(Very Preliminary Draft) The Effectiveness of Incentives to Postpone Retirement: an Evaluation of the Italian "Super-Bonus" Reform

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Abstract

The financial unsustainability of pension systems is a well-known problem of modern societies. In this paper, we try to assess if financial incentives may be used as an effective device to induce workers to postpone retirement by evaluating the Italian so called "super bonus" reform. The bonus consisted in economic incentives given for a limited period to private sector workers who had reached the requirements for seniority pension but who chose to postpone retirement. Crucially for this study, public workers were not entitled to the bonus. Using data from the Bank of Italy Survey on Household Income and Wealth, and exploiting the DID-Probit strategy proposed by Blundell et al. (JEEA, 2004), we assess the effect of the bonus on the decision to postpone retirement, by comparing private and public workers before and after the reform. Results suggest a reduction

of 12ppt in the proportion of private workers who decided to retire among those qualifying for retirement. Results also suggest, not trivially, that most of the effect of the reform is driven by the poorest share of population. Finally, we propose an estimate of the intensive margin elasticity of Italian older workers.

1 Introduction

In the recent years, there has been increasing interest among both economists and policy makers in the possible consequences of population ageing, and in particular on how to make the social security system more sustainable in light of this.

Among the many developments arisen from this interest, one developed within the literature on optimal taxation, and in particular within the Mirrlees optimal tax model. Under this model the optimal marginal tax rate at a particular income depends on the hazard rate of the income distribution, the elasticity of labour supply and the distribution of skills (Diamond, 2008). As old workers, like the young, have both high hazard rates and elastic labour supply relative to prime age workers, there is scope for age-related taxation.

Even before considering the potential benefits of age-related taxation, however, one should probably question the adequacy of pension systems. On this issue, a number of works show that there are strong implicit and explicit incentives to leave the labour market embedded in the pension systems of most developed economies.

First of all, the different labour market participation of old and young individuals has been noticed. D'Addio et al. (2010), for example, show that in OECD countries older workers (50-64) are less likely to be in employment than their prime-aged counterparts (aged 25-50), with high cross-

country variability. At one extreme, there are countries like Japan and United States where older participation rates is over 70 per cent; at the other extreme there are countries, including Italy, where older participation rate is below 50 per cent.

Data show that older workers participation rate is higher now than in the seventies, but the authors suggest that this is mainly driven by increased labour force participation of women. Thus, the higher participation rate of older workers is due to catching up of women rather than to a trend towards increased older workers participation. Despite this, a sizeable gap in participation rates of older workers still persists, with Italy among the countries where the gap is larger.

Besides, in most OECD countries workers tend to leave the labour market before the pensionable age. Italy was the country with the lowest pensionable age for workers who retired in 2006 and one of the countries with the lowest average effective age of labour-market exit in the period 2002-07 (57 and 60 years respectively, for both men and women).

Some authors tried to provide estimates of the unused productive capacity of older workers in specific age ranges as a percentage of the total labour capacity at that same age range. Gruber and Wise (1999) calculated that in Italy the proportion of unused productive capacity in the 55-65 age range was almost 60% in 1996, one of the highest among the countries considered by the authors.[1] More recent results from the Survey of Health, Ageing and Retirement in Europe (Borsch-Supan et al., 2005) show that there is potentially huge unused labour capacity of health individuals in some countries. In Italy, for example, 50% of Italian healthy respondents above 55 were not in the labour force.[2]

[1]The countries with the lowest and highest unused productive capacity were Japan (22%) and Belgium (67%), respectively.

[2]In particular, 21.5% of good health individuals in the 50-60 age range are retired and not working; this percentage reaches 69.3% for individuals above 60 years.

There is now a lot of evidence explaining why this is happening and describing the incentives to leave the labour market embedded in the pension system. First, analysts who have recently examined cross-national differences in pension incentives generally find they have predictable and significant effects on labor force withdrawal (Gruber and Wise, 1999). Second, countries with early pension ages, generous income replacement, and heavy implicit taxes on earnings in old age tend to have earlier exit from the labor force than countries with pension systems that provide fewer work disincentives (Burtless, 2004).

The incentives to leave the labour market embedded in pension systems have been measured in various ways. The level of pension wealth, defined as the discounted present value of the lifetime flow of pension benefits, may be important but what is crucial is the change in pension wealth. The change in pension wealth measured between two consecutive periods is called one-year accrual. The literature on the "option value" of retirement, however, has shown that an even better measure of the incentive to retire should take into account all future wealth accruals.

Probably the most striking estimate of effects of the implicit social security tax on earned income was uncovered by a group of international economists, coordinated by Gruber and Wise (1999). The authors compared labour force withdrawal rates of older workers with the accrual from keeping working an additional year. Italy was one of the countries with the highest implicit taxes together with the highest withdrawal rates.

