To work or not to work? The effect of higher pension age on cardiovascular health

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Abstract

The study explores the possible unintended health effects of reforms aimed at making eligibility criteria for occupational retirement more severe. The causal link between retirement age and hospitalization for cardiovascular diseases is investigated in a large sample of male Italian retirees (N=94,521). Endogeneity is addressed by an Instrumental Variable identification strategy, in a quasi-natural experiment set-up. The instrument exploits the variation in pension age determined by the standardization of the labour market transitions, which induce workers born during the first months of the year to retire at an older age. The analysis is performed on a longitudinal dataset that combines several Italian administrative archives on pensions, working histories and hospitalization.

Results show a significant health detrimental effect of extended working life. A one-year delay in retirement increases the incidence of hospitalization for cardiovascular diseases (CVD) at 68-70 years old by 2.4 percentage points (p-value<0.01). Retirees who, during their careers, were lower income earners, mainly employed in the secondary sector and in manual occupations, are the groups paying the highest price for staying longer at work, as for them the impact of pension age on CVD is even higher. Sensitivity analyses show that results are robust to different model specifications; to the inclusion of career controls and to seasonality.

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1. INTRODUCTION

Since the 1980s, there has been a remarkable increase in life expectancy across Europe, while the duration of working life has been decreasing, causing serious financial pressures on welfare systems. As a consequence, active ageing policies have been recently put at the core of Italian and European reforms' agenda. Within this framework, European countries have started to change radically their pension systems, by promoting the labour-market participation of elder people, restricting or eliminating possibilities for early labour-market exit, and increasing the age at which people are eligible for pensions, which is now set at around 67 years old in most European countries. Moreover, further increases are expected, as some states, and Italy among them, have linked pension age to changes in life expectancy, meaning that retirement age in these countries will soon grow well beyond age 67.

In this context of major transformations, an analysis of the actual costs and benefits associated with these reforms is crucial. It is of concern that the increase in retirement age may protract the exposure to adverse working conditions, work-related stress and occupational hazards, which may deteriorate health or pushing out of the labour market vulnerable workers categories via other social welfare programmes (i.e. long term sick leaves, disability pensions, unemployment). Since the desired outcome of such reforms is indeed not only a reduction in pensions' expenditures, but also the rise in the participation rates and the extension of working life, the target of having a healthy and productive workforce is fundamental, not only for ethical reasons, but also for the important economical and societal consequences that triggering health deterioration may have.

This paper investigates the potential health consequences of rising pension age. For this purpose, we have analysed Italian administrative data on social security and hospitalization records, which allow to measure very precisely both the outcome and the age at retirement, while controlling for important career characteristics. The health outcomes that we have considered in this paper are cardiovascular diseases (CVD), which represent the first cause of death and hospitalization (after child birth) in Italy, as well as worldwide (WHO 2014, Ministero della Salute 2014). The choice of this outcome is also motivated by the fact that CVD major risk factors have been shown to be influenced by working conditions, through widely recognized behavioural and pathogenic pathways (Marmot et al. 1997; Brunner 1997; Brunner et al. 2006; Perk et a. 2012).

The existing evidence on the relationship between retirement and physical health has so far provided mixed results. Several research design issues are a likely reason for this inconsistency across studies. The identification strategy that we have proposed, which relies on an instrumental variable approach that is novel to the health-retirement literature, together with the quality of the data analysed here, address most of these concerns. The chosen instrument has several nice properties. It exploits the exogenous variability induced by the month of birth on retirement age, which follows from the general standardization observed in most of the relevant labour market transitions. Thus, it captures the variability in retirement age *within* cohorts, while also allowing to test several hypothesis on its validity.

Our results show that the probability of being hospitalized for cardiovascular diseases at 68-70 years increases with higher pension age. Delaying retirement by one year raises the likelihood of hospitalization by 2.4 percentage points ($p<0.01$). This age gradient is large relative to the 6.7 percent baseline hospitalization rate in the sample, as it corresponds to a growth of around 36 per cent. This risk is not homogenous among individuals, as disadvantaged socio-economic groups suffer the highest increase in the probabilities of experiencing the health outcome (with an estimated increase growth up to 4.4 percentage points among retirees who were employed in low wage manual occupations, $p<0.01$). Our analysis has focused on the 1937-1944 cohorts of male retirees, because, due to data availability, they are the ones for which the health outcome under study can be observed.

