# Trends in Employment and Social Security Incentives in the Spanish Pension System: 1980-2016\*

Pilar Garcia-Gomez Erasmus University

Silvia Garcia-Mandico Erasmus University

 $\label{eq:sergi} Sergi Jiménez-Martín \\ Universitat Pompeu Fabra, Barcelona GSE and FEDEA^{\dagger}$ 

Judit Vall-Castello CRES, Universitat Pompeu Fabra

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<sup>&</sup>lt;sup>†</sup>Department of Economics, Ramon Trias Fargas 25. 08005 BARCELONA (SPAIN). sergi.jimenez@upf.edu

# 1 Introduction

Labor force participation rates at older ages have been on the rise since the mid-1990s in many OECD countries. In Spain, participation rates of men aged fifty-five to sixty-four have increased by almost ten percentage points over this period, while participation rates of women have more than doubled (see Panel B of Figure 1 below). Existing descriptive evidence (see Gruber and Wise 1999 and Gruber and Wise 2004 for Spain) points out to the potential role of changes in the skill composition of workers, favorable economic conditions until the Great Recession or the effect of wife's labor market participation on the probabilities that men retire later. In this paper, we investigate to what extent changes in the financial incentives to retire derived from the old-age pension system, as well as unemployment insurance or disability insurance, can explain these trends.

Panel A in Figure 1 shows the employment rates over time for men and women aged fifty-five to fifty-nine, sixty to sixty-four, and sixty-five to sixty-nine. For men, employment rates were decreasing for all age groups until the mid-1990s. At the end of the 1990s, the employment rates began to rise until the trend was reverted with the financial crisis in 2008. The drop in employment rates due to the financial crisis does not translate into lower labor force participation rates (see Panel B in Figure 1). From 2015 onwards, we observe again an increasing trend in employment rates, coinciding with the recovery of the Spanish economy. Employment rates, as well as labor force participation rates, for men aged sixty-five to sixty-nine remained relatively constant at low levels over the entire period. The picture for women is distinctively different. Women experienced flat employment trends until the late nineties, when their employment rate soared. This increasing trend continued even during the period of economic recession from 2008 to 2013. As for men, employment and participation rates of women aged sixty-five to sixty-nine were rather constant at low levels through the entire period observed.

García-Gómez et al. (2012) argue that the social security system cannot be the main driver of the reversal of these trends given the lack of major reforms until 2011. However, changes in the old-age pension system, as well as unemployment and disability insurance, have modified the incentives that different (groups of) workers have to retire at different ages. The empirical literature exploring the effect of financial incentives on retirement behavior of employed workers is ample (Samwick 1998; Gruber and Wise 1999, 2004; Börsch-Supan 2000; Belloni and Alessie 2009). A more recent line of research also investigates the behavior of unemployed workers. This is the case of Coile and Levine (2007) or Coile and Levine (2011) using US data. In Europe, using French data, Hairault et al. (2010) find that the distance to the statutory retirement age is a key predictor of retirement behavior. Although in general the authors find that financial incentives have an effect on retirement behavior, eligibility conditions turn out to be the most important determinant of retirement behavior.

In the Spanish case, the seminal papers by Boldrin et al. (1999, 2004) and Jiménez-Martín and Sánchez-Martín (2004) find that financial incentives have a significant effect on financial incentives, although the magnitude is small. More recently, Cairó-Blanco (2010), García-Pérez et al. (2013) and Sánchez-Martin et al. (2014), who explicitly consider the behavior of unemployed workers, also find a significant but weak influence of financial incentives of retirement from the labor force. A common feature of those papers is that they empirically restrict to one

Figure 1: Trends in Employment rates and Labor Force Participation of men and women from  $1987 \mbox{ to } 2017$ 







or (at most) two social security rules. In this paper, we go one step forward and extend the analysis to include a long time series period which covers several sets of rules and may, thus, contribute to improve the identification of the effects.

In more detail, we analyze the association between financial incentives and retirement decisions using aggregate data over four decades in Spain. We first compute expected social security benefits from each possible retirement route (old-age pension, disability insurance or unemployment insurance) at ages fifty-five to sixty-nine for a typical worker for each cohort in this age range in our observational period. We allow typical workers to differ by marital status, gender and skill level. Next, we calculate the *implicit tax rate on working longer*, a measure that compares gains and losses from social security wealth and earnings from working one year longer for each typical worker. Finally, we test the correlation between the implicit tax rate on working longer and employment rates for older workers using both graphical inspection and regression analysis with aggregate data at the regional level.

Our results suggest that financial incentives matter for retirement patterns of both employed and unemployed workers. However, there are many other factors at play that prevent a uniform interpretation for all types of workers.

The rest of the paper proceeds as follows. Section 2 describes the reforms of the Spanish Social Security system over the last three decades. Section 3 explains the measurement of the Social Security incentives, and the assumptions behind our calculations. Section 4 reports the resulting calculations, and Section 5 analyzes the relationship between the Social Security incentives and employment rates since 1980. Section 6 concludes.

# 2 Reforms in the Spanish Social Security System

#### 2.1 Changes in the Old-Age Pension System

The Spanish old-age pension system is a Defined benefit pay-as-you-go system. There have been many reforms in the system over the last 30 years (see Table 1 for a summary, and Boldrin et al. (2010) and García-Gómez et al. (2012) for a detailed exposition of the changes in old-age pension system in Spain). We start describing the system before the 1985 reform. Since this reform, there have been substantial parametric reforms in 1997, 2002, 2007, 2011 and a nonparametric reform in 2013. Figure 2 depicts the timeline of the reforms of the Spanish Social Security System from 1980 until 2015, as well as the main parameters that were modified in each of the reforms.

## 2.2 The system before the 1985 reform

As described in Boldrin et al. (1999) the transition from the old *Mutualidades* system to the modern Social Security contribution system was completed in 1979, when the *bases tarifadas* (fixed covered wages) were removed. The basic ingredients of the system until 1985 were as follows<sup>1</sup>:

• The statutory eligibility age was set at 65 and the earliest eligibility age at 60

<sup>&</sup>lt;sup>1</sup>See Boldrin et al. (1999, 2004) for other details regarding disability and survivor pensions.



## Figure 2: Timeline of the Reforms of the Spanish Social Security System

- 10 years of contribution were required to gain access to a contributive pension
- The pension was calculated on the basis of three elements: the average of the 24 monthly contributions preceding retirement; the penalty for early retirement (8 per cent per year advanced) and the penalty for insufficient contributions (2 percent per year not contributed).

#### 2.2.1 The old-age pension system after the 1985 reform

The key elements of the Spanish pension system prevailing until 2011 were set in 1985. Eligibility to the old-age pension benefits in Spain required at least 15 years of contributions to the system. The individual could enter the system at the statutory retirement age of 65 if she did not have any job that required affiliation to the Social Security system. The pension amount was calculated by multiplying a regulatory base by a percentage which depended on the age of the individual and the number of years contributed to the system. If the individual entered the old-age system after the statutory retirement age of 65, there was an additional percentage that would also be multiplied to the regulatory base. Under the 1985 regime, the regulatory base was obtained by dividing by 112 the wages of the last 96 months before retiring and the percentage applied to this regulatory base depended on the number of years of contributions (n) as follows:

 $\begin{cases} 0, \text{ if } n < 15\\ .5 + 0.03(n - 15), \text{ if } 25 > n \ge 15\\ .8 + 0.02(n - 25), \text{ if } 35 > n \ge 25\\ 1, \text{ if } n \ge 35 \end{cases}$ 

The pension amount was capped from below by the minimum pension which is currently about the same level than the minimum wage (see Jiménez-Martín 2014 for details) and the maximum benefit (between 4 and 5 times the minimum wage).