Of course this evidence, even if suggestive of a possible causal relationship, can not be interpreted as a causal effect of pension incentives on retirement. However, a number of works try to uncover exactly this type of relationship. Alessie and Belloni (2009), for example, use a quasi-reduced form of the option-value model on Italian data and find that financial incentives do in fact have a strong effect on retirement: the change

in financial incentives experienced by workers when they become eligible for pension determines a 30 percentage points increase in their retirement probability.

In general, the great majority of the available evidence points in this direction [3]. This is quite surprising, in light of the well-documented issue of increasing risk of non-sustainability of pension systems around the world. Rather, one would probably expect the diffusion of incentives to induce older workers to delay retirement. This raise a question which is of course important for policy reasons: are incentives to postpone retirement as effective as those embedded in pension systems that induce workers to retire early?

In this paper, we will try to answer this question. We will evaluate the so called "super bonus" reform, implemented between 2004 and 2007 in Italy and involving financial incentives directed to older workers who decided to delay early retirement. A difference-in-differences strategy will allow us to interpret the results causally. Besides, we will exploit a new approach to diff-in-diffs estimation in probit models proposed by Blundell et al. (2004) which accounts for the fact that the marginal effects on interaction terms cannot give a difference-in-differences measure analogous to the coefficients from a linear model. Finally, we will also try to provide a (reduced-form) estimate of the intensive margin elasticity of older workers in Italy, by relating the change in participation to the change in work incentives embedded in the social security and tax systems.

The structure of the paper is as follows. In section II, we briefly describe the Italian institutional setting and in particular the characteristics of the "super bonus" reform. In section III, we describe the data and provide some descriptive statistics on retirement in Italy and on the characteristics

[3] See, among the others, the series of papers on within countries, micro-econometric analysis coordinated by Gruber and Wise (2004).

of our sample of workers. In section IV, we describe the estimation strategy and in section V we show our results. In Section VI we try to assess the intensive margin elasticity of Italian older workers. Section VII concludes.

2 The "Super Bonus" Reform

Italy underwent three major reforms of the social security system in the nineties, with the aim of increasing the financial sustainability of the system.[4] The main features of the reforms were an increase in the retirement age and minimum years of contributions for pension eligibility, the gradual passage from a defined benefit system towards a contribution based system, indexation of pension benefits to prices rather than to wages and the introduction of complementary social security. Besides, they abrogated seniority pensions for all those who started working after 1995, where seniority pension in Italy consists in the possibility of early retirement for workers who possess a minimum number of years of contributions.

These three main reforms were followed by other minor measures up until the Maroni reform of 2004. The aim of this reform was twofold: first of all, increasing retirement age, mainly on voluntary basis, and second the development of complementary social security next to the usual public social security system. It provided also for further increases in pensionable age and contribution requirements and was partly modified in 2007.

It should be mentioned that in 2011, given the persistence of the Italian financial problems, a new reform of the pension system (the so called "Fornero" reform) intervened in order to accelerate the effects of previous reforms. In particular, it introduced the contribution based system for everybody starting from 2012, further tightened age requirements for old

[4]Riforma Amato in 1992, riforma Dini in 1995 and riforma Prodi in 1997.

age pension and the definitive abrogation of seniority pension [5].

The focus of this study will be on the so called "super bonus", which was indeed part of the 2004 reform, to study its effect on the decision to delay retirement. The bonus consisted in economic incentives, given for a limited period (2004-2007) to private workers who had reached the age and contribution requirements necessary for seniority pension. The bonus was directed to private sector workers who had reached seniority pension requirements in between October 2004 and the end of 2007 (but who had not reached requirements for old age pension yet[6]) and who chose to continue working. Crucially for our study, public workers were not entitled to the bonus. The age and contribution requirements in the reform years were the same for both public and private workers and for both men and women and amounted to either 57 years together with 35 years of contributions or 38/39 years of contributions independently from age. The effects of the bonus ceased either voluntarily if the worker decided to retire, or compulsorily by reaching old age pension requirements or with the end of 2007. After this date, the worker could decide to continue working with no incentives, thus going back to the pre-bonus compensation net of social security contributions.

The amount of the incentive to postpone retirement corresponded to the pension contributions that the employers normally pay to the social security system and that they had now to pay directly to the employees who applied for the bonus. The gross salary increase then amounted to the salary fraction normally devoted to social security contributions, that is 32.70% for most workers (33.70% on earnings above 37,884 Euro). Clearly, this implies that in absolute terms the incentive increased as the gross salary increased, but the percentage increase with respect to gross earn-

[5] Actually, seniority pension was substituted by early retirement, with similar characteristics but stronger requirements in terms of years of contributions.

[6] Old age pension requirements consisted of 65 years for men and 60 years for women.

ings was almost constant among different earners.

However, as the extra salary was untaxed and due to the progressivity of labour income taxes, the percentage increase with respect to net earnings was even bigger than the nominal contributions value as it increased more than proportionally with net earnings. An example will help visualizing the implications of the incentive (see Table 1): a worker earning a gross yearly salary of 20,000 Euro would earn a net salary of 15,153 Euro with no incentive and of 21,693 Euro with the incentive, while at the other extreme one individual earning a gross salary of 100,000 Euro would earn 56,813 Euro with no incentive and 90,134 Euro with the incentive, meaning that for this individual the increase exceeds 60% of the net salary, versus a 43% increase for the former worker [7].

