

ESTUDIOS SOBRE LA ECONOMIA ESPAÑOLA

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An approach to its life time effects**

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EEE 55



Fundación de Estudios de Economía Aplicada

<http://www.fedea.es/hojas/publicado.html>

REDISTRIBUTION IN THE SPANISH PENSION SYSTEM: AN APPROACH TO ITS LIFE TIME EFFECTS *

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ABSTRACT

This paper computes first the internal rates of return of different population cohorts. Secondly, we study the intragenerational aspects by calculating the returns over life-time contributions for workers of different categories, grouped by earnings, gender and marital status.

Under a set of assumptions on contribution rates and wage profiles –in absence of actual data on longitudinal contributions- we show the existence of significant intergenerational effects. They favour older cohorts due basically to the contribution bases applied during the 60s and 70s. Some of these effects follow a rather erratic pattern, mostly due to the changes overtime of the definition of the maximum allowable contribution. These limits play a similar crucial role for the intragenerational analysis, although in general, the social security ‘deal’ favours high income individuals, women and married males.

J.E.L. classification number: H55.

Keywords: Social Security in Spain, Life-time contributions and pensions and Social Security internal rates of return.

* We are grateful to A. Duran, W. García-Fontes and C. Monasterio and to the participants of the Workshop in Applied Economics at Universitat Pompeu Fabra, the II Encuentro de la Asociación Española de Economía Pública, the FISS 1998 Congress and the XXIII Simposio de Análisis Económico. Usual disclaimers apply. Guillem López acknowledges financial support from the DGICYT under the project PB94-0848.

1. INTRODUCTION

The life-time income redistribution effects of the Social Security public pensions programs have been approached in the literature from two directions. On the one hand, the studies of Pellechio and Goodfellow [1983], Hurd and Shoven [1985], Ferrara and Lott [1985], Boskin [1986], Boskin et al. [1987], Myers and Schobel [1993] and Steuerle and Bakija [1994] have focused on the impact of the programs on a hypothetical individual or family. On the other hand, some studies have been based on population surveys and actual social security records for different population cohorts of retirees, in the case of Hurd and Shoven [1985], Meyer and Wolff [1987a, 1987b] and Nelissen [1987], and of workers still in the labour market, in the case of Creedy et al. [1993].

Ours is a middle-of-the-road approach, since we have resorted to simulating data in some cases and taken actual figures in others. Simulation is used for calculating contributions (increase in earnings and changes in the pay-roll tax) and the benefits for hypothetical workers and pensioners. However, whenever possible, we have taken the available information based on the Social Security Law, life expectancy of pensioners and, where applicable, of his beneficiary, so as not to stray from the real world.

The way the literature evaluates how Social Security redistributes income across and within generations is to compute the present values of life-time benefits and contributions or the relative values of both receipts and payment flows. Other views refer the expected rates of return or the net transfer component –defined as the difference between real and actuarially fair old-age pensions. All these methods follow the standard actuarial approach.

For the analysis of the redistribution effects of the Spanish Social Security system, we take the case of the ‘General Regime’ (the so-called *Régimen General de la Seguridad Social*), which covers a 70% of the contributors and a 53% of the pensioners. By adopting this we do not consider the intragenerational impact due to the existence of other Social security regimes (civil servants, self-employees, and for agricultural workers, among others) regarding their different,

and generally more ‘profitables regimes’.¹ We follow a life-time approach for workers who differ according to age, their earnings level, gender and marital status.

The application of this type of analysis to the Spanish case differs from previous studies. On one hand Monasterio and Suárez [1992] and Monasterio, et al. [1996] study the redistribution effects amongst different social security regimes; on the other hand Durán [1995], and Jimeno and Licandro [1999] analyse the internal rates of return for a representative individual, under different assumptions on working careers and retirement ages. Bandrés and Cuenca [1998] focus on the intragenerational redistribution effects by regimes and income levels induced by the 1997 Pension Reform Act, for a cohort of contributors retired in 1993. Our work differs in the following respects: we assume individuals’ heterogeneity according to age of birth and entrance in the labour market, different initial wages and earning profiles. In addition, in each cohort, they differ by gender and marital status. Individuals are born in four cohorts: 1935, 1945, 1955 and 1965 and contribute to the general social security regime from 1960 onwards.

Earlier studies (cf. Hurd and Shoven, 1985, Boskin 1986, Boskin et al. 1987, Meyer and Wolff, 1987a, 1987b and Steuerle and Bakija, 1994) found out that U.S. Social Security net transfers create important intergenerational redistribution effects.² In general, older cohorts of retirees achieved up to three times their contribution, with high rates of return (greater than 10% in real terms in the case of retirees during the fifties and sixties). By contrast, future pensioners will get much lower rates, say in 2025, estimated at a mere 2%. In addition, intragenerational redistribution effects seem to be due to the fact that the PAYG system shows different net transfers and rates of return for individuals in the same cohort but with different income, gender and marital status.

In particular, Steuerle and Bakija (op. cit.) find that the system has been regressive within generations during most of the US Social Security’s history. That is, given a cohort of retirees, net transfers have been inversely related to need: people with the highest life time incomes have

¹ As shown by Monasterio and Suárez [1992] and Monasterio et al. [1996], internal rates of return are higher for the Special rather than for the General Regime due, in general, to the shorter contribution periods required for reaching the full pension.

² What is to be understood as equity in this context is a much controversial issue. We will identify here equity as ‘ex ante equi-proportionality’. ‘Ex post’, equity takes the former as the reference notion, and it results from actual computations. No systematic bias should be present in these results in order to validate the principle.

tended to receive the largest absolute transfers above and beyond what they contributed. For the first century of retirees in the system, the largest amount of net transfers went to high income individuals who turned 65 around the year 1980. Boskin et al. (op. cit) also show very significant differences in the treatment of households with regard to their circumstances, particularly in relation to income differences and marital status.

