Work Longer, Train More?

The Effects of Pension Reforms and Training Incentives on the Retirement and Training Decisions of Older Workers in Italy

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Abstract

Using overlapping sources of exogenous variation in the minimum retirement age and in training costs, we study the effects that training and retirement policies have had on the decisions to train and retire taken by older workers in Italy during the second part of the 1990s and the early 2000s. We show that the increase in minimum retirement age has contributed to reduce retirement and to increase training, and that the introduction of training subsidies has had a small positive effect on training. These subsidies have been more effective for younger workers. We compare the relative effects of changes in minimum retirement age and in training subsidies on the training of older workers and estimate that, to compensate for the negative effects induced on training by a one-year reduction in minimum retirement age, training subsidies would have to increase by 7 to 13 real euro per head, significantly more than the average flow of tendered subsidies during the period 1994-2004.

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Introduction

Population ageing is a key challenge facing OECD economies. Over the next 50 years, all OECD countries will experience an important increase in the share of elderly persons in the population and a significant decline in the share of the population of prime working age (OECD, 2006). Policy options to offset ageing include the promotion of immigration, higher fertility and faster productivity growth. Since many individuals aged above 50 are out of the labour market, an additional option is to improve their employment prospects so that they can stay longer in the labour market.

According to official figures, in 2010 close to 61 percent of the individuals aged 50 to 64 in OECD countries had a job, compared to 64 percent in North America and to 58 percent in Europe. Policies that increase these activity rates can reduce the pressure of ageing on public finances, and at the same time ensure living standards. The range of options to meet this goal includes reforms of retirement systems, which increase the value of staying in the labour market, age dependent employment protection (see Cheron, Hairault and Langot, 2011), which increases the penalties faced by firms that layoff older workers, and training policies.

Many OECD Governments have embraced training as one possible means of bringing older workers out of unemployment or inactivity and into employment (see Mahyew and Rjkers, 2004).[1] Training policies are often advocated because of the evidence showing that skilled older workers remain in the labour market longer than their unskilled peers. This evidence also suggests that there is a positive correlation in European countries between the incidence of training among older workers - relative to younger cohorts - and the average effective age of retirement (see OECD, 2006, and Bassanini *et al.*, 2007).

Another important reason for encouraging training is that it might facilitate employability in the presence of technical shocks that depreciate existing skills (see Behaghel, Caroli and Roger, 2011). In 1999 the American Association of Retired Persons reported that 80 percent of baby boomers were expected to postpone retirement, quoting economic reasons as one of the major motivations for continuing labour force participation. Since the 1980s, corporate retrenchment and technological change have put substantial pressure on workers above 50 by compelling them to stay abreast of

[1] The European Commission has strongly encouraged member countries to promote lifelong learning and training of older workers, by promoting equal opportunity in the workplace and by providing training incentives with the European Social Fund. See for instance Commission of the European Communities (2002) and the European Directive on Equal Treatment (2000). According to the Bruges Communiquè (2011) "...the future European labour market will be simultaneously confronted with an ageing population and shrinking cohorts of young people. As a result, adults - and in particular, older workers - will increasingly be called upon to update and broaden their skills and competences through continuing VET..." (p.2). US training policies targeted at older workers are reviewed by Eyster, Johnson and Toder (2008).

new techniques (Farber, 1997). The effects of technological change on retirement decisions are discussed by Bartel and Sicherman (1993). They suggest that workers employed in industries characterized by high rates of technological change tend to retire later because the net effect of technological change on training is positive.[2] On the other hand, older workers are more likely to retire sooner when an unexpected increase in the rate of technological change occurs.[3]

The emphasis on training as a viable policy to address the problems of an ageing society has been met with some scepticism by economists. In particular, Heckman (2000) and Cunha *et al.* (2006) have argued that investing in the training of older workers is unlikely to yield high returns, as these workers and their employers have only a short time to recoup their investment and cannot benefit as much as younger workers from the dynamic complementarities that characterize human capital accumulation. An implication of this view is that, if one wants to promote the training of older workers, offering monetary incentives to workers and firms in order to reduce their training costs may not be as effective as implementing policies that increase the residual planning horizon by delaying retirement. According to this view, the distance to retirement, or the horizon effect, is "*the key feature to understanding the economics of older worker employment*" (Cheron, Hairault and Langot, 2011, p.1478).

Theory suggests that the shorter working horizon implied by early retirement systems has, ceteris paribus, a negative impact on human capital formation and training, because it shortens the period during which the worker and/or the employer can reap the benefits of the investment and recoup the costs (Porath, 1967). The effects of training on the timing of retirement are less clear-cut. Training is expected to increase earnings and the probability of gainful employment.[4] Increased earnings, however, have theoretically ambiguous implications for the timing of retirement. A higher wage yields greater foregone earnings, if the worker retires, and a higher lifetime income, which in turn may raise the value of leisure and the incentive to retire early.

Although the policy interest in this area has been increasing, at least in Europe and in the OECD, there are only a few studies that have investigated the interaction between training and retirement and provided evidence from quasi-experimental settings. These studies have examined either the effects of training policies (or adult education policies) on the decision to retire, or the impact of changes in the minimum retirement age on training decisions. Montizaan, Cörvers and De Grip (2010) use a natural experiment in the Dutch public sector to study the effects of an exogenous increase in

[2] The positive effect of technological change on the returns to training has to be discounted by the negative effect on individual human capital.

[3] Charness and Czaja (2006) argue that older workers are quite capable of learning new skills, albeit at a slower pace than younger workers.

[4] See Leuven and Oosterbeek (2008) for a review of the large literature on the private returns to training, and Behaghel, Caroli and Roger (2011) and Picchio and Van Ours (2011) for evidence of the effects of training on the employment of older workers.

expected retirement age on training participation. They find that a shock to pension rights which postpones retirement has a positive but small impact on the training participation of older men. Stenberg, de Luna and Westerlund (2012) study whether adult education, which includes training, delays retirement and increases labour force participation among older Swedish workers. They find no significant effect on the timing of retirement. In contrast, Kristensen (2012) uses Danish data and find that additional training increases retirement age. The estimated effect, however, is small.

To the best of our knowledge, no empirical study so far has compared the effects that training and retirement policies have on the decisions to train and retire. Understanding the relative effectiveness of these policies is especially important in the context of fiscal retrenchment that characterizes many OECD countries. Our paper intends to fill this gap using data for Italy, and to provide quasi-experimental evidence resulting from overlapping sources of exogenous variation in the minimum retirement age and in training costs.

Italy is an interesting case for the topic at hand. According to the OECD, it shares with Spain and Greece both a very low labour force participation rate in the age group 50 to 64 and a high predicted old age dependency ratio. During the 1990s, the country has experienced both the introduction of training subsidies – paid by the national government or by the European Community – and a sequence of pension reforms that have progressively increased minimum retirement age.

We consider the variation generated by these reforms in the rules that determine entitlement to pension benefits, resulting in increasingly more stringent eligibility criteria across contiguous cohorts of individuals. We overlay to such effects the additional variability that results from the introduction of incentives to training provision, the intensity of which has varied over time and across regions for the cohorts of individuals affected by pension reforms.

We exploit the variability across cohorts and regions to study the effects of training and pension policies on training and retirement decisions, by considering exogenously defined groups who have faced different rules for pension eligibility and have worked in environments characterised by heterogeneous training costs. Our main sample consists of longitudinal data for Italian males entering their fifties during the 1990s and early 2000s, a period characterized by important exogenous adjustments in the minimum retirement age and by the introduction of regional training subsidies to continuous vocational training.

We group individuals depending on their cohort of birth, construct their labour market profiles and study how these profiles have been affected by the institutional changes brought forward by pension and training policies. Our maintained identifying restriction is that, in the absence of these policies and net of the characteristics we control for in the analysis, the life cycle profiles of the selected contiguous cohorts of individuals are characterized by parallel trends. We run falsification tests for this assumption by comparing pre and post reform cohorts, which we observe for a wide enough age window.

Our main results can be summarised as follows. First, we find that the increase in minimum retirement age that occurred in Italy in the second part of the 1990s has contributed to reduce retirement and to increase training among older workers. Since we find no sign that the reduction in retirement rates has been accompanied by an increase in unemployment rates, we conclude that the employment rate of older workers must have increased. Second, we find that the introduction of training subsidies has had a small effect both on retirement and on the likelihood of having a positive training stock. These effects, which we show depend on the age of individuals, have not translated into higher real disposable income. We argue that the mild positive effect of training subsidies on retirement is driven by the fact that these subsidies have affected training for the youngest among older workers, and retirement for the oldest, suggesting substitution effects within the group of older workers. Third, we document that training subsidies are more effective for younger workers. Independently of the age group, we confirm that the effects of subsidies are small in size, and that substantial deadweight is associated to this policy instrument.

As a thought experiment, we then compare the relative effects of changes in minimum retirement age and in training subsidies on our measure of training and find that, to compensate for the negative effects induced on training by a one-year reduction in minimum retirement age, training subsidies would have to increase by 7 to 13 real euro per head, significantly more than the average flow of tendered subsidies during the period 1994-2004. This suggests that increases in minimum retirement age, that are typically motivated by the need to accommodate an increasing ageing society, maybe a much more effective tool to promote the training of older workers that “proper” traditional training policies, which consist in subsidizing workers and firms. We believe that policies that increase minimum retirement age are effective for training because they contribute to substantially increase the relatively short work horizon of older workers.

The remainder of this paper is organized as follows. Section 1 provides some background on institutional details and describes the Italian reforms of minimum retirement age as well as the provision of regional training incentives. The data and the empirical approach are introduced in Section 2 and 3 respectively, and results are discussed in Section 4. A brief Section 5 with sensitivity analysis precedes our conclusions.

1. Background

The aim of this section is twofold. We first review pension arrangements in Italy, and how the various reforms that were implemented during the 1990s impacted on retirement age. Second, we discuss the role played by tendered training incentives, and examine the extent to which their introduction overlapped with changes in the mandatory rules that came with the reforms.

1.1. *Reforms to minimum early retirement age in Italy*

The Italian retirement system comprises both *old age* and *seniority* pensions. In this sub-section, we only consider the retirement rules that apply to *male employees in the private sector*, who are the focus of our empirical analysis. Until 1992, this group of workers qualified for old age pensions at age 60 and for seniority pensions at any age, provided that they had accumulated 35 years of social security contributions.[5] Empirical evidence – documented below – suggests that eligibility for seniority pensions was acquired, in the large majority of cases, way before that for old age pensions. As a result of this, until 1992 male employees in the Italian private sector with a continuous working career from age 15 could retire as early as age 50 (i.e. after 35 years of contributions).

Starting from 1992, eligibility conditions were progressively tightened by a sequence of pension reforms, aimed at containing public expenditure. The overall impact of these interventions is discussed in detail in Appendix A. In the new system, access to seniority pensions required not only at least 35 years of contributions, but also a minimum age. For male workers in the private sector this age was initially set to 52 in 1996, and then progressively increased up to 57 by 2002. The age condition for old age pensions also changed, increasing progressively from 60 to 65. Subsequent interventions overlaid additional criteria for the computation of eligibility. We document these changes in Appendix A.

The effect of changes in eligibility conditions over time is most simply put across by considering Figure 1, where we report the number of years required to qualify for “seniority” and “old age” pensions for an hypothetical individual aged 50 and with 35 years of contributions. The figure sets out the comparison of consecutive cohorts of individuals, who share the same number of years of contributions and are indexed by the year in which they reach age 50. The empirical relevance of seniority vis-à-vis old age pensions is clear-cut, as the former guarantees less stringent requirements for eligibility. It also emerges that relatively close cohorts of individuals face sharp differences in their eligibility rules.

1.2. *Tendered training incentives*

Government subsidies to continuing vocational training (CVT) are managed by regional authorities. Public intervention includes: 1) the European Social Fund (ESF); 2) national measures (Laws 236/93 and 53/00) and 3) industry based training funds (ITF), managed by the social

[5] See, for instance, Battistin et al (2009). In Italy, social security contributions are paid by the employer and the employee.

partners.[6] By and large, these measures are funded by the European Community (EC) and by a compulsory levy of 0.3 percent on national payroll (see Appendix 2 in Brunello, Comi and Sonedda (2012) for details). We estimate that, during the period 1994-2005, about 3.37 billion euro at constant prices have been tendered by regions to support CVT, of which 2.7 billion euro funded by the EC. Before 1994, there were no incentives for CVT.