As the worker was not contributing anymore to his own pension during the three years of incentives, the pension she was entitled to remained fixed to the level cumulated up until the moment she joined the super bonus (it was only increased by cost of living adjustments). Related to this, it should be also taken into account that every working year with no incentive determines a pension increase equal to 2% of last working years average salary, percentage that progressively decreases to 0.90% for salaries above the 37,884 Euro pensionable limit. This is an additional reason making the incentive more convenient for richer workers.

3 Data and Descriptive Analysis

The data I will use to investigate the super bonus effects on retirement decisions are taken from the Bank of Italy Survey on Household Income and Wealth (SHIW), as to our knowledge this is the only dataset that in-

[7] It should be also taken into account that the amount of the incentive not always corresponds to 32.7% of gross earnings due to

Table 1: The Size of the Incentive by Earnings

Gross Earnings	After Tax Earnings without Incentive	After Tax Earnings with Incentive	Difference	Difference as proportion of net earnings
20,000	15,153	21,693	6,540	43.16
30,000	20,752	30,562	9,810	47.27
40,000	26,295	39,396	13,101	49.82
50,000	31,358	47,829	16,471	52.53
60,000	36,557	56,398	19,841	54.27
70,000	41,921	65,132	23,211	55.37
80,000	47,165	73,746	26,581	56.36
100,000	56,813	90,134	33,321	58.65

Own calculations based on Ipsoa, 2004

cludes information on both private and public workers and on the number of years of contributions. The SHIW started in the 1960s, it is realized approximately every two years and microdata are available starting from the 1977 survey. Up to 1987 the survey was conducted with time-independent samples (cross sections) of households but since 1989 part of the sample has comprised also households interviewed in previous surveys (panel households). The sample size in the most recent surveys comprises about 8000 households, corresponding to around 24000 individuals. The questionnaire focuses on perceived wellbeing, the situation of the household of origin, payment instruments and financial information.

In our empirical analysis, we will exploit data from 2002 to 2008, as we will be interested in comparing retirement behaviour during reform years and in pre-reform years. We said above that the reform took place in be-

tween October 2004 and the very end of 2007. However, because of the peculiar exit mechanism involved once one individual formally applies for retirement, we need to redefine reform and pre-reform years. In particular, individuals who reached pension requirements and ask to retire in a given quarter of the year have then to wait the first "exit window" to actually retire. This window falls two quarters after the time of the retirement request, thus the individuals we see retiring in 2005 are individuals who took their decision to retire at the end of 2004, and individuals who joined the reform up until the end of 2007 could retire only in 2008 [8]. For this reason, pooled data from 2002 and 2004 surveys will give us information on pre-reform behaviour, while data gathered from the 2006 and 2008 surveys will inform us on individuals' behaviour during the reform period.

Our sample of individuals will be made up of those who reached the age and contributions requirements necessary for seniority pension, and our outcome of interest will be the percentage of retired among these individuals. As we will rely on a difference-in-differences evaluation method, we will need to compare the behaviour of individuals not only through time (before and during the reform) but also between individuals who were affected by the reform (private workers) and individuals who were not affected (public workers).

Figure 1 shows the hazard rate of retirement (the percentage retired at a specific age conditional on not being retired at any prior age) averaged over pre-reform years (1998 to 2004). It is possible to notice a clear tendency towards retirement before old age (60 years for women and 65 years for men). This is also apparent from the red bars in the graph, representing sample medians. The average age of retirement is 58 years for women and

[8] It must also be taken into account that the survey defines as retired those whose main condition in the year was retirement, thus presumably individuals who retired in the first semester of the year.

59 for men.

In Table 2 and 3 we show the results of two questions that appeared only in 2002 survey. Specifically, the questions asked to those retired before maximum retirement age (Table 2) and to those expecting to retire before maximum pensionable age (Table3) if they would have worked longer, or would work longer, under some conditions. These comprise economic incentives, part-time or more flexible work and the possibility of cumulating pension and earned income. We also split the results by sex and work sector (public, private or self-employed). The percentage of retired who claim they would have not worked longer is higher than the same percentage among workers who expect to retire early. However, for both categories economic incentives seem to be the most appealing condition for postponing retirement, followed by the possibility of cumulating pension and earned income and by part-time or more flexible work. Males are more prone to continue working under certain conditions than females. Finally, while economic incentives and part-time are preferred by private and public workers and retired relatively to self-employed, the possibility of cumulating pension and earned income seems relatively more appealing for the self-employed.