The rest of the paper is organized as follows. Section 2 provides a critical review of the literature more closely related to our study. Section 3 presents the data, discusses the definition of the treatment and the health outcome variables, and describes the analytical sample. Section 4 discusses the empirical strategy based on instrumental variable. Section 6 presents and discusses the findings relative to previous research and Section 7 offers concluding comments and policy implication.

2. REVIEW OF THE LITERATURE ON HEALTH AND RETIREMENT

Based on the existing literature, from a theoretical perspective it is not clear what should be the effect of retirement on health. Retirement is a major life transition, with high stressful potential because it entails a disruption of own social role, habits and identity (Atchley 1976). Postponing retirement may reduce the age-related decline of health, due to a greater exposure to cognitive and physical stimuli, social relationships and other intrinsic benefits associated to work (Jahoda et al. 1981; Warr 1987). Moreover, according to the health capital accumulation theory (Grossman, 1972), the incentives to invest in health cease to exist with retirement, because there is no more the need to keep work productivity high. On the other way around, retirement makes more leisure time available, which could be beneficial for individuals' well-being if more time is spent in enjoyable and healthy activities. Moreover, with retirement there is a relief from the exposure to physical and psychological demands associated to work, which might be harmful for health (Karasek 1990, Singrist 1996). Hence, relying solely on the existing theories, it is not possible to give a definitive prediction of what should be the relationship between retirement and health.

As we discuss below, also the available empirical evidences have not been fully conclusive so far. In this respect, differences in research designs, as well as in the definition of the exposure and the outcome variables, may explain why results are often puzzling. Depending on the health outcome that is analyzed, the association between retirement and health is different. A systematic review of longitudinal studies has found strong evidence that retirement has beneficial effects on mental health (van der Heide et al., 2013). Another stream of research has provided almost unanimous evidence of an acceleration of the decline in cognitive abilities following retirement (Dave et al. 2008; Rohwedder et al. 2010; Bonsang 2012; Mazzonna et al. 2012 and 2016). Instead, results are conflicting for physical health (for a systematic literature review, van der Heide et al., 2013). This might be due to the longer latency required for a physical health outcome (e.g. CVD and other chronic diseases) to display changes, but also to the fact that methodological issues, in the case of physical health, are more relevant.

A first source of inconsistency across studies regards the definition of the exposure variable. It is common to operationalize retirement as a dichotomous treatment, with little or no attention on retirement timing and intensity.[2] However, retirement is potentially more complex than a binary treatment, which, by construction, displays its effect in a "one off" manner regardless the age of the exposure. Moreover, different reasons for being "not in paid employment" (e.g. inactivity, voluntary, involuntary and health driven retirement) are often pooled together. This conceptualization, often driven by data constraints, might create a misclassification problem, since it mixes the effects of "heterogeneous exposures" on health. Another important issue is the type and quality of the job performed before retirement, as emerged in a few studies which have found that retirement is associated with better physical and mental health only among workers in low quality jobs (Matthews 2014; Westerlund et al. 2009; Kalousova et al. 2015).

Finally, yet importantly, identifying the causal effect of retirement on health is problematic due to the potential endogeneity of retirement. Retirement can be driven by health conditions, as people in bad health might tend to retire earlier. Thus, observing poor health after retirement might not be the effect, but the cause of retirement (Behncke 2012). The studies that have attempted to identify the causal effects of retirement on health have used different strategies to overcome this empirical challenge, often providing contradictory evidence. Limiting our attention to studies on physical health outcomes (self-assessed general health, mortality, chronic diseases), those that adopted a longitudinal design and controlled for confounding factors have generally found negative health effects of retirement (Morris et al., 1994; Dave et al., 2008; Bamia et al., 2007; Moon et al. 2012; Wu et al. 2016). Instead, studies that adopted a quasi-natural experiment set-up (IV, RDD) have generally found that the effect of retirement on health is either beneficial (Coe et al. 2011; Inlser 2014; Eibnich 2015 Bound et al. 2007) or null (Hernaes et al. 2013; Johnson et al. 2009; Behncke 2012).