For the Spanish case, Bandrés and Cuenca [1998] also find, for the General Regime and the 1993 cohort of retirees, a regressive pattern (not corrected but worsened by the 1997 legal amendments). In fact they show a positive relationship between the net transfer component of pensions and the income decile.

The paper is organised as follows. In the second section we detail method, data and assumptions. We then proceed in the third section to calculate the income redistribution effects and in the fourth section we present the results according to the strategy adopted. We end by discussing the main results and some suggestions for future research in the field when additional data becomes available.³

2. METHODOLOGY AND DATA

In order to understand how Social Security redistributes income across and within generations it is required to adopt a life-time approach. We need to compare how retirement benefits and tax contributions evolve over life for people of different cohorts, earnings, gender and marital status.

Computation has been used to convert assumptions about households' wages, expected mortality and economic growth in real wages into expected present values of Social Security contributions, pension benefits, net transfers and internal rates of return. In doing so, we assume four cohorts of hypothetical workers, born in 1935, 1945, 1955 and 1965, and three types of workers with different income levels for each of the four cohorts: high, intermediate and low income earners.

³ A more complete analysis of the Spanish Social Security can be found in "La Seguridad Social en España: aspectos redistributivos inter e intrageneracionales, y consideraciones para su reforma" (cf. Gil, 1997).

We also assume that individuals contribute to the Social Security system up to retirement at age 65.⁴ Without unemployment this guarantees full pension. In fact, this is actually the case of 75% of the General Regime insurees.⁵

We have assumed 25 years for the entrance age⁶ when we study both intergenerational and intragenerational redistribution effects by gender and marital status. Only in the case of the analysis of the intragenerational effects by income levels we have considered different affiliation ages, since they are likely to be positively correlated to the worker's education level, as shown in Table 1.⁷

Table 1: Entrance ages into the labour market				
Cohorts: Year of Birth	High Income Earners	Intermediate Income Earners		Low Income Earners
		R. w. i. (2,5%;2%) and (2%; 1,5%)	R. w. i. (1,5%;1%) And (1%; 0,5%)	
1945	23 years	20 years	18 years	15 years
1955	25 years	22 years	20 years	16 years
1965	28 years	26 years	24 years	22 years

Note: High Income Earners are here identified with graduate educated people (the so called Professional Category 1 or *Titulados Superiores*); Low Income Earners, or unskilled workers, with Professional Category 10 or *Peones*).

R. w. i.: stands for real wage increase and in brackets we include the percentual increase in real wages until the individual is 55 years old and since then up to retirement we assume different rates.

Source: Own elaboration from the *Anuario de Estadísticas Laborales 1996*, Ministerio de Trabajo y Seguridad Social.

We consider that the age of entry to the labour market is higher for the 1965 cohort, independently of the education level achieved, due to the larger incidence of youth unemployment in the 80s and 90s.⁸

⁴ In practice, 63 is the average age for retirement once we account for some factors in existing regulations that induce early retirement (cf. Gómez-Sala, 1993).

⁵ In the case of self employed workers and agricultural labourers, on average 56% of pensions are obtained after contributing for 15 years or less.

⁶ In order to know the actual age of entrance in the labour market by cohort, we have explored a random sample from the 140.100 workers' Fichero Técnico de la Seguridad Social, 1993, taken from García-Fontes and Hopenhayn, (1996). For the 1955 cohort the average age is 20 years (12,5% have 25 years). For the 1965 cohort the average age is 22 years. For the 1935 and 1945 cohort, data are not reliable, given the lack of information for the younger ages in each of these generations.

⁷ We have not considered the 1935 cohort in this case due to the fact that at so early age, we would have had to consider contributions of up to 50 years for low income workers. Data for the whole period are not available.

⁸ In 1995, the average affiliation age was 23 years. For workers with high education (*Titulados Superiores*) it was 28, and 22 for the lower categories (unskilled workers or *Peones*). For the intermediate income earners the figure was 24/25 years old.

2.1 Life time contributions

In this subsection we briefly present the main assumptions employed for the calculation of the contribution basis⁹ and the pay-roll taxes applied in the computations of the redistribution effects.

2.1.1 Contribution Basis

We identify high income earners with professionals with a higher university degree (professional category 1 or *Titulados Superiores*), while low income earners are identified with unskilled workers (professional category 10 or *Peones*), according to the Earnings Survey (E.S.). Their contribution basis are then adjusted using this classification.

For the 1960 to half of the 1963 period their contributions will be based on effective wages, whereas between the second part of the year 1963 and 1978 both types of workers contribute according to their respective ‘basic’ basis (*Base Tarifada*). Moreover, for the period going from the second part of year 1972 and 1978 only high income earners will additionally contribute by the so called ‘complementary basis’ (*Base Complementaria*). This is defined once a limit on the ‘basic’ basis is applied. Between 1979-1996 high and low income earners will contribute to the system according to the allowable maximum and minimum contribution amount, respectively. Since 1996 contribution basis for all of them are assumed to be linked to price increases (estimated at 2,5% per annum). As a result, average monthly contribution basis at age 64 are 374.880 pesetas for high income earners and 75.687 pesetas for low income earners (in constant 1996 pesetas).