These resources are transferred from the EC and the national government to regional authorities, which have substantial discretion and autonomy in management. For instance, funds received by the national government in a given fiscal year are not necessarily allocated to regional budgets, nor tendered within the same period. While some regions manage to issue invitations to tender a few months after receiving funds, other regions either are not able or decide not to do so.[7]

Funds are mainly directed at firms, but include also vouchers for private employees. The left hand side panel of Figure 2 shows the discounted sum of tendered CVT subsidies per head (at constant prices) across Italian regions in 2004, using a 3 percent discount rate as in Brunello, Comi and Sonedda (2012).[8] The right hand side panel of the figure shows the average annual flow for the period 1994-2004. There is substantial variation across regions, with Apulia in the South tendering the least (1.36 euro per head per year) and Emilia in the North planning to spend the most (12.07 euro per head per year).[9] Not only the level, but also the dynamics of the discounted stock of incentives exhibit important regional variation. Brunello, Comi and Sonedda (2012) show these dynamics do not merely reflect regional trends in productivity. They argue that an important source of this regional variation is the political orientation of regional governments, which have changed on several occasions during the period considered. In particular, they find that having a government with a centre-left political orientation significantly increases the stock of tendered training incentives.

2. Data

2.1. *The longitudinal survey of Italian households*

[6] Industry based training funds have become operational in Italy from the second half of 2004. Since our longitudinal information ends in 2004 (see Section 2), we ignore them in what follows.

[7] As an example, the time lag between the allocation of Law 236 funds from the Ministry of Labour to the regions and the first invitations to tender issued by regions ranged in 2003 from 17 to 484 days.

[8] To avoid having region by year cells with too few observations, we grouped the 20 Italian regions into 13 macro-areas using active population in each region as weight. These macro-areas are: Piemonte, Lombardia, Trentino Alto Adige and Veneto, Friuli Venezia Giulia, Emilia Romagna, Toscana, Liguria, Marche and Umbria, Lazio and Abruzzo, Campania, Puglia, Basilicata and Calabria, Sicilia and Sardegna.

[9] The fact that the stock of tendered training subsidies in 2004 was much higher in Northern Friuli than in Southern Campania does not support the view that subsidies have been targeted at regions with training deficits (training incidence is typically lower in Southern regions).

We use individual data from *ILFI* (*Longitudinal Survey of Italian Households*), a representative household survey comprising about 4,000 Italian households (10,000 individuals). Despite its richness, this is still a relatively under-utilized source of data for empirical economic analysis. The ILFI panel consists of five waves, conducted every two years, starting in 1997 and ending in 2005. It collects detailed information on retirement decisions, number and duration of training episodes and number and duration of occupational spells throughout the entire life, and several household and individual level demographics, including education and geographic mobility. The first interview was carried out using a detailed face-to face life-course event history calendar instrument, and collected for all household members older than 18 data the key episodes since birth. The information that we have access to therefore combines retrospective (until 1996) and survey data (from 1997) for all individuals in the sample, yielding aggregate figures that are in line with those from other surveys conducted by the Italian National Statistical Office.[10]

The definition of the training stock

Training in these data refers to any programme organized by firms, local authorities and industrial associations that takes place after completion of upper secondary education and is not included in vocational tertiary education. We use recall information on the year and the month when each training spell started and ended to retrieve the annual number of *training episodes* (flows) and to compute a measure of *duration* (in months) of each episode. We allocate to each year all training episodes that started in that year, and add up these flows into the training stock with the perpetual inventory method, using a 3% discount rate. In our regressions, we use both this measure and a binary variable equal to one if the individual has a positive training stock, and to zero otherwise.[11]

The definition of distance to pension eligibility

We follow Battistin et al (2009) and construct a variable that measures the time to/from pension eligibility. For each individual in the sample we compute the number of years required to become eligible given the accumulated social security contributions and the pension regime in place at all ages. This variable takes on negative values if eligibility is not yet accrued, and positive values otherwise (retirement being possible, but not mandatory, only for eligible individuals). In what follows, we will label this variable "distance to/from retirement age". The detailed information

[10] For example, considering a sample of Italian males aged 45 to 55 in year 2000, ILFI data suggests that 84.2 percent of them are employed, 3.65 percent are unemployed and 12.17 percent are either retired or inactive. In a similar sample drawn from European Labour Force Survey, these percentages are 84.9, 3.1 and 12 respectively.

[11] This measure of training, which considers all training episodes, can be computed for Italy using ILFI, but cannot be computed with alternative and perhaps better known data sources such as the Labour Force Survey and the European Community Household Panel, because of the lack of key information on relevant ingredients. The Labour Force Survey only includes the training episodes that occurred in the month before the interview. The European Community Household Panel has information on training episodes that occurred in the year before the interview.

contained in the ILFI data allows us to compute the number of accrued years of contributions at all ages, for all individuals. To this end, we use retrospective information on labour market histories, including the spells of inactivity and unemployment, and information on labour market status at the end of each year.[12] We then combine this information with the minimum retirement age imposed by Law across the various phases of the pension reforms described in Section 1.1.

The definition of retirement status

We identify retired individuals on the basis of the self-declared labour market status at the time of interview, which we further refine as follows. In each wave, all individuals who were not employed were asked whether they classified themselves as unemployed, retired or out of the labour force (which includes housewives, students, serving army, disabled, dismissed workers, or on leave). We distinguish individuals retired from those out of the labour force by using the available information on the individual eligibility status and the fact that retirement is an absorbing state. Therefore, we consider an individual as temporarily out of the labour force rather than as retired if the following two conditions are met: a) the worker does not satisfy the eligibility conditions for retirement; b) the individual experiences at least an additional employment episode after the inactivity spell.

The definition of training incentives

We compute the stock of training incentives by adding up annual flows with the perpetual inventory method, using a 3% discount rate and measuring flows as ratios of annual tendered subsidies in the region (in real euro) to the active population in the same region. Since incentives started in 1994, we set the stock to zero before that date. As discussed above, we consider tendered subsidies rather than actual expenditures since the former do not depend on actual applications by firms and workers.

2.2. *Sample selection criteria*

A detailed breakdown of the selection criteria adopted to derive the final sample used in the analysis is presented in Table 1.[13] We consider only males. Since we need information on labour market histories to study the interplay between changes to the working horizon of individuals and

[12] In Italy, contributions are usually accumulated when individuals are either employed or self-employed. There are few exceptions according to which the government pays the contribution: during the periods covered by unemployment insurance, maternity leave, sickness leave and compulsory military service. Furthermore, . up to 1996, it occurred when the individual was eligible to receive benefits associated to temporary layoffs (*Cassa Integrazione Guadagni*). When calculating the social security contributions accrued to individuals, we take account of these contributions paid by the government.

[13] Our key variables are defined as to 31st December of each year. Therefore for all individuals interviewed earlier than December 2005 we use information up to 2004, and we drop the very few observations related to those interviewed at the end of 2005.

their incentives to train, we drop all individuals with no labour spell or with missing information on the region of residence. The former criterion is motivated by the fact that pension eligibility cannot be computed. The latter criterion is required to merge in external information on training incentives. We also use the detailed retrospective information available in the data to reconstruct individual labour market histories as far back as 1980. By combining retrospective and survey data, we are able to follow the individuals in our sample from 1980 to 2004.

Finally, we apply some "other selection criteria", as labelled in Table 1, to contain the extent of heterogeneity or measurement error in the final sample. Therefore, we drop observations with missing sector of activity, drop individuals living in the two tiny regions, Valle d'Aosta and Molise, those living abroad, those with at least one spell of inability, and those who started working before age 10. Finally, we retain in our sample only employed individuals working in the private sector, as well as unemployed and retired individuals who were employees in the private sector during their last job spell.

2.3. *Descriptive statistics*

We perform various data cuts depending on the question addressed in the analysis. Our *main working sample* keeps only individuals born between 1942 and 1950. The sample consists of 2772 observations and 336 individuals, for whom descriptive statistics are reported in the left hand panel of Table 2. We centre our data around 1996, the threshold year when the Italian pension system changed from the *old* to the *new* seniority pension system (see Appendix A). Because of this choice, individuals born after 1946 enter their fifties after the change, and are arguably the most affected by pension reforms.

These reforms affected eligibility for a seniority pension. Since retirement can only be conditional on eligibility, retirement profiles should differ sensibly across contiguous cohorts in the sample. To verify this, we compare in Figure 3 the retirement behaviour of the pre-reform and post-reform cohorts. The former are born between 1942 and 1945 and comprise almost entirely individuals who are at least as old as the minimum retirement age prescribed by law, and therefore not bound by it. The latter are born between 1946 and 1950 and consist of individuals who are by and large younger than prescribed minimum retirement age, and thus bound by it. As expected, the retirement probability of individuals after age 50 is always lower among treated cohorts.[14]

We overlay to changes in the eligibility criteria the additional variability that results from the existence of various incentives to training provision, the intensity of which varies over time and

[14] This finding suggests that the information conveyed by the ILFI sample is qualitatively the same as that provided by the Bank of Italy sample – see Manacorda and Moretti (2006) - and by the National Statistical Office – see Battistin, De Nadai and Padula (2013).

across regions for all cohorts of individuals affected by the above mentioned pension reforms. These incentives started in 1994, when the pivotal cohort born in 1946 was 48. Figure 4 plots the training - age profiles of pre and post-reform cohorts. These profiles are broadly parallel until about age 48, with the older birth cohorts having higher training. Starting around age 48, however, the gap rapidly closes and training participation for the post-reform cohorts quickly overcomes participation for pre-reform cohorts. This is also the age when some of the post-reform cohorts are already exposed to the pension reforms that started in 1996. The figure clearly suggests that the two overlapping sources of exogenous variation have concurred to encourage the investment in training.[15]

Figures 5 and 6 show the annual average stock of training subsidies and its regional variation, by source (European Social Fund versus national sources). These incentives started in 1994 and affected our cohorts to a different degree, depending on the region of residence. Not only the average stock of subsidies but also its regional variability increased rapidly over the years. Following the literature (see for instance Bassanini et al, 2007 and Falch and Oosterbeek, 2012), we expect these subsidies to produce substantial deadweight losses and to affect differently younger and older workers.

To verify this in our data, we also study the effects of the interplay between changes to the working horizon and incentives to train on younger cohorts of individuals. Our *secondary working sample* consists of 4170 observations and 586 individuals born between 1962 and 1970, and thus 20 years younger than the individuals in the main sample. Summary statistics for this sample are reported in the right hand side panel of Table 2.

3. Methods

3.1 *Notation*

Our data are informative on (R^a,T^a,D^a,Z^a,Q^a,X), where *a* denotes age and the index for individuals is suppressed for the sake of simplicity. R^a is the *retirement status*; T^a is a dummy equal to one if the *stock of training* is positive, and to zero otherwise; D^a is *distance* to/from the eligibility. These are the variables described in Section 2. Z^a summarises the (exogenous) mandated *rules* for minimum early retirement age and eligibility for seniority pension (see Section 1.1). These rules are constant across individuals at a given point in time, but may vary over the life cycle of individuals depending on the retirement rule in place at various ages. Q^a is the discounted stock of (exogenous) *incentives* to train accumulated by individuals up to age *a*, which varies over time and

[15] A similar graph obtains when we use the stock of training rather than the percentage of individuals with positive training.

across areas where the individual has lived until age *a*. This variable was defined in Section 2. Finally, X are *exogenous* regressors which are *predetermined* with respect to the decisions that we consider. In the empirical exercise some of these regressors may vary themselves with age (e.g. the unemployment rate in the area where the individual lived at age *a*). To ease notation, the fact that we condition on these regressors will be left implicit throughout.

The data come in the form of individual time series obtained both from retrospectively collected information and from survey data. Therefore, there is a block of records containing (R^a,T^a,D^a,Z^a,Q^a,X), at various ages for the first individual, for the second individual, and so on. The question is then to establish which causal parameters are identified using the available information. Since the key variation in *Z* and *Q* occurs by age, year of birth and region, we collapse the data into cells characterized by these three dimensions.

3.2.*Identification strategy and policy parameters retrieved*

A reasonable setting that describes the causal relationships amongst the relevant variables is presented in Figure 7, which can be derived from optimization principles in the economic model that we discuss in Appendix B. The analysis is conditional on age *a*, although dynamics in the retrieved policy parameters can be added along the lines of what we discuss further below.

There are *two* exogenous sources of variation: the one coming from pension reforms (Z^a), and the other coming from incentives to provide or undertake training (Q^a). It is assumed that these two sources act independently. The key maintained exclusion restriction is that Z^a affects R^a and T^a only through its effect on D^a. This amounts to saying that pension reforms may have an impact on the propensity to train only because they act on the working horizon of individuals, which is represented by D^a. Finally, it is assumed that Q^a enters the model only through its positive effect on T^a (which is the variable that it targets).