In this paper, we have overcome several problems and limitations which typically arise when studying the health-retirement relationship, contributing to the literature in several aspects. We have studied the impact of the *age at retirement* on health, as rising minimum pension age

[2] Among the exceptions, there are the works by Harnaes et al. (2013), who has focused on the impact of retirement age on mortality, and by Mazzonna et al. (2012, 2016), who has looked at the effect of time spent in retirement on cognitive abilities.

is the main objective of most of the recent pension reforms. To solve the problem of endogeneity, we have adopted a novel approach, exploiting the exogenous variability in retirement age induced by the month of birth. To the best of our knowledge, this is the first time that birth month is used as instrument in the retirement-health literature. This approach has several advantages, which are discussed in more detail in Section 1.4.2. By using Italian administrative data on social security and hospitalization records, we have been able to measure precisely both the outcome and the age at retirement, while controlling for important career characteristics. Finally, we have considered occupational retirement alone, limiting the problem of mixing the exposition variable, which usually arises from pooling together different reasons for retirement.

3. DATA AND VARIABLES DEFINITION

This study is based on WHIP&Health, a longitudinal database on work and health histories in Italy built upon administrative records drawn from the National Social Security Institute (INPS) and the national archive on Hospital Discharge Data (Bena et al. 2012). The INPS insures approximately 23 million workers, representing more than 80 per cent of the workforce in Italy. By means of a unique individual identifier, we linked a 7 per cent random sample, taken from the social security archive on the whole careers of employed and self-employed private sector workers, to the national archive on hospitalization events registered in all private and public Italian hospitals.

THE TREATMENT

Our treatment variable is "retirement age", i.e. the actual age at which the individual starts officially receiving an old age pension or a seniority pension benefit from the Italian Social Security Institute (INPS). This is operationalized as

$$Pension\ age = (Date\ of\ First\ \ Pension\ Flow - Date\ of\ Birth)/365{,}25$$

We adopted an administrative definition of retirement, and we focused only on occupational retirement, in the attempt of overcoming some of the limitations previously discussed. Indeed, defining retirement as anyone who is not in the paid labour force has the main pitfall of mixing occupational retirement with unemployment, inactivity, and disability pension, which may all have independent effects on health[3]. Moreover, an administrative definition of retirement has

[3] In fact, the presence of a disabling health condition is a formal requirement for a disability pension; unemployment is a major stressful life event linked to inflammatory processes leading to ill-health (Hughes et al. 2015), increased risk of depression (Paul and Moser, 2009), all-cause mortality (Roelfs et al. 2011) and coronary heart disease (Ardito et al. 2016). Moreover, bad health is among the factors favoring early withdrawal from the labour market (McGarry 2004; Ranzi et al. 2011).

the advantages of not suffering from the possible biases typical of self-reported measures (recall bias, justification bias, and adherence to social norms) (Currie et al. 1999).

A pure administrative definition of retirement however has also limitations. Retirement is a more complex life and labour market transition than starting receiving a pension flow. The borders of this transition are not always sharp, and retirement may occur through an array of heterogeneous "bumpy" (Contini and Leombruni 2006) or "gradual" pathways (Bloemen et al. 2016; Eurofound 2016). Workers may not enter into retirement abruptly, but rather through an intermediate transition into other programmes, e.g. disability and unemployment benefits, or after reducing gradually their labour participation.

THE HEALTH OUTCOME

The archive on hospital dismissal is based on the systematic collection at the national level, by the Italian Ministry of Health, of the regional archives of hospital admissions (*Schede di Dimissione Ospedaliera, SDO*). This archive contains information for years 2001-2014 about all patients admitted to public or private hospitals in Italy, including the diagnosis at the moment of the discharge from the hospital, codified according ICD disease codes (ICD-IX)[4].

