Seriously Strengthening the Tax-Benefit Link[*]

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Abstract

On January 1st 1994, Portugal introduced, for the first time, inflation indexation in the old-age pension formula. This change significantly decreased the uncertainty regarding the perception of the link between the stream of labor earnings and future pensions.

The effect of indexation was large and, by itself, increased the expected pension amount by 28% in real terms. Individuals appear to have reacted to the policy change: labor earnings increase significantly during the eligible years approaching retirement age.

Keywords: Pension policy reform, hours, earnings, tax-benefit link

JEL codes: J14, J26, J31

1   Introduction

A critical aspect in the discussion of the social security reform is whether individuals respond to the link between the social security taxes they

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pay and the retirement benefits they receive. The reaction of individuals to this link is influenced by the way they envision the future stream of benefits.

Feldstein (2005) argued that social security should be redesigned, strengthening the tax payers' perceptions of the link between taxes paid and future benefits, that is to say, by increasing the tax-benefit link. This might ameliorate the adverse effect that the public pension system has on working incentives. With an improvement of the tax-benefit link individuals understand more clearly that it is worth saving for retirement. In a social security context, a change in his current earnings may represent an increase in his future pension earnings. Once they perceive the link, they might react to it.

The reform of the Social Security system that was introduced in Portugal on January 1st, 1994, provide us exceptional conditions to evaluate the impact of a significant change of link between the taxes paid and the expectation of amount of pensions to be collected in the future. A critical element of this reform, one that decreased substantially the uncertainty regarding the definition of future pensions (by at least one third, in terms of the mean square errors of predicted pensions), was the indexation of social security contributions that were eligible to the formation of pensions. Thus, from January 1st, 1994 onward, the reference earnings became the best 10 real (deflated) yearly earnings out of the last 15 years, ruling out the previous formula where the pension was determined by the best 5 nominal yearly earnings out of the last 10 years.[1]

The new formula is actuarially fairer than the previous one, in the sense that it closed the gap between what people payed to what they would receive. An important implication of this change was that not only it reinforced the link between contributions and benefits, but also that it made the social security system significantly more generous, increasing the average pension by 28 percent in real terms, simply as a consequence

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[1]The number of years of contributions necessary to obtain a full pension also increased from 36 to 40 years.

of indexation. Since under the new law an individual's perception of the link between current earnings and future pension is much clearer, one may expect a better command over the age-earnings profile, one where the worker is aware of the relationship between that profile and the determination of his pension.

The contribution of this study to the literature is twofold. First, given the richness of information in the matched employer-employee (*Quadros de Pessoal*), one can straightforwardly characterize the impact of the policy change on the definition of the pensions. Thus, for each worker, it is possible to estimate his future pension. This calculation can be computed both for the pre- and the post-reform period, providing us a clear picture of the empirical distributions of the pensions over the two periods. And second, we should be able to disentangle the differences of the earning profiles as the workers approach retirement age, over the two distinct pension regimes. More specifically, in the present work, we will try to assess whether individuals reacted to this change in policy by increasing their work effort, measured in terms of hours worked and labor earnings collected.

We take advantage of the characteristics of the Portuguese pension system, together with the matched employer-employee nature of the dataset, to design our identification strategy in a way that allow us to analyze this reform in a quasi-experimental setting: first, one identify a clear group of affected individuals (the treatment group); second, one observes different intensities of impact of the policy change during the final years prior to retirement; and third, one can also follow a group of non-affected individuals (comparison group): in this case, prime-age workers are used to control for a general (aggregate) trends in wages over the sample period.

The structure of the remainder of the chapter is as follows. In Section 2 a brief review of literature is given. Section 3 summarizes the institutional setting in Portugal, in terms of both social security and wage setting. Section 4 provides description of the data used and Section 5 presents

the analysis of the effects on the pension distribution. Section 6 include discussions of how individuals reacted at the intensive margin. Section 7 concludes.

2 Earlier literature

In the study by Dominitz et al. (2003) the authors performed an intensive face-to-face survey to study how Americans perceive their benefits. They found substantial uncertainty and heterogeneity of beliefs. In general, however, individuals expect that the benefits level will not be reduced, even if some prefer to save through a private pension plan (Boeri et al. (2001)). Chan and Stevens (2008) use self-reported, employer reported, and social security administrative data from the health and retirement study (HRS) to examine the relationship between the knowledge of retirement benefits and the individual response to those benefits. They found that individuals well-informed about their own pension plans are more responsive to pension incentives than the average individual. Feldstein (2005) favors an architecture of the social security that strengthens the tax payers' perception of the link between taxes paid and future benefits.

Even if the tax-benefit link exists, individuals may not react to it, not because they do not see it, but because of specific behavioral reasons. Saving theory presumes that individuals are able to solve the optimization problem and it presumes that they have the necessary self-control to execute the optimal problem (Benartzi and Thaler (2007)). According to O'Donoghue and Rabin (2001) saving for retirement is very important, but procrastination leads individuals to do a very poor job at it. It is argued that they underweight outcomes in the distant future and overweight outcomes in the near future. (Lynch Jr. and Zauberman (2006)). Madrian and Shea (2001) analyze the 401K saving in the U.S. and find that the slope of the saving gradient with respect to age is positive, meaning that individuals postpone their decision to start saving for retirement,

but once they start saving, they save at an increasing rate.

A branch of the empirical literature has focused on the impact of social security on labor supply, at both the extensive margin and the intensive margin. At the extensive margin, Gruber and Wise (2004) and Blöndal and Scarpetta (1999) suggest that in many countries pay-as-you-go systems generated a dramatic decrease in labor force participation among older workers. To analyze this phenomenon, Disney (2004) splits the pension contribution into a tax component and an actuarial (forced saving) component. He applies several within and across generation indicators to 22 OECD countries over selected time periods (1961, 1975, 1997). The results suggest that it is only the tax component of the contribution that tends to distort the employment decision. Fisher and Keuschnigg (2010) develop a model based on a pay-as-you-go system with tax-benefit link to investigate how pension reform might affect labor supply. They find that reforms that increased the tax-benefit link tend to stimulate labor supply at both the intensive and extensive margins.

Disney and Smith (2002) explore the abolishment, in 1989, of the earnings rule in the United Kingdom, using data from the Family Expenditure Survey from April 1984 to March 1994. According to the earnings rule, the basic pension was withdrawn at 50 pence per £ of earnings from £75 up to £79, and one £ for one £ thereafter. They explore the reform as a quasi-experiment, comparing changes in hours of men aged 65-69 and those of women aged 60-64, before and after the reform. According to the authors, in reaction to the abolition of the earnings rule, older male participants raised their working hours by around four hours per week. They find a smaller effect for women (two hours).

Keuschnigg and Keuschnigg (2004) calibrated a general equilibrium with overlapping generations model, using data from the Austrian social security. Austria has increased the pension calculation reference period from the five highest earnings years, to the entire earnings history. The authors found that this change in policy had produced strong labor market

effects. In particular, they conclude that workers increased their supply of hours by 4%.

Liebman et al. (2009) use U.S. data for individuals born in 1931 and 1941 taken from the Health and Retirement Study longitudinal survey linked to Social Security earnings records. They explore discontinuities created by changes in the benefit rules, and found evidence of an increase in the elasticity of hours with respect to the net-of-tax share of 0.42. They did not find, however, any significant effect on the earnings elasticity with respect to the net-of-tax share.