Finally, there exist several intermediate income earners who contribute according to different (longitudinal) wage profiles. The starting point to calculate initial cross-section wages profiles is the average monthly gross wage of the Earnings Survey (E.S.), published by the Spanish Statistical Institute (I.N.E.). However, we have had to estimate the average income

⁹ Given the lack of accurate data on this issue, the own estimations of some Spanish social security officials point out an increase over time in the average contribution period. This is partly due to the fact that the process of early retirement due to the economic recession has stopped in the last decade. In fact, according to Anuario de Estadísticas Laborales (INE, several years), the average initial pensioners’ age was 65,2 years in 1975, 62,7 years in 1986 and 62,5 years in 1997. For the same period, the average age of the occupied workers were 40 years (1975), 39,5 years (1986) and 36,7 years (1997). This seems to be the case despite the later age of entrance of younger generations in the labour market early mentioned.

earnings for these workers, since there was no single homogeneous E.S. between 1960 and 1996.¹⁰

For this purpose we have utilised the 1977 E.S. and the 1981 E.S. Both cover the period from 1977 to 1988 and employ similar methodology. From 1960 to 1976, and due to the changes introduced in 1977 on previous 1963 Survey methodology¹¹, we have backwards estimated the 1977 earnings up to 1960. We have done this by taking into account the annual rates of growth of average earnings per hour.¹² Finally for the 1989-1996 period, and again because of the methodological changes introduced in 1989 E.S.¹³ -having omitted earnings by type of workers-, we have had to estimate wages by applying the annual rates of growth of monthly gross wages of the 1989 E.S. From 1996, onwards, we assume that wages increase at the forecast inflation rate of 2,5%.

For each of the four cohorts we looked at several longitudinal wage-contribution series for the intermediate income earner, from his entrance into the labour market until retirement. For this purpose we have assumed different hypotheses on wage growth in order to construct the longitudinal series.¹⁴ This is due to the fact of existence of overlapping different cohorts of individuals at any given point in time.

We do this by taking the cross section annual gross earnings growth rates for the average worker. Once in the labour market, these rates are additionally increased by different percentage rise in real wages. They are assumed to be inversely correlated to age as reflection of lower productivity, throughout individuals' working life (before and after the cut-off point of 55). This is shown in Table 2.

¹⁰ Despite the I.N.E. Earnings Survey suffers an upward bias, although basically corrected in the 1989 E.S. (cf. Malo de Molina, 1983, for discussion), we have opted for employing these data, because they will allow us to construct wage series by contributors' groups.

¹¹ Cf. Malo de Molina [op. cit.] for an explanation of these changes.

¹² In addition, information on earnings by types of Professional Categories of workers was suppressed.

¹³ See *Metodología de la encuesta de salarios en la industria y los servicios*, The National Statistical Institute (INE), 1989.

¹⁴ This assumption is consistent with some empirical evidence on a positive relationship between the increase of earnings over time and the investment in human capital (cf. Díaz and Alemany, 1998, and Corugedo, 1998).

Table 2: Real wage growth rates according to age for intermediate income earners (alternative values in columns).				
≤ 55 age	2,5%	2%	1,5%	1%
> 55 age	2%	1,5%	1%	0,5%

We show in Table 3 the resulting monthly contribution basis for hypothetical intermediate income earners, who enter the labour market at age 25 and leave it at age 64.¹⁵ Notice that the final wage level ends with the same values for each of the four cohorts, since we have assumed identical wage increases and the same age on entry to the labour market. In particular, contribution basis of those workers who experiment a faster wage increase is not allowed to overcome the maximum allowable contribution base. Their contribution basis at age 64 coincides, in fact, with the maximum one (374.880 in 1996 pesetas).

Table 3: Monthly contribution basis at age 64 (in constant 1996 pesetas) Entrance age at 25.	
Real wage increase	Monthly contribution basis
≤ 55 age: 2,5 %; and > 55 age: 2%	374.880
≤ 55 age: 2 %; and > 55 age: 1,5%	374.880
≤ 55 age: 1,5 %; and > 55 age: 1%	323.133
≤ 55 age: 1 %; and > 55 age: 0,5%	266.467

Finally, in Table 4 we change the basic assumptions by allowing for different ages on entry to the labour market (see Table 1).¹⁶ As it can be seen, in this case wages in the last year of work differ across generations due to different wages according to their entrance ages into the labour market. Again, contribution bases are ‘capped’ by the maximum allowable contribution base whenever they apply.

¹⁵ In practice, we have additionally assumed that the worker’s entrance wage at age 25 is just 80% of the actual average wage for every cohort (for empirical evidence, see Castillo and Toharia [1991], Table 26, page 72).

¹⁶ We have assumed that the wages at the workers’ entrance age follow this pattern: individuals with ages between 15 and 24 years old obtain an average wage of 64% of the actual all ages wages, and those between 25 and 29 years old obtain a 80%, as commented before. These data are based on Castillo and Toharia (op.cit.).

Table 4: Monthly contribution basis at age 64 (in constant 1996 pesetas) Different entrance ages.				
Cohorts: Year of birth	Real wage increase (≤ 55 age: 2,5 % > 55 age: 2%)	Real wage increase (≤ 55 age: 2 % > 55 age: 1,5 %)	Real wage increase (≤ 55 age: 1,5 % > 55 age: 1 %)	Real wage increase (≤ 55 age: 1 % > 55 age: 0,5%)
1945	374.880	345.778	286.902	228.551
1955	374.880	332.351	278.484	224.047
1965	374.880	374.880	262.384	215.305

The intermediate income earners contribution basis for the 1960-1963 period will be calculated as the effective (longitudinal) wages -as commented above-, whereas for the 1963 to 1978 period, we have assumed as the ‘basic’ basis that of Professional Category 5. Moreover, from 1972 to 1978 the intermediate income earners will additionally contribute according to their *complementary basis*. This is defined as the difference between longitudinal wages or as a result of applying a limit on the ‘basic’ basis and the actual basis, depending on the case. From 1979, onwards, contributions evolve according to the computed longitudinal wages.

2.1.2 Payroll tax rates

We have calculated the Social Security contributions to the General Regime for each hypothetical worker between 1960 and 1996 in accordance with the regulations then in force. This means that for the 1960/1963 period the payroll tax rate is 14%. From 1963 to 1978 the basic base tax rate ranges from a value as high as 50% to a 34,3% and between 1972 and 1978 the complementary basis tax rate raises from a 10% to 34,3%. Finally for the 1979 to 1996 period the social security tax rate goes from 34,3% to 28,3%. We have assumed that 1996 legislation will remain in force and that payroll tax will continue to be levied at 28,3% rates.