#### 2.2.2 The 1997, 2002, and 2007 reforms

In 1997 the number of contributory years used to compute the benefit base was progressively increased from 8 to 15 years and the formula to calculate the replacement rate was also made less generous. On the other hand, the 8% penalty applied to early retirees between the ages of 60 and 65 was reduced to 7% for individuals with 40+ years of contributions at the time of early retirement.

In 2002 further changes in the old-age were introduced. Before 2002, only individuals who had contributed to the system earlier than 1967 could benefit from early retirement at sixty, while the rest had to wait until the normal retirement age of sixty-five. In 2002, earlier retirement at sixty-one was made available for the rest of the population. At the same time, there was an impulse to the partial and flexible retirement schemes with the possibility of combining income from work with old-age benefits and the introduction of incentives for individuals to retire after the statutory eligibility age of 65 (an additional two percent per additional year of contribution beyond the age of 65 for workers with at least 35 years of contributions on top of the 100% applied to the regulatory base). At the same time, the possibility to access retirement was extended to individuals who are unemployed for reasons beyond their willingness at sixty-one and who have contributed for at least 30 years and have been registered in the employment office for the previous 6 months.

In 2007 the incentives to retire later than sixty-five were further increased providing an additional three percent, instead of the two percent agreed in 2002. Moreover, in order to have access to an old-age pension the individual must have contributed for at least two out of the last 15 years. On the other hand, the 8% penalty applied to early retirees between the ages of 60 and 65 was reduced to 6-7.5%, depending on the number of years contributed, for those individuals with 30 years of contributions. In addition, the contributions for unemployed workers older than fifty-two were increased so that they would receive a higher old-age pension when retiring.

Although these reform tried to increase labor supply of older male workers, the existing evidence (see for example Cairó-Blanco 2010, García-Pérez et al. 2013) does not show any clear link between these reforms and the increased labor supply of older male workers.

#### 2.2.3 The 2011 reform

The terrible demographic and labor market scenarios that arose during the first years of the great recession led the Spanish government (forced by the EU pressure to reduce the underlying future deficits) to reform in 2011 the pension system. Two crucial elements were changed: the extension of the number of years of contributions taken into account to calculate the pension (from 15 to 25), and the increase in the statutory eligibility age (from 65 to 67, gradually). This second change was extremely relevant for Spain because the statutory eligibility age had not been amended since the year it was first established in 1919. These two changes caused a cut in the generosity of the pension system. The first one reduced the replacement rate by 10

to 20 percent depending on the worker's characteristics and earnings history, and the second reduced the social security debt of those individuals planning to retire at the statutory eligibility age (see Sánchez et al. 2017 for a recent evaluation). The reform also changed (restricted) the eligibility conditions for early retirement but the effects of these changes are less clear. Finally, note that, since the reform barely changed the eligibility conditions to access to the minimum pension, workers expecting to receive the minimum pension (that is workers with low income and short contributive careers) were less affected by the reform (Jiménez-Martín 2014).

The case of Spain is not an isolated one, as most European countries have initiated or are about to initiate a process of pensions reform (European-Commission 2012). In most of the cases, reforms involve the following three elements: (i) a delay in the statutory eligibility age, together with relaxing the requirement to make compatible work and pension income, (ii) a reduction of the systems generosity, and (iii) the introduction of a sustainability factor, which adds some uncertainty to the final benefit, thereby transitioning the system from a Defined Benefit to a Defined Contribution model.

The 2011 Spanish reform (law 27/2011), which included elements (i) and (ii) above, should, in normal circumstances, have been sufficient to alleviate the medium-term financial pressure on the Spanish pension system. However, some recent studies demonstrate that it was clearly insufficient from a financial point of view (Díaz-Giménez and Díaz-Saavedra 2017; Sánchez et al. 2014).

#### 2.2.4 The 2013 Reform and the Sustainability Factor

The importance of the 2013 reform lies on the introduction of an automatic link between the initial pension and the evolution of life expectancy (Conde-Ruiz et al. 2013). The reform was an attempt of the government to ensure that its short- and long-term social security finances were under control. The Sustainability Factor (SF) can be seen as a mechanism that transforms a defined benefit scheme, such as that operated by Spain, to a defined contribution scheme.

The pension system in Spain was a defined-benefit, pay-as-you-go scheme, so the pension did not fulfill any criteria of financial balance. Thus, when demographic characteristics (for example, life expectancy) or the economic outlook (primarily, the relationship between contributors and pensioners, and productivity) deteriorated, the system became unbalanced. The SF, among other things, automatically adjusted the system when exposed to these demographic changes.

The SF had two key components, the intergenerational equity factor (IEF) and the pension revaluation index (PRI). The aim if the IEF was to provide equal treatment to those that retired at the same age and with the same employment history, but who had different life expectancies. This factor didn't give rise to much controversy, since it was perceived as reasonable that if pensioners were to receive the same total pension throughout their retirement, an individual with a greater life expectancy should receive a little less each year. The second factor, the PRI, fixed a budgetary constraint on the economic cycle and, as such, was relatively flexible in the short term. However, the discretionary rule chosen by the Government guaranteed that, even though Social Security revenues were insufficient to cover pension costs, pensions would rise each year by at least 0.25% (that is, frozen, though seeking to generate a certain degree of monetary confidence) and by no more than the annual changed in the CPI + 0.25%.

In summary, the 2011/2013 pension reform was expected to incentivize the labor supply of older workers in Spain, by reducing benefit expectations and including incentives to work longer (partial benefit compatibility after the normal retirement age) (Sánchez et al. 2014). However, it is still too early to fully detect its implications.

Year of the reform	Main changes
1985	<ul> <li>Increased the minimum mandatory annual contributions from 8 to 15</li> <li>The number of contributive years used to compute the pension increases from 2 to 8.</li> <li>Several early retirement schemes are introduced; Partial retirement and special retirement at age 64</li> </ul>
1997	<ul> <li>The number of contributive years used to compute the pension increases from 8 to 15 (progressively by 2001).</li> <li>The formula for the replacement rate is made less generous.</li> <li>The 8% penalty applied to early retirees between the ages of 60 and 65 is reduced to 7% for individuals with 40 or more contributory years.</li> </ul>
2002	<ul> <li>Early retirement only from age 61</li> <li>Impulse partial retirement; possible to combine it with work</li> <li>Unemployed aged 61 can retire if contributed for 30 years and the previous 6 months registered in employment offices</li> <li>Incentives to retire after age 65</li> </ul>
2007	<ul> <li>15 effective contributory years are used to calculate the pension.</li> <li>Reduction from 8% to 7.5% of the per-year penalty applied to early retirees between 60 and 65 for individuals with 30 contributory years.</li> <li>Broaden incentives to stay employed after age 65.</li> <li>Increase contributions made by the social security administration for individuals receiving the special scheme of UA for 52+ (they will receive a higher old-age pension when retiring).</li> </ul>
2011	<ul> <li>The number of contributive years used to compute the pension increases from 15 to 20</li> <li>The normal retirement age increases from 65 to 67</li> <li>Eligibility conditions for early retirement are modified</li> </ul>

Table 1: Main reforms of the old-age pension system Spain since 1980

### 2.2.5 Evolution of Key Parameters

To conclude this section, we show how the key parameters of the old-age pension system (years of contributions, early and statutory pension ages, and minimum and maximum benefits) have changed over time. Panel A in Figure 3 shows the increase in the years of contributions included in the benefit calculation. Reform years are marked with a vertical red line. We see that after the reforms in 1985, 1997 and 2011, the number of years included increased staggeringly. Panel B shows the earliest and statutory eligibility pension ages. The latter has only been increased with the latest reform of the pension system in 2011. The earliest eligibility age increased from sixty to sixty-one in 2002, and in 2011, retirement at sixty-one became limited to situations of involuntary retirement. At the same time, the earliest eligibility age for voluntary retirement was set at sixty-three. Panel C shows the increasing trend in the ratio of minimum benefit to minimum wage, highlighting the generosity of the Spanish pension system. This trend was reverted with the 2013 reform and the introduction of the sustainability factor. Panel D shows the ratio of the minimum to the maximum benefit. Since the early nineties, and in particular after the 1997 and 2002 reforms, we can observe a narrowing trend of the gap between minimum and maximum pensions. This tendency was curbed with the 2013 reform.

