information about employment status that every 2nd quarter survey has. For both gender the hazard out shows the typical shape with two peaks located at the early retirement (s) and the normal retirement age respectively. The peak at the early retirement age is more pronounced for men than it is for women, because of the pre-2002 regulation, which states that only those individuals that started contributing before 1967 can retire at age 60. Nowadays, the likelihood that a male had started contributing before 1967 is much greater than the likelihood for a women. In fact the early retirement peak for women is observed at age 61. This is so because the 2002 amendment of the previous regulation opens the possibility to retire at 61 for all workers regardless when they started contributing. Notice that women use this possibility in a great proportion, specially when unemployed.

Figure 8:

#### Male hazard out employment and participation by gender: LFS 2003-II



### 5.2 Effect of the reforms on the employment rate in 2005 and 2010

In this section we simulate the effect of the recent, 1997 and 2002, Spanish reforms, a modification of the 2002 reform, and, finally, an actuarial reform described above in the employment level by age in 2005 and 2010. For each reform we simulate the hazard rate out of the labor force by age.

Having the estimated hazard rate and in order to obtain the parti-

**Table 5:**  
**Levels and hazards out employment and participation by gender and age. Spain. LFS 2nd**  
**quarter 2003. Base participation probabilities at age 54: M (0.849), F(0.374)**

age	Male				Female			
	employment		participation		employment		participation	
	hazard	level	hazard	level	hazard	level	hazard	level
55	0.018	0.757	0.033	0.810	0.017	0.336	0.034	0.372
56	0.040	0.732	0.050	0.782	0.070	0.277	0.060	0.315
57	0.038	0.680	0.052	0.712	0.069	0.293	0.066	0.332
58	0.051	0.714	0.065	0.748	0.048	0.264	0.077	0.291
59	0.052	0.645	0.073	0.684	0.043	0.254	0.034	0.282
60	0.149	0.556	0.168	0.589	0.083	0.230	0.144	0.243
61	0.106	0.531	0.122	0.556	0.103	0.191	0.161	0.205
62	0.124	0.459	0.141	0.490	0.039	0.179	0.059	0.192
63	0.096	0.411	0.120	0.430	0.048	0.138	0.076	0.145
64	0.195	0.305	0.217	0.318	0.131	0.113	0.208	0.119
65	0.719	0.103	0.718	0.109	0.691	0.043	0.682	0.047
66	0.459	0.070	0.468	0.070	0.449	0.036	0.456	0.036
67	0.182	0.031	0.237	0.031	0.271	0.019	0.247	0.020
68	0.094	0.039	0.094	0.039	0.167	0.020	0.161	0.020
69	0.105	0.028	0.155	0.028	0.294	0.012	0.294	0.012

icipation rates (which are closely related to employment rates since the unemployment rate of older individuals is very low) we additionally need participation rates at the age (54) before the simulation begins. Instead of using the current activity rates (2nd quarter 2003) we use projected activity rates at age 54 taking into account, as described in section 3.2, the potential composition effects due to the changes in the educational attainment of more recent Spanish cohorts.

Table 6 and Figure 9, and Table 7 and Figure 10 report the results of our analysis for males and females respectively. In each table we report by year and age, the hazard rate and the implicit activity rate and the unconditional probability of retiring at that particular age for each of the three reform we have simulated. In each graph we report the hazard and the implicit activity rates by age.

For both gender and all the reforms the shape of the hazard is very similar the the shape of current hazard (2nd quarter of 2003 depicted in figure 8). However, there are significant differences in the level of the hazard at practically all ages, specially between both Spanish reforms and the actuarial reform.

For instance, at age 60, the male hazard in 2005 is 0.166 for the R97 reform, 0.127 for the A02 reform, 0.125 for the A02C reform

and 0.107 for the AR. For females, the figures are 0.154, 0.186, 0.168 and 0.092, respectively. As a consequence, the implicit male activity (employment) level at age 60 is much higher in the case of the actuarial reform (0.72), than for the other reforms (0.609 and 0.64 for the R97 and A02 respectively). For females, the accumulated differences at age 60, are similar (0.31, 0.252 and 0.242 for respectively the AR, A02 and R97 reforms). By age 65 the accumulated differences are still very important in all cases.