Figure 1: Hazard Rates, 1998-2004

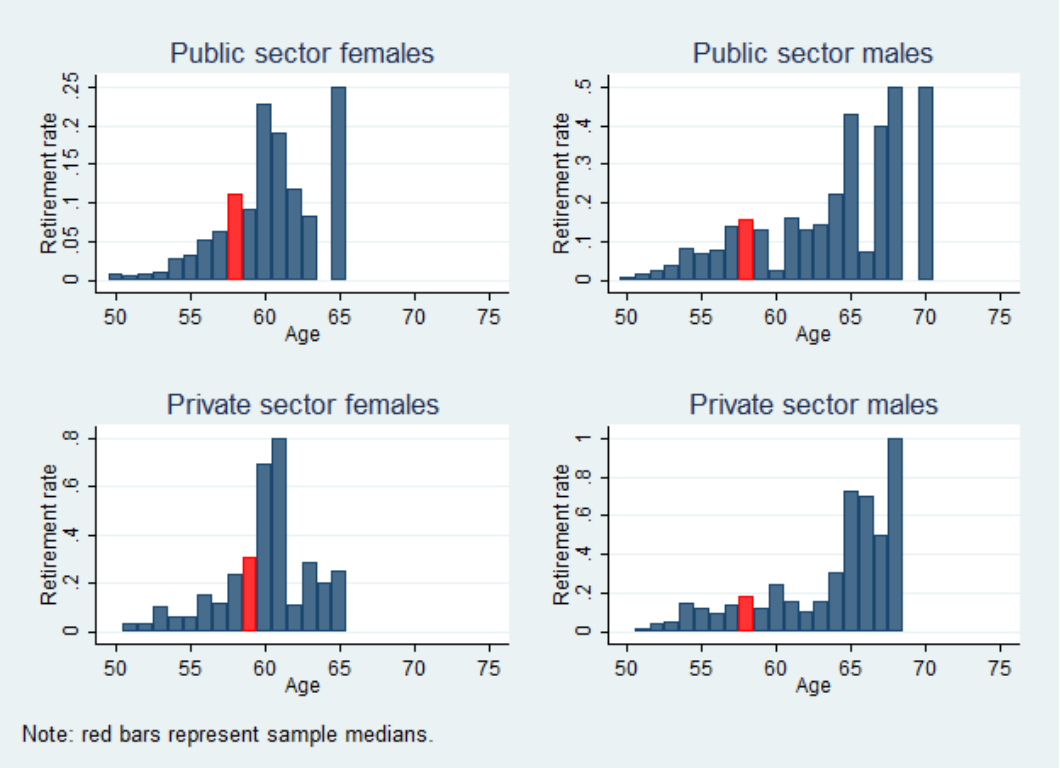


Table 2: Early Pensioners (retired before maximum retirement age): in what conditions would he\she have worked longer?

	All	Males	Females	Public	Private	Self-employed
Economic Incentives	8.03	9.75	6.21	9.91	8.48	4.76
Part-time or more flexible work	4.10	3.52	4.70	8.04	3.42	1.79
Possibility of cumulating pension and earned income	5.08	7.19	2.85	2.62	5.35	6.94
Other	4.00	4.96	5.04	5.98	4.70	4.76
None	78.34	75.14	81.70	74.77	78.47	81.75
Total	2442	1251	1191	535	1403	504

Table 4 reports descriptive statistics for our sample of individuals, separately for public and private workers (respectively, the control and the treatment groups) and pre- and post-reform periods (2002-2004 and 2006-2008 respectively). The share of women is higher in the public sector than in the private sector. The distribution of workers among educational levels seems quite different, with a higher share of individuals with at least high school diploma in the public sector than in the private one. Despite the small sample size, there seems to be a larger presence of public workers and pensioners in the Centre-South of Italy and of private workers and pensioners in the North of Italy. Both the age and the years of contributions are evenly distributed among sectors. The same seems true about marital status. As regards working categories, most private workers are blue collars (more than 60%), a smaller fraction is composed by office workers (around 25%) and the remaining consists of junior and senior manager or similar positions. As for public workers, the biggest share is composed of office workers (more than 40%), followed by school teachers,

Table 3: If expect to retire before maximum pensionable age: in what conditions would he\she have worked longer?

	All	Males	Females	Public	Private	Self-employed
Economic Incentives	14.89	17.67	10.45	16.73	16.67	10.64
Part-time or more flexible work	6.30	6.71	5.65	6.08	8.06	4.26
Possibility of cumulating pension and earned income	10.33	11.31	8.76	9.51	8.06	14.18
Other	7.07	7.95	5.65	6.08	3.76	12.41
None	62.72	57.95	70.34	63.88	64.52	59.22
Total	920	566	354	263	372	282

blue collars and managers. Finally, at the bottom of the table retirement percentages of public and private workers, before and after the reform, are presented. These show that while the average percentage of retired among public workers qualifying for seniority pension increases of something more than 5pps in the post-reform period, the same percentage decreases of around 5pps for private workers.