At this point, a controversial issue is what these contribution rates have financed. In the early years, the pensions share in the Spanish social security budget was very low since workers’ contributions financed some other benefit programs too (health and family income support, amongst others). For this reason, we have adjusted, year to year, the contribution rates by the ratio of the sum of retirement and survival pensions (the only two considered in our work) over the total expenditure on contributive pensions. We have adopted this approach since we believe

that it is closer to reality: it better reflects the past institutional arrangements and the fact that revenues have adjusted to the evolution of the dependency rates.¹⁷ The estimated effective contribution rate evolves in a non uniform way from 0,492 to 0,769. This has been needed since no other form of identification between spending and contribution is available under the actual Social Security financing system.¹⁸

Lastly, we consider a backwards incidence of payroll taxes in terms of lower wages.¹⁹ Thus they are considered as ‘differed wages’.

2.2. Life time retirement benefits

The new rules defined by the 1997 Pension Reform Act (Ley 24/1997 de Consolidación y Racionalización del Sistema de Seguridad Social) are taken into account in our calculations. Among the reform measures introduced by the new legislation, we have considered the gradual enlargement of the period in order to calculate the initial old-age pension, P_0 (from the last 8 to the last 15 years before retiring).

It is worth to note that neither the change in the way in which entitlements cumulate as contribution goes²⁰ nor the gradual suppression of the maximum base for each professional group –below Professional Category 1- affect our results. This is due to the fact that (i) our hypothetical workers contribute over 25 years (the accrual rate only changes for those who contribute between 15-25 years) and (ii) their wage increases are not constrained by the limitations imposed by the existence of different professional categories.

¹⁷ This has been a very complex exercise due to information problems and lack of data. For the 1964 to 1966 period, we have taken the actual figures on pension survival and invalidity and we have deflated them by 0,72 (this being the weight once we exclude that part of pensions which are not considered in our IRR calculations for the eighties). The resulting figure has been divided by the annual contributions, excluding any existing superavit and non ‘contributive’ pensions (unemployment, accident and health insurance and similar). For the 1967 to 1976 period our data allow for a separate treatment of each different type of pensions. As a result, health expenditure coverage and unemployment pensions have been excluded. Having done this, we have had some minor gaps. For the 1960 to 1963 period we have taken the actual average rate for 1964-67. For the intermediate 1977 to 1979 we have taken the values from smoothing the increase between 1976 and 1980 (years with already known values). From 1980 to 1996 the figures reflect actual values. From 1996 onwards, this ratio has been maintained constant at the 96 level (77%).

¹⁸ Another alternative would have been to weight the contribution rates by the average ratio between pensions and contributions for the full sample, or to assume that the complete contribution rates finance just the pension system.

¹⁹ Argimón and González-Páramo [1987] and Escobedo [1991] find empirical evidence for this hypothesis.

²⁰ From 1997, the first 15 years of contributions (the minimum period to be eligible for retirement pensions) guarantee a 50% of the full pension, each additional contribution year between the 16th and the 25th adds 3 percentage points to the pension, and between the 26th and 35th adds 2 percentage points.

Therefore the retirement pension is derived by computing the contribution of the last years before retirement (the last 11 years for the cohort born in 1935). These bases are adjusted by the price index, except for the two final years. The fact that workers retire at age 65, after having contributed at least 35 years (this is the case of three quarters of the contributors under the General Regime), guarantees the payment of the full pension (i.e. 100% of the permitted maximum). After retirement, the initial pension, expressed in 1996 constant pesetas, is indexed to price increases up to the moment the pensioner dies.

As a result, the estimated retirement pension for a high income worker is bounded by the maximum allowable pension, 274.508 in 1996 pesetas per month, and for a low income worker the pension is 62.870 pesetas per month. This corresponds with the minimum allowable pension (for married individuals older than 65 years).

Table 5 reveals that retirement pensions for intermediate income earners end with the same pension in real terms. This is the case despite the fact that we have assumed different assumptions on real wage increases once we set the entrance at age 25. In fact, for those workers who experience a faster wage growth, their old-age pensions are bounded by the maximum allowable amount. This is the case except for the 1935 cohort, due to the different timing applied in computing their estimated pensions.

Table 5: Monthly retirement pension at age 65 (in constant 1996 pesetas) Entrance age at 25.				
Cohorts: Year of birth	Real wage increase (≤ 55 age: 2,5 % > 55 age: 2%)	Real wage increase (≤ 55 age: 2 % > 55 age: 1,5 %)	Real wage increase (≤ 55 age: 1,5 % > 55 age: 1 %)	Real wage increase (≤ 55 age: 1 % > 55 age: 0,5%)
1935	274.508	274.508	244.726	206.714
1945, 55, 65	274.508	274.508	244.977	208.981

Finally, Table 6 shows the retirement pensions granted by the social security system when individuals affiliate at different ages (see Table 1) with different entrance wages.

Table 6: Monthly retirement pension at age 65 (in constant 1996 pesetas) Different entrance ages.				
Cohorts: Year of birth	Real wage increase (≤ 55 age: 2,5 % > 55 age: 2%)	Real wage increase (≤ 55 age: 2 % > 55 age: 1,5 %)	Real wage increase (≤ 55 age: 1,5 % > 55 age: 1 %)	Real wage increase (≤ 55 age: 1 % > 55 age: 0,5%)
1945	274.508	253.354	217.319	179.082
1955	274.508	243.721	211.128	175.712
1965	274.508	274.508	198.922	168856

Replacement rates derived from our calculations range from 73% (for contributors constrained by both the maximum contribution and pensions amounts), to 83% (for the lower income earner).

2.3 Survival and life expectancy

In general, there exist two approaches for adjusting life-time contributions and retirement pensions of our hypothetical workers: survival and the life expectancy tables. The first one takes the survival probability at each age, according to Mortality Tables, once we assume a given age on the worker's entry to the labour market. The second one takes observed life expectancy from worker's affiliation to the social security system.