Panel A. Contributive Years in Benefit Calculation



Panel C. Ratio of Minimum Benefit to Minimum Wage





Panel D. Minimum and Maximum Contribution



#### 2.3 Reforms in the Disability and Unemployment system

Another factor that may affect the labor market behavior of older workers are disability and unemployment insurance policies (García-Gómez et al. 2012). In what follows, we summarize the main reforms of both the disability and unemployment systems in Spain.

Permanent disability benefits were used extensively as an early retirement mechanism for workers in restructuring industries (such as shipbuilding, steel, mining, etc.) or as substitution for long-term unemployment subsidies in depressed regions during the late 1970 and 1980 (OECD, 2001), which resulted in an increase in the inflows into the disability system and permanent disability benefits. These events prompted a number of reforms introduced during the second half of the 1980s and beginning of the 1990s (see Table 2 for a summary). The main objective of these reforms was to abolish the incentive effects to permanently leave the labor market before reaching the statutory eligibility age for retirement through the disability system. Here we focus on some distinctive features of the main reforms since the creation of the National Institute of Social Security (NISS) in 1979, while we refer the reader to Table 2 for a summary of all the reforms in the disability system in Spain during this period.

The first biggest reform of the disability system took place in 1997 and included 4 main points:

- 1. Sickness benefits: stricter control of the sickness status by doctors of the Social Security system, reduction of the level of long-term sickness benefits, and replacement of the old own job assessment by a more objective definition of the usual occupation of the individual.
- 2. Permanent disability pensions of individuals aged at least sixty-five were automatically

Panel B. Earliest and Statutory Eligibility Age

transferred to the old-age pension system. This was just a change in the classification within the pensions system.

- 3. Organizational reform: all the issues related to disability insurance were transferred to the NISS. The permanent disability status was in the past assessed and granted by local GPs and this reform created a group of experts (the disability assessment team inside the NISS) which was in charge of assessing the persons ability to work on the basis of the available medical files and a special medical assessment done by one of the NISS doctors.
- 4. The claimant did no longer lose entitlement to non-contributory disability benefits if she started working. She would remain entitled to receive non-contributory disability benefits in case of job loss.

In addition to this major reform in 1997, the 1998 budget law introduced the possibility for doctors from the NISS and mutual insurance companies to review the health situation and status of beneficiaries. However, only very few claimants in the permanent disability system effectively exit the program.

In 2004 and 2005 monitoring of the use of sickness leave was tightened with the creation of a new sub-department at the NISS and a new monitoring tool to reduce absence rates. In 2005, a general absence control was put in place for cases in which the absenteeism took longer than six months.

Finally, at the end of 2007 the minimum contributory period to access permanent disability pensions was reduced for young workers in order to adjust for the current later entrance into the job market of younger workers. At the same time, the formula to calculate the regulatory base of the benefit was slightly modified: the regulatory base of permanent disability due to a common illness is since then decreased by 50% if the individual had not contributed at least 15 years and it is lower the further the individual is from age 65.

All these reforms ensured the financial stability of the disability system in Spain as inflow rates have remained stable, at odds with the dramatic increases experienced in other industrialized countries.

The extent to which reforms in the disability system have successfully decreased the outflows from employment at older ages hinges on the evolution of other social security programs, which could be used as alternative early retirement routes. Therefore, we now summarize other important reforms that have taken place in the unemployment system.

In 1984, both temporary contracts and non-contributory unemployment benefits (also called unemployment assistance benefits) were introduced. In addition, a special provision was established for workers aged over fifty-five who were allowed to receive unemployment assistance benefits until the claiming age. To receive these benefits, individuals had to satisfy the entitlement requirements of the retirement pension except for the age. The subsidy paid 75% of the minimum wage until reaching the age to be transferred to an old-age pension. Furthermore, the years spent unemployed under this special scheme were counted as contributive years towards an old-age pension. In 1989 the special provision of unemployment assistance benefits until the retirement age of sixty-five for individuals aged at least fifty-five was extended to individuals aged fifty-two, thus increasing the incentives of older workers to leave the labor market at younger ages.

The reform in 2002 opened up the possibility for individuals aged fifty-two or more receiving unemployment benefits to combine the receipt of these benefits with earnings, as they could receive 50% of normal benefits and the employer would pay the remaining amount in wages.

Finally, in 2012 the amount an individual received from UI after the first six months was reduced from sixty to fifty percent of previous earnings.

Year of the reform	Main changes			
1984	<ul> <li>Introduction of temporary contracts and non-contributory unemployment benefits (also called unemployment assistance benefits)</li> <li>Special provision for workers 55+ to receive unemployment assistance benefits until retirement age</li> <li>Eligible if satisfying the old age pension entitlement requirement except for the age</li> <li>Paid 75% of the minimum wage</li> <li>Years spent under this scheme were counted as contributive years towards an old-age pension</li> </ul>			
1985	Tightening eligibility criteria to DI			
1989	Extension of special provision for older workers to all <b>workers <math>52+</math></b>			
1990	Introduction of a <b>means-tested non-contributory disability pensions</b> for people aged $65+$ and for disabled people aged $18+$ who satisfy residency requirements.			
1997	<ul> <li>Sickness Benefits: <ul> <li>Stricter control of the sickness status by doctors of the Social Security system</li> <li>Reduction of the level of long-term sickness benefits</li> <li>Replacement of the old own job assessment by a more objective definition of the usual occupation of the individual</li> </ul> </li> <li>Permanent disability pensions individuals 65+ are automatically converted to old-age pensions. Organizational change, creation of the National Institute of Social Security (NISS): Disability is assessed by benefit administrators based on a medical assessment performed by the NISS own doctors</li> <li>Complementarities between work and benefits: Entitlement to non-contributory benefits is not lost if working, and can be collected if losing the job.</li> </ul>			
1998	Possibility for NISS doctors and mutual insurance companies to review health situation of beneficiaries.			
2002	<ul> <li>Individuals aged 52+ receiving unemployment benefits could combine the receipt of these benefits with earnings (50% of the total benefits paid by the employer, and 50% paid by the Social Security)</li> <li>Extension of program that helps integrate people in the labor market to all individuals aged at 45+ who have been unemployed for one month and to people with disabilities, among others.</li> </ul>			
2004-2005	Stricter monitoring of sickness and absenteeism through the creating of a department at the NISS, and a general absence control was put in place when the duration of absence was greater than six months. Possibility to combine non-contributory disability with some earnings.			
2007	Increase contributions made by the social security administration for individuals receiving the special scheme of UA for $52+$ (they will receive a higher old-age pension when retiring)			
2012	Replacement rate was reduced from 70% to 50% after the 180 days of unemployment spell– previously it was lowered from 70% to $60\%$ – for all unemployment spells starting after the 15th of July 2012.			

Table 2: Main reforms since 1980 of the disability insurance and unemployment systems in Spain

# **3** Measurement of Social Security System Incentives

The Spanish Social Security System provides different incentives to leave the labor market at different ages and over time, as detailed in the previous section. In this section, we explain the measures we use and the assumptions we make to capture the impact of social security programs on retirement decisions.