The situation by year 2010 is qualitatively similar but the hazard out, at all ages, is quantitatively lower. This is so because the income effect, since the average incomes in sample are considerably larger. For instance, for males the hazard out of activity at 65 for the actuarial reform in 2010 is 0.637, much lower than the corresponding hazard in 2005, 0.663. As a consequence, the activity rate at age 65 is much higher in all cases. For instance, 0.146 (0.124) in 2010 against 0.118 (0.084) in 2005 for reform R97 for males (females).

Comparing our simulations with the 2003 situation (as reported in Table 5) we observe that:

1. In the current situation, by age 60, 37.2 and 35.3 percent of the active males and females are retired. In year 2005, by the same age and under the actuarial reform only 15.2 and 18.9 percent of the males and females would be retired. By year 2010, the difference is even more significant, since only 13.1 and 14.3 of respectively males and females would be retired.
2. The differences are also significant at age 65. In the current situation, 90.8 and 88.1 percent of respectively the males and females are retirees. In contrast, by year 2005 only 0.782 and 0.598 of respectively males and females would be retired. And, finally, by year 2010 only 0.747 and 0.567 of respectively males and females would be retired.

Table 8 (PANEL A) summarizes the overall impact of the reforms on the participation rate by gender in 2005 and 2010 and compares them to the current situation (2003). In 2005, the simulated participation rate is practically four basis points higher in either the R97 or the A02 scenarios than in the current situation. More importantly, in the AR scenario the participation would be practically 10 basis points higher. By 2010 the differences are projected to be even more significant for all reforms. Note that since the A02 is the current system

(from 2002) our projections imply that under the current rules and the current level of generosity, participation of older individuals would increase significantly in the forthcoming years.

Note that for men, since the base LFP rate is very similar in 2010 (0.8539) than in 2003 (0.8492), most of the effects are due to the changes in hazard rates. For women, the situation is sensibly different. By 2005, an important fraction of the effects are due to changes in the educational composition of the population. However, by 2010 approximately the 55 % of the total change can be imputed to changes in the retirement patterns of Spanish women.

The effect of the changes in the hazard translates into changes in the expected average retirement age. In Table 8 (Panel B) we present the implicit average retirement age conditional of participation at age 54 for the set of reform considered. Note that the increases in participation imply into increases in average retirement ages for all the reform considered in both years. The AR has the highest retirement rate for both gender. The increase in average retirement age from 2005 to 2010 is significant for all the reforms and gender. The average increase for female (practically one year) nearly doubles that of men, because of the change of the workforce composition is more important for them. Our results have to be taken with some cautions since they overestimate published figures (for example, those published by Eurostat), because of two reasons: first, our figures are conditional on participation at age 55 while published figures are conditional on working at age 49; and, second, our model cannot account for the fact that workers are likely to react to changes in regulation.

The financial implications of the actuarial reform, as noted by Boldrin and Jiménez-Martín (2002, 2006),<sup>6</sup> are also very important since the benefits are sharply reduced. They computed the financial implications of the various reform for the cohort of workers born in 1940 (aged 55 in 1995 and 70 by 2010) extracted from the sample described above. For the actuarial reform the amount of saving is set at about 0.55 percentage points of GDP. While this is a large amount, it is not so large in relation either to the annual expenditure for Social Security pensions (which is about 10 percentage points of GDP) or to the size of outstanding Spanish “pension debt”, which is estimated to range around 175-200 percentage points of GDP (see for example Bonin et al (2001) or, more recently, Balmaseda et al

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6. In Boldrin and Jiménez-Martín the actuarial reform we define here is called Common Reform.

(2005)). Even by multiplying these quantities by a factor of fifty (that is: even assuming that savings of similar size can be achieved during the next fifty year for each cohort born between 1940 and 1990) we would still be projecting total savings equal to, at best, 20 percent of the outstanding pension debt. From this perspective, the savings which can be achieved via the reforms considered here are somewhat modest and, probably, still below the level which appears to be desirable.