The present paper investigates the risk associated to retirement age and cardiovascular diseases (CVD), a group of diseases that includes myocardial infarction and other acute or chronic forms of coronary heart diseases (ICD-IX 410–414) and stroke (ICD-IX 430-438). The outcome is operationalized as an incidence. That is, it is a dichotomous variable defined on the population of individuals who were never hospitalized for cardiovascular diseases between the age 64 and the age 67. It takes value one if the individual had a first occurrence of CVD hospitalization at 68-70 years old, and zero if the individual had no CVD in that age range. In this way, we keep constant, among all the individuals and among all the birth cohorts, the age-window to observe the first occurrence of the outcome (at 68-70 years old) and the "baseline" window to drop out individuals who already had a previous CVD (at 64-67 years old). A caveat with this data source is that we only observe hospitalizations for the years 2001-2014; hence, we cannot exclude the possibility that a minority of our first CVD events are recurrent ones, for it might be that a small proportion of individuals had a CVD before age of 64.[5] Nevertheless, under this data limitation, this way of defining the outcome offers the advantage of not

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[4] ICD-9-CM is the ninth version of the International Classification of Diseases, adopted in 1975 by the World Health Organization. This is the classification adopted by Italian Ministry of Health to codify diagnosis and procedures included in the Hospital Discharge Data (Scheda di Dimissione Ospedaliera , SDO). For more detail visit the page: http://www.salute.gov.it/portale/temi/p2_6.jsp?lingua=italiano&id=1277&area=ricoveriOspedalieri&menu=classificazione

[5] Based on our database of CVD hospitalizations, only around 5 per cent of recurring episodes happened after four or more years from the previous hospitalization. This figure was computed using all (first and subsequent) CVD events occurred in Italy between 2007 and 2014.

generating any correlation between birth cohorts and the probability of having the outcome, which is instead induced when using windows of observation of different length for different cohorts (Herneas 2013).

CVD hospitalization is a health indicator based on the assessment of hospital physicians, thus it is free from some of the typical biases associated to self-reported measures, like the "justification bias". Indeed, previous contributions have documented that unemployed, retirees and inactive individuals tend to justify their exit from the labour market emphasizing the importance of their health conditions, even if the decision was to some extent motivated by financial considerations or by a relative preference for leisure (Bound 1991; Kapteyn et al. 2007; Kerkhofs et al. 1995). Moreover, CVD hospitalization is a severe health outcome, reducing the potential biases associated to care seeking behaviors and social gradient in the utilization of medical care (Van Doorslaer et al., 2000).

Nevertheless, also a measure based on administrative records for CVD hospitalization is not free of limitations. There exists the possibility that a number of CVD events have not been recorded, as it happens for example with the so-called silent or unrecognized myocardial infarction[6] or when the person dies before hospitalization. Moreover, there might be some quality difference between hospitals that may translate in a more or less rigorous compilation of hospital discharges records. However, although some possibility of misclassification yet exists, Italian hospital discharge data have been proven to be a valid and reliable tool for public health surveillance (Leone et al. 2004; Palmieri et al. 2007; Leombruni et al. 2010). Furthermore, the instrumental variable design prevents the problem of a systematic measurement error that may bias the estimate.

SAMPLE SELECTION & SUMMARY STATISTICS

Since we are interested in analysing the impact of retirement age on the probability of being hospitalized for CVD at 68-70 years old, we selected from the social security archives, only males born in Italy in years 1937-1944 who received an occupational pension between 1985 and 2012. In this way, we eliminated all the persons who received any disability or early-retirement pensions (N= 106,934)[7]. We then further selected who at the age of 68 was retired (>99 per cent), alive (>90 per cent) and with no CVD in the previous four years (>88 per cent). We obtained a final sample of 94,521 retirees, which constituted our first sample of analyses,

[6] An unrecognized myocardial infarction is defined as asymptomatic or associated with minor or unusual symptoms. Estimates based on a recent literature review suggest that up to 6 per cent of the general elderly population have experienced one (Valensi et al. 2011). However, prevalence vary widely between study populations. For example, silent myocardial ischaemia affects 20–35 per cent of diabetes patients (Rydén et al. 2013).