#### 3.1 Definitions and Methodology

The key concept used to assess the impact of social security programs upon retirement decisions is the annual accrual of social security wealth, which is the present discounted value of lifetime social security benefits. For an individual of type i, where the type is defined by her gender and skill level, starting to claim benefits from program k at age R, her social security wealth is defined as:

$$SSW_{k,t}(R,i) = \sum_{a=R,T} B_{k,t,a}(R,i)\sigma_{t,a}\beta^{a-R}$$
(1)

Where  $\sigma_{t,a}$  is the survival probability at age *a* in year *t*, and  $\beta^{a-R}$  is the discount factor set at a rate of 3%.

Postponing claiming by one year has two effects on social security wealth. On the one hand, annual benefits  $B_{k,t,a}(R,i)$  increase with later claiming due to additional contributions and actuarial adjustments. On the other hand, however, benefits are received one year less. We thus define the accrual of social security wealth as:

$$ACC_{k,t}(R,i) = SSW_{k,t+1}(R,i) - SSW_{k,t}(R,i)$$

$$\tag{2}$$

The Social Security System provides incentives to retire when  $ACC_{k,t}(R, i) \leq 0$ , and to continue working otherwise. That is, when the accrual of social security wealth is negative, the social security system imposes an implicit tax on working longer and claiming later. We define the resulting implicit tax rate as the (negative) accrual of social security wealth divided by the after tax earnings obtained during the additional year of work:

$$ITAX_{k,t}(R,i) = -\frac{ACC_{k,t}(R,i)}{Y_{t+1,i}}$$
(3)

Finally, we also consider the replacement ratio, rr, defined as the ratio of the initial pension to the last wage, for (planned) retirement age  $\tau$ :

$$rr_{\tau} = P_{\tau}/W_{\tau-1} \tag{4}$$

#### **3.2** Assumptions and Scenarios

In order to compute the social security wealth, and its corresponding accrual and implicit tax rate, we take the following steps.

We first calculate the previously defined measures for twelve different cases: men, women of three different earnings levels, and two marital statuses (married and single). We thus evaluate the retirement incentives for low earners males and females, median earners males and females, and high earners males and females. The earnings is based on educational attainment. In particular, low earners are those workers having up to some secondary education, median earners are those having at most completed upper secondary education, and high earners are those having tertiary education. We consider three potential pathways of retirement: old-age, unemployment and disability insurance. Figure 4 shows the evolution of the transitions to retirement from unemployment, disability and old-age pensions program, obtained from the Spanish Labor Force Survey (Encuesta de la Poblacion Activa, EPA). DI and UI represent about 20% of all transitions to retirement, with an increasing trend in the recent years.



Figure 4: Pathways to Retirement for men and women from 1975 to 2016

*Notes:* Data obtained from the shares of males and females in each pathway from the EPA. There was a major change in the survey in 1988, so we cannot obtain a consistent definition of the different pathways prior to 1988. We then normalize each share in this time interval to the level in 1988.

In order to construct the financial incentive measures, we first obtain age earnings profiles for each of our six types of workers. We use two different age-earnings profiles. First, we use a synthetic earnings profile obtained from earnings of the US Current Population Survey (CPS), the German Socio-Economic Panel (GSOEP) and administrative data from the Italian pension system (INPS) for 2016. Using this data, we compute a simple average of the median income, separately for three earnings levels and by gender. We then re-scale this synthetic profile such that earnings at age 50 are one, and multiply them by the Spanish median annual earnings at age 50 reported in the Spanish longitudinal employment survey (Muestra Continua de las Vidas Laborales, MCVL) in 2014 for the respective sex and earnings group. Second, we use a time-invariant Spanish earning profile based on the Spanish median earnings by age, gender and earning level in 2014, calculated from the MCVL. Figure 5 shows how the two earning profiles compare for a male and female workers born in 1925, by different earning levels. We note that for high earners, the synthetic earnings profile follows quite closely the Spanish time-invariant one. Instead, the synthetic earning profiles of median and low earners are much flatter than what we observe for the one based on Spanish workers.

Figure 5: Synthetic and Spanish Earning Profiles for a worker born in 1925



In order to construct survival probability curves for each type of worker, we use average EU-28 survival rates (Eurostat, 2016). The underlying life expectancy at age 15 is 67.8 years for women and 64.7 years for men. We adjust these survival curves for differences in life expectancy across skill levels. In particular, we generate a life expectancy which is 3 years higher (lower) to reflect the difference in life expectancy across the three earnings categories (Van Baal et al. 2016 and Regidor et al. 2016). <sup>2</sup>

All calculated magnitudes are net of Social Security contributions and personal income taxes. Exact calculations of after-tax social security wealth and replacement rates are complicated by the fact that the number of bend points in the Spanish marginal tax schedule is high although decreasing over time (thirty-four in 1985, seventeen in 1995, seven in 2011 and five in 2016). As an approximation, we proceed as follows. We first use the 1995 tax schedule to trace out the relation between the average tax rate (net of standard deductions) and income (net of social security contributions paid by a worker). We then fit by least squares a fourth-order polynomial to this relation. Finally, the estimated coefficients are used to determine after-tax earnings for all previous and subsequent years.

The following sections present the results of the Social Security incentives calculations using the previous definitions and assumptions. Before moving to the results, some comments are in order. First, regarding the presentation of the results, when we want to obtain population aggregated social security incentives, we use different weights for each possible scenario. We aggregate the old age, DI and UI pathways to retirement using as weights the population share of transitions from employment to retirement through each of the three programs, as presented in Figure 4. As we have information on these shares over time and gender, we are able to attribute a particular weight to each gender-age time observation. The second step is to aggregate the retirement incentives over gender, earnings level and age. We obtain population data by age, gender and earnings level over time from Eurostat and construct sample averages by gender and earnings level for each age over time. We use these sample averages as the second weight

<sup>&</sup>lt;sup>2</sup>The measures of financial incentives remain practically unchanged using Spanish survival rates in 2014. Results available upon request.

applied to the retirement incentives.

# 4 Social Security Incentives Over Time

In order to ease the exposition of how the different components of the Spanish Social Security system shape financial incentives to retire over time, and facilitate comparison with the evolution in other countries, most of our results are presented for a base-case worker. This worker is a male median earner, born in 1925. In addition, we focus on the incentives of social security for workers retiring through the old-age pension pathway, but we present a comparison of the incentives for workers retiring through the disability or unemployment pathway in Subsection 4.7.

#### 4.1 The Base Case

Our base case is a male worker of median earnings level born on 1 January 1925, who has been contributing to social security without interruption since he turned twenty, on 1 January 1945. He reaches the earliest eligibility age of sixty in 1985 and the statutory eligibility age of sixty-five in 1990. He is married to a woman who is three year younger than he is and has never worked, and have no dependent children.

Simulations start in year 1980, when our base-case worker turns age fifty-five and completes thirty-five years of contributions, and run for each year until he turns sixty-nine, in the year 1994.

Our basic assumptions are the following. First, if the worker stops working before age sixty, then he chooses to first collect his old age pension benefits at age sixty, the earliest eligibility age, whereas, if he stops working past age sixty, then he starts receiving his old age pension immediately. Second, if he stops working before age sixty, then he receives no benefits or unemployment compensation in the interim years until he starts drawing a pension.

It may be worth summarizing the main qualitative effects of working one more year beyond age sixty in the simulations that we are about to present: (1) It may increase social security benefits by increasing the benefit base BR, or the replacement rate. The benefit base increases if earnings from the extra year of work exceed average earnings during the last eight years. The replacement rate increases if the worker has contributed for fewer than thirty-five years, in which case an extra year of work buys an extra 2 percent of the benefit base. If the worker has already contributed for thirty-five years, as in the base case, only the effect on the benefit base is relevant. (2) It reduces the penalty for early retirement by 8 percentage points. (3) It reduces by one year the expected period over which the worker will receive a pension. (4) It implies paying additional social security contributions. (5) The marginal tax rate on labor income may turn out to be higher than the marginal tax rate on pension income, owing to the high progressiveness of the Spanish income tax schedule.