Training and retirement decisions closely interact. Clearly, the decision to retire affects training. On the other hand, training T^a is likely to have a direct effect on R^a. On the one hand, training can increase wages. As pointed out by the existing literature, higher wages have both a substitution effect (toward work) and an income effect (toward more leisure and retirement) with an overall uncertain effect on retirement. On the other hand, training can increase employment and reduce the risk of unemployment by providing marketable skills, especially if these are work related. A lower risk of unemployment is likely to reduce the incentive to leave the labour market for good with an early pension. Last but not least, additional training can lead to better and more satisfying tasks and jobs, and therefore induce employees to retire later. We expect training to be positively correlated with Q^a, and to be affected by the working horizon D^a. On the one hand, higher incentives reduce the costs of training. On the other hand, a longer residual working horizon increases expected training benefits to workers and firms.

We consider a setting that allows us to study what would happen to training T^a and to the retirement probability R^a if we were to exogenously manipulate the working horizon D^a. The source of identifying variation that is needed to this end is that coming through changes in Z^a , induced by pension reforms. Similarly, we investigate what would happen to the retirement probability R^a if we were to exogenously manipulate training T^a. The source of identifying variation that plays a role in this case is the one coming through changes in incentives Q^a.

3.3. *Estimation*

We estimate reduced form regressions in which the outcomes D^a, T^a and R^a are related to the policy instruments Q^a and Z^a. The latter variable is constructed as follows. First, we consider the *minimum* age at which an individual in our sample could possibly retire depending on the legislation in place. As discussed in Section 1.1, this age results from the combination of years of contributions accrued and increasingly more stringent minimum age requirements imposed by the various reforms. Before 1996 individuals were entitled to retire independently of age as early as they had accumulated 35 years of social security contributions. The minimum age requirement *M* is set to 50 up to 1995 by taking as benchmark an individual who enters the labour market at age 15 and has no unemployment spells ever since. According to the legislation, *M* is equal to 52 between 1996 and 1997, to 54 in 1998, to 55 between 1999 and 2000, to 56 in 2001 and to 57 from 2002 onwards. Second, since *M* is binding only for individuals younger than *M*, we define a dummy *B* to identify these individuals. We define $Z^a=(M^a - 50)*B^a$, where both *M* and *B* are indexed by the individual's age. This variable measures how stringent the eligibility conditions have become after each pension reform, using age 50 as benchmark – this was the age when individuals could retire in the pre-reform period.

To illustrate, consider individuals aged 50 in 1995. For them, $Z^{50}=0$, because 1995 is a pre-reform year and thus $M^{50}=50$. Consider instead individuals aged 50 in 1996. For this group $Z^{50}=2$, because the reforms have shifted the minimum retirement age to $M^{50}=52$. It follows that, by exploiting the variability across cohorts, we can measure the effects of varying Z^{50} on the outcome of interest when individuals are aged 50. The same source of variability can be used to study the effects on outcomes at different ages, thus investigating the effects on life cycle profiles.

We consider the following regression:

$$Y_{cj}^{a} = \beta_0 + \beta_1 Z_{cj}^{a} + \beta_2 Q_{cj}^{a} + \beta_3 X_{cj}^{a} + \delta_c + \xi_j + \varepsilon_{cj}^{a}, \quad (1)$$

where the variables of interest refer to values by cohort (c) and region (j), and δ_c and ξ_j are fixed effects. We always use linear probability models and cluster standard errors by region and cohort. As an alternative to the specification in (1), we specify a regression in which the effects of Z_{cj}^a and Q_{cj}^a are allowed to vary with age.

In the vector of covariates X_{cj}^a we include a quadratic polynomial in age, age at entry in the labour market, years of schooling, real GDP per capita and the unemployment rate in the region. In the presence of different regional trends, one might worry that regional variations in training incentives pick up these trends rather than exogenous variations in the marginal cost of training. By adding the real GDP per capita, we control for these trends. Furthermore, regional shocks may temporarily reduce training investments, and trigger as a consequence an increase in the amount of subsidies that regional governments decide to tender. By controlling for the regional unemployment rate, we effectively remove this threat to the orthogonally of Q_{cj}^a with respect to the error term ε_{cj}^a in the equation.

Our estimation strategy follows a DiD (difference-in-differences) logic. Consider Tables 3 and 4, where we tabulate the average value of Z^a and Q^a in our working sample by birth cohort and by age in the range 46-56. Table 3 shows that the older cohorts (1942 to 1944) are never affected by pension reforms. Younger cohorts are affected instead as they age. Table 4 shows that all birth cohorts are treated – to a different extent - by the introduction of training subsidies since 1994. Consider the cohort of those born in 1946. Individuals are followed over time, and any age before 1994 is a pre-reform age (for both treatments Q and Z). The "treatment status" at each age, with respect to both Q and Z, is "as good as randomly assigned" to individuals depending on their cohort of birth. We can therefore use the variability in the exposure to treatment across cohorts to identify causal effects.

4. Results

4.1 *Main Findings*

Table 5 presents our estimates of the effects of the policy variables Z and Q on retirement R for the sample of individuals born between 1942 and 1950 and aged between 46 and 56. The table is organized in four columns: column (1) is based on cell data (by age, year of birth and region) derived from the ILFI dataset; column (2) uses individual data from ILFI; columns (3) and (4) use either cell or individual data drawn from an alternative dataset, the Survey on the Income and Wealth of Italian Households (SHIW). This latter survey is conducted on a bi-annual basis by the Bank of Italy on a representative sample of Italian households and has been previously used to study retirement in Italy.[16] By replicating our estimates on SHIW, we verify whether our empirical results based on ILFI data hold qualitatively in alternative datasets.

We find that an increase in *Z*, the distance between minimum age requirement for pension eligibility and age 50 for those younger than the minimum requirement, reduces retirement. Depending on whether we use cell or individual data, the marginal effect of an additional year of *Z* on retirement *R* ranges from 16 to 18 percent, a sizeable effect. This effect is confirmed when we use SHIW data, albeit its size is much smaller (between 6 and 8 percent). There is also evidence that an increase in training incentives Q increases retirement. The size of this effect, however, is comparatively much smaller than the effect of Z, and ranges between 2.6 and 2.9 percent with ILFI data and between 0.63 and 0.78 percent with SHIW data.

Table 6 considers the effects of Z and Q on training for two samples of individuals: those born between 1942 and 1950 and aged between 30 and 56, and those born between 1962 and 1970 and aged between 26 and 36. For both samples, we report estimates using cell and individual data. Therefore, training in the table is either the percentage of individuals in the sample who have had at least one training episode in the case of cell data (columns (1) and (2)), or a dummy equal to one if the stock of training is positive, and to zero otherwise (column (3) and (4)). In contrast with Table 5, we do not present estimates for an alternative dataset. As discussed above, we do not know of any alternative dataset which allows us to compute a measure of training similar to that computed using ILFI data.[17]

The table shows an interesting contrast between the older and the younger generation of private sector workers. In the case of older workers, we find that training is affected by changes in Z and unaffected by changes in Q. We estimate that increasing by one year the distance between minimum age requirement for pension eligibility and age 50 for those younger than the minimum requirement increases training by 6.5 percent when we use cell data and by 5.2 percent when we use individual data. We also estimate that adding one real euro per head to the stock of training subsidies raises training by 0.48 to 0.70 percent. However, the coefficient associated with Q is not statistically significant using both individual and cells data. In contrast, we present evidence that changes in Z have no statistically significant effect on the training of younger workers, who are affected instead by an increase in training subsidies. We estimate that adding one real euro per head to training subsidies raises the probability of having a positive training stock by 1.3 to 1.7 percent, depending on whether we use individual or cell data.

[16] See for instance Battistin *et al.* (2009).

[17] Table B1 in the Appendix replicates Table 6 when the dependent variable is the stock of training rather than the percentage with positive training. Qualitative results are unaffected.

Although we find evidence that training subsidies affect significantly the training decisions of younger workers, the very modest size of the effect points to the presence of substantial deadweight losses. The presence of these deadweight losses is not new to the literature. Among the others, Abramovsky *et al.* (2011) find no effect on the take-up of training from the UK National Employer Training Programme and the Employer Training Pilots.

Our results also confirm previous evidence (see Heckman, 2000) suggesting that training incentives are unlikely to be effective for older workers. When we compare the estimated marginal effects on training of changes in retirement policy Z and in subsidies Q, we find that the ratio of these effects ranges from 7 to 13. Ceteris paribus, this suggests that a policy which provides training incentives to employers and employees can be as effective on training as a policy which increases minimum early retirement age by one additional year if tendered subsidies increase by 7 to 13 real euro per head, more than what has been tendered on average in training subsidies by the 13 Italian regions between 1994 and 2004.[18]

Table B2 in the Appendix shows how our two sources of exogenous variation affect the distance to/from eligibility. Eligibility status depends upon the retirement rule in place and comprises an exogenous component (age) and an endogenous component (years of contributions). The table clearly shows the nature of the policy reforms being implemented: if more stringent rules for eligibility are introduced, these in turn induce a (negative) shift in the distribution of the eligibility status at a given age for all individuals affected. Pension reforms, however, may act on distance only through the exogenous age component. The endogenous component (i.e. the years of contributions) can only be manipulated exogenously by changes in training subsidies. Column (1) in the table points to the presence of a positive and significant effect of the incentives to provide or undertake training on the eligibility status. This effect is not robust, however, when we replicate our analysis using individual data (see Column (2)). This positive effect of subsidies Q on distance D may be mediated by a reduced risk of unemployment.

4.2 *Additional findings*

In the estimates of Tables 5 and 6, we have assumed that the effects of *Z* and *Q* on retirement and training do not vary with age. We allow for heterogeneous effects in Tables 7 and 8, where we only use cell data and report the estimated coefficients of the interactions of either policy variable with

[18] On average, these regions have tendered 5.69 real euro per head. Letting $T = T(Z,Q,X)$, the increase in training subsidies required to compensate the effect on training of a reduction in Z by one year is $\frac{dQ}{dZ} = -\frac{T_Z}{T_Q}$, which corresponds to 13 euro per head using the estimates in the first column of Table 6.

age dummies. Table 7 shows that the effects of both policies on retirement are stronger for the oldest groups aged 55 and 56. In Table 8, we use cell data and consider both older and younger workers. For the older cohorts, we find that we cannot reject the hypothesis that both changes in minimum age requirements and changes in training subsidies affect training. This is partially in contrast with the estimates presented in Table 6, where we have shown that training subsidies have no statistically significant homogeneous effect on the training of older workers. When we relax the restriction that effects are homogeneous across age, we notice that subsidies matter for the training of those aged close to 50. For the younger cohorts, we confirm the results shown in Table 6 that only training subsidies affect training.

The presence of heterogeneous effects can help us in the interpretation of the finding that an increase in training subsidies has a positive and mild effect on retirement probabilities (Table 5). This effect could be the result of substitution patterns within the older age group: higher subsidies have increased training among workers in their late forties and early fifties, whose productivity has most likely increased with respect to workers aged 55 or 56, who have not been affected by the subsidies. The productivity differential produced by training differentials could have either motivated firms to induce workers in the oldest age group to retire earlier, or could have convinced these workers to take their earliest opportunity to retire. It is this increase in retirement that shows up in the estimates with homogeneous average effects presented in Table 5.

Policies that alter the minimum required pension age have the potential of affecting labour market transitions into retirement and the probability of unemployment. This would happen, for instance, if stricter retirement requirements induce firms to terminate older workers, or if older workers try to increase their consumption of leisure by switching from career to temporary bridge jobs, experiencing unemployment spells in the transition process.[19]

We investigate this issue in Figure 8, where we use cell data for two groups of cohorts, the pre-reform cohorts born in 1942-45 and the post-reform cohorts born in 1946-50. If changes in minimum retirement age induced by pension reforms had an effect on unemployment, we would expect to see differences between pre- and post-reform cohorts as they approach age 50. The figure, however, does not suggest that this is the case. We therefore conclude that changes in Z have reduced retirement without any significant effect on the unemployment of older workers.