They also show that Spanish reforms are much less effective. In both cases the total SSW varies very little, retirement patterns remain almost identical (a very mild shift to the right is predicted for the RETA affiliates), and the net fiscal effect is tiny. Also, they find that these reforms are regressive when one looks at within cohorts redistribution. The amount of regressivity is, naturally, limited by the small reduction in aggregate SSW. Still, and quite paradoxically, the 2002 Amendment seems to make the overall Spanish reform more regressive than it was after the 1997 change. In any case, there is no reason to believe that the very minor improvement in the government fiscal position that A02 engenders will be sufficient to contain the forthcoming Spanish pension deficit.

In short, the introduction of a draconian actuarial reform has important consequences on the retirement hazard of Spanish workers. Moreover, the financial implications of this reform, as noted by Boldrin and Jiménez-Martín (2002,2006) are also very important, since the level of benefits is sharply reduced. However, while important, the implied saving of 0.5 percentage points of the GDP are not sufficient to eliminate the important implicit debt of the Spanish Social Security system which in the long run is mostly driven by demographic forces.

## 6 CONCLUDING REMARKS

In this paper we have analyzed the current situation of the Spanish labor market for older workers and the labor force consequences of alternative pension reform scenarios. As pointed out in the main text, some of the quantitative estimates reported should be taken with (more than) the usual grain of salt as they are based on estimations of reduced form behavioral equations that appear to have only a limited power to capture observed retirement patterns.

All the reforms reduce the current hazard rates by a amount ranging from small (in the case of the R97 or the A02, which more or less represents current system) to large (in the case of the Actuarial reform). Two factors help explain these positive trends: the increase in the education attainment of the Spanish workforce (which implies higher earnings) and the increase in the average wage of workers. Although the results should be taken with the natural caution, we provide an optimistic scenario of the evolution of retirement patterns in the forthcoming years and show the effectiveness of the actuarial reform in reducing early retirement.

Our results also show that the participation rate under the system in place (A02) and the current level of generosity is expected to significantly increase in the forthcoming years (from the current 30.8 percent in 2003 to 38.7 by 2010). Note that the actual trends imply, at the current level of generosity, a significant improvement in the short run sustainability of the system. Moreover, the necessity to any drastic parametric reform, such as the actuarial reform just analyzed, which implies much larger increases in participation and much greater savings, is much less evident (specially when we take into account the accelerated increase of employment in recent years) in the short term, which coincides with current political perceptions of the agents involved. However, recent policy changes, such as the increase of generosity introduced by the Socialist government in 2004 may reverse or reduce these favorable trend in labor force participation and employment of older workers.

To conclude, it is important to note that this favorable short term tendency does not compensate at all the long run trend of the Social Security system which is mostly driven by the unstoppable aging process of the Spanish population. Thus, indirectly, we offer support to a more drastic change towards a system with a funded component.

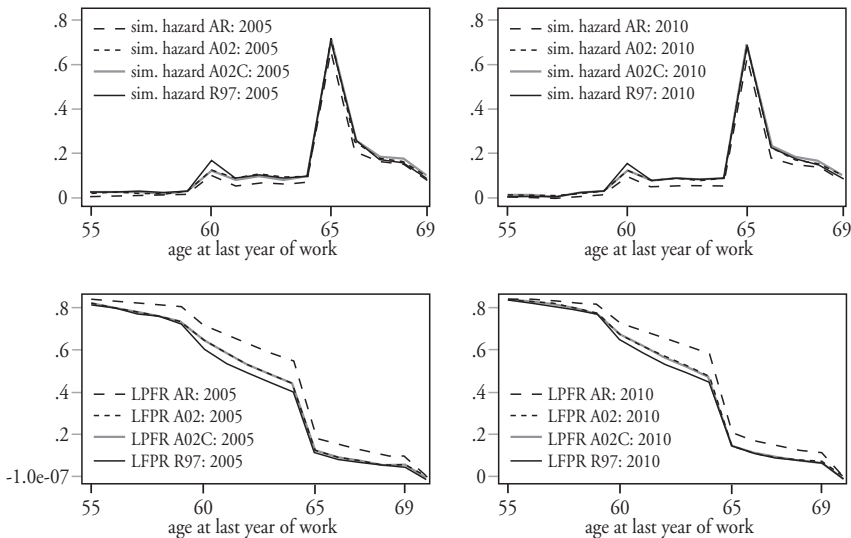
**Table 6:**  
**Projected retirement hazard, employment and retirement densities by age,**  
**reform and period: Males 2005 and 2010.**