Figure 6 depicts the computed replacement rate, social security wealth, accrual of social security wealth and implicit tax rate at each age between fifty-five and sixty-nine for our base case. Social security wealth and its accrual are net of income taxes and presented in  $\in$ 1,000 at 2015 prices.

The replacement rate is zero before reaching sixty, the earliest eligibility age for retirement. It then increases gradually, converging to one and exceeding it slightly by age sixty-five. Social security wealth starts up at  $\in$ 85,982, remains flat until reaching fifty-eight and increases steadily, peaking at sixty-five with a value of  $\in$ 187,958. This increase is due to a very progressive reduction of the penalty for early retirement (effect 2) and the reduction in one year in the expected period of pension receipt and increase in one year of social security contributions (effects 3 and 4). Given that the base case worker would reach the statutory retirement age in 1990, where no incentives for late retirement were considered. Thus, from age sixty-five on when additional years of work add nothing to the expected pension amount, effects 3 and 4 dominate and the social security wealth falls. The implicit tax rate on continuing work is negative between the ages fifty-five and sixty, due to the earliest eligibility age for retirement. From sixty to sixty-five, the implicit tax rate increases, showing the disincentives generated by the program to work an additional year. From age sixty-five on, the implicit tax rate falls slightly, but remains large and positive.

Figure 6: Incentives Calculation for a Male Median Earner Worker born in 1925 (after-tax values in  $\leq 1,000$  at 2015 prices)



We compare the previously specified base-case worker born in 1925, to an analogous worker (that is male median earner) born in 1945. The latter will likely face different social security incentives, as he would retire under a different old-age pension system. For this worker, simulations start in year 2000, when he reaches fifty-five and completes thirty-five years of contributions, and run for each year until he turns sixty-nine, in 2014. Figure 7 shows the comparative incentives calculation for both cohorts of workers, with a solid line for workers born in 1925, and a dashed line for workers born in 1945. In Panel A, we note that the replacement

rate at the early eligibility age for retirement is higher for the younger worker than for the older one. It converges when reaching the statutory eligibility age, and then becomes larger again for the younger worker. The social security wealth followed a similar pattern: workers born in 1945 started at age fifty-five with a social security wealth  $\in 10,000$  larger than workers born in 1925. Thorough the age period, their social security wealth remained larger, until reaching sixty-five, where they converged. The drop in social security wealth upon reaching the statutory eligibility age for retirement was smaller for workers born in 1945, possibly due to the late retirement incentives introduced by the reform in 1997. Panel D shows the implicit tax/subsidy rate for both cohorts of workers. We note that the tax schedule faced by workers born in 1945 was quite different than the one of workers born in 1925. First, as with workers born in 1925, workers born in 1945 had a negative tax rate on working before they reach sixty. However, they did not experience the subsidy peak at age fifty-eight that workers born in 1925 did. This is clearly related to the diverging age trends in social security wealth prior to the early eligibility age for retirement. Second, younger workers experienced a peak tax rate at age sixty, whereas the tax rate was close to zero for older workers. This resulted from the heightened generosity of the old-age pension system at age sixty for younger workers. Following this peak, the implicit tax rate fell to zero at age sixty-two, before increasing steadily until age sixty-nine.

The comparison of these two cohorts of workers is informative of the significant changes in retirement incentives that the reforms of the old-age system have brought up. In particular, male workers becoming eligible for retirement under the system of 1980 seem to have smaller incentives to retire at the early eligibility age than male workers eligible for retirement under the system of 2005. This can be due to two factors. The first one is that the penalization for early retirement became smaller, in particular for workers having already contributed 30 years at the time of first eligibility to retirement. The second one comes from the adjustment of the earning profiles for older cohorts, which are slightly disproportionate, and intercept the maximum contribution base at several points in time, resulting in smaller incentives to retirement prior to the statutory eligibility age.

#### 4.2 Differences in Social Security Incentives, by Level of Earnings

In this section we evaluate to what extent workers with different levels of earnings face different social security incentives. First, we define low earners as workers with at most lower secondary education, and high earners are defined as workers with tertiary education. Median earners, as used in the previous section, corresponds to workers with upper and/or post-secondary education. We take the median earnings of workers of each category to calculate the earning specific wage profiles.

Figure 8 depicts our calculations for the base-case worker described in the previous section, a married male born in 1925, varying his earnings level from median to low, and from median to high. In each figure, the dashed darkest line corresponds to low earnings, the solid line to median earnings, and the light dashed line to high earnings. Panel A shows the replacement rate for each type of workers, and we note that low and median earners had identical replacement rates. The replacement rate of high earners followed the same pattern until age sixty, to then remain at a significantly lower level for all subsequent ages. This is possibly due to the fact Figure 7: Incentives Calculation a Male Median Earner Worker born in 1925 and in 1945 (after-tax values in  $\leq 1,000$  at 2015 prices)



Panel A. Replacement Rate



that high earners' earnings for workers born in 1925 were significantly above the maximum contribution level, implying that they get a capped pension, that replaced only partially their earnings. The social security wealth and resulting implicit tax rate followed a similar pattern across workers, but with different levels. High earners experienced larger social security wealth at all ages, followed by median earners (base case), and then low earners. The incentives to retire before the statutory eligibility age are lower for high earners thorough the ages analyzed.

#### 4.3 The Effects of Varying the Earnings Profile

In this section, we assess to what extent the measures of social security incentives are sensitive to the earnings profile used. We thus reproduce our simulations using Spanish time-invariant earning profile. Figure 9 compares the resulting incentives using the synthetic earnings profiles (blue) and the Spanish earnings profiles (red). The shape of all the measures across all ages is very close independently of the earnings profiles used. In addition, there are marginally no differences in the levels for any of the measures of incentives for low and median earners between the synthetic and Spanish specific earnings profiles. The differences in the level of social security wealth become more notable the higher the earnings level: synthetic earnings profiles seem to overestimate the social security wealth of low and median earners before reaching the statutory eligibility age. This results in a slightly lower implicit tax rate when using the synthetic earnings profiles. Overall, these differences are minimal, and do not affect the interpretation of our calculations. In what follows, we continue using the common earnings profiles.

Panel B. Social Security Wealth

62 63 64 65

66

57 58 59 60 61

Figure 8: Incentives Calculation for a Male Married Worker Born in 1925 by Level of Earnings (after-tax values in  $\leq 1,000$  at 2015 prices)



#### 4.4 Social Security Incentives by Gender and Marital Status

Figure 10 presents a comparison of the calculations for single (in red) and married (in blue) male and female workers. The main difference between a married and a single worker was the survivor benefit that can potentially be added at each age point. Across genders, the main difference in the incentives simulated came from the differences in earnings profiles and survival probabilities. From Panel A, we conclude that replacement rates were very close across gender. We note a small difference regarding the replacement rate of high earning women, which was higher than that of men, most likely because the earnings of women were above the maximum contribution level to a lower extend than those of men. Social security wealth and implicit tax rates were very close across genders, both in shape and levels. The differences across single and married workers were also quite marginal, consistently across gender. For males, married workers had a slightly higher social security wealth than single workers, across all earning levels. For females, the difference between married and single workers was much smaller, and only became noticeable from age sixty onwards. A particularity is that single female workers had larger social security wealth than married female workers. There are virtually no differences across marital status in the resulting tax rates for males. For females, the resulting tax rate on working an additional year is slightly larger for married than single workers.