In a similar vein, we ask whether changes in the policy variables Z and Q have affected the real disposable income of private sector employees belonging to cohorts born between 1942 and 1950. Disposable income is imputed to individuals according to the following rules. We use SHIW data

[19] Compared to the US, the percentage of older workers who are in bridge jobs in much lower in Europe and Italy. See Brunello and Langella, 2012.

for monthly earnings as disposable income for the employed, impute a zero value as disposable income for the unemployed, and apply a 70% pension replacement rate to all retirees. We plot in Figure 9 real disposable income for the pre-reform and the post-reform cohorts. As in the case of unemployment, we find no evidence of a differential effect from around age 50 onwards, when both training subsidies were switched on and pension reforms took place.

These figures suggest two main conclusions: a) pension reforms reduced the retirement rate of older cohorts, without generating higher unemployment rates; b) training subsidies have had small effects on the take up of training by older workers, but no effect on their average wages.

Conclusions

We have used overlapping sources of exogenous variation in the minimum retirement age and in training costs to study the effects that training and retirement policies have had on the decisions to train and retire taken by older workers in Italy during the second part of the 1990s and the early 2000s. We have shown that the increase in minimum retirement age has contributed to reduce retirement and to increase training, and that the introduction of training subsidies has had a small positive effect on training. These subsidies have been more effective for younger workers. We have compared the relative effects of changes in minimum retirement age and in training subsidies on the training of older workers and have estimated that, to compensate for the negative effects induced on training by a one-year reduction in minimum retirement age, training subsidies would have to increase by 7 to 13 real euro per head, significantly more than the average flow of tendered subsidies during the period 1994-2004.

Our estimates have potentially important implications for the design of policies aimed at encouraging the labour force participation of older workers in ageing societies. Many policy commentators have identified training as a key mechanism to promote labour market attachment and delay early retirement. Yet the pressing question is how can we design policies that stimulate older workers and firms to invest in further training. We share the view of other economists that training subsidies are unlikely to be an effective policy tool, especially when fiscal retrenchment is spreading across developed economies. The Italian experience suggests that policies that increase minimum retirement age, which are originally aimed at reducing pension expenditures, may also payoff in terms of higher training for older workers, because they extend their relatively short working horizon and the perceived benefits from additional training.

Appendix A: Pension Reforms in Italy

Since 1969 (Law n.153/69) Italy adopted a mandatory PAYG (Pay-As-You-Go) pension system which included both "old age" and "seniority" pensions.[20] The system was quite generous[21] and by the end of the 1980s required urgent reforms to guarantee its sustainability. A stark example of the generosity of the system were the so called "baby pensions", which allowed married females employed in the public sector to retire and draw generous benefits after having accumulated only 14 years, 6 month and one day of social security contributions. Men in the public sector were slightly less fortunate and could retire after 20 years of contributions.

The 1992 Amato reform (Law n. 503/92) [22] reduced the generosity of benefits by introducing the principle that either 10 years to be applied to workers with more than 15 years of contributions or the entire working life for all the others workers– not just the last five years – should be used to compute average earnings as the denominator of the pension replacement rate. Eligibility to old age pensions was also tightened. The critical age increased gradually for men from 60 years old and 15 years of contributions (55 years old for females) in 1992 to 65 years old and 20 years of contributions (60 years old for females) in 2001. These tighter rules did not apply to workers with at least 15 years of accumulated contributions at the end of 1992. The disparity of treatment between older and younger cohorts was maintained in the subsequent reforms, leaving the former relatively unaffected.

Law n. 503/92 also stated the intention to abolish the so called "baby pensions" in the public pensions. Due to heavy resistance, actual implementation of the Law started only in 1998. Law n. 335/95, the so called Dini pension reform changed the system from defined benefits to defined contributions. This epochal reform, however, applied entirely only to the new workers hired after 1995 and did not apply at all to older workers who had at least 18 years of accumulated contributions by the end of 1995.

The Dini pension also changed the minimum age required to access seniority pensions. With the new law, from 1996 employees could retire with 35 years of accumulated contributions only if they satisfied a minimum age requirement (52). This minimum was not binding only for those workers who had accumulated a higher number of years of social security contributions (36 in 1996). Table A1, corresponding to Table B of Law 335/95, describes in more details the eligibility rules for access to seniority pensions.

At the end of 1997, the Prime Minister Prodi tightened further eligibility requirements. The rules in Table A1 were maintained for blue collar workers in the private sector and for individuals who had paid at least one year of social security contributions when aged 14 to 19. Tables A2 (corresponding to Table C, Law n.449/97) and A3 (corresponding to Table D, Law n.449/97) illustrate the new eligibility rules after the

[20] Individuals older than 65 who are not covered by old age pensions receive social pensions.
[21] Blondal and Scarpetta, 1998, and Angelini, Brugiavini and Weber, 2009, argue that the generosity of the system has been a key reason for the relatively low labour force participation of individuals aged 55 to 64.
[22] The main Italian pension reforms that occurred in 1992, 1995 and 1997 are known as Amato, Dini and Prodi reforms respectively.

enactment of Law n.449/97, which introduced different eligibility requirements for the private and the public sector.

Table A1: Eligibility Rules for Access to Seniority Pensions. Law n. 335/95

Year	Age and Years of Contribution	Only Years of Contributions
1996	52 and 35	36
1997	52 and 35	36
1998	53 and 35	36
1999	53 and 35	37
2000	54 and 35	37
2001	54 and 35	37
2002	55 and 35	37
2003	55 and 35	37
2004	56 and 35	38

Table A2: Eligibility requirements for the private sector. Law n. 449/1997

Private Sector

Year	***Age and years of Contributions***	***Only years of contributions***
1998	54 and 35	36
1999	55 and 35	37
2000	55 and 35	37
2001	56 and 35	37
2002	57 and 35	37
2003	57 and 35	37
2004	57 and 35	38

Table A3: Eligibility requirements for the public sector. Law n. 449/1997

Public Sector

Year	***Age and years of Contributions***	***Only years of contributions***
1998	53 and 35	36
1999	53 and 35	37
2000	54 and 35	37
2001	55 and 35	37
2002	55 and 35	37
2003	56 and 35	37
2004	57 and 35	38

Appendix B: The Economic Model

In this appendix, we develop a discrete time model of training and retirement which motivates Figure 7 in the paper[23]. There are two agents: a senior worker aged a, who cannot retire earlier than minimum retirement age a_M and later than age a_F, and a firm. Each agent has a single decision, retirement for the worker and training for the employer[24]. The match between the worker and the firm ends only when the worker retires[25]. Let T_a represent the training stock at age a. Conditional on having attained minimum retirement age and on her training stock, the senior worker decides when to retire. Retirement is a permanent decision. The employer decides training intensity at age a, τ_a, by comparing the costs and benefits of providing additional training. While the costs are borne at the time of the decision, the benefits span over the worker's residual working life, and depend on her decision to retire. Each agent in this setup "plays Nash", and decisions are taken simultaneously: the worker decides when to retire by taking the training decisions of the firm as given, and the firm decides training by taking the retirement decision of the worker as given.

The Retirement decision

Let the benefits from labour market participation at age a be $W_a = W(a, T_a)$, and the benefits from retirement at the same age be $B_a = W(a, T_a)$[26]. Monetary payoffs to labour market participation vary according to whether the individual is employed or unemployed. Training can affect these payoffs either because it increases the probability of employment or because it increases earnings.[27] The utility from labour market participation or retirement at age a is $U(W_a)$ and $\Gamma(B_a)$, respectively. The senior worker decides to retire at age a if $a \geq a_M$ and the following conditions hold:[28]

$$U(W_a) \leq \Gamma(B_a) \qquad \text{(A1)}$$

$$\sum_{k=0}^{K} EU(W_{a+k}) \leq \sum_{k=0}^{K} E\Gamma(B_{a+k}) \text{ for any K=1,...,F} \qquad \text{(A2)}$$

[23] The model draws from standard literature in the areas of training and retirement. Useful reviews of these literatures include Bassanini *et al.* (2007) and Lumsdaine and Mitchell (1999). See also the option value model by Stock and Wise (1990). Theoretical examples include Echevarria (2004), Echevarria and Iza (2006) and Fleischhauer (2007).

[24] We choose to model the training decision as an employer's decision based on the evidence that 80% of vocational training courses are paid for or provided by employers. See Bassanini et al, 2007.

[25] We ignore other sources of endogenous and exogenous separations.

[26] Benefits are affected also by a vector of exogenous (or predetermined) age invariant covariates *X*, which include educational attainment and potential labour market experience. We omit *X* from the notation for the sake of simplicity.

[27] Leuven and Oosterbeek (2008) and Bassanini *et al.* (2007) review the empirical evidence on the (private) returns to training. Behagel, Caroli and Roger (2011) and Picchio and Van Ours (2011) show that training positively affect the employment of senior workers.

[28] Utility in the final period does not depend on labour market status. Equation (1) uses the simplifying assumption that the effect of employment status at age *a* on benefits is small and can be overlooked.

where E is the expectations operator[29], $F = a_F - a$ and we set the discount factor to 1. The following assumption is maintained throughout:

Assumption 1. If $U(W_a) \le \Gamma(B_a)$, then $EU(W_{a+x}) \le E\Gamma(B_{a+x})$, where $x > 0$.

This assumption implies that if current benefits from labour force participation are below the current benefits from retiring, the worker expects this to hold also for future benefits, and ensures that condition (A2) holds when (A1) is satisfied. As in Stock and Wise (1990), the worker retires if there is no expected gain from continued labour force participation.

Individual utilities are given by:

$$U(W_a) = \ln W_a + f + \varepsilon_a \qquad \text{(A3)}$$

where f is a time invariant unobservable, and:

$$\Gamma(B_a) = k(a)\ln B_a + f + \eta_a \qquad \text{(A4)}$$

where $k(a)$ is the value of leisure, which increases with age and there is:

$$\varepsilon_a = \phi_\varepsilon \varepsilon_{a-1} + \zeta_\varepsilon, \qquad \eta_a = \phi_\eta \eta_{a-1} + \zeta_\eta$$

with $E\zeta_\varepsilon = E\zeta_\eta = 0$.

Thus, the terms ε_a and η_a are individual–specific random effects that vary with age following a first-order autoregressive process, capturing persistent individual characteristics such as preferences for work versus leisure, health status and unobserved wealth (see Stock and Wise, 1990).

Using (A3) and (A4), the probability of retiring at age a conditional on eligibility is:

$$\Pr(RT_a = 1 \mid D_a \le 0) = \Pr(\varepsilon_a - \eta_a \le k(a)\ln B_a - \ln W_a \mid D_a \le 0) \equiv G(a, T_a, D_a) \qquad \text{(A5)}$$

where RT_a is a dummy for the retirement status at age a, $D_a = a_M - a$ is the distance from minimum age, and $\Pr(RT_a = 1 \mid D_a > 0) = 0$ because there is no eligibility. When distance is positive, the worker has a certain and positive working horizon before retirement, because the probability of retirement is zero. Upon reaching eligibility for retirement, the worker can retire at any time and the remaining working horizon is uncertain.

The unconditional probability of retiring at age a, $\Pr(RT_a = 1) \equiv R_a$, is given by

$$\Pr(RT_a = 1) \equiv R_a = G(a, T_a, D_a)\Pr(D_a \ge 0) \equiv R_a(a, T_a, D_a) \qquad \text{(A6)}$$

Conditional on eligibility, we expect an increase in age to lead to a higher probability of retirement, because the value of leisure increases faster than the value of work. Conditional on age, an increase in minimum

[29] Utility in the final period does not depend on labour market status.

retirement age reduces the probability of retirement because it mechanically rolls back eligibility.[30] A higher training stock influences the retirement decision because it can affect wages, employment, job satisfaction, benefits and the value of leisure. As shown by Stock and Wise (1990), higher earnings have theoretically ambiguous implications for the timing of retirement, which depend on the shape of the utility function, subjective time preferences, and the link between income from work and pension entitlement.

The decision to train: employers

The (private) employer decides how much to train the senior worker in order to maximize expected profits. In doing so, she takes the retirement decision as given. Let profits net of training costs at age *a* be given by:

$$\pi_a = (1-\sigma) y(T_a, X) - c(q_a)\frac{\tau_a^2}{2} \qquad \text{(A7)}$$

where y is output, q_a is the flow of training incentives, $T_a = \tau_a + (1-\delta)T_{a-1}$ is the training stock and training costs are assumed to be quadratic in the training flow, as in most of the relevant literature[31].