To better analyse the characteristics related to retirement, in Table 5 we show the results of a linear probability model regression for the probability of seniority retirement on the pre-reform sample of individuals. The probability of seniority retirement is 7pps higher for private than for public workers and, as expected, it is positively correlated with age. It is also negatively correlated with having at least high school diploma, while it is not correlated with sex, with being married or with having only children who left parental home. However, the probability of seniority retirement seems to be correlated with being male and not having children at home,

as we see from the significance of the coefficient of the interaction of these two variables.

Table 4: Descriptive statistics

	Public pre-reform	Public post-reform	Private pre-reform	Private post-reform
Variable	Mean	Mean	Mean	Mean
Women	30.60	37.02	18.34	19.56
High education (high school or higher)	56.03	62.98	23.96	25.07
Centre-South	59.48	57.02	40.10	40.22
Age	56.36	57.65	55.86	56.46
Years of contributions	36.45	36.78	36.81	36.84
Blue collars	18.53	14.04	62.84	63.64
Office workers	43.97	41.28	25.92	24.24
School teachers	21.98	27.66	0.00	0.00
Junior manager/cadre	7.43	9.36	6.85	6.34
Manager, senior official, principal, headmaster, university teacher or magistrate	9.05	7.66	4.40	5.79
Married	83.62	82.13	86.55	88.98
Observations	232	235	409	363
Percentage retired	14.22	19.57	26.16	21.21

4 The Estimation Strategy

Under certain assumptions, we will be able to compare the behaviour of Italian workers regarding seniority pension before and after the reform, so to study the efficacy of the reform in delaying the retirement decision of private workers, as we would expect given the sizeable economic incentive involved. As we can clearly identify individuals who were affected by the reform (private workers) and individual who were not affected (public workers), we can rely on a difference-in-differences (DID) technique.

The classical linear DID is based on an additive structure for potential outcomes in the no-treatment state: in our case, this means assuming that in the absence of the super bonus, retirement decisions are determined by the sum of a time invariant effect specific to each category of workers (public/private) and a time effect capturing the common trend. The common trend assumption may be expressed as:

$$E[Y_{i2}^0 - Y_{i1}^0 | X, T] = E[Y_{i2}^0 - Y_{i1}^0 | X]$$

where Y_{it}^0 is the outcome in the no-treatment case, i is the individual, t is time ($t = 2$ in the post-treatment period, $t = 1$ in the pre-treatment period), X is a set of covariates and T a treatment dummy. This assumption is of course non testable, but we can at least gain some insight by looking at seniority retirement percentages through time for public and private workers. These are shown in Figure 2 and 3. In Figure 2 we report seniority pension percentages for individuals at the contributions threshold while Figure 3 presents retirement percentages for individuals at or above contributions threshold. We present both because, as graphs them-

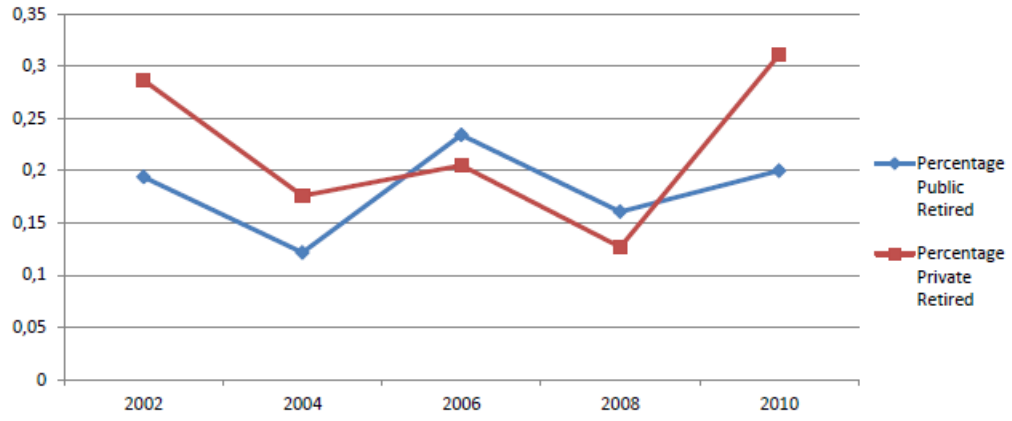
Table 5

Linear Probability Model for retirement, pre-reform period

	(1)
VARIABLES	y2
priv	0.0742**
	(0.036)
age	0.3334***
	(0.108)
agesq	-0.0028***
	(0.001)
male	-0.0380
	(0.052)
married	0.0697
	(0.047)
childout	-0.0886
	(0.067)
Centre South	-0.0526
	(0.033)
diploma	-0.1178***
	(0.036)
male*childout	0.1536**
	(0.077)
Constant	-9.6800***
	(3.016)
Observations	641
R-squared	0.0809

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 2: Percentage retiring among workers qualifying for seniority pension at the age/contributions threshold