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Figure 9: Incentives Calculation for a Male Married Worker Born in 1925 by Level of Earnings and Earnings Profile (after-tax values in  $\in 1,000$  at 2015 prices)

Panel B. Social Security Wealth



Panel A. Replacement Rate

# 20

Figure 10: Incentives Calculation for a Male and Female Worker Born in 1925 by Level of Earnings and Marital Status (after-tax values in  $\in$ 1,000 at 2015 prices)



#### 4.5 Temporal Variation of Retirement Incentives

The evidence shown in the previous subsections provides an interesting snapshot of the incentives to retire of a worker born in 1925 from his 55th to his 69th birthday. However, it fails to encompass the role of the numerous reforms of the Spanish social security system over the last three decades in shaping the social security incentives. In this subsection, we show how the measures evolve over time and how they relate to policy reforms, from 1980 to 2015.

Figure 11 shows the evolution of the replacement rate, social security wealth and its accrual, and the implicit tax rate, for different age groups. Panel A shows the calculated replacement rate from 1980 to 2015 for workers aged fifty-six, fifty-eight, sixty, sixty-two, sixty-four and sixty-five. The replacement rate was zero for workers not eligible for retirement. We note from the Figure the change in the early eligibility age from sixty to sixty-one from the pension system reform in 2007, and from sixty-one to sixty-three in 2013. Besides these changes, replacement rates were quite stable over time.

Figure 11: Time-Varying Incentives Calculation for a Married Male Worker with Median Earnings (after-tax values in  $\in 1,000$  at 2015 prices)



Panel B presents the social security wealth, and also notice that it remained rather constant over time. We note some discontinuities in the trends that correspond to reform periods of the

system. For instance, we note an increase in social security wealth in 1985 for ages fifty-eight to sixty-five, associated to the significant reform in 1985. The principal changes were an increase in the minimum number of years of contributions for pension eligibility (from eight to fifteen), and an increase in the number of years entering the computation of the benefit base. Although this reform was implemented to tighten the generosity of the old-age pension system, we observe the opposite effect on the expected social security wealth from workers. This larger incentive to retire may actually have been generated by the increase in the number of working years entering in the benefit base, together with decreasing earning profiles from ages forty-five to sixty.

In 2002, we observe a peak in the social security wealth for ages fifty-six to sixty, coinciding with the introduction of the earliest eligibility age at sixty-one for workers that started contributing into the system after 1967. The increase in the social security wealth seems to affect only a few cohorts. For instance, for those aged fifty-six, the increase in social security wealth peaks in 2002, and entirely subsides in 2003. Those aged fifty-eight experience this increase for three years, 2002 to 2004, and those aged sixty for five years. This means that only these born in 1942-1946 experience an increase in the social security wealth.

The latest reform of the pension system in 2011 generated a drop in social security wealth for all claimants younger than sixty-four. This is possibly due to an increase in the earliest eligibility age from sixty-one to sixty-three.

The implicit tax rate responds to the changes in social security wealth previously described, although not intensely. We notice a change in trend in 1985, increasing for all ages above fiftysix. We also notice a change in 2002, coinciding with the introduction of the earliest eligibility age at sixty-one for claimants contributing after 1967. For claimants born in between 1942-1946 when at age sixty, this represented an increase in their incentives to retire from 2002 to 2007. This is so, because in 2007 the reform removed the possibility to retire at age sixty and increased it to sixty-one, independently of the year of contribution. For claimants born in 1947, the reform translated in a drop in their retirement incentives when they were aged below sixty.

Regarding the level of the implicit tax rate, we note that workers sixty-four or above were incentivized to retire thorough the observed period. So were workers aged sixty-two, although the incentive became zero in 2013 with the increase of the early eligibility age from sixty-one to sixty-three. Workers aged sixty were incentivized to retire under the system of 1980 and part of that of 1985. In the mid-nineties, the system seemed to subsidize employment, but by the late nineties it was incentivizing retirement. From 2007 onwards, claimants aged sixty were incentivized to work, mostly as they became ineligible for pension benefits. As expected, workers aged below sixty were always incentivized to remain employed.

#### 4.6 Average Old-Age Pension System Incentives

Figure 12 summarizes the previous results on the implicit tax rate by aggregating it over the workers aged fifty-five to sixty-nine.<sup>3</sup> The vertical dashed lines signal the reform years, and the notes indicate the main change in the parameters of the old age pension system in each reform. In 1985, following the increase in the minimum required service years for eligibility, we see a

<sup>&</sup>lt;sup>3</sup>We use time varying population weights on the fraction of individuals in each age category (fifty-five to fifty-nine, sixty to sixty-four, and sixty-five to sixty-nine) to compute these averages.





large spike in the implicit tax rate. As previously described, this was due to using decreasing income profiles from age forty-five on. The reduction in generosity of benefits in 1997 decreased the implicit tax rate, albeit with some delay. The impulse of partial retirement in 2002 had mild effects in curbing the implicit tax rate on work. A bigger drop in the retirement incentives was induced by the increase in the earliest eligibility age in 2007. The latest reform in 2011 an the increase in the statutory eligibility age and the introduction of the sustainability factor in 2013 have surprisingly mild effects on the aggregated measure of retirement incentives.

### 4.7 Other Pathways to Retirement

In this subsection we explore two additional pathways to retirement in the Spanish Social Security System, namely through disability and unemployment insurance programs. Figure 13 shows the incentives for our base case worker for each retirement pathway. Panel A shows the replacement rate for the three different pathways over age, for a married male worker with median earnings. First, we notice that the replacement rate was not zero for UI and DI pathways prior to sixty. For DI, the replacement rate was the fraction of benefits to the wage at the onset of disability, and it was linked to the severity of the disability, but not to age. For the unemployed, the system contemplated the possibility to enter in an early retirement route if losing their job at age fifty-two or later, where a positive replacement rate was ensured. From the age of the early eligibility onwards, the workers in this pathway were automatically moved to the old-age pathway. It is thus not surprising that the old-age and the UI pathways were very close in the social security wealth they provided (Panel B). The DI pathway ensured a

rather constant social security wealth to disabled workers. From age sixty onwards, there is a small decline in wealth. Correspondingly, the implicit tax rate for the DI pathway is flatter and always positive.

Figure 13: Incentives Calculation for a Base Case Worker born in 1925 by Retirement Pathway (after-tax values in  $\leq 1,000$  at 2015 prices)



Our Base Case Worker corresponds to a married male with median earnings, born in 1925.

#### 4.8 Weighted Temporal Variation of Retirement Incentives

We reproduce the figures showing the temporal variation of the retirement incentives in Spain, aggregated over gender, level of earnings and pathway to retirement. As explained in Subsection 3.2, we weight the previously presented results by gender, earnings level and pathway using the time-varying share of population in each pathway and from each gender and earning level. Figure 14 depicts these aggregated financial incentives to retire. In Panel a, we notice that the replacement rate was no longer zero for workers younger than the earliest eligibility age at any point in time, given that UI and DI programs offered a positive replacement rate before reaching this threshold. Panel B shows the trends in the aggregated weighted social security wealth. This trend is puzzling as it seems to have been increasing over time, for all ages. However, this was by construction of the aggregation: for the DI pathway, social security wealth was rather stable over time but larger for younger workers, the opposite than for the UI and old-age pathways, which had constant social security wealth over time but larger for older ages. The resulting aggregation kept the order of UI and old-age pathways, but the inverted order of the wealth in the DI pathway resulted in an artificially increasing trend.



Figure 14: Time-Varying Weighted Incentives Calculation (after-tax values in  ${\lesssim}1,000$  at 2015 prices)

# 5 Social Security Incentives and Employment

In this section, we analyze the correlations between the employment rate and the retirement incentives from the social security program. We first examine these correlations graphically, by plotting the employment rate against the weighted implicit tax rate of working an additional year. We present the results in Subsection 5.1. In Subsection 5.1.1, we use out of the labor force transitions from the Labor Force Survey (EPA) to provide estimates of the association between the implicit tax/subsidy rate and transitions from employment to retirement.