3 Institutional context

3.1 Social security in Portugal

Social security in Portugal covers the majority of employees in the private sector, including agricultural workers, the self-employed, and domestic help, and it is based on a *pay-as-you-go system*, in which current contributions are used to pay current pensions. Retirement is organized in a *defined benefit* system, that entitles the individual to a monthly pension calculated on accrued seniority at retirement, which is a weighted average of the labor earnings throughout a period in the person's working years.

In the general scheme, the employee pays a contributory rate of 11% of the gross wage, while the employer pays 23.75%. This contribution, in the form of a tax, entitles individuals to retirement, survivor, and disability pensions, as well as unemployment, health insurance, maternity, or paternity leave benefits.

Since 1984 and until 1993 the statutory retirement age was 65 for men and 62 for women, and the reference earnings to calculate the pension were the best 5 nominal earnings out of the last 10 years. Following retirement, pensions were linked into inflation. The minimum entitlement contributory period was 10 years. Full retirement pension was only obtained after 36 years of contributive payments.

3.2 The reform of the old-age pension system

A social security reform was implemented in Portugal (*Decreto-Lei 329/93*) with the objective of increasing the link between taxes and benefits. The 1993 law increased women's statutory retirement age from 62 to 65 years, raised the minimum entitlement contributory period from 10 to 15 years, changed from non-indexed earnings based to indexed pensions earnings based and changed the full old-age pension entitlement period from 36 to 40 years of contributive payments.[2] This law defined that from January 1st 1994 on, the reference earnings for the calculation of the pension took effect.

In the pre-reform period, the reference earnings were the 5 highest annual labour earnings (in nominal terms) out of the last 10. The pension was calculated as $P = W \times 2.2\% \times N$, where P is the pension, W is the reference earnings (in nominal terms) and N is the number of years of contributions to the system, which was at least 36 for a full pension. The reference earnings were computed as the average earnings received in the eligible period.

Thus, in the post-reform period, the reference earnings became the highest 10 annual labour earnings (in real terms) out of the last 15. The pension was calculated as $P = W_R \times 2\% \times N$, where P is the pension, W_R is the reference earnings (in real terms) and N is the number of years of contributions to the system, which was at least 40 for a full pension. The reference earnings are computed as the average earnings received in the eligible period.

This new formula was implemented fully and immediately, which means that there was no transitory period. Benefit rules changed in an actuarial direction, while maintaining a pay-as-you-go system.

In the pre-reform period, the reference earnings are the highest 5 annual nominal labour earnings out of the last 10. We call this period the

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[2]The retirement age for women increased by six months every year, until it converged in 1999 to the level of men. See Martins et al. (2009) for details on the impact of this reform.

pre-reform *eligible period*, and to the period corresponding to the worst 5 the pre-reform *non-eligible period*, meaning that the worst years are not used when calculating the pension. In the post-reform period, the reference earnings are the highest 10 annual real labour earnings out of the last 15. We call the period corresponding to the best 10 years before retirement the post-reform *eligible period*, and to the period corresponding to the worst earnings the post-reform *non-eligible period*. The reference earnings are computed as the average earnings received during those eligible periods.

Figure 1: **Set-up of the analysis: Policy Illustration**
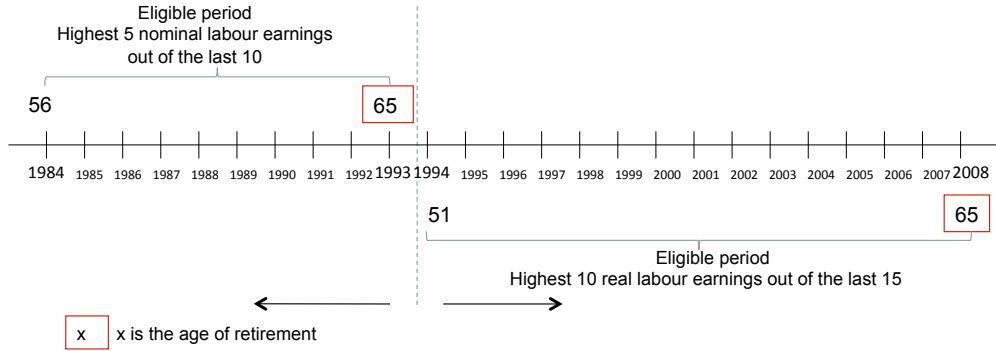
Notes: This figure illustrates the pension policy. An individual that retires in 1993 is entitled to a pension that is calculated from the highest 5 nominal annual labour earnings out of the last 10. In the post-reform period, meaning after 1993, an individual that retires in 2008 is entitled to a pension that is calculated from the highest 10 real annual labour earnings out of the last 15. In the sample the retirement age varies between 55 and 65 years old.

Figure 1 provides a representation of the rules behind the analysis design. For a typical individual, who retires at the age of 65 in 1993, the eligible period would be the highest 5 annual nominal labour earnings between 1984 and 1993, and the non-eligible period would be the lowest 5 annual nominal labour earnings in the same last 10 years prior to retirement.

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4 Data

In this study, a longitudinal data set matching firms and workers in the Portuguese economy, called *Quadros de Pessoal* (QP – "Lists of Personnel") is used for the period 1984 until 2008. The data are gathered annually by the Ministry of Employment, based on an inquiry that every establishment with wage-earners is obliged by law to fill in. Reported data cover all the personnel working for the establishment with at least one wage earner in a reference month (in March until 1993, and in October from 1994 on)[3]. Currently QP gathers information for more than 300,000 firms and 3 million workers. Given the mandatory nature of the survey plus the fact that these data cover all wage earner in the private sector, problems commonly associated with panel data sets, such as panel attrition, are considerably reduced.

Reported data on the worker side include gender, age, schooling, monthly earnings (split into several components), base wages, regular payments (e.g., seniority), irregular benefits (profits distribution and premium), and overtime payments. The information on earnings is reported by the employer, which is known to be subject to less measurement error than worker-provided earnings data. The firm data include detailed information on region, industry, shipments, and size. A worker identification code, based on a transformation of the social security number, enables tracking him over time. In the current study, the data set is limited to the population of male workers that are full-time wage earners in the private non-farm sector , who retire between 55 and 65 years old. A worker is considered to be retired if he is over 55 years old, leaves the sample, and does not return to the database. Female workers are excluded, as they were subject to other policy changes.

There are specific constraints pertaining to the surveys that must be mentioned. QP is available from 1984 on, which means there are only 10 years of data available before the new law was implemented. In order to

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[3]See Cardoso(2006) for more details.

avoid contamination of the sample plan with the effects of the legislation existing prior to the 1993 law, we consider a post-reform period that is observed entirely after 1993. Since this law establishes a 15 year period of reference earnings for the calculation of the pension in the post-reform period, we select individuals who retired in the year 2008.

The outcome variables are earnings, real base wage, real total earnings, real hourly earnings, and total hours. Hourly earnings are computed as the ratio of total earnings to total number of hours. Total number of hours is the sum of normal hours and overtime hours. All earnings variables were deflated using the Consumer Price Index (see Appendix A for details).[4]

5 The impact of the reform on the pension system

In order to calculate the impact of the policy change on the social security system we look into the pension distribution calculated under either regimes. First, we compute the monthly pensions of individuals retiring in 1993 using the pre-reform rules. Second, we calculate the monthly pensions of individuals that retired in 2008 using the post-reform rules.