The firm maximizes:

$$\Omega_a = \sum_{k=0}^{a_M - a} \pi_{a+k} + \sum_{k=a_M - a}^{a_F - a} [1 - R_{a+k}]\pi_{a+k} - c(q_a)\frac{\tau_a^2}{2} \qquad \text{(A8)}$$

The first order condition for a maximum yields

$$\sum_{k=0}^{a_M - a} \frac{\partial \pi_{a+k}}{\partial \tau_a} + \sum_{k=a_M - a}^{a_F - a} [1 - R_{a+k}]\frac{\partial \pi_{a+k}}{\partial \tau_a} - \sum_{k=a_M - a}^{a_F - a} \frac{\partial R_{a+k}}{\partial \tau_a}\pi_{a+k} = c(q_a)\tau_a$$

A higher minimum retirement age a_M increases the flow of certain marginal benefits, reduces the flow of uncertain benefits and the flow of benefits accruing from a lower retirement probability if $\frac{\partial R_{a+k}}{\partial \tau_a} < 0$. Under the additional simplifying assumptions that retirement occurs when reaching minimum retirement age ($a_M = a_F$) and that the marginal profits from training are constant, this condition becomes

30 Hairault, Langot and Sopraseuth (2010) show that the likelihood of employment is significantly affected by the distance to retirement.

31 When the employer belongs to the public sector, we assume that the public agency sets training to maximize the worker's wage $\sigma y(T_a, X)$ net of training costs. In this case, the optimal choice of training is similar to the one described for the private provider.

$$D_a \frac{\partial \pi_a}{\partial \tau_a} = c(q_a)\tau_a \qquad \text{(A9)}$$

Condition (A9) shows that a longer working horizon before minimum retirement age is reached (a higher value of *D*) increases the optimal training flow τ_a.

In general, we expect training investments to increase with the length of the working horizon and with the flow of training subsidies, and to decline when the probability of retiring after reaching minimum retirement age increases. We summarize this with the following implicit function

$$\tau_a = \tau[q_a, R_a, a, D_a] \qquad \text{(A10)}$$

As distance D_a increases, the working horizon lengthens and the incentive to invest in training increases. Starting from equation (A10), we model the training stock as

$$T_a = T[Q_a, R_a, a, D_a] \qquad \text{(A11)}$$

where Q is the discounted sum of current and past training incentives.[32]

The decision to train: individuals

Whilst the majority of training events is organized and paid by the employer, a minority of training episodes are decided and funded by individuals, who pay the training costs. In this case, the model above needs to be adapted. The key change that we need to make is to assume that decisions are taken sequentially: first, the senior individual decides training, by taking into account both her probability of retirement and the effects that training has on this probability. Second, and conditional on training, the individual decides when to retire by comparing utilities. The sequential structure implies that these utilities are net of training costs, which are bygones when retirement is decided. Under this assumption, individual behaviour can be described with a pair of equations similar to (A6) and (A10).

Distance from minimum retirement age

Distance D_a is minimum retirement age a_M minus age and measures the time to and from pension eligibility. This variable captures the horizon effect in our model of training and retirement decisions. By

[32] To illustrate why we use the discounted sum of training incentives rather than the simple sum, assume only two periods and let the training flow at time zero and one be given by $t_0 = bi_0$ and $t_1 = bi_1$, where i_0 and i_1 are the flows of training subsidies. The training stock at time one is $T_1 = t_1 + (1-\delta)t_0 = b[i_1 + (1-\delta)i_0]$, where δ is the estimated discount rate.

construction, it is positive when the horizon is positive and negative when the horizon turns negative, because the individual is older than minimum retirement age. When pension eligibility is reached, the probability of retirement switches from zero to positive and distance *D* switches from positive to negative.

In Italy, as in most European countries, we distinguish between statutory old age that restricts access to old age pensions and mandatory minimum retirement age, that affects eligibility for seniority pensions. The latter is typically lower than the former. Moreover, access to both types of pension requires that individual age satisfies the eligibility criteria and that a minimum number of years of social security contributions has been completed (35 is the key number for seniority pensions in Italy). While age eligibility rules are exogenous policy measures that cannot be manipulated by individuals, years of social security contributions depend on labour market experience and are therefore the outcome of endogenous individual behaviour. Both eligibility rules and social security contributions affect a_M and distance *D*. To illustrate, conditional on the same age and eligibility conditions, workers who have started their working life later are likely to have higher minimum retirement age because they have accumulated fewer years of contributions.

Let *Z* be a function of exogenous mandated rules regulating minimum early retirement age and eligibility for seniority pensions. In Italy, minimum retirement age was tightened by important reforms taking place in the 1990s, the Dini reform in 1995 and the Prodi reform in 1997. We assume that

$$D_a = D[a, Z_a, T_a] \qquad \text{(A11)}$$

Distance *D* is also a function of the vector *X*, which includes education and age when the first job was started, and of the training stock T, because a higher training stock is likely to affect employability and social security contributions.

Our model is described by the following three equations

$$R_a = R_a[a, T_a, D_a]$$

$$T_a = T[Q_a, R_a, a, D_a]$$

$$D_a = D[a, Z_a, T_a]$$

Let the triple T_0, R_0, D_0 be an equilibrium of the model. Then a first order Taylor expansion of each equation around this equilibrium yields

$$R_a = r_0 + r_1 T_a + r_2 D_a + \eta_R \qquad \text{(A12)}$$

$$T_a = g_0 + g_1 R_a + g_2 D_a + g_3 Q + \eta_T \qquad \text{(A13)}$$

$$D_a = d_0 + d_1 T_a + d_2 Z_a + \eta_D \qquad \text{(A14)}$$

where η are random errors and we omit for brevity age *a*. In the parlance of the simultaneous equations literature, equation (A13) is not identified, because fails to meet the order conditions, which prescribe that the number of excluded variables be weakly greater than the number of equations minus one. To address this problem, we use (A12) into (A13) and re-write equation [A13) as

$$T_a = a_0 + a_1 D_a + a_2 Q + \varepsilon_T \tag{A15}$$

where ε is the error term and the coefficient of distance *D* measures both the direct effects on training and the indirect effects, which occur because of changes in the probability of retirement. In our study, we can only identify the overall effects.

Since the model is identified, we can retrieve its parameters from the corresponding reduced form

$$R_a = \theta_0 + \theta_1 Z_a + \theta_2 Q_a + \omega_R \tag{A16}$$

$$T_a = \xi_0 + \xi_1 Z_a + \xi_2 Q_a + \omega_T \tag{A17}$$

$$D_a = \psi_0 + \psi_1 Z_a + \psi_2 Q_a + \omega_D \tag{A18}$$

References

Abramovsky, L., Battistin, E., Fitzsimons, E., Goodman, A. and Simpson, H., (2011) “Providing Employers with Incentives to Train Low-Skilled Employees: Evidence from the UK Employer Training Pilots”, *Journal of Labor Economics*, Vol 29, pp. 153-192.

Angrist J and Pischke J, (2009) Mostly Harmless Econometrics: an Empiricist’s Companion, Princeton University Press

Bartel, A. P. and Sicherman, N., (1993) "Technological Change and Retirement Decisions of Older Workers," *Journal of Labor Economics*, vol. 11, pages 162-83.

Bassanini A, Booth A, Brunello G, De Paola M and Leuven E, 2007, Workplace Training in Europe, in Brunello G, Garibaldi P and Wasmer E, eds., *Education and Training in Europe*, Oxford University Press

Battistin E, Brugiavini A, Rettore E and Guglielmo Weber, (2009). "The Retirement Consumption Puzzle: Evidence from a Regression Discontinuity Approach," American Economic Review, American Economic Association, vol. 99(5), pages 2209-26, December

Battistin Erich, De Nadai Michele and Padula Mario, (2013) "On The Intergenerational Effects of Pension Reforms", mimeo.

Behaghel, Luc & Caroli, Eve & Roger, Muriel, (2011) "Age Biased Technical and Organisational Change, Training and Employment Prospects of Older Workers," IZA Discussion Papers 5544, Institute for the Study of Labor (IZA).

Bison, F, Rettore E and Antonio Schizzerotto, (2009), The Treu Reform and contractual mobility in Italy. A comparison between labour-market entry cohorts, IRVAPP Progress Report n. 2009-02, Trento

Brunello, G. and Langella, M, (2012), Bridge Jobs in Europe, IZA Discussion Paper

Brunello, G, Comi, S and Sonedda, D, (2012), "Training Subsidies and the Wage Returns to Continuing Vocational Training: Evidence from Italian Regions," Labour Economics.

Charness N. and Czaja S. J., (2006) “Older worker training: what we know and don’t know”, AARP: Public Policy Institute, n. 22, Washigton DC

Cheron A., Hairault, J.O.and Langot, F., (2011) "Age - Dependent Employment Protection," *Economic Journal*, Vol. 121, pages 1477-1504.

Cunha, F., J. J. Heckman, L. J. Lochner, and D. V. Masterov (2006). Interpreting the evidence on life cycle skill formation. In E. A. Hanushek and F. Welch (Eds.), Handbook of the Economics of Education. Amsterdam: North-Holland.

Echevarria, Cruz A., 2004. "Life expectancy, retirement and endogenous growth," Economic Modelling, Elsevier, vol. 21(1), pages 147-174, January

Echevarria, Cruz A. & Iza, Amaia, 2006. "Life expectancy, human capital, social security and growth," Journal of Public Economics, Elsevier, vol. 90(12), pages 2323-2349, December.

Eyster, L., Johnson, R., & Toder, E. (2008), “Current strategies to employ and retain older workers”, Washington D.C.: The Urban Institute. Retrieved from *http://www.urban.org/publications/411626.html*.

European Commission, The Bruges Communiqué on enhanced European Cooperation in Vocational Education and Training for the period 2011-2020, 2011

Falch T and Oosterbeek H, (2012), Financing lifelong learning: funding mechanisms in education and training, EENEE Analytical Report n.10

Farber, H. (1997). “The changing face of job loss in the United States, 1981–1995, *Brookings Papers on Economic Activity. Microeconomics*,Vol. 1997, pages 55-142

Fleischhauer (2007), The Effects of Pension Reform on Retirement and Human Capital Formation, University of Saint Gallen WP.

Gagliarducci, S. (2005), "The dynamics of repeated temporary jobs", *Labour Economics*, 12 (4): 429-448.

Heckman J., 2000 "Policies to foster human capital," *Research in Economics*, Elsevier, vol. 54(1), pages 3-56.

Imbens G and Wooldridge P, (2007), Control Function and Related Methods, NBER

Kristensen N., (2012), "Training and Retirement", IZA Discussion Paper No. 6301.

Leuven E and Oosterbeek H, 2008, An alternative approach to estimate the wage returns to private-sector training, *Journal of Applied Econometrics*, vol. 23, pages 423-434.

Lumsdaine, R., Mitchell, Olivia S., 1999. "New developments in the economic analysis of retirement," Handbook of Labor Economics, in: O. Ashenfelter & D. Card (ed.), Handbook of Labor Economics, edition 1, volume 3, chapter 49, pages 3261-3307 Elsevier.

Jones, M, Jones, R., Latreille, P. and Sloane, Peter J., 2008. "Training, Job Satisfaction and Workplace Performance in Britain: Evidence from WERS 2004," IZA Discussion Papers 3677, Institute for the Study of Labor (IZA).

OECD, (2006), "Live Longer, Work Longer: A Synthesis Report of the Ageing and Employment Policies Project", Paris: OECD.

Mahyew, K. and Rjkers, B., (2004), "How to improve the human capital of older workers or the sad tale of the magic bullet", Paris: OECD.

Manacorda, M. and Moretti, E., (2006), "Why do most Italian youths live with their parents? Intergenerational Transfers and household structure" *Journal of the European Economic Association*, Vol. 4, pages 800–829.

Montizaan R., Cörvers F., De Grip A. (2010), "The effects of pension rights and retirement age on training participation: Evidence from a natural experiment", *Labour Economics*, Vol. 17, pages 240-247

Picchio, M. & van Ours, J. C., (2011) "Retaining through Training: Even for Older Workers," IZA Discussion Papers 5591, Institute for the Study of Labor (IZA).

Pisati, M. and Schizzerotto, A. (2004), The Italian Mobility Regime: 1985-1997**,** in Breen R., National Patterns of Social Mobility, 1970-1999: Divergence or Convergence? Oxford, Oxford University Press.

Porath B., (1967) "The Production of Human Capital and the Life Cycle of Earnings", *The Journal of Political Economy*, Vol. 75, pages 352-365

Silva O., (2007) 'The Jack-of-All-Trades Entrepreneur: Innate Talent or Acquired Skill?', *Economics Letters*, vol. 97, pages 118-123.

Simpson, Greller and Stroh (2002)

Stenberg A., de Luna, X. and Olle Westerlund O., 2012, "Can adult education delay retirement from the labour market?," *Journal of Population Economics*, vol. 25, pages 677-696.