year 2005, base LFPR at age 54: 0.8495												
1997 Reform: base				2002 reform			2002 reform + MP			Actuarial reform		
age	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)
55	0.027	0.827	0.027	0.026	0.828	0.026	0.024	0.829	0.024	0.008	0.843	0.008
56	0.032	0.800	0.058	0.031	0.802	0.056	0.029	0.804	0.053	0.010	0.834	0.018
57	0.030	0.776	0.086	0.029	0.779	0.084	0.028	0.782	0.080	0.010	0.825	0.028
58	0.026	0.756	0.110	0.026	0.759	0.107	0.024	0.763	0.102	0.009	0.818	0.037
59	0.035	0.730	0.141	0.033	0.733	0.137	0.032	0.738	0.131	0.013	0.807	0.050
60	0.166	0.609	0.283	0.127	0.640	0.247	0.125	0.646	0.240	0.107	0.720	0.152
61	0.093	0.552	0.350	0.091	0.582	0.315	0.084	0.591	0.304	0.057	0.680	0.200
62	0.106	0.494	0.419	0.104	0.521	0.386	0.099	0.533	0.373	0.068	0.633	0.255
63	0.090	0.450	0.471	0.088	0.475	0.440	0.085	0.488	0.426	0.063	0.593	0.302
64	0.099	0.405	0.523	0.099	0.429	0.495	0.096	0.441	0.481	0.071	0.551	0.352
65	0.709	0.118	0.861	0.714	0.122	0.856	0.714	0.126	0.852	0.663	0.186	0.782
66	0.253	0.088	0.896	0.258	0.091	0.893	0.258	0.093	0.890	0.211	0.146	0.828
67	0.178	0.072	0.915	0.185	0.074	0.913	0.185	0.076	0.910	0.165	0.122	0.856
68	0.163	0.061	0.929	0.172	0.061	0.928	0.172	0.063	0.926	0.161	0.103	0.879
69	0.094	0.055	0.935	0.102	0.055	0.935	0.102	0.057	0.933	0.106	0.092	0.892
70	1.000	0.000	1.000	1.000	0.000	1.000	1.000	-0.000	1.000	1.000	0.000	1.000
year 2010, Base LFPR at age 54: 0.8539												
1997 Reform: base				2002 reform			2002 reform + MP			Actuarial reform		
age	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)
55	0.008	0.847	0.008	0.008	0.847	0.008	0.008	0.847	0.008	0.004	0.850	0.004
56	0.010	0.838	0.018	0.010	0.838	0.018	0.010	0.838	0.018	0.005	0.846	0.009
57	0.009	0.831	0.027	0.009	0.830	0.027	0.009	0.831	0.027	0.005	0.842	0.014
58	0.025	0.810	0.052	0.025	0.810	0.052	0.024	0.811	0.050	0.008	0.835	0.022
59	0.034	0.782	0.084	0.034	0.783	0.084	0.033	0.784	0.081	0.013	0.825	0.034
60	0.156	0.660	0.227	0.128	0.683	0.201	0.126	0.686	0.197	0.100	0.742	0.131
61	0.084	0.605	0.292	0.086	0.624	0.269	0.080	0.631	0.261	0.049	0.706	0.173
62	0.090	0.550	0.356	0.092	0.567	0.336	0.088	0.576	0.326	0.055	0.667	0.219
63	0.083	0.504	0.409	0.085	0.518	0.393	0.083	0.528	0.382	0.054	0.631	0.261
64	0.089	0.459	0.462	0.091	0.471	0.448	0.088	0.481	0.436	0.057	0.595	0.303
65	0.683	0.146	0.829	0.692	0.145	0.830	0.691	0.148	0.826	0.637	0.216	0.747
66	0.229	0.112	0.868	0.234	0.111	0.870	0.234	0.114	0.867	0.182	0.177	0.793
67	0.176	0.093	0.892	0.182	0.091	0.893	0.182	0.093	0.891	0.144	0.151	0.823
68	0.154	0.078	0.908	0.163	0.076	0.911	0.163	0.078	0.909	0.134	0.131	0.847
69	0.089	0.071	0.916	0.096	0.069	0.919	0.096	0.070	0.918	0.084	0.120	0.860
70	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000	1.000