Table 1 provides the summary statistics of pension values. An individual retiring in 1993 would expect on average a pension of 565 euros. An individual retiring in 2008 would expect on average a pension of 912 euros. Results exhibit an increase in the amount of pensions along the entire distribution. The shift in the distribution affected all quantiles, from the lowest pension values to the individuals who would be entitled to the highest pensions. This shift means a very significant increase of around 61 per cent, on average. The increase is higher on the right tail of the distribution. Figure 2 plots the simulated pension distributions summarized above. The distribution shifts clearly to the right. This represents

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[4]Appendix B gives a table with a summary of statistics of the key variables in the data set.

Table 1: Monthly pensions summary statistics

	Pre-reform (1984-1993)	Post-reform (1994-2008)	Δ (%)
Mean	565	912	61
Coefficient of variation	0.63	0.59	
P10	288	437	52
P25	355	512	44
P50	454	674	48
P75	621	976	57
P90	944	1633	73
Minimum wage	376	426	13
No. observations	7309	16023	

Notes: This table shows summary statistics of pension values calculated according to the pre-reform rules and post-reform rules. In the pre-reform, pensions are calculated using individuals that retire in 1993 and in the post-reform, pensions are calculated using individuals that retire in 2008. Numbers are in euros (deflated using as base year 2008). The last line is the average legal minimum wage in euros (deflated using as base year 2008). The last column shows the growth between pre- and post-reform (%).

a sizable increase in the values of pensions for the social security pension system.

These results do not reflect yet the policy change because they include the overall wage trend over this period. There is a 15 year time window between the post-reform observations and the pre-reform observations. One would expect that the overall wage level increased in 15 years. Thus, in order to identify the effects of this policy change, it is necessary to offset the overall wage trends throughout the period.

In order to properly decompose the effects of this policy change, from this point on, we will focus the analysis solely on individuals who retired in 2008.[5] We thus calculate the indexation effect and the period effect, by applying pre-reform rules and post reform rules. In other words, we simulate both pension regimes using the wage distributions that prevailed until 2008.[6] Table 2 presents the results of the decomposition exercise

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[5]This allows us to use their information in either in a 10 or 15 year reference period window without contaminating the sample plan with the ruling of 1993.

[6]This is not trouble free. The 2008 wage distribution may have changed due to the

Figure 2: **Pensions distribution - Simulation using pre- and post-reform rules**
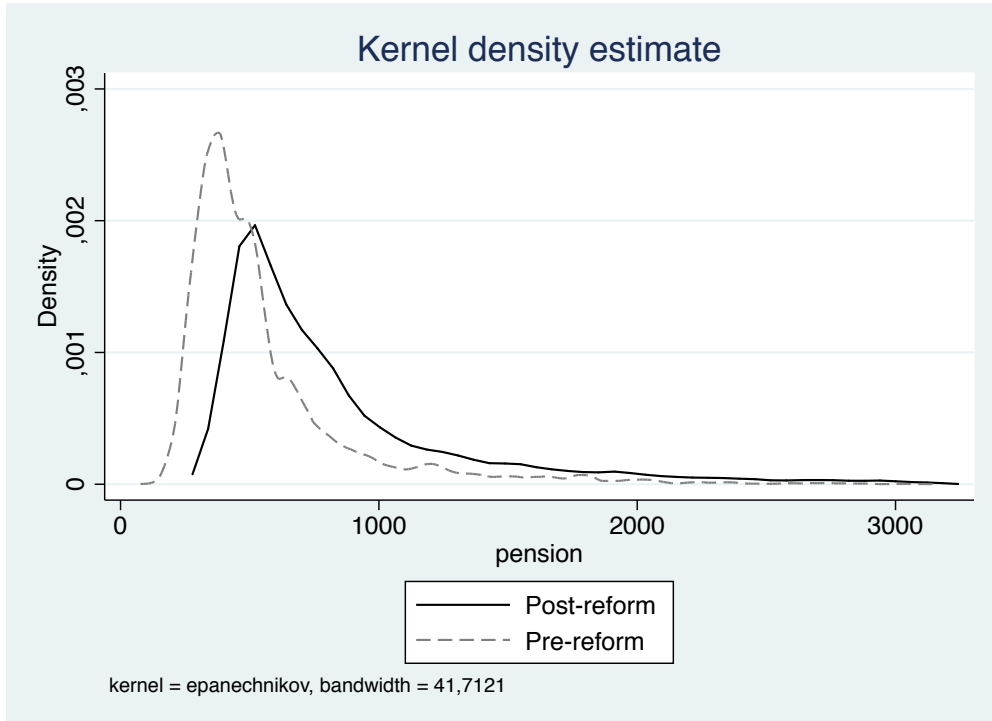
Notes: This figure shows the distributions for pensions calculated according to the pre-reform and the post-reform rules. Pre-reform distribution represents the computed pensions for individuals retiring in 1993. Post-reform distribution represents the computed pensions for individuals retiring in 2008.

using information from individuals retiring in 2008. The total policy effect on the mean pension is expected to be 28% (computed as -3 plus 31% or -1 plus 29%). Column (a) represents the mean pensions using the pre-reform reference period (highest 5 out of 10) and column (b) represents the mean pensions using the post-reform reference period (highest 10 out of 15). In line (1) we use non-indexed earnings as reference earnings and in line (2) we use indexed earnings as reference earnings. In line (3) we compute the difference between the level of pensions using the non-indexation (line (1)) and the indexation (line (2)) criteria. This provides a measure of the *indexation effect*. The *indexation effect* can be computed in two different

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pension law, as will be shown below.

ways (using column (a) or column (b)). Regardless of the decomposition, the *indexation effect* is very large in both decompositions, 29% and 31%, respectively.