Stock, James H & Wise, David A, 1990. "Pensions, the Option Value of Work, and Retirement," Econometrica, Econometric Society, vol. 58(5), pages 1151-80, September.

Figures and Tables

Figure 1. Number of years required to qualify for “seniority” and “old age” pensions for an hypothetical individual aged 50 and with 35 years of contributions

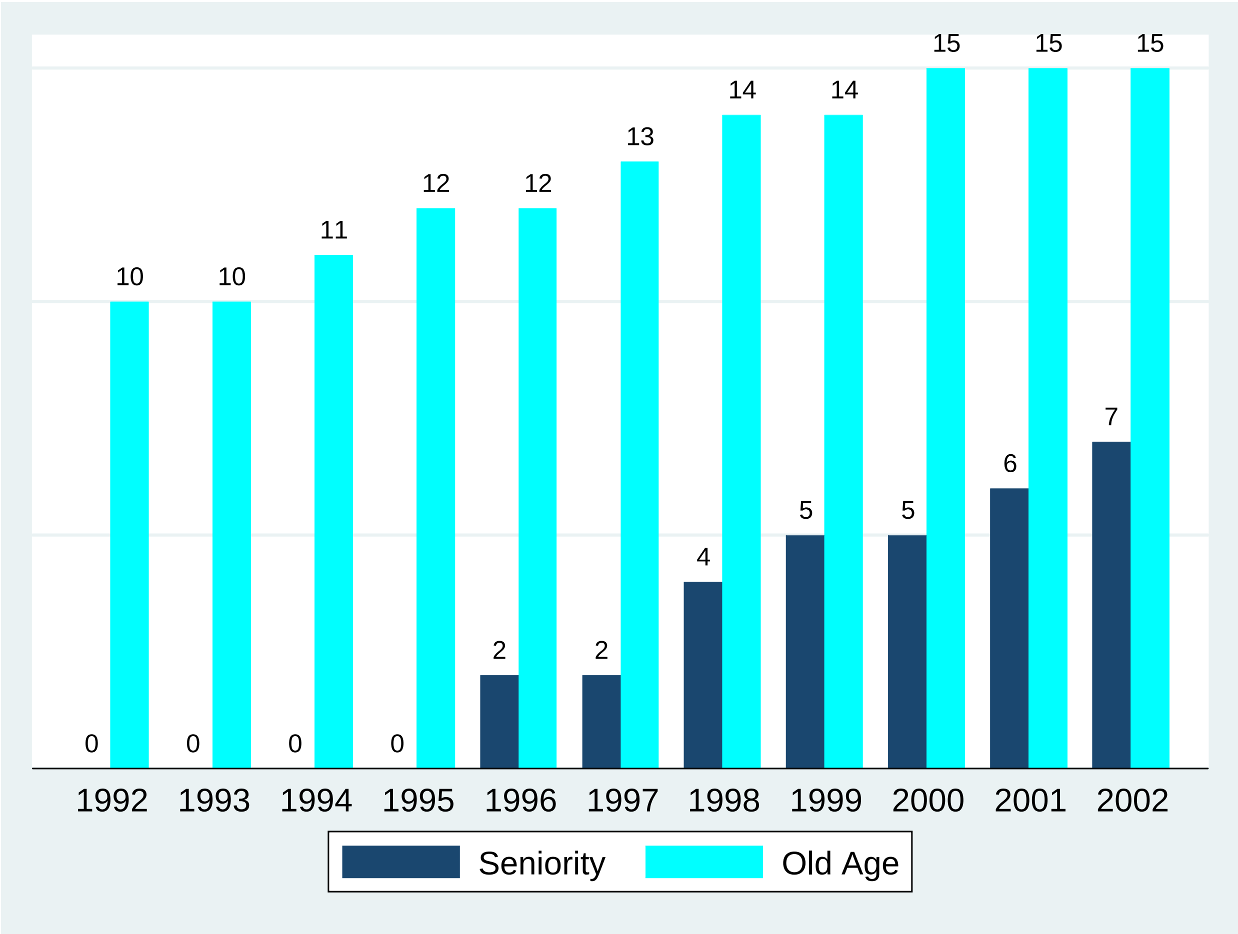


Figure 2. Stock and flow of tendered training incentives. Italy 1994-2004

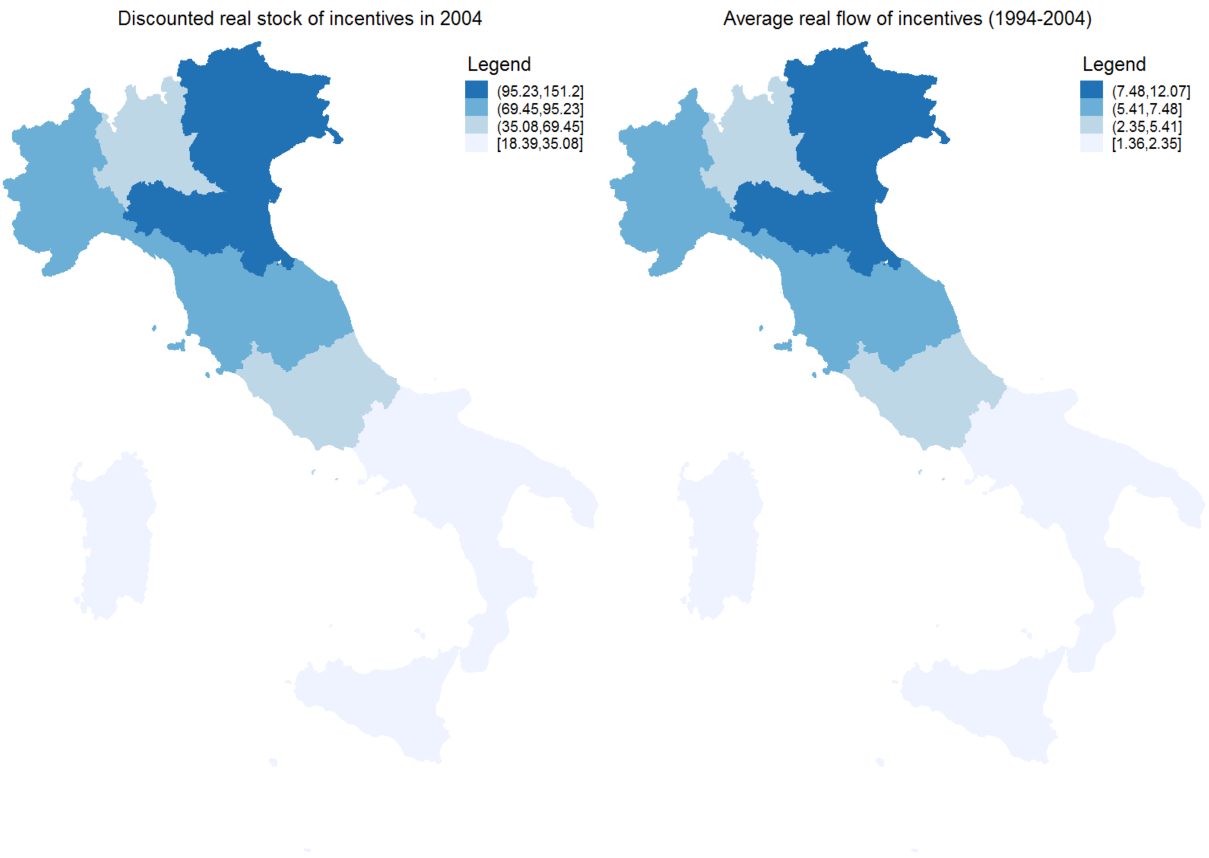
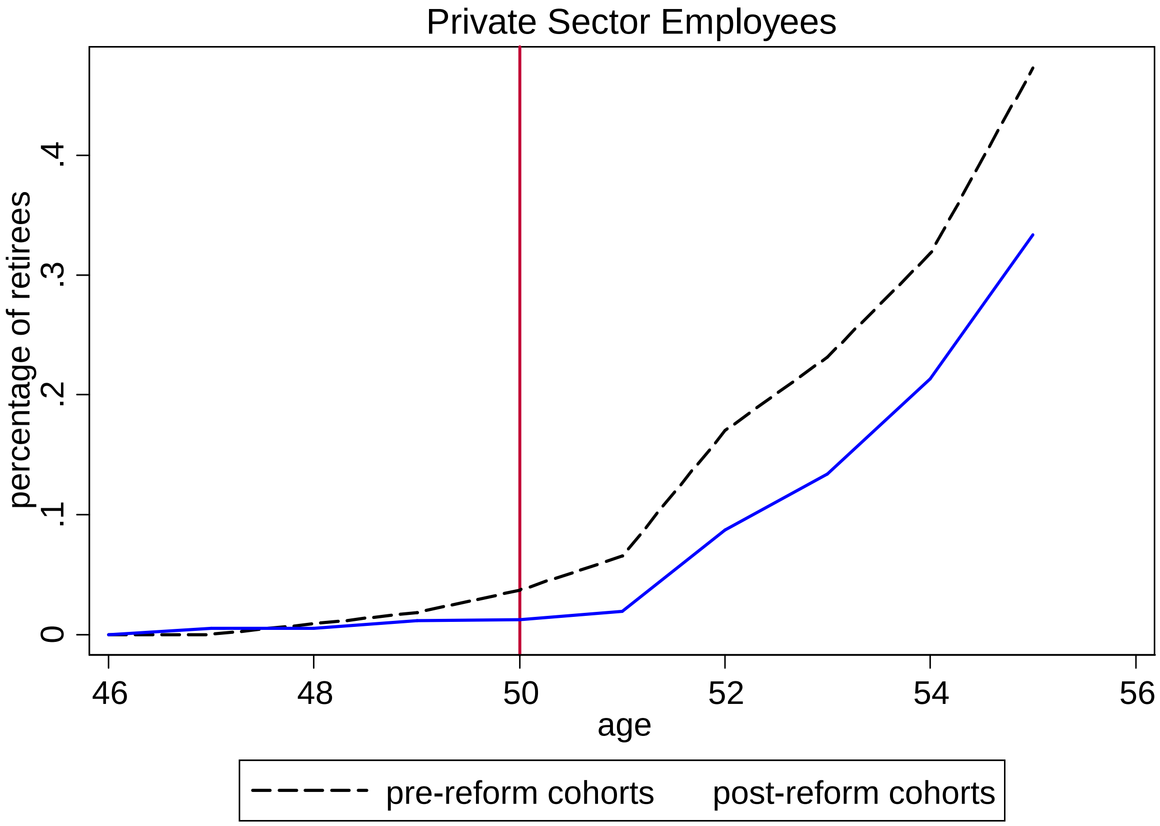


Figure 3. Age Profiles for Retirement Probabilities. By cohort of birth. Cohorts born between 1942 and 1945 (pre-reform) and between 1946 and 1950 (post-reform)



Data Source: ILFI

Figure 4. Age Profiles for Training Probabilities. By age. Cohorts born between 1942 and 1945 (pre-reform) and between 1946 and 1950 (post-reform)