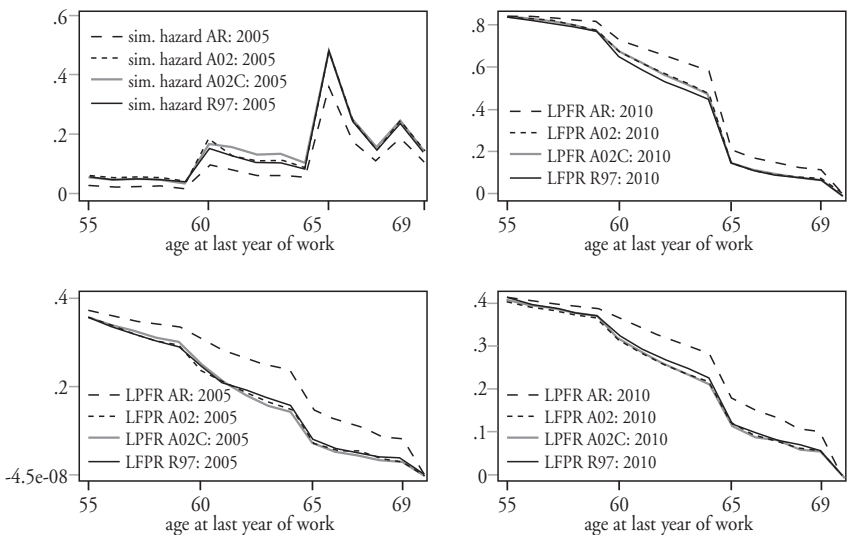
**Table 7:**  
**Projected retirement retirement hazard,employment and retirement densities by age, reform and period: Females 2005 and 2010.**

year 2005. Base LFPR at age 54: 0.3856												
1997 Reform: base				2002 reform			2002 reform + MP			Actuarial reform		
age	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)
55	0.056	0.364	0.056	0.057	0.364	0.057	0.052	0.366	0.052	0.025	0.376	0.025
56	0.050	0.346	0.103	0.051	0.345	0.105	0.046	0.349	0.095	0.022	0.368	0.047
57	0.051	0.328	0.149	0.052	0.327	0.152	0.046	0.333	0.137	0.022	0.359	0.068
58	0.052	0.311	0.194	0.054	0.309	0.198	0.046	0.318	0.176	0.025	0.350	0.091
59	0.040	0.298	0.226	0.041	0.297	0.231	0.034	0.307	0.204	0.018	0.344	0.107
60	0.154	0.252	0.345	0.186	0.242	0.373	0.168	0.255	0.338	0.092	0.313	0.189
61	0.127	0.220	0.428	0.130	0.210	0.455	0.158	0.215	0.442	0.073	0.290	0.249
62	0.107	0.197	0.489	0.109	0.187	0.514	0.132	0.187	0.516	0.062	0.272	0.295
63	0.106	0.176	0.544	0.109	0.167	0.567	0.133	0.162	0.580	0.061	0.255	0.338
64	0.085	0.161	0.583	0.087	0.153	0.604	0.104	0.145	0.624	0.052	0.242	0.373
65	0.476	0.084	0.781	0.482	0.079	0.795	0.482	0.075	0.805	0.360	0.155	0.598
66	0.245	0.064	0.835	0.252	0.059	0.847	0.252	0.056	0.854	0.177	0.127	0.669
67	0.151	0.054	0.860	0.156	0.050	0.871	0.156	0.047	0.877	0.109	0.114	0.706
68	0.232	0.041	0.892	0.244	0.038	0.902	0.244	0.036	0.907	0.188	0.092	0.761
69	0.139	0.036	0.907	0.148	0.032	0.917	0.148	0.031	0.921	0.107	0.082	0.786
70	1.000	0.000	1.000	1.000	0.000	1.000	1.000	-0.000	1.000	1.000	0.000	1.000
year 2010. base LFPR at age 54: 0.4208												
1997 Reform: base				2002 reform			2002 reform + MP			Actuarial reform		
age	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)	hazard	LFPR	p(ret)
55	0.032	0.408	0.032	0.032	0.407	0.032	0.030	0.408	0.030	0.018	0.413	0.018
56	0.029	0.396	0.060	0.030	0.395	0.061	0.027	0.397	0.057	0.016	0.407	0.034
57	0.027	0.385	0.085	0.028	0.384	0.087	0.025	0.387	0.081	0.016	0.400	0.049
58	0.030	0.373	0.112	0.031	0.372	0.115	0.028	0.376	0.107	0.018	0.393	0.066
59	0.022	0.365	0.132	0.023	0.364	0.136	0.021	0.368	0.125	0.013	0.388	0.078
60	0.106	0.326	0.224	0.135	0.315	0.253	0.129	0.321	0.237	0.070	0.361	0.143
61	0.092	0.296	0.296	0.094	0.285	0.323	0.106	0.287	0.318	0.060	0.339	0.194
62	0.085	0.271	0.356	0.086	0.260	0.381	0.097	0.259	0.384	0.054	0.321	0.238
63	0.077	0.250	0.405	0.078	0.240	0.429	0.087	0.237	0.438	0.050	0.305	0.276
64	0.085	0.229	0.456	0.087	0.219	0.479	0.101	0.213	0.495	0.060	0.286	0.319
65	0.458	0.124	0.705	0.462	0.118	0.720	0.462	0.114	0.728	0.364	0.182	0.567
66	0.220	0.097	0.770	0.225	0.091	0.783	0.225	0.089	0.789	0.170	0.151	0.641
67	0.123	0.085	0.798	0.126	0.080	0.810	0.126	0.078	0.816	0.095	0.137	0.675
68	0.217	0.067	0.842	0.225	0.062	0.853	0.225	0.060	0.857	0.181	0.112	0.734
69	0.116	0.059	0.860	0.121	0.054	0.871	0.121	0.053	0.874	0.089	0.102	0.757
70	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	0.000	1.000