Table 2: Pension simulation: Decomposition analysis using 2008

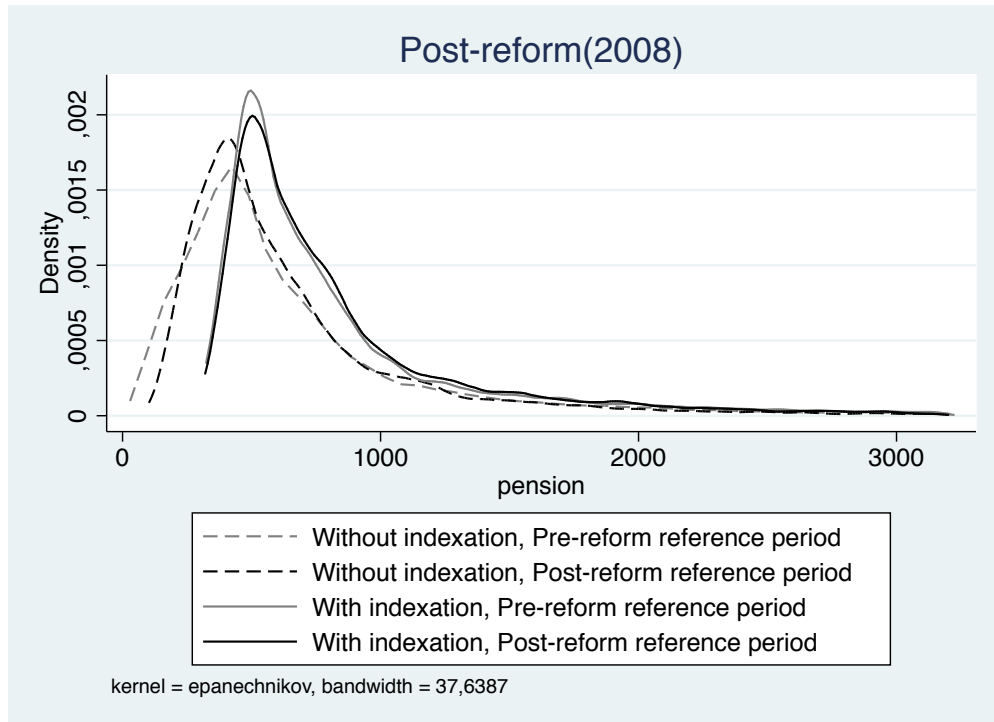|		1999-2008 Pre-reform reference period	1994-2008	Period effect
		(a)	(b)	% $\frac{(b)-(a)}{(a)}$
Non-indexation	(1)	716 (0.78)	696 (0.72)	-3
Indexation	(2)	921 (0.62)	912 (0.59)	-1
Indexation effect	% (3)=$\frac{(2)-(1)}{(1)}$	29	31	28

Notes: This table shows the simulated values for the mean pension according to four different rules which allows decomposing the reform effect into an indexation and a period effect. The decomposition is done using information from individuals that retired in 2008. Columns (a) and (b) represent the simulation of the pension using respectively the pre-reform and post-reform reference period. Lines (1) and (2) represent the simulation of the pension for those individuals using the criteria to choose the eligible wages, using the non-indexation and indexation criteria, respectively nominal and real values. Numbers in the last column are the growth rate using the values in euros (2008 prices) (% in 0-1 scale). Line (3) represent the simulated indexation effect (% in 0-1 scale). Coefficient of variation is in parentheses.

The last column in Table 2 shows the difference between columns (a) and (b) and represents the period effect. The period effect accounts for a decrease of the pension mean of -1% or -3%. Thus, the indexation effect is considerably more important in explaining the change of pension in 2008.

Overall, between 1993 and 2008, pensions increased 61% on average. About half of this increase is generated by the overall wage trend during this period. Indexation explains almost all of the remaining 28% change.

Figure 3 show the distribution of pensions in 2008 for the same decomposition exercise illustrated in Table 2. The increase of the pension mean is due mainly to the indexation effect. Using the post-reform reference period (black lines) the indexation curve has a clear shift to the right

Figure 3: **Pensions distribution - simulation**

Notes: This figure shows the distributions for pensions calculated for individuals that retire in 2008 using the pre-reform and post-reform reference periods. Non-indexation and indexation criteria represent the computed pensions for individuals applying respectively the nominal earnings rule and the real earnings rule.

(positive and significant *indexation effect*) and there is no clear change in the shape of the distribution. Using the pre-reform reference period (grey lines), a positive and significant *indexation effect* is also observed. The change in the shape of the distribution of the pensions is also notable. It is clear that the 5 out of 10 rule generates a less dispersed pension distribution.

The *indexation effect* is represented in the shift between dashed and bold lines. The *period effect* is observable by comparing within the dashed or the bold lines, meaning that we are comparing the situation applying the pre-reform reference period with the situation where the pension calculation applies the post-reform reference period.

The *period effect* results are less clear-cut. The *period effect* moved the distribution slightly to the left while also slightly decreasing the dispersion around the mode. The results of the analysis clearly indicate that the *indexation effect* dominates. It moved the distribution to the right and it is the main element driving the decrease in the dispersion of the pension distribution. The coefficients of variation reported in Table 2 confirm that the decrease in the dispersion is due mainly to the *indexation effect*. Indexation made the amount of the pension significantly more predictable. One way to measure the reduction in the uncertainty of the amount of the pension is to regress pensions on wages. The residual sum of squares in the pre-reform period regression is 972.5 and in the post-reform period it became 326. Thus, uncertainty was reduced by one third.

In a nutshell, changing the reference period had a much greater impact than changing the indexation. The impact is clear, not only at the mean, but also along the whole pension distribution. The period effect decreases dispersion and the indexation effect increases the mean of pensions and reduces even further the dispersion of pension values.[7]

6 The time profile of earnings and hours adjustment prior to retirement

In this section we address the following question: Do workers react to changes in the tax-benefit link by increasing their earnings near the age of retirement?

In labor economics much attention has been given to the effects of the incentives at the workplace on the worker's effort. In this section we study the improvement of the tax benefit link as an incentive to increase earnings. In the context of this study there are at least three mechanisms enabling workers to obtain higher earnings at the end of their contri-

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[7]The inflation rate was on average 13.5% and 3.1% respectively in the pre-reform period (1984-1993) and post-reform period (1994-2008).

butions career. First, a promotion scheme can be used as an incentive or reward to those individuals who performed well on a job. Suppose that the promotion premium or the promotion probability depend on the performance of the worker. By increasing effort, the kind that increases productivity, the worker is promoted. This in turn leads to higher earnings. Second, firms and workers have incentives to collude through a plan that would increase earnings in order to increase workers' pensions.[8] This can be partly explained by selective attrition from employment (Boeri and Van Ours, 2008, p. 134). The most productive workers are most likely to be the last to retire, and the firm might thus collude with the workers as a way to compensate long-term high productivity and the dedication to the firm. In Portugal, there is anecdotal evidence that some firms increase a worker's last year earnings (which, under the 1993 rules, represents 1/10 of the pension) in order to increase the pension of the worker. Third, under a scheme of deferred compensation, workers are paid below their marginal productivity in the first years of the contract and then paid above it during the latter part of their career. This produces an earnings profile that is upward sloping with age. This differed scheme discourages workers from shirking and it self-selects matches where both workers and firms seek to engage in long-term relationships. As a consequence of the improvement of the tax benefit link, such a plan would be interesting for both the worker and the firm. In this context, one would expect to observe an increase in earnings over the last working decade.

The 1993 reform offers a setting that allows for comparing workers that retired under the new policy system with workers that retired under the old pension system. The distinct factor in the analysis performed in this section is that we will use the same 10 year sample plan prior to retirement for both pre- and post-reform periods. This means that we employ the sample of individuals retiring in 1993 to obtain the effect under the pre-reform period, and individuals retiring in 2003 to reveal the

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[8]See (Lazear, 1998, p. 430) for collusion in the presence of portability on pension plans.

effect under the post-reform period.

6.1   Set-up of the analysis

Individuals in an earnings based pension system know that their pension level is related to their earnings, and know that if they increase their earnings during the eligible period this will have an impact on the final pension level. So, if there is a response to the social security tax, it can be detected by comparing the old reference period, meaning the last 10 years of earnings, in the pre-reform and post-reform regimes. However, making this comparison fails to control for aggregate changes due to macroeconomic trends or shocks, in particular, wage trends. A feasible solution to this problem is to use prime-age male individuals' earnings as a control. The prime age individuals group is constructed in the following way. We select them if they are between 35 to 45 in the year 1993 and 2003. These are the same years of retirement of the retired workers. After we identify them we add information on their wages for the previous 10 years. This design of the sample allows us to have individuals in a given year with different ages (age effect). And it also allows us to have individuals with the same age in different years (calendar year effect).