[7] In Italy, early retirement schemes have been widely used during the 80s and the 90s, as a legal instrument offered to manufactory firms under financial constrains to favour turnover of older workers, hence early retirement was essentially used to replace unemployment.

described in the first column of Table 1. The sample is rather representative of the general population of Italian private sector retirees, as confirmed by comparing our data with official statistics obtained on the census of retirees. For example, over all the occupational pensions paid to men retirees at the 31st December 2012, the average pension benefit was 1,008 euro (in 2005 prices), the average proportion of seniority pensions was 70 per cent and the proportion of individuals insured in the Employee funds was 63.3 per cent.[8]

For the subsample of retirees who were employed in 1985, we could observe also their late career, since starting from the year 1985 the dataset includes also detailed information on job spells. Hence for retirees employed at 1985 it was possible to investigate the association between pension age and CVD controlling also for a set of career variables. This subsample of retirees constituted our second sample of analysis (N= 50,854) and is described in the second column of Table 1. They are certainly not a random sample of the whole retirees, as they were selected for being "in employment". Therefore, they are likely to have different characteristics with respect to the retirees who were already out of employment in 1985.

In the last column of Table 1, we reported the results of the hypothesis test that the two samples means were equal between the sample of individuals with job spells after 1985, and individuals without an observable work history. It emerges that retirees who were employed after 1985 were a few months younger than the retirees who stopped working before 1985, they had greater labour market attachment, as shown by higher levels of contributions and pension benefit. They also retired more often via a seniority pension, a type of pension stream for which the most relevant eligibility criteria is years of contribution rather than age, and they retired on average two years earlier. However, importantly, both the incidence and the prevalence of CVD were statistically the same in the two groups. All the subsequent analyses will be based on these two final samples, denoted from now on as "All retirees" and retirees "Employed after 1985".

[8] Authors' elaborations based on (INPS 2013, p. 243, 261 and 262).

Table 1 Description of the Final sample

		All retirees mean (sd)	Employed mean(sd)	Test Equal means
Demographics	Age (at 2001)	60.14(2.29)	60.06(2.29)	-0.175***
	Birth region: North (%)	0.44	0.46	0.041***
	Centre (%)	0.16	0.16	-0.0008
	South (%)	0.40	0.38	-0.04***
Characteristics at Retirement	Pension Age	59.26(4.86)	58.21(4.77)	-2.281***
	Pension year	2000(5.16)	1999(5.07)	-2.073***
	Employees fund (%)	0.60	0.88	0.614***
	Seniority pension (%)	0.72	0.79	0.159***
	Contributions (Yrs)	31.76(9.17)	33.91(6.34)	4.667***
	Monthly Pension (€,real)	1,071(712.61)	1,396(744.02	703.29***
CVD	Incidence at 68-70	0.07	0.07	0.0007
Career characteristics	Manual Occupation		0.68	
	Contributions at 52 (Yrs)		28.72(7.28)	
	Annual wage (€,real)		23,481(16,360)	
	Services sector		0.68	
	Industry sector		0.31	
	#Obs.	94,521	50,854	

*Note: Pension benefit and monthly wage are real, at 2005 price. T-test for the hypothesis that the subsamples of retirees who were and who were not employed after 1985 have equal means. The difference between the samples means and the significance level is reported. Legend: * p<.10, ** p<.05, *** p<.01*

4. EMPIRICAL STRATEGY

ENDOGENEITY ISSUES

We want to study the effect of age at retirement x_i (continuous) on a measure of health y_i (CVD hospitalization), controlling for a set of covariates W_i. In particular, we want to estimate the following linear model

$$y_i = \beta_0 + \beta_1 x_i + W_i + u_i \quad (1)$$

However, there are several reasons why retirement age might be correlated with the unobservable error term, u_i, producing biases of different signs.

The problem of simultaneous causality must be remarked at the outset. If prior poor health is positively correlated with successive incidence of health outcomes, and negatively correlated with actual pension age, since it induces individuals to anticipate retirement, this imposes a negative bias to our coefficient β_1. This type of bias, usually denoted as a "healthy worker effect", was very common to most of the literature during the nineties, yielding a misleading picture of how health evolves with retirement. Indeed, ignoring the fact that workers in better health are more likely to survive and to continue to work, and simply comparing the health of retired against that of workers, has usually led to the finding of worst health among retirees than in the employed population (Maimaris et al., 2010; Shim et al. 2013; Ranzi et al. 2013 for Italy).