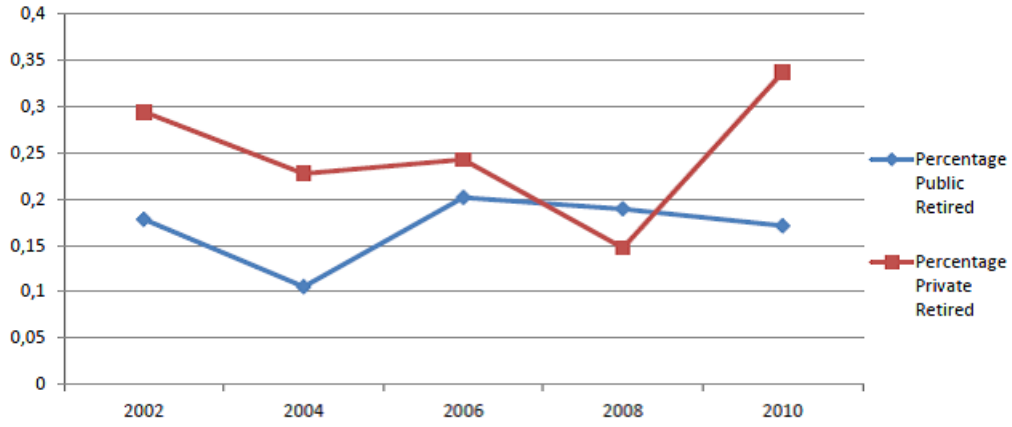
selves seem to suggest, we believe the effect to be stronger for individuals who just reached pension requirements than for those who already decided to continue working despite having reached pension requirements. Although these graphs cannot be interpreted as evidence that the common trend assumption is true, they seem to support it.

Following Disney et al. (2008), we can write a general model of retirement decision of individual i at time t, where Y_{it}^* can be interpreted as a latent variable measuring the utility from retiring once seniority pension requirements have been reached. This utility depends on a set of individual characteristics like age, years of contributions, working sector, earnings, career history and on a vector of time dummies to capture trends over time:

$$Y_{it}^* = \beta' X_{it} + \tau' d_t + \epsilon_{it} \tag{1}$$

We do not observe Y_{it}^* but a dichotomous variable taking up value one if

Figure 3: Percentage retiring among workers qualifying for seniority pension



the individual decides to retire (when $Y_{it}^* \geq 0$) or value zero if the individual postponed retirement (when $Y_{it}^* \leq 0$), suggesting the use of a probit or logit model. As we are interested in measuring if and how much the percentage of those retiring changed in response to the super bonus differently for those affected by the reform and those who were not, we need to define both a treatment and a post-reform variable. The former will be a dummy variable T_i equal to one for treated individuals, that is private workers, and equal to zero for public workers. The latter will be a dummy variable P_t equal to one for post-treatment observations, that is those observed in years 2006 and 2008, and equal to zero for year 2002 and 2004 observations.

If we knew Y_{it}^*, we could estimate the effect of the reform by looking at the coefficient α of the interaction between treatment and post-reform dummies:

$$Y_{it}^* = \beta' X_{it} + \tau' d_t + \varphi T_i + \alpha T_i P_t + \epsilon_{it} \tag{2}$$

However, as the outcome we observe is a dichotomous variable, we know we are in the presence of a non-linear model. Despite this, our strategy will be first of all to estimate a linear probability model of the type:

$$Y_{it} = \beta' X_{it} + \gamma' P_t + \varphi T_i + \alpha T_i P_t + \epsilon_{it} \tag{3}$$

In fact, the linear probability model has often proved to be a very good approximation of probit and logit models and it usually works well for values of the independent variables that are near the averages in the sample (see Wooldridge, 2008). The reason why it may be sometimes problematic is that we may get predictions outside the unit interval, as a linear relationship is assumed to hold between the probability and the independent variables.

Probit and logit models, however, are not free from drawbacks as well when used in a DID framework. Here the issue is that the marginal effects calculated on interaction terms do not have the same interpretation as in linear models (Blundell et al., 2004; Disney et al., 2008)[9]. However, we can circumpass this problem by assuming that the common trend assumption holds for a transformation of the expectations (retirement probabilities), rather than for the expectations themselves. Specifically, it is safe to assume that the common trend assumption holds for the inverse of the probability function (that we will assume to be Normal, as in the probit model) or, in other words, for the index rather than for the probability (Blundell et al. 2004):

$$\begin{aligned} &\Phi^{-1}[E(Y_{it}|X_{it}; L_{it} = 1, I_t = 1)] - \Phi^{-1}[E(Y_{it}|X_{it}; L_{it} = 1, I_t = 0)] = \\ &\Phi^{-1}[E(Y_{it}|X_{it}; L_{it} = 0, I_t = 1)] - \Phi^{-1}[E(Y_{it}|X_{it}; L_{it} = 0, I_t = 0)] \end{aligned} \tag{4}$$

[9]Besides, it is worth remembering that commonly used software packages like Stata do not give a true measure of interaction effects (Ai and Norton, 2003).