In this exercise the goal is to observe how individuals respond to the policy. It is interesting to know if the highest earnings are concentrated in the last years prior to retirement or if they start changing at the beginning of the period.

To evaluate the effect of the policy change, we estimate the following specification:

$$Y_{i,t} = \lambda_t + \theta\, ret_{i,t} + \alpha\, post_t ret_{i,t} + \beta X_{i,t} + \epsilon_{i,t} \tag{1}$$

The dependent variable $Y_{i,t}$, represents alternately the base wage, total earnings, hourly earnings, and total hours for individual i in the period from 1984 to 2003. $ret_{i,t}$ is an indicator for an individual i retiring (in

1993 or 2003). $post_t$ is an indicator for the post-reform period, 1994-2003. $post_t ret_{i,t}$ is the indicator for the individual that retires in 2003. $X_{i,t}$ is a set of characteristics of the worker (age, tenure and education) and the firm where he works (firm size and industry) and λ_t represents the conventional calendar year fixed effects, while $\epsilon_{i,t}$ is an error term.

The parameter of interest is α, which measures, for each labor market outcome, the reaction prior to retirement in the post-reform period in comparison with the pre-reform period, after withdrawing the effect of prime-age earnings profile. Under the null hypothesis that the policy change does not affect earnings near retirement, $\alpha = 0$. There is a policy effect if $\alpha > 0$, which indicates that individuals have increased their capability to command higher earnings near retirement.

6.2 Preliminary evidence

Figure 4 panel a) shows the evolution of average real total earnings in the 10 years prior to retirement (bold lines). The grey lines refer to earnings received in the pre-reform period, and the black lines, to earnings received in the post-reform period. Earnings in the pre-reform period have an increasing profile in the 10 last years prior to retirement. Earnings increased more than 14 per cent over the whole period. Earnings in the post-reform period are almost flat, at around 2% prior to retirement.

Figure 4 panel a) also shows the evolution of average real total earnings in the last 10 years of male prime-age individuals (dashed lines). The grey lines refer to earnings received in the pre-reform period and the black lines, to earnings received in the post-reform period. Earnings in the pre-reform period have an increasing profile in the 10 years of the period between 1984 and 1993, where they increased 24%. Earnings in the post-reform period also show an increase, although less pronounced, of around 8%.

Figure 4 shows the difference (in percentage points) between retiring workers' real total earnings in the last 10 years prior to retirement and prime-age workers' real total earnings.

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Figure 4: Real total earnings in the last 10 years
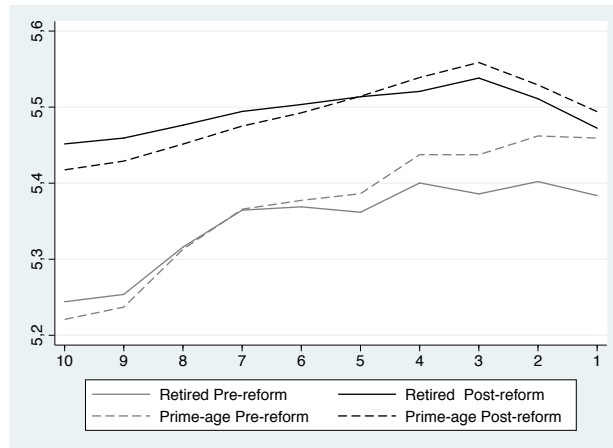
(a) Real total earnings (Retired and non-retired workers)(pre-reform and post-reform)
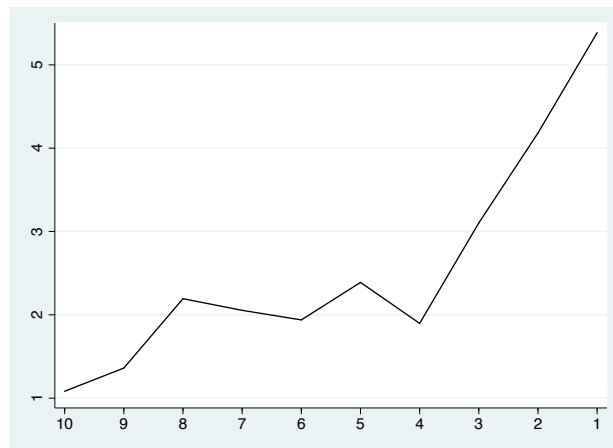
(b) Difference between retiring workers and prime-age workers' real total earnings (%)

Notes: This figure shows in panel a) the monthly real average earnings in the last 10 years prior to retirement (measured in logs) (bold lines) or prior to selection for the non-retired workers (dashed lines). In the pre-reform period, the sample includes individuals working between 1984 and 1993 (grey lines). In the post-reform period, the sample includes individuals working between 1994 and 2003 (black lines). In panel b) this figure shows the difference (in percentage points) between retiring workers' real total earnings in the last 10 years prior to retirement and prime-age workers' real total earnings (measured in logs). In both panels, on the horizontal axis, "10" represent the first year of the 10 years, respectively 1984 and 1994.

There is a positive increasing profile throughout the 10 years prior to retirement, most notably in the last 4 years prior to retirement.

6.3 Discussion of the regression results

To analyze the impact of pension reform on chosen labor market outcomes, we compare the behavior of individuals in the last 10 years prior to retirement in the post-reform period with that in the pre-reform period, after subtracting the evolution observed for prime-age workers. First, we examine the change in retiring workers' real total earnings relative to prime-age workers' real total earnings, both in the pre-reform and post-reform period. Table 3 reports the regression estimates of the parameters of equation (1).[9] We shall use different labor market outcome measures, such as base wage (column 1), total earnings (column 2), hourly earnings (column 3), and total hours (column 4). The conventional determinants of wages in the Mincer functions have been considered: schooling, age, tenure, firm size, and industry indicators. We include here a brief discussion of the relevance of including these controls. Theory dictates that the rate of return to education is positive at a diminishing rate per incremental year of schooling (Becker (1993)). Earnings generally rise with age at a decreasing rate and it is expectable that earnings increase with tenure. There are different reasons to expect this effect of tenure on earnings. This effect might be due to on the job specific training investment or due to the job match hypothesis, meaning, individuals who remain with a firm a long period are those who have found a job which matches their interests. It is generally found that large firms pay more for equivalent workers than do small firms (Oi and Idson (1999)). The inter industry wage differentials that exist among comparable workers has long been documented (see for example, Krueger and Summers (1988)).

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[9]However, if wages affect the retirement decision, reverse causality may be an issue. Fortin et al. (2011) suggest that in the presence of two groups A and B even if there is a reverse causality problem, the difference in difference should solve the problem as long as the correlation is the same between the two groups. Although it seems plausible to believe that this would be the case in this chapter there could be a simultaneous decision going on due to the policy change.