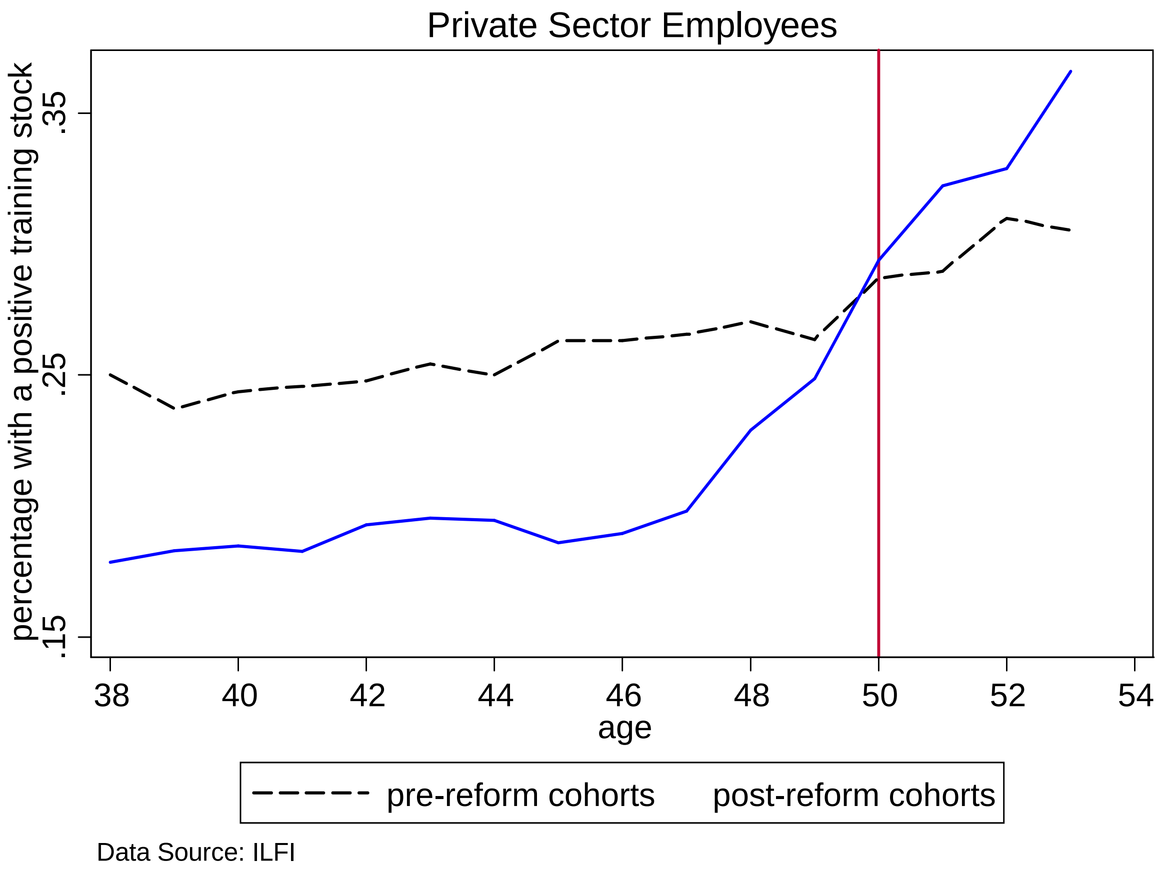


Figure 5. Average stock of training subsidies, by year and source

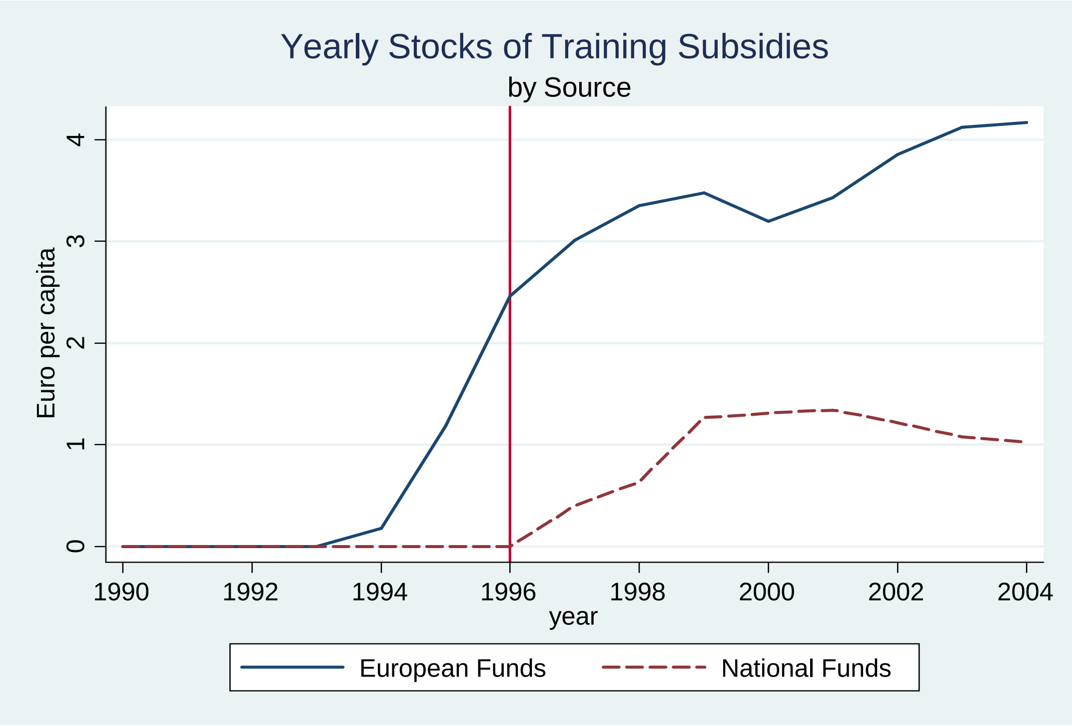


Figure 6. Regional variability (inter-quantile range) of the stock of training subsidies, by year and source

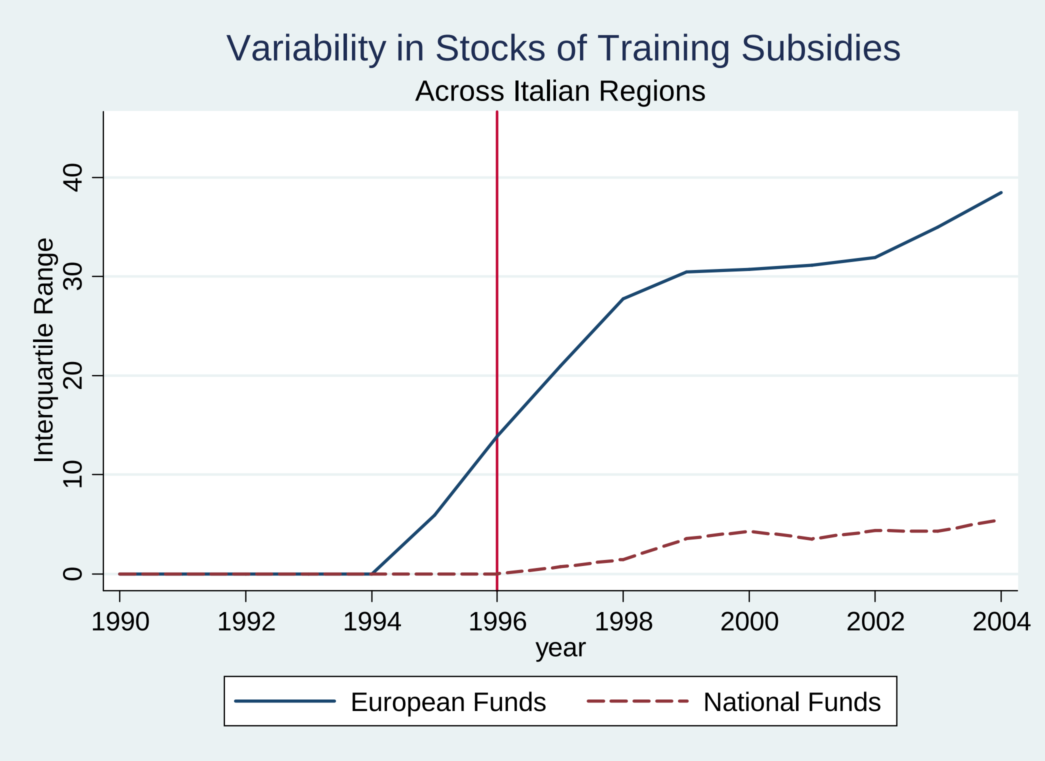


Figure 7. The relationship between Z, Q, D, R and T as implied by the economic model

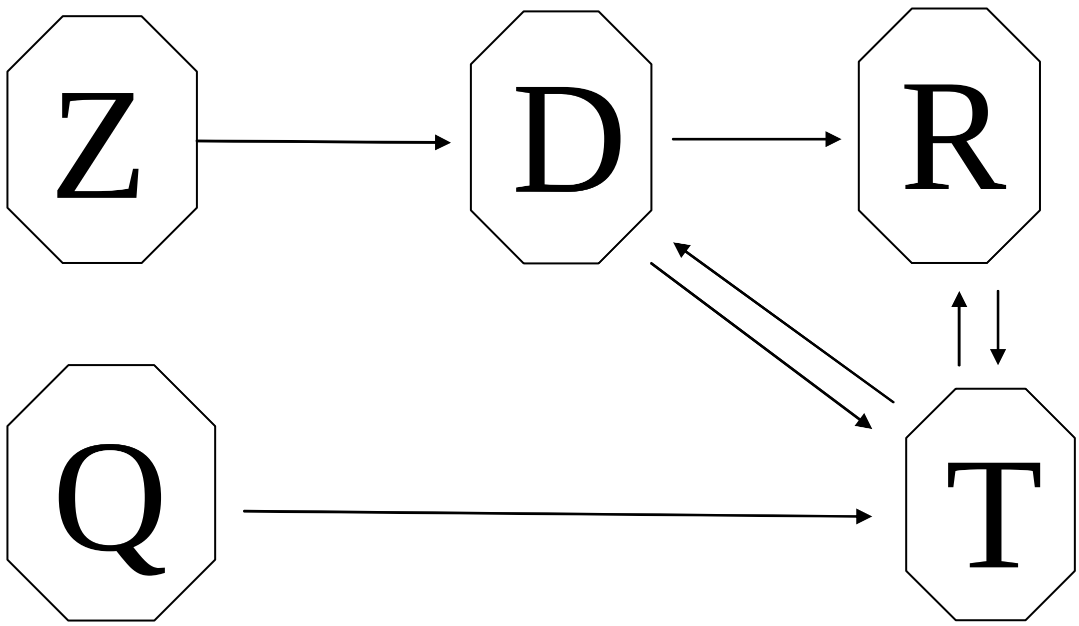


Figure 8. Age Profiles for Unemployment Probabilities. By age. Cohorts born between 1942 and 1944 (pre-reform) and between 1946 and 1950 (post-reform)

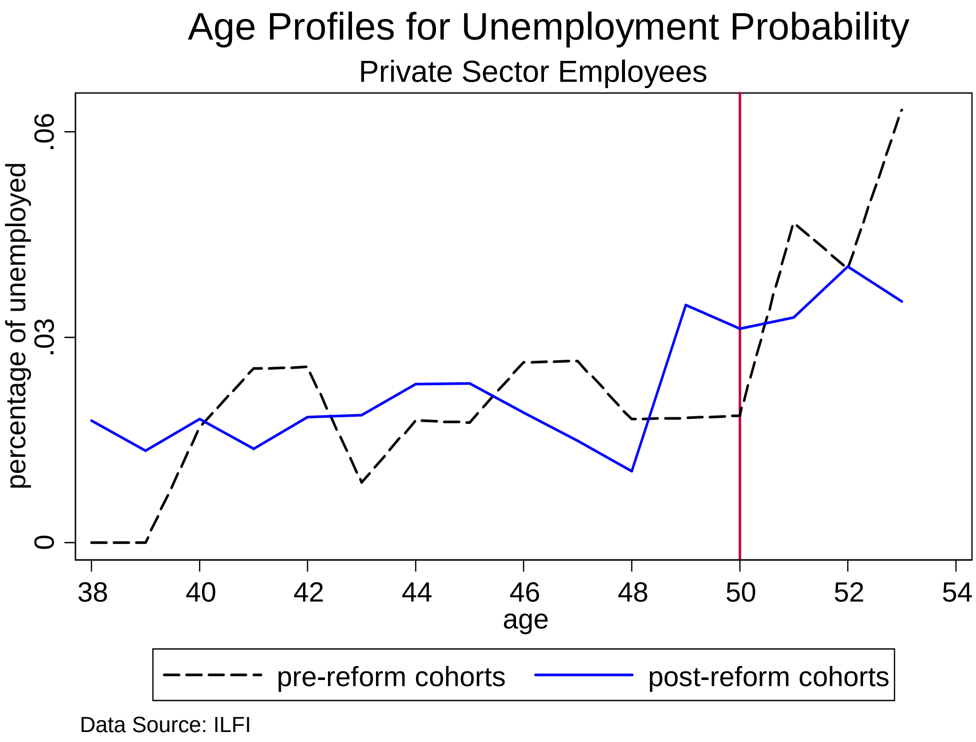


Figure 9. Age Profiles for Disposable Real Income. By age. Cohorts born between 1942 and 1944 (pre-reform) and between 1946 and 1950 (post-reform)