Given this, the impact of the reform can be evaluated as:

$$\begin{aligned} I(X) =& E(Y_{it}|X_{it}; L_{it} = 1, I_t = 1) - \Phi\{\Phi^{-1}[E(Y_{it}|X_{it}; L_{it} = 1, I_t = 0)] + \\ & \Phi^{-1}[E(Y_{it}|X_{it}; L_{it} = 0, I_t = 1)] - \Phi^{-1}[E(Y_{it}|X_{it}; L_{it} = 0, I_t = 0)]\} \end{aligned} \tag{5}$$

Blundell et al. (2004) suggest to implement this estimator of the effect of a policy by estimating four different probit regressions for each of the four groups defined by the interactions of time and treatment. Doing so, we get an estimate of the behavioural patterns of the four groups, included that triggered by the reform. Then, by predicting the outcome of the treated using the untreated behavioural equations, one can get an estimate of how the treated would have behaved without the treatment, conditional on their observable characteristics. Finally, plugging these estimates in Equation (5) one can get the estimate of the impact of the treatment on the treated. This procedure is less restrictive than the usual DID in that it allows for the effect of the treatment to depend on observable characteristics of individuals [10].

5 Empirical Results

Table 6 reports the results of our DID linear probability model specification. In column (1) we exploit the entire sample and show the most basic result. This is obtained by regressing the dichotomous variable for retirement (y2) on a set of dummy variables. The results indicate that, if as-

[10] Blundell et al. (2004), however, underlines that "Despite the similarity to the linear case, the non-linear assumption stated above entails two additional restrictions on the nature of the error terms: only group-effects are allowed for and between groups homoscedasticity is required".

sumptions are true, the super bonus reform determined a 10pps reduction in the proportion of private workers who decided to retire among those qualifying for retirement.

In column (2) we show results of the same regression performed on the subsample consisting of individuals just at the age and/or contributions necessary for seniority pension. In fact, we expect the effect of the bonus to be stronger on these individuals who are relatively younger (or with less working years on the shoulders). Actually, what we are able to estimate is a lower bound of the effect on these individuals. This is due to the fact that, as workers joining the reform stop paying contributions, we are not able to separate individuals who just reached the contributions-only requirement of 38/39 contribution years from those who had already reached it. As our lower bound estimate (-11pps) is higher than the full-sample estimate, we can conclude that, as expected, the effect is actually stronger on relatively younger (by age or working years) workers.

Table 7 reports DID Probit results. They seem to be in line with LPM results and, if anything, they indicate an even bigger estimated impact of the super bonus (-12pps).

In column (4) of Table 6 we include a full set of interaction dummies for time, sector and economic condition. Specifically, we divide the sample in two groups of similar size, where the "poor" are blue collar workers or blue collars retired as this is the category with the lowest average income, while the "rich" are the four remaining working categories as defined by the SHIW survey (broadly: office workers, school teachers, junior managers and managers). Probably due to the small sample we are dealing with, we are not able to get significant results for the interactions of interest (post*priv and post*priv*rich), which nevertheless are sizable in their magnitude and coherent with our previous results. In particular, we obtain that most of the effect of the reform is driven by the poorest share

of population (-11pps), while it is much less effective for the richest share (-4pps).

6 Extensive Margin Labour Supply Elasticity

In previous section we showed that the reform had a sizeable and significant effect on retirement decisions. However, this result does not allow to draw general conclusions on individuals' response to monetary incentives. If we want to infer predictions on workers' behaviour, we need to put this result in relation to the change in economic incentives implied by the reform.

Thus, in the spirit of Manoli and Weber (2014), we will try to provide an estimate of the extensive margin intertemporal labour supply elasticity. As Manoli and Weber, we shall also stress that this is a reduced-form elasticity that do not correspond to any of the structural parameters that can be derived in a theoretical framework. Besides, differently from Manoli and Weber, we exploit the shock created by a temporary reform, which makes the comparison with elasticities found studying expected and permanent reforms not trivial.

The main advantage of estimating the extensive margin elasticity in our setting is given by the quasi-experimental framework which allows identification of the causal effect of the bonus. However, the SHIW dataset does not allow a full reconstruction of workers' career histories, making the formulation of assumptions to derive individuals' social security wealth inevitably necessary.

The reduced-form participation elasticity may be written as:

Table 6

DID Linear Probability Model

VARIABLES	(1) y2	(2) y1	(3) y2	(4) y2
post	0.0535	0.0440	0.0263	0.0169
	(0.038)	(0.049)	(0.037)	(0.094)
priv	0.1194***	0.0777*	0.0945***	0.0205
	(0.033)	(0.041)	(0.034)	(0.067)
post*priv	-0.1030**	-0.1131*	-0.0898*	-0.1114
	(0.048)	(0.060)	(0.047)	(0.101)
age			0.3317***	
			(0.075)	
agesq			-0.0027***	
			(0.001)	
diploma			-0.0931***	
			(0.026)	
Centre South			-0.0398*	
			(0.024)	
married			0.0405	
			(0.033)	
rich				-0.1394**
				(0.069)
post*rich				0.0499
				(0.103)
priv*rich				0.1000
				(0.080)
post*priv*rich				0.0729
				(0.119)
Constant	0.1422***	0.1560***	-9.7543***	0.2558***
	(0.027)	(0.033)	(2.108)	(0.062)
Observations	1,239	765	1,239	1,239
R-squared	0.0106	0.0070	0.0624	0.0185