Table 3: Earnings and hours adjustment prior to retirement

	base wage		total earnings		hourly earnings		total hours	
	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
post.retired α	0.048 (0.001)**	0.028 (0.002)**	0.039 (0.002)**	0.025 (0.002)**	0.043 (0.002)**	0.029 (0.002)**	-0.004 (0.000)**	-0.004 (0.000)**
$\overline{R}^2$	0.495	0.503	0.526	0.540	0.566	0.587	0.332	0.381
No. Observations	3,213,481	1,240,540	3,213,481	1,240,540	3,213,481	1,240,540	3,213,481	1,240,540

Note: Ordinary least squares estimates of equation (1); Unbalanced sample with retired workers (33,527 retired in 1993 and 25,974 retired in 2003); Balanced sample with retired workers that were observed in each of the previous 10 years before retirement (7,309 in 1993 and 5,032 in 2003); The dependent variables are all represented in logs; Robust standard errors in parentheses; $post_t$ is an indicator for the post-reform period, 1994-2003; a **/* indicates that the coefficient is different from zero at a 5%/10% level of significance; used but not reported are individual and firm controls. These controls include age dummies, tenure, squared tenure, education (9 categories), firm size (logs), and industry (28 categories) in addition to calendar year fixed effects.

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The coefficient estimate $\hat{\alpha}$ is positive for all outcome measures. Retiring workers' real earnings in the last 10 years prior to retirement increased in the post-reform period. Their base wages increase by 5% (3% for the balanced sample) and monthly and hourly earnings by 4% (3% for the balanced sample) in comparison with the pre-reform period. Total hours have decreased but the size of the effect is very small (-0.4%).[10] This suggests that individuals did not change their labor supply in terms of hours but their earnings increased, and therefore it can be tentatively taken as evidence of a reaction to the improvement of the tax-benefit link.[11]

In order to reveal the time profile of the effect throughout the 10 years prior to retirement we adapt equation (1) by splitting the coefficient α into 10 coefficients given by α_j. To evaluate the effect of the policy change we estimate the following specification:

$$Y_{i,t} = \lambda_t + \beta X_{i,t} + \sum_{j=1}^{10}(\theta_j ret_{i,j} + \alpha_j post_t ret_{i,j}) + \epsilon_{i,t} \qquad (2)$$

$post_j$ is a time dummy for each of the 10 years in the post-reform period and therefore, $post_t ret_{i,j}$ is the indicator for each of the 10 years prior to retirement for the individual retiring in 2003. The parameters of interest are α_j, which measure, for each labor market outcome the reaction for each of the last 10 years prior to retirement in the post-reform period in comparison with the pre-reform period, after deleting the effect of prime-age earnings profile. For example, α_1 and α_{10} represent the effect 1 and

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[10]Working hours in Portugal are defined by collective agreements and hours legislation. Thus, the fact that I do not find any hours effect is not unexpected. The 4.1% reduction of hours for post coefficient is consistent with the results found by Raposo and Van Ours (2010). This study finds that for workers who were affected by the new law, working hours decreased.

[11]Promotions can be taken as indirect evidence of an increase of the workers' effort. Retiring workers' promotions in the last 10 years prior to retirement increased 3.1 percentage points in the post-reform period. Retiring workers that had a promotion observed a further increase in the total earnings of around 3.2%. Although the effect does not completely explain the wage increase, it is statistically significant. To sum up, the effect on earnings in the post-reform period is only partly explained by an increase in the incidence of promotions.

10 years away from retirement, respectively. Table 4 shows a summary of the results from α_j (equation (2)) using again different labor market outcome measures.

Under our identifying assumptions, the new pension policy had the following impacts. Retiring workers' real total earnings relative to prime-age workers' real total earnings have increased and there is a clear increasing pattern over the last 10 years prior to retirement. Retiring workers' real base wage 10 years prior to retirement increased 2% and it continued increasing, and in the last year prior to retirement the base wage increased 7%. The pattern for total earnings and hourly earnings are in line with the base wage results. In sum, there is evidence that earnings have increased especially close to the end of the period prior to retirement, indicating a concentration effect in the last years prior to retirement. With some reservation, we offer the tentative explanation that this increasing pattern is the result of procrastination. Individuals have postponed the decision to start making an effort to increase their earnings but once they start, they do it at an increasing rate. This is consistent with the suggestion given by Madrian and Shea (2001) that individuals often post-pone their decision to start saving for retirement. However, the same authors find evidence suggesting that once they start saving, they save at an increasing rate.

In the post-reform period, total hours of retiring workers present a different pattern but the effects are very small. We find no clear pattern for hours. Retiring workers total hours 10 years prior to retirement remained constant and then in the last year prior to retirement, their total hours decreased 0.5% (0.3% for the balanced sample). This represents a clear decreasing pattern in the last 10 years prior to retirement, although the size of the effect is very small. This result is interesting because it reveals a mild decreasing pattern in hours worked along with an increasing rising pattern of retiring workers' real earnings.

Table 4: Time profile of earnings and hours adjustment prior to retirement

Period 1994-2003		base wage		total earnings		hourly earnings		total hours	
		Unbalanced (1)	Balanced (2)	Unbalanced (3)	Balanced (4)	Unbalanced (5)	Balanced (6)	Unbalanced (7)	Balanced (8)
10 years to retirement	α_{10}	0.016 (0.005)**	0.025 (0.006)**	0.003 (0.006)	0.012 (0.007)**	0.003 (0.006)	0.012 (0.007)	0.000 (0.001)	0.000 (0.002)**
9 years to retirement	α_9	0.024 (0.005)**	0.021 (0.006)**	0.020 (0.005)**	0.018 (0.007)**	0.020 (0.005)**	0.018 (0.007)**	0.000 (0.001)	0.000 (0.002)**
8 years to retirement	α_8	0.035 (0.005)**	0.029 (0.007)**	0.030 (0.005)**	0.025 (0.007)**	0.030 (0.005)**	0.033 (0.007)**	-0.006 (0.001)**	-0.009 (0.002)
7 years to retirement	α_7	0.038 (0.005)**	0.031 (0.007)**	0.035 (0.005)**	0.029 (0.007)**	0.035 (0.005)**	0.036 (0.007)**	-0.007 (0.001)**	-0.006 (0.002)
6 years to retirement	α_6	0.039 (0.005)**	0.029 (0.007)**	0.036 (0.005)**	0.034 (0.007)**	0.036 (0.005)**	0.033 (0.007)**	-0.002 (0.001)	0.001 (0.002)**
5 years to retirement	α_5	0.041 (0.005)**	0.028 (0.007)**	0.033 (0.005)**	0.024 (0.007)**	0.033 (0.005)**	0.025 (0.007)**	-0.003 (0.001)**	-0.001 (0.002)*
4 years to retirement	α_4	0.036 (0.005)**	0.025 (0.007)**	0.028 (0.005)**	0.023 (0.007)**	0.028 (0.005)**	0.028 (0.007)**	-0.004 (0.001)**	-0.005 (0.002)**
3 years to retirement	α_3	0.049 (0.005)**	0.022 (0.007)**	0.046 (0.005)**	0.018 (0.007)**	0.046 (0.005)**	0.027 (0.007)**	-0.005 (0.001)**	-0.009 (0.001)
2 years to retirement	α_2	0.060 (0.004)**	0.028 (0.007)**	0.057 (0.004)**	0.023 (0.008)**	0.057 (0.004)**	0.032 (0.007)**	-0.004 (0.001)**	-0.009 (0.001)**
1 year to retirement	α_1	0.074 (0.004)**	0.034 (0.007)**	0.067 (0.004)**	0.032 (0.007)**	0.067 (0.004)**	0.034 (0.007)**	-0.005 (0.001)**	-0.003 (0.001)**
$\overline{R}^2$		0.495	0.503	0.527	0.540	0.566	0.587	0.332	0.381
No. Observations		3,213,481	1,240,540	3,213,481	1,240,540	3,213,481	1,240,540	3,213,481	1,240,540