#### 5.1 Graphical Representations

Figure 15 plots the employment rate of men and women over the implicit tax rate from the old-age pension scheme weighted over earnings level, for age groups fifty-five to fifty-nine and sixty to sixty-four. The graphs also show a linear fitted line over the scatter plot, as well as the correlations between the employment rate and the implicit tax rate.

We find that both the significance and the sign of these correlations vary across age groups and gender. For men aged sixty to sixty four, we find a significant positive correlation between their employment rate and the implicit tax rate. As part of their implicit tax rate took negative values, this could indicate that higher retirement incentives were correlated with lower employment rates. However, it could also indicate a counter-intuitive correlation, where higher retirement incentives were correlated with higher employment rates. As expected, for men aged fifty-four to fifty-nine, we find a positive association, albeit being statistically insignificant. Women aged sixty to sixty-four experienced a negative association between the implicit tax rate and the employment rate. The correlation is statistically significant, but of lower value than for males (-0.324 and 0.525, respectively). For women aged fifty-four to fifty-nine, we find a positive non significant correlation between the retirement incentives and the employment rate, in line with the fact that the implicit tax rate is negative for this group.



Figure 15: Employment rates over weighted implicit tax rates of men and women

#### 5.1.1 Correlation Estimates

The previous graphs showed that the incentives stemming from social security systems could be impacting the national employment rates. However, we were not able to explain all of the results. For instance, we found a positive correlation between the incentives and employment rate for males aged sixty to sixty-four, and were not able to explain whether this result was due to the sign of the incentives, or was counterintuitive. To get a better idea of the potential effect of social security incentives, we want to assess its association to the probability of transitioning out of the labor force. In this section, we provide such estimates. We focus in particular on transitions out of the labor force for employed workers, and contrast it with the incentives provided by the old-age pension system. For each individual, we obtain information on her current employment status and the situation in the previous year from the EPA for years 1978-2004 and 2006-2016. We then construct an indicator for transition out of the labor force by using the information from a retrospective question on the past employment situation, and difference it with the current employment situation. Because we only consider the incentives from the old-age pathway, we focus on claimants that were employed at time t-1. We aggregate the data at the region level for the analysis. We estimate the following model:

$$Tr_{art}^{emp} = \alpha + \beta INC_{at} + X_{at} + \mu_t + \epsilon_{art}$$
(5)

Where  $Tr_{art}^{emp}$  is the transition out of the labor force for an employed individual of age a in region r in year t,  $INC_{at}$  are the incentive measures,  $X_{at}$  are the covariates (age in all Models, and dummy variables for the earliest and statutory eligibility age in Model 4), and  $\mu_t$  are year fixed effects. Standard errors are clustered at the region and year level.

Table 3 shows the results. Model 1 shows a statistically significant positive impact of the implicit tax rate on the probability to exit the labor force of 12.9 percentage points. This effect was quite similar to that obtained in Model 3, where we also included the logarithm of the social security wealth. A one percent higher social security wealth increased the probability to exit the labor force in 16.3 percentage points. In Model 2, the estimated effect of the social security wealth is only slightly lower. We include two dummy variables for the earliest and statutory eligibility age in Model 4. The inclusion of these controls increases slightly the estimates of the implicit tax rate and of the social security wealth. Our results seem to indicate a strong impact of the social security incentives on the exit from the labor force.

	Model 1	Model 2	Model 3	Model 4
Implicit Tax Rate	$\begin{array}{c} 0.129^{***} \\ (4.34) \end{array}$		$0.134^{***} \\ (4.13)$	$\begin{array}{c} 0.137^{***} \\ (4.03) \end{array}$
Social Security Wealth (log)		$0.163^{***}$ (1.96)	$0.180^{***}$ (2.81)	$0.186^{***}$ (1.56)
N adj. R-sq	$\begin{array}{c} 420\\ 0.380\end{array}$	$420 \\ 0.339339$	$\begin{array}{c} 420\\ 0.409\end{array}$	$\begin{array}{c} 420\\ 0.409 \end{array}$

Table 3: Exit from the labor force of employed individuals

*Notes:* Estimates of the impact of calculated incentive measures on the probability to exit the labor force while employed for workers aged fifty-five to sixty-nine. The probability to exit the labor force is aggregated over gender and earnings for each region. All models contain a variable age and year fixed effects, and have their standard errors clustered by region and year. Model 1 includes the implicit tax rate as explanatory variable, whereas Model 2 includes the logarithm of the social security wealth. Model 3 includes both variables. Model 4 includes in addition a dummy variable for the earliest eligibility age, and a dummy variable for the statutory eligibility age.

# 6 Concluding Remarks

Employment and labor force participation trends of older, especially male workers in Spain, and elsewhere, reverted and started to increase around the mid-1990s after two decades constantly falling. In this work, we analyze to what extent the incentives from the social security system can play a role in explaining this evolution. In this respect, we extend existing evidence on the impact of financial incentives on labor force participation in Spain (Boldrin et al. 1999), by computing the financial incentives to leave the labor market that Spanish workers aged fiftyfive to sixty-nine have faced during the past four decades through three different pathways: Old-age pension system, disability insurance and unemployment insurance. Our main measure is the implicit tax rate, that compares the change in social security wealth from working an additional year with the earnings obtained during the additional year of work. We compute the implicit tax rate for different types of workers based on their gender and skill level using both a synthetic earnings profile based on data from Germany, US and Italy, as well as a Spanish specific earnings profiles.

Our results show that, in general, and excluding those having very low wages or discontinued careers which lead to minimum pensions at all ages (Jiménez-Martín 2014), incentive profiles for the different cohorts are very similar, except for some specific cases in which changes in eligibility ages play a crucial role. Regarding the variation over time of incentives, we find that, apart from the substantial real growth of pension rights (Social Security Wealth) observed in the last 35 years and the effect of changes in eligibility conditions, the results seem to be remarkably stable.

As a summary exercise, we compute bivariate correlations between the implicit tax rate and the employment rate of the different types of workers over time and we estimate simple regression models exploiting the regional and time variation of the data.

Our results, in contrast with the previous evidence (see Boldrin et al. (2004), García-Pérez et al. (2013) or Sánchez-Martin et al. (2014)), due to the long time series used in the analysis provide suggestive evidence that financial incentives, and later reforms, may be able to explain part of the initial decrease and later increase in labor force participation at older ages for the Spanish case. In addition, they highlight that changes in eligibility ages may be more relevant in explaining these changes than other parameters modified during these period, like the number of years of contributions used to compute the benefit.

Of course the results for men are less prone to unobserved factors such as interrupted labor market trajectories due to maternity episodes. This is particularly relevant for the oldest cohorts of women in our analysis so that results for the case of women have to be interpreted with care. In this sense further research exploiting individual variation is required.