A second identification problem is given by the fact that the association between retirement age and bad health might reflect a purely spurious association, if an unobservable third factor correlates with both health and the time of retirement. For example, people with economic constraints might prefer to work longer, and at the same time, their economic disadvantage is probably correlated with bad health, according to the well-known socio-economic gradient of health (Marmot 2005), leading to a positive bias of the estimated coefficient.

A third problem is that age of retirement may be measured with errors, since it may occur that some periods before retirement are spent out of the labour market voluntarily, waiting for an age eligibility criteria, or in various unemployment, partial unemployment or disability benefit schemes. This would result in an "actual" retirement age that is lower, and simply looking at the official date at which a person starts receiving a pension flow might lead to a measurement error. The error could be correlated with health if, for example, people with some medical conditions tend to exhibit higher unemployment or inactivity before achieving the pension eligibility, which means that the estimated coefficient would again be biased up.

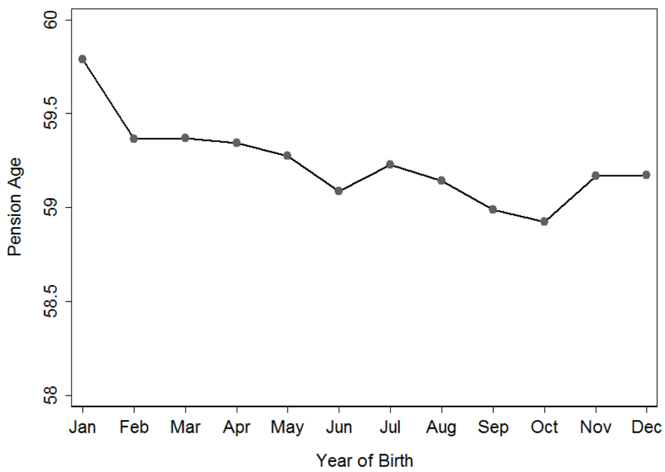
In conclusion, because of these opposing signs of bias, it is not possible a priori to define a direction to the overall bias that would affect the estimated retirement age coefficient by adopting an OLS model. However, since it is common among studies where there were few or no controls for endogeneity to find out that retirement was associated with worsening health conditions, this might suggest a possible predominant role of a downward bias.

TWO-STAGE LEAST SQUARES INSTRUMENTAL VARIABLE

In order to estimate the causal relationship between pension age and the subsequent risk of CVD, we implemented a Two-Stage Least Squares Instrumental Variable (TSLS-IV) estimation strategy, exploiting the variation in the retirement age induced by birth month. The IV strategy relies on the discontinuity in retirement age that arises from an exogenous factor that does affect CVD only through pension age. The proposed instrument is based on birth month. To the best of our knowledge, it is the first time that this kind of instrument is adopted in the literature on the health effects of retirement.

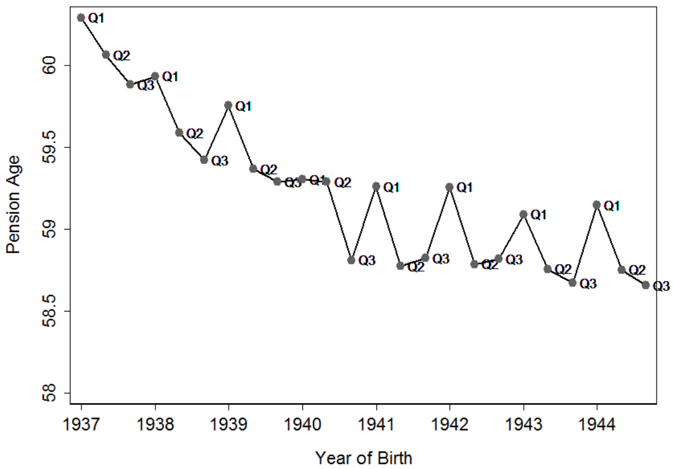
The instrument, which is operationalized as a variable taking value one for individuals born in the first four months of the year, has several nice properties. To begin with, it is relevant, in the sense that it influences positively and significantly the age of retirement. As a preliminary graphical evidence shows, there is an almost perfect linear (unconditional) correlation between retirement age and month of birth, with January being the month with highest pension age (Figure 1). This association is confirmed also once we condition on year of birth (as well as in the fully adjusted IV model, Table 2). Among all the cohorts (but with the partial exception of the 1940 one), individuals born in the first months of the year have the highest retirement age. In Figure 2 we have combined the birth months by groups of four (*i.e. quadrimester*). It emerges a clear "zig zag" pattern, with individuals born in the first quadrimester (Q1) that have consistently higher retirement age than the individuals born in the next months.