Note: Ordinary least squares of equation (2); Unbalanced sample with retired workers (33,527 retired in 1993 and 25,974 retired in 2003); Balanced sample with retired workers that were observed in each of the previous 10 years before retirement (7,309 in 1993 and 5,032 in 2003); The dependent variables are all represented in logs; α_{10} and α_1 represent the time distance to retirement, respectively 10 and 1 year to retirement; robust standard errors in parentheses; a **/* indicates that the coefficient is different from zero at a 5%/10% level of significance; used but not reported are ret and post indicator as well as individual and firm controls. These controls include tenure, squared tenure, education (9 categories), firm size (logs), and industry (28 categories) in addition to calendar year fixed effects.

6.4   Sensitivity analysis

To further check the adequacy of the procedures used to perform this policy analysis, we perform a sensitivity analysis, as explained below.

6.4.1   Sensitivity to age of retirement

It is reasonable to expect that the individual near retirement is more worried about the conditions of retirement, namely about the age of retirement and about the level of pension he will be entitled to receive. In the previous analysis we do not distinguish between the individual who retires before the age of 65, from the one who waits to retire exactly at that age.

The individual who retires at 55 might have different characteristics than the individual retiring at 65, but more importantly, these differences may also influence the labor supply decisions prior to retirement, as well as before that. In Table 5 the results of a sensitivity analysis are reported, distinguishing two distinct moments of retirement: first, individuals who retire between 55 and 60 years old; and second, those who retire between 61 and 65 years old.

Results shown in Table 5 are consistent with the baseline results. There is evidence that both workers that retire between 55 and 60 and those that retire between 61 and 65 have increased their earnings.

Retired workers aged between 55 and 60 (and also aged between 61 and 65) had an increase in their real base wage of around 5% (3% for the balanced sample). The pattern for total earnings and hourly earnings are in line with the base wage results.

As expected, there are some differences in terms of magnitude and statistical significance, but in general we conclude that the age of retirement does not appear to seriously alter the policy effects.

Table 5: Sensitivity (I) to age of retirement

	base wage		total earnings		hourly earnings		total hours	
	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
55-60								
Period 1994-2003								
post.retired α	0.047 (0.002)**	0.028 (0.003)**	0.036 (0.002)**	0.022 (0.003)**	0.037 (0.002)**	0.022 (0.003)**	0.000 (0.000)	0.000 (0.001)**
$\bar{R}^2$	0.495	0.503	0.527	0.540	0.567	0.588	0.334	0.383
No. Observations	3,109,995	1,195,720	3,109,995	1,195,720	3,109,995	1,195,720	3,109,995	1,195,720
61-65								
Period 1994-2003								
post.retired α	0.049 (0.002)**	0.028 (0.003)**	0.043 (0.002)**	0.030 (0.004)**	0.054 (0.003)**	0.042 (0.004)**	-0.011 (0.000)**	-0.012 (0.001)**
$\bar{R}^2$	0.496	0.504	0.528	0.541	0.568	0.589	0.338	0.390
No. Observations	3,028,371	1,161,950	3,028,371	1,161,950	3,028,371	1,161,950	3,028,371	1,161,950

Note: Ordinary least squares based on 39,690 (7,859), 19,811 (4,482) retired individuals aged respectively between 55-60, and 61-65 in the case of the unbalanced (balanced) sample. See footnote of Table 3 to complete this information.

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6.4.2 Sensitivity to period following the reform

The design of the experiment is constrained on the period before the reform, because the data set *Quadros de Pessoal* is available only from 1984 on. Nevertheless, there are no such year constraints in the post-reform period.

In 2002 (*Decreto-lei 35/2002*) a new reform in the social security scheme was introduced in order to attenuate the persisting financial problems. This law introduced a new formula for calculating the value of retirement pensions.[12] However, given a transition period, this 2002 reform only affects individuals who start working in 2002 or who retire after 2016.[13] Nevertheless, we can use the years between 2004 and 2006 to check if the chosen period after the policy (1994-2003) is too specific.

In Table 6 it is possible to see that the baseline results are not perturbed. The magnitude of α increases between 2003 and 2006 for the three earnings measures. Retired workers' (in 2004) real base wage increased 6.0% (5% for the balanced sample). Retired workers' total hours (in 2006), decreased at a similar magnitude. In the last 10 years prior to retirement hours decreased, on average -0.7%.

Overall, although there are differences in the results when different years of retirement are considered, the broad conclusions of the baseline results remain qualitatively the same.

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[12]With the 2002 reform, pensions are calculated using the whole contributive career (instead of the best 10 out of the last 15 years) or the best 40 years when the contributive career is longer. At the same time, this law sets out different accrual rates depending on the workers' compensation (the higher the compensation, the lower the marginal rate, varying between 2.3 and 2 percent) and on career length.

[13]Given the significant impact of the new formula, the 2002 law established a transition period, according to the age of individuals at the end of 2001. Individuals 50 to 65 years old on December 31 2001, who are entitled to retirement between January 1 2002 and December 31 2016, can choose the highest pension. In principle, they choose the pension calculated according to the 1994 rules. Individuals who retire only after December 31 2016 have their pensions calculated as a weighted average between the pension from the last regime and from the new regime, where the weights correspond to the number of years of service before and after December 31 2001.

Table 6: Sensitivity (II) to period following the reform

	base wage		total earnings		hourly earnings		total hours	
	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
2004								
Period 1995–2004								
post.retired α	0.060 (0.001)**	0.047 (0.002)*	0.047 (0.002)**	0.036 (0.002)**	0.052 (0.002)**	0.042 (0.002)**	-0.005 (0.000)**	-0.005 (0.000)**
$\bar{R}^2$	0.497	0.504	0.529	0.540	0.568	0.587	0.341	0.387
No. Observations	3,302,477	1,297,950	3,302,477	1,297,950	3,302,477	1,297,950	3,302,477	1,297,950
2005								
Period 1996–2005								
post.retired α	0.083 (0.002)**	0.068 (0.002)*	0.065 (0.002)**	0.055 (0.002)*	0.072 (0.002)**	0.062 (0.002)*	-0.007 (0.000)**	-0.008 (0.000)**
$\bar{R}^2$	0.500	0.502	0.529	0.537	0.568	0.583	0.345	0.390
No. Observations	3,376,212	1,288,660	3,376,212	1,288,660	3,376,212	1,288,660	3,376,212	1,288,660
2006								
Period 1997–2006								
post.retired α	0.096 (0.002)**	0.069 (0.002)*	0.079 (0.002)**	0.057 (0.002)*	0.087 (0.002)**	0.064 (0.002)*	-0.007 (0.000)**	-0.007 (0.001)**
$\bar{R}^2$	0.500	0.510	0.530	0.542	0.568	0.587	0.347	0.388
No. Observations	3,447,798	1,311,610	3,447,798	1,311,610	3,447,798	1,311,610	3,447,798	1,311,610

Note: Ordinary least squares in the three panels based on 59,601 (12,546), 58,968 (11,870) and 58,758 (11,700) retired individuals respectively in 2004, 2005 and 2006 in the case of the unbalanced (balanced) sample. See footnote of Table 3 to complete this information.