Both approaches give similar results, since both take the same basis: mortality rates. We have adopted, whenever possible, the 'survival method' for estimating inter and intragenerational redistribution effects for income levels and gender, since they allow for a more accurate adjustment of survival rates at each worker's age. However, in adjusting for the marital status of the workers, we have had to use the life expectancy approach due to data availability.

In short, first, for the analysis of the redistribution impact across cohorts and within cohorts by income levels and gender, we use the survival table on a longitudinal or *generational* basis²¹, in order to reflect the dynamic survival rate at each age. Second, in analysing redistribution by income levels, once we allow for different entrance ages and earning levels,

²¹ As it is known, the longitudinal survival tables allow for an increase in the survival rate in relation to the static mortality tables, since they incorporate the improvement in health states of the individuals along time.

longitudinal survival probabilities for high and low income earners are modified in order to account for income differentials. Finally, for the study of the redistribution effects among workers according to their marital status, we take the average life expectancy at age 25, as mentioned above (see Appendix).

3. CALCULATION

In practice, we can distinguish three methods to analyse how Social Security redistributes income across and within generations. All of them share the use of standard actuarial procedures. The first refers to the difference between life-time benefits and contributions (net transfers). This is the ratio of benefits-to-tax over the life-cycle. The second consists of calculating the transfer component of the old-age pensions –defined as the difference between real and actuarially fair pension. The third method is based on the calculations of the internal rates of return (ie. the yield earned on cumulated pay-roll taxes).

We have chosen the rate of return in order to capture the degree of the income redistribution caused by the pension scheme. As it is known, this rate does not depend on the discount factor. However, it is important to keep in mind that while we compare how payments and receipts evolve over an individual life-cycle, the ‘pay-as-you-go’ system is based on direct transfers from workers to pensioners in any given year.

The expected internal rate of return, r , offered by the system is calculated as the real rate of discount where the present value of contributions (LHS of the equation) and present value of benefits (RHS of the equation) are equal according the following expression:

$$\sum_{t=e}^{64} w_t^{96} tc_t (1+r)^{-(t-64)} Ps_{t,e} = \sum_{t=65}^m P_0 (1+r)^{-(t-64)} Ps_{t,e}$$

where ‘ t ’ is the contributor’s age, ‘ e ’ is the age of entrance into the labour market, ‘ w_t^{96} ’ are annual wages (in constant 1996 pesetas); ‘ tc_t ’ is the adjusted contribution rates²²; ‘ P_0 ’ is the initial retirement pension (again in 1996 pesetas); ‘ r ’ is the discount rate; ‘ m ’ refers to the age of death

²² See footnote 14.

according to the available mortality rates; and ' $Ps_{t,e}$ ' is the survival probability, determined by the age of entry to the labour market. This last variable is set at 25 years, in order to study both the intergenerational redistribution effects and the intragenerational effects according to gender and marital status, and the actual values of labour market entry for the intragenerational effects for income levels, as explained before.

4. RESULTS

According to the hypothesis of the previous section, the results show:

Intergenerational redistribution effects

Table 7 shows the internal rate of return (hereafter IRR) of the Spanish pension system across generations. It has been assumed that individuals entry to the labour market at age 25 and the longitudinal survival tables were adopted.

The Table reveals, by reading down each column (within the earnings categories and across the age cohorts), that the IRR declines for the four cohorts.²³ For example, if we take the intermediate income earner of the 1935 cohort -who experiments a real wage increase of 2% up to age 55 and 1,5% since then up to retirement- the IRR is as high as 5,1%. However, the same individual born thirty years later (1965) can expect a return of just a 3,38 per cent.²⁴

²³ It is important to remember that we have weighted the contribution rates, according to the evolving share of the pension program in social security budgets. Without this adjustment, our results for this case would show lower IRRs, particularly for the older cohorts given their higher contributions to the system, and an overall decrease in the intergenerational redistribution effect.

²⁴ In order to check the consistency of our calculations we have also estimated the IRR for an hypothetical worker who enters the labour market at age 25 and contributes for 40 years. But in this case we have taken the observed average contribution basis for the period 1960 to 1996 (as collected by, Informes Económico-Financieros de los Presupuestos de la Seguridad Social, several issues). By taking the longitudinal mortality table, we find that this contributor obtains an IRR of 4,44 %. This is a value relatively close to that reported in Table 7.

TABLE 7 Internal Rates of Return Entrance age into the labour market at 25						
Cohorts: Year of Birth	High Income Earners	Intermediate Income Earners				Low Income Earners
		Real wage Increase (2,5%; 2%)	Real wage Increase (2%; 1,5%)	Real wage Increase (1,5%; 1%)	Real wage Increase (1%; 0,5%)	
1935	3,513%	4,841%	5,090%	4,987%	4,689%	3,210%
1945	2,518%	3,585%	3,798%	3,718%	3,495%	2,734%
1955	2,150%	3,239%	3,430%	3,342%	3,119%	2,565%
1965	2,301%	3,194%	3,378%	3,285%	3,059%	2,658%

The reduction in IRRs for the second and third cohorts: their higher contributions more than offset their increasing life expectancy. This is not totally the case for the youngest generation due to the fact that the maximum and minimum allowable contribution basis have reduced progressively their value in real terms during the period 1980-1996. The result has particularly benefited the 1965 cohort, once we take into account that, in addition to the former fact, we have assumed constant values in real terms for the maximum and minimum allowable basis from 1996 and onwards. Notice however that for intermediate income earners, the increase in life expectancy for the 1965 cohort is not enough for a full recovery of IRRs, since they do not benefit from the erosion of the maximum and minimum allowable contribution basis.²⁵

If we measure the degree of intergenerational redistribution by the use of the benefit-tax ratio (the ratio of life-time benefits to life-time contributions) we observe again that workers in the 1935 cohort have clearly benefited from the Spanish public pension system. For instance, we find out that the same intermediate income earner of the 1935 cohort receives a large windfall gain by obtaining a present value of retirement pensions of 71% above the present value of contributions (this is, a net transfer equal to 13,6% of the life-time income). This contrast with the case of the worker for the 1965 cohort: he experiences a net gain of just a 13% (equivalent to 2,9% of his life-time income).²⁶

²⁵ Life-time contributions for high and low income earners of the 1965 cohort are lower than for those of the 1955 cohort. This results from higher contribution basis in real terms for the eighties than for the nineties. High earners in both cohorts pay at the maximum base, but the contributions -in present value terms- for the 1965 generation are lower. This is due to the fact that they confront a relatively lower maximum basis in real terms (during the period 1980-1989). A similar argument applies for low income earners.