**Figure 9:**  
**Impact of the reforms on the LFP and hazard rates by age and year. Males**



**Figure 10:**  
**Impact of the reforms on the LFP and hazard rates by age and year. Females**



**Table 8:**  
**Summary of the effects of the reforms**

Panel A. Participation in the 55-69 age group									
	1993	2005				2010			
	current (03)	R97	A02	A02C	AR	R97	A02	A02C	AR
male	0.4513	0.4909	0.5014	0.5066	0.5673	0.5278	0.5335	0.5368	0.5900
female	0.1790	0.2054	0.2006	0.2026	0.2578	0.2589	0.2539	0.2534	0.2957
Total	0.3079	0.3414	0.3439	0.3470	0.4052	0.3875	0.3872	0.3880	0.4363

Panel B. Average retirement age conditional to participation at age 54									
	current(03)	2005				2010			
	current(03)	R97	A02	AR	A02C	R97	A02	AR	A02C
male	61.97	62.99	63.18	64.36	63.27	63.65	63.74	64.76	63.80
dif10-05						0.65	0.55	0.40	0.53
female	62.11	62.60	62.41	64.70	62.47	63.86	63.67	65.21	63.66
dif10-05						1.20	1.26	0.51	1.19

## A DATA AND VARIABLES

In this section we define the variables that have been employed in the specification of the reduced form probit. The data source is the HLSS, unless we state otherwise.

### A.1 The HLSS dataset

Our main microeconomic data set is based on administrative records from the Spanish Social Security Administration (*Historiales Laborales de la Seguridad Social*, or HLSS from now on). The sample consists of 250,000 individual work histories randomly drawn from the historical files of SS affiliates (*Fichero Histórico de Afiliados* or FHA). The sample includes only individuals aged 40+ on July 31, 1998, the date at which the files were prepared. The sample contains individuals from the RGSS and the five special regimes, RETA, REA, REEH, RTMC and RTMAR. As we mentioned above, civil servants and other Central Government employees are not covered by the SS Administration and are not considered in this study.

#### *Variables from HLSS*

Experience, education and occupation.

- Spell: Length of the current spell in the data set.