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 7: Diff-in-Diff Probit

Predicted level after treatment	Estimated impact of the reform
(1) Full sample	
21%	**-12ppt ****
	(0.0583)
(2) Threshold Individuals	
16%	**-12ppt ***
	(0.0749)
(3) Poorest Individuals	
18%	**-11ppt**
	(0.1153)
(4) Richest Individuals	
27%	**-7ppt**
	(0.0804)

$$\epsilon = -\frac{\Delta p/p}{\Delta(1-\tau)/(1-\tau)} \tag{6}$$

where p and $(1-\tau)$ denote the probability of participation and the pre-reform net-of-tax rate. Δp is the change in participation due to the reform that we estimated in previous paragraphs. $\Delta(1-\tau)$ is the change in net-of-tax rate implied by the reform.

In an option value framework, workers in each period evaluate the choice between continue working and retire by comparing current and future benefits from these two choices. For this reason, the implicit tax (or subsidy) rate τ of postponing retirement must subtract taxes and benefits deriving from a lost year of retirement to the taxes and benefits deriving from an extra year of work.

Specifically, the implicit tax rate on gross earnings is given by τ such that:

$$(1-\tau)y = y(1-\tau_{SS})(1-\tau_E) - b(1-\tau_b) + \Delta SSW \tag{7}$$

where τ_{SS} denotes social security contribution, τ_E denotes income taxes, b denotes annual pension benefits, τ_b denotes taxes on pension benefits and ΔSSW denotes the increase in social security wealth.

Given the characteristics of the super-bonus reform, the implicit tax rate on gross earnings with the bonus is given by τ such that:

$$(1-\tau)y = y(1-\tau_{SS})(1-\tau_E) + y\tau_{SS} - b(1-\tau_b) \tag{8}$$

Thus, the change in the net-of-tax rate may be written as:

$$\Delta(1-\tau) = \frac{y\tau_{SS} - \Delta SSW}{y} \tag{9}$$

as it involved the suspension of due contributions, as well as a freeze of

social security wealth at the pre-reform level.

In order to derive τ, we need to perform a series of operations. First of all, we need to gross up wages by using information on tax rates, deductions due to family composition and social security contributions. Then, in order to calculate social security wealth, we need to make a few assumptions on individuals' working history, in particular on the number of years individuals contributed to the social security system and on the earnings average of the last working years. Due to the cross-section nature of our data, we need to assume that individuals who are observed working did not experience unemployment spells and thus contributed continuously to social security. Finally, we estimate the growth rate of earnings as in Bottazzi et al. (2006) [11].

[...to be completed...]

7 Conclusion

Policymakers are often interested in policies that are able to delay retirement and/or increase labour income at older ages. Only very recently, however, taxes have been started to be thought as a possible instrument to do that. This interest, however, is relegated to the economic literature, as in practice younger and older individuals are treated in a similar manner. Social security contributions are an example of tax that could be used for this purpose; however, there is limited evidence of the effect of incentives on retirement behaviour.

In this paper, we want to contribute to this limited evidence by eval-

[11] Specifically, growth rates are obtained from a median regression of log-earnings of 50 to 65 years old individuals (SHIW, years 2002-2008) on sex, employment dummies and full interaction of age with a college dummy.

uating the effectiveness of the Italian so called super bonus reform, that provided economic incentives to older workers eligible for seniority pensions who decided to postpone retirement. As the reform was directed to private workers only, we are able to use public workers as counterfactual group. Thus, we can exploit the difference-in-differences approach and compare retirement rates of private and public workers before and after the reform to assess the effect of the reform.

A problem with interaction terms in probit models, however, is that they do not have the same straightforward interpretation as in linear models. Thus, we employ the estimation strategy proposed by Blundell et al. (2004), where the common trend assumption holds for the index rather than the probability.

Our results show that old workers responded to the incentives offered by the reform, as retirement rates among those eligible decreased by 9ppt-12ppt depending on the specification and method used. Results also suggest that the reform was particularly effective among the poorest share of the population, despite the incentives were disproportionately growing with earnings, maybe due to the predominance of substitution effect for these workers. If assumptions are correct, this means around 35% of those who would have retired chose not to because of the reform.

This is a sizeable effect, but of course from this partial analyses we cannot say anything on the efficiency of the reform. In fact, it is possible that the cost to the social security system in terms of lost contributions from the workers who would have continued working even in the absence of reform exceeds the gain from those who delay retirement because of the reform. The fiscal cost of the super bonus, however, may have been offset also by other factors, like taxes paid on labour income and taxes generated by additional spending of those who postponed retirement.

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