²⁶ These calculations are performed at a real 3 % discount rate. Relative differences hold whether we use 2% or 4 % as the discount rate.

The differential treatment across generations which derives from the pension system - despite the fact that younger generations enjoy higher survival rates- is basically due to the contribution bases applied during the 60s and 70s, well below real wages, and to the evolution in the (weighted) contribution rates. For instance, the present value of contributions for the 1965 cohort is on average 80% higher than that of the 1935 cohort, while the present value of retirement benefits is only 19% higher.

We then temptatively²⁷ conclude that Spanish pension system has been an important vehicle for transferring resources from the younger, richer working generation to the older, poorer, retired generation. Indeed, we derive significant lump sum transfers from the youngest to the oldest pensioners.²⁸ This pattern is rather similar to the one found in the US case. Hurd and Shoven [1985] and Steuerle and Bakija [1994] show that for 1950 and 1960 pensioners, with low life-time contributions, the Social Security system offered real rates of return above 15%, against those obtained by the workers who retired during the 70s (just half: 8%), and an estimated 2% for the pensioners retiring in the year 2000.

Intragenerational redistribution effects.

As in most of the literature we have surveyed, we find that there is a significant differential impact of the pension system among individuals of identical cohorts, due to differences in income, gender, and marital status.

Redistribution effects by income levels

As the purpose of this section is to ground the analysis of intragenerational redistribution effects within each age cohort, a row's perspective rather than a column perspective has to be adopted. With this in mind Table 7 shows the rates of return offered by the pension system by income levels.

²⁷ At any rate, we should be cautious with this conclusion. Remember that in absence of actual data on longitudinal individual contributions we have had to assume hypothetical wage profiles. Therefore, our results should be taken as the potential redistribution effects under the specified assumptions.

The Table reveals some interesting results. First of all, there exists a positive relationship between rates of return and income levels, as a consequence of the existence of maximum contribution and pension limits, up to a certain earning levels. If we take the 1955 cohort IRR values we observe that rates of return steadily increase with the wage rate until a peak is reached and then decline quite sharply. This can be seen if we compare the rate of return (2,56 %) for low income workers (contributing at the minimum basis) with respect to a return (3,43 %) for an intermediate worker who experiences a 2% real wage increase up to age 55 and 1,5% up to retirement. At the same time, the return earned by the high income worker (contributing at the maximum basis) declines up to a value of 2,15%.²⁹

Of course, the highest IRR would be obtained by a contributor (not considered in Table 7) who experiments the highest wage increase over time (particularly, during the final years of the working life), with basis not constrained by the maximum allowed. This is due to the fact that pensions are calculated according to just the last fifteen final years and not as a result of the actual life time contributions.³⁰ If no limits would exist we would have found, for the 1955 cohort, a rate of return of 3,96% for the high income worker. In obtaining this result, the existence of the maximum pension limit is crucial.

Secondly, when low and high income workers are compared for some cohorts (assuming the same entrance age into the labour market at age 25) we find that social security tends to favour the former. Indeed, low income workers obtain relatively higher IRRs. The exception to this pattern is the 1935 cohort. At first glance this seems amazing because, in this case, high income earners achieve a higher rate of return on past contributions, despite of having a lower replacement rate.³¹

²⁸ While part of this public redistribution of wealth between generations may be offset by private intrafamily transfers or bequests, it is unlikely that this offset is sufficient to alter our conclusions.

²⁹ The decrease in IRRs for the two richer contributors (the first two columns in Table 7) is explained by a higher present value of contributions. This is due to the greater number of years contributing at the maximum contribution base, despite the fact that they achieve the same maximum pension amount.

³⁰ Duran (1995) shows that after 35 years of contributions and for the same wage when retire, two workers with different wage increase profiles (1% versus 4%) show very different IRRs: 3,1% and 4,7%, respectively. Of course, if we had assumed for the different initial wages identical growth rates, the returns of the system would have been practically the same.

³¹ There is not a direct relationship between replacement rates and internal rates of return. While the former compares the initial pension with the last worker's wage in a given year, the latter compares pensions and payments over the entire life-cycle.

This results from the specific design of social security contributions in the 60s and 70s (well below real wages). It tends to favour in a major extent those contributors with the highest wages, because these are comparatively less heavily taxed than in a more actuarially just case. For instance, the ratio of present value of contributions between 1963-1978 (when the basic and complementary basis apply) to total present value of contributions (covering the entire working career) is much more higher for low income workers, 47%, than for high income earners (32%).³² This is not longer the case for high income workers born between 1945 and 1965, once maximum contribution and pension basis are applied (since 1980).

So far we have assumed the same entrance age at 25 years. An interesting exercise is to analyse the returns achieved with different initial wages and entrance ages (cf. Table 1). Table 8 shows the corresponding IRRs accounting for longitudinal survival probabilities, subject to the worker's entrance age. Survival probabilities for high and low income earners are adjusted for income differentials (see Appendix).