7 Conclusions

On January 1st 1994 new legislation introduced two important changes in the Portuguese social security system. First, and very important, there was a change from non-indexed earnings based to indexed pensions earnings based. The second change is related to the enlargement of the eligible period. Specifically, Portugal changed the reference earnings used to calculate the pension into the highest 10 annual labour earnings (in real terms) out of the last 15, instead of the highest 5 out of the last 10 years (in nominal terms).

We find evidence of a strong positive effect of the policy change on the distribution of pensions. Overall, between 1993 and 2008, pensions increased in real terms by 61% on average. About half of this increase is generated by the overall wage trend during this period. Indexation explains almost all of the remaining change (28%). Indexation also made the amount of the pension significantly more predictable.

Labor earnings increase more in the years close to retirement. Three mechanisms leading to wage increase may be at work: promotions; collusion between firms and workers; and the operation of deferred compensation schemes. The effect on earnings is partly explained by an increase in the incidence of promotions. We interpret this as evidence that individuals reacted to a policy change that altered the link between contributions and benefits.

The time pattern of wage increases is also notable. Higher wage hikes are observed closer to retirement age. We can only speculate about the reason why the effect is especially large for the last 4 years prior to retirement. We offer the tentative explanation that this increasing pattern is the result of procrastination and collusion.

Our interpretation of these findings is that reforms that change the tax-benefit link should give special attention to the labor supply responses of the workers.

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8 Appendix

Appendix A - Description of variables

Pension: Refers to the retirement pension. It is the monthly amount calculated on accrued seniority at retirement, which is a weighted average of the labor earnings obtained throughout a period in the person's working career. It is calculated according to the pre- and post-reform rules (own calculations).

Retired worker: A worker is considered to be retired if he is over 55 years old, he exits the sample, and does not return to the employer-employee matched database.

Firm closure: A firm closure is observed if the identification number of one firm appeared in period t but did not appear in t+1, t+2 and t+3.

Base wage: Labor earnings that are fixed and paid regularly on a monthly base.

Total earnings: Labor earnings that are a combination of several components: base wage, regular payments (e.g., seniority and transportation), irregular benefits (profits and premium), and overtime hours payments.

Normal hours: Actual hours during a normal week at the going wage.

Overtime hours: Time worked in a week at an overtime premium (50% for the first hour, 75% for additional hours).

Total hours: Sum of normal and overtime hours.

Hourly earnings: Ratio between total earnings and total hours.

Promotion: Identified by the reported date of the last promotion in that year. Promotion is a categorical variable equaling one if the individual had a promotion in the last 12 months.

Tenure: Duration measured on years of current job or contract.

Age: Age of the individual measured in years.

Prime-age workers: workers aged between 35 and 45.

Education level: Seven education categories were defined: (1) Less than Basic School, which includes individuals with fewer than 4 years of schooling, (2) Basic School, which includes individuals with 4 completed years of schooling, (3) Preparatory, which includes individuals with 6 completed years of schooling, (4) Lower Secondary, which includes individuals with fewer than 10 years but more than 6 completed years of schooling, (5) Upper Secondary, which includes individuals with secondary schooling and (6) College, which includes individuals with at least a bachelor degree, and undefined category (7) for the individuals with an undefined level of education.

Firm size: The number of workers currently working in the firm, measured in logarithm.

Industry: Six categories were defined: (1)Manufacturing, (2)Construction, (3)Commerce, (4)Transports, (5)Financial, and (6)Education/Health.

Appendix B - Descriptive statistics

	Non-retired workers		Retired workers	
	1993	2003	1993	2003
	(1)	(2)	(3)	(4)
Base wage (real euros)	245.69	289.60	243.84	292.93
Monthly earnings (real euros)	294.54	353.14	289.04	355.33
Hourly earnings (real euros)	1.67	2.07	1.62	2.05
Total hours (per week)	41.74	39.98	42.34	40.40
Normal hours (per week)	41.15	39.39	41.81	39.62
Overtime hours (per week)	0.59	0.58	0.53	0.78
Promotion (percentage 1-100)	13.80	12.14	8.19	8.42
Tenure (years)	10.50	8.73	18.09	16.35
Age (years)	36.57	36.52	55.81	55.44
Education:				
Less than Basic School	2.91	1.57	17.62	5.56
Basic School	53.95	33.23	58.63	64.54
Preparatory	12.54	24.43	6.61	10.39
Lower Secondary	8.51	16.23	3.83	9.69
Upper Secondary	14.85	16.30	7.73	4.45
College	4.52	6.80	2.88	3.99
Undefined	2.72	1.44	2.70	1.38
Firm size (no.-workers)	2091	827	1849	802
Industry:				
Manufacturing	47.15	36.87	48.97	39.44
Construction	8.89	15.70	12.40	14.30
Commerce	19.61	24.55	19.00	21.51
Transports	11.64	8.97	13.68	14.58
Financial services (except banks)	3.63	5.78	3.43	5.95
Education/Health	1.76	3.83	2.52	4.22
Banking services	7.32	4.30		
No. Observations	1358802	1566083	165292	123304

Notes: This table reports summary statistics (mean) for 1993, and 2003, the two base years used in the analysis. Columns (1) to (3) are statistics computed using non-retired male workers and columns (3) to (5) are computed using the sample of male workers who retired in the given years. Variables represented are those described in detail in Appendix A. The units are explained in front of the variables while Education and Industry are shown as a percentage.

Appendix C - Wage setting in Portugal

Portugal is considered to have a regulated labor market, with minimum wages, strong employment protection, and collective bargaining widely applied (OECD (2001) and Cardoso (2006)). In the 1990s, Portugal was characterized by low unemployment rates, approximately 3-4 percentage points below the EU-15 average. In 1994, the minimum legal monthly wage was 246 euros. The mandatory minimum wage represented around 37% of the median total monthly earnings of full-time employees (Eurostat).[14]

Concerning the bargaining mechanisms, the Portuguese collective bargaining regime calls for direct negotiation between unions and employers' associations, establishing the minimum conditions of the base wage for each job title, the normal hours of work, and overtime pay. Collective agreements are typically updated annually. Most of those are settled at the industry level, but there are also firm level agreements. Even though industry collective bargaining is clearly predominant in Portugal, firm level bargaining, more common in large public companies, affects only 10% of the workers.

Since the Portuguese government often decides to extend collective agreements to workers not covered, the impact of collective bargaining reaches more than the union members. In this sense, the impact of collective bargaining on a given worker or firm is essentially unrelated to the fact of the worker being a member of a union or not, or the firm belonging to an employer association. In fact, firms can offer better conditions than those established by the collective agreement. In particular, they can pay higher wages to their workers. Cardoso and Portugal (2005) call this the 'wage cushion", the difference between the contractual part of the wage and the actual wage. They estimate that in 1999 actual wages exceeded the level of bargained wages by 20-50%.

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[14]Minimum wage is updated every year by government proposal, taking into account inflation and GDP growth as well as the social partners' expectations.