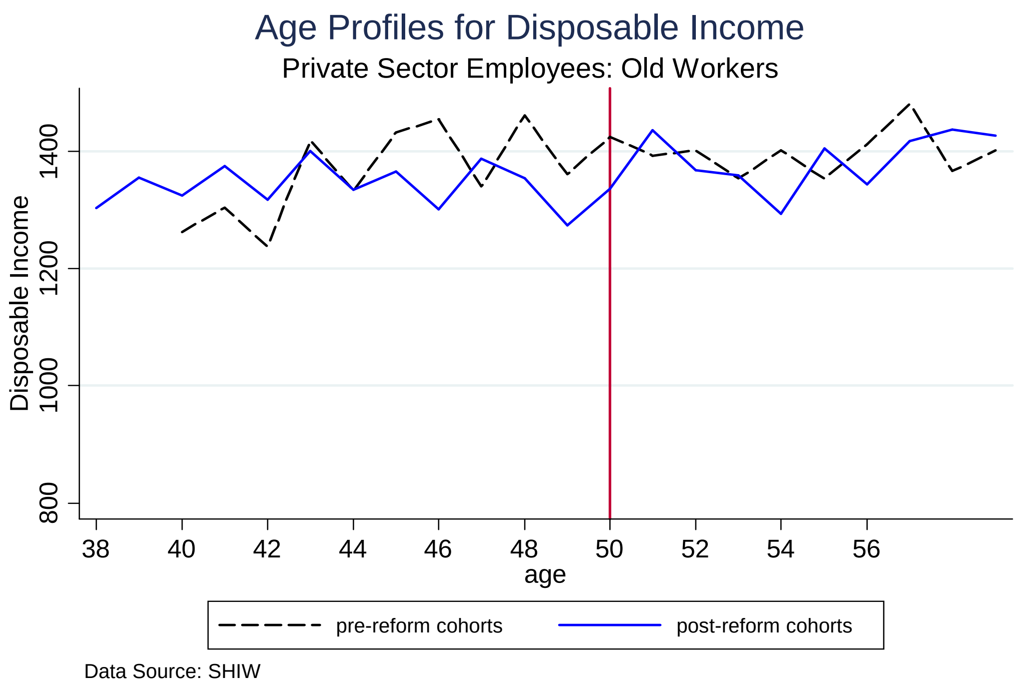


Table 1: Sample Selection Procedure

	Number of Observations	Number of Individuals
Raw data	256336	11299
Selection Criterion 1	15458	1732
Selection Criterion 2	15430	1728
Selection Criterion 3	15243	1656
Selection Criterion 4	6942	922

Raw Data: Total number of observations and individuals
Selection Criterion 1: we keep only males born between 1942 and 1950 aged 46-56 and those born between 1962 and 1970 aged 26-36.
Selection Criterion 2: we keep individuals with no missing information in the region of residence
Selection Criterion 3: we keep individuals with at least one labour spell
Selection Criterion 4: other sample selection criteria (see text)

Table 2. Summary statistics. Workers born between 1942 and 1950 and between 1962 and 1970

	Workers born between 1942 and 1950	Workers born between 1962 and 1970
Years of schooling	8.801(3.91)	10.635 (3.33)
Percentage of Retirees	0.103 (0.30)	-
Percentage of Unemployed	0.030(0.17)	.030(0.17)
Age when first job started	17.788 (4.53)	19.607 (4.32)
Training stock	1.926 (3.92)	2.177 (5.20)
Positive training stock	0.281 (0.44)	0.239 (0.42)
Stock of training incentives	16.830 (22.56)	14.303 (21.09)
Minimum retirement age	52.621 (2.58)	52.38 (2.48)
Distance to/from retirement age	2.040 (5.08)	23.46 (4.46)

Table 3. Average value of Z=(M-50)*B, by age and cohort

Age	Year of birth								
	1942	1943	1944	1945	1946	1947	1948	1949	1950
46	0	0	0	0	0	0	0	0	0
47	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0	0
50	0	0	0	0	2	2	4	4	5
51	0	0	0	2	2	5	5	5	6
52	0	0	0	0	4	4	5	5	6
53	0	0	0	4	5	5	6	7	7
54	0	0	0	5	5	6	7	7	7
55	0	0	0	0	6	7	7	7	
56	0	0	0	0	7	7	7		

Table 4. Average value of the stock of training incentives Q, by age and cohort

Age	Year of birth								
	1942	1943	1944	1945	1946	1947	1948	1949	1950
46	0	0	0	0	0	0	0.219	2.899	7.686
47	0	0	0	0	0	.080	2.326	8.114	14.108
48	0	0	0	0	0.300	3.534	7.457	12.852	20.370
49	0	0	0	0.219	3.175	9.717	13.208	18.165	29.009
50	0	0	0.229	1.917	9.453	17.549	18.986	27.096	32.380
51	0	0.211	2.611	6.075	17.90	24.975	27.565	29.793	38.278
52	0.088	1.793	7.749	12.254	25.57	33.260	30.426	36.953	43.824
53	2.592	6.910	16.481	17.796	34.21	37.706	34.666	42.606	50.302
54	8.285	13.074	24.760	26.26	38.69	40.830	43.498	47.632	55.681
55	14.949	18.168	35.505	29.25	46.078	46.826	49.955	55.864	
56	21.477	26.820	39.735	36.099	53.844	53.844	56.309		

Table 5: Retirement Equation. Reduced Form Regression

	(1)	(2)	(3)	(4)
Z	-0.0200**	-0.0171*	-0.0128*	-0.0164***
	(0.009)	(0.009)	(0.007)	(0.006)
Q	0.0031***	0.0027***	0.0014*	0.0015**
	(0.001)	(0.001)	(0.001)	(0.001)
# observations	985	2,772	568	3,739
R-squared	0.428	0.309	0.507	0.240
Unit	cells	individuals	cells	individuals
Controls	YES	YES	YES	YES
Data source	ILFI	ILFI	SHIW	SHIW
Marginal percent effect of Z	-18.30	-16.58	-5.95	-8.58
Marginal percent effect of Q	2.87	2.59	0.63	0.78
# of region by cohort clusters	100	100	117	117

Note: each regression includes regional and cohort dummies, a second order polynomial in age, years of schooling, age when the first job was started, real regional GDP per capita and unemployment rate. One, two and three stars for statistical significant at the 10, 5 and 1 percent level of confidence. Robust standard errors are clustered by region and birth cohort.

Table 6: Training Equation. Reduced Form Regression

	(1)	(2)	(3)	(4)
Z	0.0152**	-0.0060	0.0121*	-0.0024
	(0.006)	(0.011)	(0.007)	(0.008)
Q	0.0011	0.0041***	0.0016	0.0030**
	(0.001)	(0.001)	(0.001)	(0.001)
# observations	2238	1129	7074	4170
R-squared	0.428	0.309	0.520	0.240
Unit	cells	cells	individuals	individuals
Controls	YES	YES	YES	YES
Data source	ILFI	ILFI	ILFI	ILFI
Cohorts	1942-50	1962-70	1942-50	1962-70
Marginal percent effect of Z	6.49	-2.56	5.24	-1.04
Marginal percent effect of Q	0.48	1.77	0.70	1.31
# of region by cohort clusters	103	113	103	113

Note: see Table 5.

Table 7: Retirement Equation Reduced Form Regression, with heterogeneous effects. Older age cohorts. Cell data.

	ILFI data	SHIW data
Z*age50	0.0007	0.0045
	(0.006)	(0.015)
Z*age51	-0.0012	-0.0287**
	(0.007)	(0.013)
Z*age52	-0.0167**	0.0026
	(0.008)	(0.016)
Z*age53	-0.0190*	-0.0254*
	(0.010)	(0.014)
Z*age54	-0.0133	-0.0405***
	(0.011)	(0.013)
Z*age55	-0.0393***	-0.0063
	(0.013)	(0.010)
Z*age56	-0.0265*	-0.0255*
	(0.014)	(0.013)
Q*age48	0.0021**	-0.0001
	(0.001)	(0.002)
Q*age49	0.0014*	-0.0041**
	(0.001)	(0.002)
Q*age50	0.0008	0.0014
	(0.001)	(0.002)
Q*age51	0.0006	-0.0011
	(0.001)	(0.001)
Q*age52	0.0012*	-0.0007
	(0.001)	(0.001)
Q*age53	0.0021*	-0.0000
	(0.001)	(0.001)
Q*age54	0.0015	0.0020
	(0.001)	(0.001)
Q*age55	0.0056***	0.0014
	(0.002)	(0.001)
Q*age56	0.0053***	0.0032**
	(0.002)	(0.002)
# observations	985	568
R-squared	0.451	0.532
Controls	YES	YES
Cohorts	1942-50	1942-50
F-test Z	.0302	.0089
F-test Q	.0454	.0296
Clustering	region/cohort	region/cohort

Table 8: Training Equation Reduced Form Regression, with heterogeneous effects. Older and younger age cohorts. Cell data.

Older workers		Younger workers	
Z*age50	-0.0093	Z*age30	-0.0087
	(0.013)		(0.012)
Z*age51	0.0106	Z*age31	-0.0001
	(0.011)		(0.010)
Z*age52	0.0055	Z*age32	0.0057
	(0.010)		(0.011)
Z*age53	0.0231***	Z*age33	-0.0077
	(0.008)		(0.012)
Z*age54	0.0242***	Z*age34	-0.0091
	(0.008)		(0.016)
Z*age55	0.0142	Z*age35	0.0027
	(0.009)		(0.021)
Z*age56	0.0075	Z*age36	0.0024
	(0.009)		(0.035)
Q*age48	0.0028	Q*age28	0.0006
	(0.002)		(0.002)
Q*age49	0.0041***	Q*age29	0.0019
	(0.002)		(0.002)
Q*age50	0.0053**	Q*age30	0.0024
	(0.002)		(0.002)
Q*age51	0.0027	Q*age31	0.0035**
	(0.002)		(0.002)
Q*age52	0.0026	Q*age32	0.0029*
	(0.002)		(0.002)
Q*age53	0.0010	Q*age33	0.0036**
	(0.001)		(0.002)
Q*age54	0.0003	Q*age34	0.0044***
	(0.001)		(0.001)
Q*age55	0.0004	Q*age35	0.0048***
	(0.001)		(0.001)
Q*age56	-0.0005	Q*age36	0.0050***
	(0.001)		(0.001)
# observations	2,238		1,129
R-squared	0.303		0.273
Controls	YES		YES
F-test Z	.0139		.5159
F-test Q	.0435		.0025
Clustering	region/cohort		region/cohort

Table B1: Training Equation. Reduced Form Regression. Dependent variable: discounted training stock

	(1)	(2)
Z	0.143**	0.167***
	(0.068)	(0.063)
Q	0.008	0.007
	(0.012)	(0.009)
# observations	7074	2238
R-squared	0.062	0.282
Unit	Individuals	Cells
Controls	YES	YES
Data source	ILFI	ILFI
Cohorts	1942-50	1942-50
Marginal percent effect of Z	7.79	9.58
Marginal percent effect of Q	0.43	1.83
# of region by cohort clusters	103	113

Note: see Table 5.

Table B2: Distance to/from Eligibility Equation Reduced Form Regression.
with homogeneous and heterogeneous effects. Older age cohorts. Cell and individuals data.

Z	-0.2651***	-0.1482***		
	(0.086)	(0.045)		
Q	0.0287**	0.0037		
	(0.011)	(0.008)		
Z*age50			-0.2865***	-0.1541***
			(0.082)	(0.048)
Z*age51			-0.2564***	-0.1823***
			(0.074)	(0.053)
Z*age52			-0.1624***	-0.1427***
			(0.060)	(0.049)
Z*age53			-0.1584**	-0.1281**
			(0.062)	(0.049)
Z*age54			-0.1534*	-0.0722
			(0.082)	(0.052)
Z*age55			-0.2360	-0.0553
			(0.161)	(0.064)
Z*age56			-0.2785*	-0.0866
			(0.166)	(0.068)
Q*age48			0.0202	-0.0040
			(0.023)	(0.009)
Q*age49			0.0279*	-0.0076
			(0.014)	(0.007)
Q*age50			0.0359**	0.0011
			(0.017)	(0.011)
Q*age51			0.0281*	0.0051
			(0.015)	(0.010)
Q*age52			0.0230*	0.0035
			(0.014)	(0.009)
Q*age53			0.0207*	0.0049
			(0.012)	(0.008)
Q*age54			0.0164	-0.0012
			(0.010)	(0.007)
Q*age55			0.0288*	0.0012
			(0.016)	(0.007)
Q*age56			0.0307*	0.0066
			(0.016)	(0.008)
Observations	985	2,772	985	2,772
R-squared	0.863	0.902	0.862	0.902
Unit	cells	individuals	cells	individuals
Controls	YES	YES	YES	YES
Heterogeneous Effects	NO	NO	YES	YES
Cohorts	1942-1950	1942-1950	1942-1950	1942-1950
F-test Z	-	-	.0004	.0083
F-test Q	-	-	.2319	.2457
Clustering	region/cohort	region/cohort	region/cohort	region/cohort