TABLE 8 Internal Rates of Return Different entrance ages into the labour market						
Cohorts: Year of Birth	High Income Earners	Intermediate Income Earners				Low Income Earners
		Real wage Increase (2,5%; 2%)	Real wage Increase (2%; 1,5%)	Real wage Increase (1,5%; 1%)	Real wage Increase (1%; 0,5%)	
1945	2,543 %	3,711 %	3,772 %	3,412 %	3,102 %	2,075 %
1955	2,204 %	3,373 %	3,293 %	2,915 %	2,677 %	1,701 %
1965	2,719 %	3,341 %	3,523 %	3,190 %	2,962 %	2,303 %

Table 8 shows that when we consider a later affiliation age and a higher life expectancy for high income earners (who pay according to the maximum allowable contribution basis) than for low income earners (who do for the minimum contribution basis) the rates of return are greater for the first ones (cf. Boskin et al., 1983, Pellechio and Goodfellow, 1983, Hurd and Shoven, 1985, Boskin, 1986, Steuerle and Bakija, 1994, for USA; Creedy et al., 1992, for the UK; and Stahlberg, 1989, for Sweden).

³² The ratio of contribution basis to actual wages in that period are much lower for high income workers than for low income ones.

In some sense this regressive property is also found by Bandrés and Cuenca [1998] when they analyse the General Regime and the cohort of workers retired in 1993. In particular they show that the net transfer component³³ increase with the income level, with the exception of the first two income deciles due to the role played by the minimum complements.

Redistribution effects by gender

By looking at the intragenerational redistribution effects by gender, one observes that females obtain higher IRRs, all things being equal. This effect is due to the higher life expectancy of women at birth and higher survival rates at 65 years old. This is the case, although female wages are lower according to all the existing data (INE Earnings Survey, Institute for Fiscal Studies and the Spanish Tax Agency, 1996), reaching just 81% of male remuneration. Table 9 summarises the contribution basis and retirement pensions in 1996 pesetas in our calculations:

TABLE 9 Monthly Contribution Basis at age 64 and Initial Retirement Pensions (in constant 1996 ptas.) Entrance age at 25	
Real wage increase for Males (≤ 55 age: 2 %; > 55 age: 1,5%)	Real wage increase for Females (≤ 55 age: 1,5 %; > 55 age: 1%)
Contribution Base = 374.880 Initial Retirement Pension = 274.508	Contribution Base = 302.937 Initial Retirement Pension = 229.465

Table 10 shows the estimated internal rates of return by gender once we allow for several entrance wages³⁴ and we recognise different male and female profiles depending on their wage increases (2% and 1,5% for males versus 1,5% and 1% for females, up to 55 and up to 65 respectively). From this it results a 81% wage differential level at the end of a working life-time. As mentioned, longitudinal survival probabilities by gender are used to weight payments and receipts.

³³ The net transfer component of the pension system is defined as the difference between the pension received and the pension obtained under an actuarial fairness procedure.

³⁴ It is assumed that females with respect to males hold a 15% below wage differential and the average wage at 25 is just a 20% below the all ages' average wage (cf. Castillo and Toharia (op.cit.)).

TABLE 10 Internal Rates of Return Entrance age into the labour market at 25		
Cohort: Year of birth	Males Real wage increase (2%; 1,5%)	Females Real wage increase (1,5%; 1%)
1935	4,493%	5,379%
1945	3,300%	4,045%
1955	3,015%	3,603%
1965	3,037%	3,474%

The Table proves again a differential treatment in favour of females. In all cases, IRRs enjoyed by them are higher than the returns expected by males, despite higher male wages, due to the females higher survival rate. For instance, if we look at the 1955 cohort, females obtain a IRR of 3,60% (or a 22% old-age pension above their contributions: in present value terms, at a real 3% discount rate), whereas males would achieve a return over contributions of just 3,01%.

Redistribution effects according to marital status.

In order to study the redistribution impact within a given cohort by marital status, Table 11 compares rates of return earned on life-time contributions for married (one-earner couples) and single contributors. The analysis is limited here to the 1965 cohort -since the life expectancies by marital status refer to the 1991 period (cf. Burgoa et. al., 1997b)- and restricted to intermediate income workers, given the fact that life expectancies by marital status are not income adjusted. We take 25 as the age of entry to the labour market.

TABLE 11 Internal Rates of Return Entrance age into the labour market at 25				
Cohorts: Year of Birth	Real wage Increase (2,5%; 2%)	Real wage Increase (2%; 1,5%)	Real wage Increase (1,5%; 1%)	Real wage Increase (1%; 0,5%)
Married	3,388%	3,582%	3,484%	3,245%
Singles	2,354%	2,581%	2,491%	2,241%

Table 11 shows how married contributors (reaching an average age of 82, and leaving pensions to wives up to 92) receive a relatively better financial treatment from the social security system and obtain higher IRRs. Just the opposite is true for single contributors: lower life

expectancy (79 years) and no widow's surviving pension explain this result.³⁵

Likewise, a married contributor with wage increases of 2% up to the age 55 and 1.5% up to 65, achieves an IRR equal to 3,58% (a benefit-to-tax ratio of 20 per cent). A single individual with identical profile obtains an IRR of just 2,6% (a retirement pension equivalent to 90 per cent of contributions). These results are not surprising and show similar effects to those obtained for the US by Pellechio and Goodfellow [1983], Hurd and Shoven [1985], Boskin et al. [1987], despite the existing differences on pension eligibility³⁶, and by Nelissen [1987], in the case of The Netherlands.

5. DISCUSSION

In short, this paper has shown, first, the nature of the intergenerational effects of the Social Security system in Spain. The 1935 cohort has always clearly benefited in relation to the rest of cohorts in terms of receiving higher returns on past contributions. This is consequence of a maturation process of the pension system (as captured in the estimated effective contribution rates) and the nature of the observed gap between current wages and contribution bases in the 60s and 70s in Spain. For the 1965 cohort we have observed a small increase in returns partly due to the assumptions we have had to make and partly due to the relatively lower contribution basis in real terms in all those cases that maximum and minimum limits applied. Secondly, we have detected the existence of important intragenerational effects by income levels. For participants who pay between the minimum and the maximum contribution basis permitted, the system offers higher rates of return and life-time pensions over contributions. This is particularly the case for those individuals who experience faster wage increases over time and contribute for a shorter period of time, without reaching the maximum pension amounts.