Figure 1 Pension age by month of birth



Notes: Final sample of analysis (Retirees employed in 1985, N =50,854)

Figure 2 Pension age by quadrimester of birth



Notes: Final sample of analysis (Retirees employed in 1985, N =50,854)

We suggest that the main mechanism inducing this positive relation between retirement age and birth month is the high level of "standardization" of the main labour market transitions faced by individuals throughout the life course, e.g. entry in school, school-to-work and work-to-retirement transitions. Indeed, typically school entry and leave dates (September and June), or job contracts start (January) and end (December) dates are the same, irrespective of the individual month of birth. While education timing is related to the "school year", firms rely on the "fiscal year" for the activation and termination of contracts, which in most of the cases tend to be opened in January and closed in December (Leombruni and Quaranta, 2002). This implies that individuals born earlier in the year begin the school, enter in the labour market and retire at an older age. Job contracts tend to have typically standardized timing, as they tend to start at the beginning of the calendar year and to expire at the end of it following the fiscal year, which in Italy starts in January and ends in December. This produces in turn further tendencies toward a standardization of seniority contributions among members of the same cohort. Thus, individuals born earlier in the year will tend to reach the minimum contribution requirements for occupational pensions at an older age, with respect to individuals born later in the year.

The crucial advantage of using the birth-month instrument is that it allows capturing the (exogenous) variability in pension age *within* cohorts. Traditional approaches, which exploit changes in pension eligibility thresholds as a source of discontinuity in the probability of retirement, typically rely on parallel trend assumptions in health among cohorts, which may be difficult to justify in the context of improving health conditions across time. Moreover, the presence of heterogeneous responses to the policy change provides a further reason why, in the present context, the chosen instrument is to be preferred over the standard IV or RDD design considering as exogenous the discontinuity in the probability of retirement induced by changes in the eligibility rules. In fact, one of the crucial assumptions for a correct and interpretable identification of the LATE, both in IV (Imbens and Angrist 1994) and RDD (Hahn et al. 2001) study designs, is monotonicity. Monotonicity requires that when the age eligibility requirements are, for example, postponed, either all the workers will tend to anticipate or they will tend to postpone retirement ("no defiers" condition). Since the effect of retirement on physical health is probably not homogeneous in the population, due to the important differences in terms of career exposures, socio economic, individual and family resources among individuals, the plausibility of the monotonicity assumption, although not often discussed,[9] is a fundamental one. Indeed, in case of its violation the estimate of the average treatment effect can be biased (Imbens et al. 1994).

In the Italian context, the changes occurred in eligibility rules across time have been characterized by high levels of non-compliance (Brugiavini and Peracchi 2012, Franco et al. 2002; Santoro 2006), as also documented in the previous chapter of this thesis. Indeed, in Italy the pension reforms implemented throughout the 1990s, which are the relevant ones for the years covered by our analysis, have targeted different portions of the population at different points in time, leaving individuals non negligible time and freedom to adjust their labour supply. The first 1992 pension reform initially raised the minimum old age from 60 to 65, and only a few years later the seniority requirements were increased from 35 to 37 years of contribution, and even later a minimum binding age for seniority pension was introduced (INPS 2013). This fragmented implementation have induced anticipation and escape mechanisms among portions of the Italian elderly workforce which undermine the plausibility of the validity of the monotonicity of the response to such policy change. To overcome this important