# A Appendix

A.1 Key parameters of the Spanish Social Security System from 1980 onwards

	Before 1985	From 1985 to 1997	From 1997 to 2001	From 2002 to 2007
A. Eligibility Conditions				
A1. Normal retirement age [ā]	65 years	id.	id.	id.
A2. Minimum contribution years [n]	10 years	15 years	id.	id.
B. Pension Computation				
B1. Contributions entering in Benefit Base [BB]	2 years	8 years	$15 \text{ years}^a$	15 years
B2. Replacement Rate	$ \left\{ \begin{array}{l} 0,  \mathrm{if}  n < 10 \\ .5 + 0.02(n-10),  \mathrm{if}  35 > n \geq 10 \\ 1,  \mathrm{if}  n \geq 35 \end{array} \right. $	$ \left\{ \begin{array}{l} 0,  {\rm if}  n < 15 \\ .6 + 0.02(n-15),  {\rm if}  35 > n \geq 15 \\ 1,  {\rm if}  n \geq 35 \end{array} \right. $	$\begin{cases} 0, \text{ if } n < 15\\ .5 + 0.03(n - 15), \text{ if } 25 > n \ge 15\\ .8 + 0.02(n - 25), \text{ if } 35 > n \ge 25\\ 1, \text{ if } n \ge 35 \end{cases}$	id.
C. Early Retirement				
C1. Early retirement age	60, if first contribution prior to 1967	id.	id.	60, if first contribution prior to 1967. 61 if after 1967
C2. Penalization $[\kappa]$ where $benefit = 1 - \kappa(\bar{a} - a)$	$\kappa = .08$	$\kappa = .08$	$\kappa \begin{cases} .08 \text{ if } n < 40 \\ .07 \text{ if } 40 \ge n \end{cases}$	$\kappa \begin{cases} .08 \text{ if } n=30\\ .075 \text{ if } 31 \le n \le 34\\ .07 \text{ if } 35 \le n \le 37\\ .065 \text{ if } 38 \le n \le 39\\ .06 \text{ if } 40 \ge n \end{cases}$
C2. Minimum Pension				27% average income
C3. Partial Retirement	No	No	No	Yes. Working hours reduced from 25%-85%, replacement of working hours mandatory
D. Late Retirement				
D1. Incentives for late retirement	No	No	$0.8 + .02(a - 65)$ if $35 \ge n > 25$ and $a \ge 65$	$1 + .02(a - 65)$ if $n \ge 35$ and $a \ge 65$
D2. Partial Retirement	No	No	No	Yes

# Table 4: Key parameters of old age pensions from 1980 onwards

 $\overline{a}$  In 1997 the last 108 months are included, the last 120 months in 1998, the last 132 months in 1999, the last 144 months in 2000, the last 156 months in 2001, the last 180 months from 2002 onwards.

Table 5: Key parameters of old age pensions from 1980 onwards cont.

	From 2007 to 2010	From 2011 onwards	2013 Amendment
A. Eligibility Conditions A1. Normal retire- ment age A2. Minimum contri- bution years [c]	65 years 15 years	67 years <sup><math>a</math></sup> , or 65 years old if 38.5 years of contributions id.	
B. Pension Computation B1. Contribu- tions entering in Benefit Base [BB]	15 years	17 years. 25 years from 2022 onwards.	Introduction of new Ad- justment Index (IRP) $IPR_{t+1} = \bar{g}_{l,t+1} + \bar{g}_{P,t+1} + \bar{g}_{s,t+1} + \alpha \left(\frac{I_{t+1}^* - G_{t+1}^*}{G_{t+1}^*}\right)$
B2. Replacement Rate	$\begin{cases} 0, \text{ if } n < 15\\ .5 + 0.03(n - 15), \text{ if } 25 > n \ge 15\\ .8 + 0.02(n - 25), \text{ if } 35 > n \ge 25\\ 1, \text{ if } n \ge 35 \end{cases}$	$\begin{cases} 0, \text{ if } a < 15\\ 0.5 + 0.023(n - 15), \text{ if } 37 > n \ge 15\\ 1, \text{ if } n \ge 37 \end{cases}$	Where $\bar{g}_{l,t+1}$ is growth rate of contributions $\bar{g}_{P,t+1}$ is the growth rate of the number of pensions $\bar{g}_{s,t+1}$ is the growth of the median pension due to substitution effects
B3. Minimum pension	32% average earnings w/o dependent	34% average earnings w/o dependent	Minimum: .25%.
Maximum: CPI + .50% B4. Maximum pension C. Early Retirement	159% average earnings	153% average earnings	
C1. Early retirement age	61 (involuntary retirement) or 63 (vol- untary retirement), with 33 years of contr.	63 (involuntary retirement) or 65 (vol- untary retirement), with 33 or 35 years of contr. resp.	Introduction of Sustain- ability Factor (SF)
C2. Actuarial reduc- tion of benefits	$1 - \kappa(a - 61), \text{ if } 65 > a \ge 61 \text{ where } \kappa \begin{cases} .075 \text{ if } 30 \le n \le 34\\ .07 \text{ if } 35 \le n \le 37\\ .065 \text{ if } 38 \le n \le 39\\ .06 \text{ if } 40 < \le n \end{cases}$	$1 - \kappa(a - 63)$ , if $67 > a \ge 63$ where $\kappa \in [0.08; 0.085]$	Intergenerational Equity Factor (IEF) $IEF_{j,t+s} = \frac{e_{j,t}}{e_{j,t+s}}$ $e_{j,t}$ life expectancy of pensioner retiring at age j and period t $e_{j,t+s}$ life expectancy of pensioner retiring at age j and period $t+s$
C2. Minimum pension	30% average earnings w/o dependent spouse. $37%$ w dependent spouse	32% average earnings w/o dependent spouse. $39%$ w dependent spouse	
C3. Partial Retirement	Yes. Working hours reduced from 25%-75%, replacement of working hours mandatory, proportional contribution to the pension system	Yes. Full contribution to the pension system	
D. Late Retirement			
D1. Incentives for late retirement	if $a \ge 65$ , then $\begin{cases} 1 + .02(a - 65) & \text{if } n \ge 35\\ 1 + .03(a - 65) & \text{if } n \ge 40 \end{cases}$	if $a \ge 67$ , then $\begin{cases} 1 + .02(a - 65) \text{ if } 15 \le n < 25\\ 1 + .0275(a - 65) \text{ if } 25 \le n < 37\\ 1 + .04(a - 65) \text{ if } n \ge 37 \end{cases}$	
D2. Partial Retirement	Yes. No replacement of working hours.	Yes. No replacement of working hours.	

a The retirement age of 67 will be reached in 2027. From 2013 to 2018, retirement age will increase in one month per year. From 2019 to 2026, retirement age will increase in two months per year.

	Ordinary Illness	Work Related Accident	Work Unrelated Accident	Non Contributory
A. Eligibility Conditions				
	Incapacity to perform current job $(IPT)$ , workers older than 55 $(IPTC)$			
	Age $26$ : contributed 1/4 time between 20 y.o and disabling condition, $5$ years Age $\leq 26$ : contributed 1/2 time between 16 y.o and disabling condition	No contributive requirement	No contributive requirement	Non eligible for Contributory Disabil- ity Insurance Means-tested
	Full incapacity (IPA) and Severe incapac- ity (GI) 15 years of contribution			
.5 B. Benefit Calculation				
B1. Regulatory Base	$0.86^* {\rm wage}$ of last 8 years of work	Last year of work	0.86*highest wage of 24 months within last 7 years	
B2. Replacement Rate	<b>IPT:</b> 55%, <b>IPTC:</b> up to 75%, <b>IPA:</b> 100%, <b>GI:</b> 150%	Id.	Id.	55% of minimum wage
B3. Income Tax Rules	<b>IPT</b> & <b>IPCT</b> : General Income Tax reg. <sup><i>a</i></sup> <b>IPA</b> & <b>GI</b> : Tax exempted	Id.	Id.	

### Table 6: Summary of key parameters of DI

a There are tax deductions for IPT beneficiaries who are employed at the same time than receiving benefits. Precisely, there is a reduction in the earnings used to calculate the income tax of 2,800 Euros/year if their degree of disability is low (between 33% and 65%) or 6,200 if the disability level is higher (more than 65%) or if the disabled has reduced mobility.

### Classification of degrees of disability:

**Incapacity to perform current job (IPT and IPTC):** The individual is impaired to develop all or the fundamental tasks of his/her usual job or professional activity, but he/she is still capable of developing a different job or professional activity.

Full incapacity (IPA): the individual is impaired for the development of any kind of job or professional activity.

Severe incapacity (GI): Individuals who, as a result of anatomic or functional loses, need the assistance of a third person to develop essential activities of daily living.

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