In this sense it looks like if the Spanish social security system had neglected its proportional nature, being politically forced to introduce a progressive redistribution pattern. The easy way to do this may have been to change by law the values of the maximum and the

³⁵ This is calculated as 45% of the husband's pension, as established by Social Security legislation.

³⁶ In USA, a retired worker living with wife or husband gets an additional 50% of the pension. Once the worker has died, the survivor gets 100% of the initial pension.

minimum contribution basis and the maximum and minimum pension benefits. This has forgotten the rest of earnings brackets. Indeed, given the differences in wage profiles, the system has behaved in a rather regressive way for intermediate earners, with higher rates of return for higher income earners. Remember, however, that in absence of actual data on longitudinal individual contributions we have had to assume hypothetical wage profiles. Therefore, our results should be taken as the potential redistribution effects under the specified assumptions.

In general, the social security ‘deal’ is more profitable for high income individuals (with respect low income workers) due to their later entry to the labour market and higher survival rates. The system tends to favour women, despite the fact that their wages are lower than those of males, due to the differential incidence of their higher survival rates. Married individuals reach higher rates of return too than single contributors due to their higher life expectancy and to receipt of a pension for a dead spouse.

In deriving these results, we have not considered the potential impact of different unemployment rates for each of our hypothetical workers, despite knowing that they differ depending on gender, income and education. However, we do not have data by class or on for how long they are on the dole. Neither did we have data on actual retirement ages (by cohort and class in each cohort, but just for the average cohort). Data from cross-section studies on real wage differences, which relate them to age and productivity, cannot be used here given our focus on life-time redistribution.

Moreover, we have not analysed here the redistribution effects by branches of economic activity, in accordance with the different possibilities of ‘buying’ pensions (adjusting the contribution period and the contribution increases to an optimal pension claim), payroll tax evasion and ‘free riding’ the minimum pension benefits.

Finally, we have not considered either contributions or pension benefits net of taxes for each of our hypothetical workers, nor their final incidence. Due to data availability, the impact of all these factors on the distribution effects of the Spanish Social Security system, despite its relevance, has had to be excluded from our research for the time being.

APPENDIX

In this appendix we briefly present the main hypotheses used for the design of the mortality and life expectancy tables, which are relevant in our estimations of the redistribution effects.

Longitudinal Survival Tables

Life-time contributions and pensions in Tables 7, 8 and 10 have been adjusted using longitudinal survival tables. We have constructed a set of different longitudinal tables (on average by gender) according to the year workers enter the labour market. This was done in two stages. First, we have computed survival probabilities since each individual joins the labour market until 1991 through the number of surviving individuals at each age point in the general population. Second, the previous tables have been extended as a result of the estimates of the mortality functions (cf. González-Calvet [1994, 1996]). This allows the death probabilities at each age and year to be obtained up to the middle of the next century.

Longitudinal survival probabilities in Table 8 for high and low income earners have been additionally adjusted to account for income differentials. Despite the fact that there is no official table of survival rates by individual income levels, there is some evidence that high income earners and better-educated people (both factors being correlated) enjoy better health. This produces a lower mortality rates at each age and higher life expectancy at birth. In the Spanish case Regidor et al. [1996] show that manual workers and workers in agriculture (with a total mortality risk index of 1.72 and 1.56, respectively) suffer a higher mortality rate than managers and white collars in general (against a normalised value of 1, respectively)³⁷.

We have done this adjustment using some simplifying assumptions. Longitudinal survival rates for high and low income workers are modified by the mortality tables of the city of Barcelona, the only data available as far as we know (cf. *Mortalitat a la ciutat de Barcelona*, 1991, Institut Municipal de Salut Pública, Ajuntament de Barcelona. Mortality tables take five year breaks). In particular, we have taken the mortality rate of high income workers that of the highest income Barcelona post-code, and similarly for low income workers. By adopting the Reed-Merrel exponential function, we have converted mortality rates into mortality probabilities and survival rates. In addition, we have considered that mortality differences amongst areas of different income levels are constant for the four analysed cohorts.

If we compare survival rates between our longitudinal mortality table and the static INE table we find that the main difference which emerges relates to the higher survival rate of the elderly population in the case of the longitudinal table, resulting from medical advances.

³⁷ This results from a sample of males 30 to 64 years old from 8 Spanish provinces. Regidor et al. [1996] consider that these mortality differences have to do with childhood welfare (...) education and other individual psychological factors. Tobacco, alcohol consumption, lack of physical exercise and hypertension do not seem to play a major explanatory role.

Life Expectancy Tables by Marital Status

Payments and receipts in Table 11 have adjusted using a life expectancy table by marital status. Cross-sectional studies reveal that mortality rates are lower amongst married individuals than for widows and widowers, single unmarried or divorced individuals. A possible explanation relates to the social support role played by living together. It may also help to create health behavioural factors and to avoid some psychological problems related to individual isolation. Other explanations point out the fact that married people are a natural selection sample of population already grouping healthier people.

Burgoa et al. [1997a], using probabilistic models, obtain a mortality ratio, adjusted by age, of 1.67 for single males and 1.53 for single females in relation to a value of 1 for married males and females respectively. These results are used to build life expectancy tables by age groups in Burgoa et al. [1997b]. According to them, the life expectancy in 1991 of a married male 25 to 29 years old, was 52.27 additional years (44.65 for a single male). Life expectancy of a married female was 63.82 additional years. These results affect our calculations on the direct redistribution impact between single and married workers.

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