[9] Among relevant exceptions, it is worth mentioning the work of Bertoni et al. (2016), who have assumed the monotonicity condition implicitly satisfied in their analysis and Mazzonna and Peracchi (2016) also assumed no anticipation effects, although, as we will discuss, evidence for Italy suggest that the opposite is true.

limitation, we propose to use a different instrument, by relying on a source of variation that is persistent and similar across cohorts. Moreover, the evidence provided by Figures 1 and 2 suggests that the sign of the correlation between birth month and retirement age is similar across all cohorts. Therefore, monotonicity seems to be a safer assumption in the present context.

Yet, the birth-month instrument rises some concerns. In particular, the estimate might be biased if any effect on being born in the first quadrimester on old-age cardiovascular health may run through not only pension age, but also through other factors affecting health. This could be the case if the probability of CVD was correlated with season of birth. Moreover, there is the risk that children birth month is correlated with background characteristics of the family of origin, as suggested by Buckles and Hungerman (2013). Finally, month of birth also influences age at school entry and previous works have documented its role on educational attainment, earnings and other later labour market outcomes (Angrist 1991; Plug 2001; Black et al. 2011). All these possible source of biases will be discussed and tested in Section 1.5.2.

5. Results

Table 2 shows the IV-2SLS estimates[10] of the effect of retirement age on the incidence of CVD hospitalization. Each column represents a separate regression, with a different set of controls. For each regression, only the estimated coefficient of pension age is reported (the full output and first stage regression are reported in the Appendix in Tables A 2.1 and A 2.2), together with some relevant statistic, i.e. the average incidence of the outcome, the sample size and, as a diagnostic of the quality of the IV procedure, the Kleibergen-Paap (2006) test. This test is used to measure whether the instruments are weak, i.e whether the instruments are only poorly correlated with the endogenous regressor. The null hypothesis is that the effects of the excluded instruments are jointly equal to zero once that the endogenous regressor is conditioned on the controls included in the model. According to a standard rule of thumb proposed by Staiger and Stock (1997), an instrument should be considered weak if the first-stage F-statistic is less than ten. However, according to the F-test critical values calculated by Stock and Yogo (2005) for one single endogenous regression, also values lower than sixteen are suggestive of poor performance.

[10] Analysis are performed with Stata11 using the command ivreg2 for the estimation of the IV-2SLS model (Baum et al. 2010).

Table 2 Effect of pension age on CVD hospitalization incidence at 68-70 years old (TSLS)

	(1) All retirees	(2) Employed after 1985	(3) Employed after 1985
	0.029*** (0.009,0.049)	0.032** (0.007,0.056)	0.024*** (0.007,0.041)
Years FE	Yes	Yes	Yes
Regions FE	Yes	Yes	Yes
Previous career	No	No	Yes
Z	Q1	Q1	Q1
First stage estimate	0.185***	0.210***	0.278***
Kleibergen-Paap test	38	29	122
#Obs.	94,521	50,854	50,854
CVD incidence	0.066	0.066	0.066

*Notes: Each column represents IV estimate and 95% CI from separate regression. Model 1 and 2 include year and region of birth dummy variables. Model 3 adds controls for, log of wage, years of contribution and dummy for sector of activity. Legend: * p<.10, ** p<.05, *** p<.01*

In the first column, the analysis is run over the whole sample of retirees, and the included controls are dummies for region and year of birth. In this context, it is important to include region fixed effects since geographic distribution of births may vary across the year, and such cross-sectional variation may contribute to seasonality (Buckles and Hungerman, 2013). The IV estimated a highly significant ($p<0.01$) coefficient of 0.029, meaning that for an additional year of age at retirement, the incidence of CVD hospitalization at 68-70 years old increased by 2.9 percent points. The F-test is greater than 30, suggesting that our instrument is performing quite well. In the subsequent column, we replicated the same specification on the subsample of retirees who were still employed at 1985, which implied a reduction of slightly less than 50 per cent of the observations. The point estimates resulted higher in size, but the 95 per cent confidence interval almost perfectly overlapped, suggesting that the two are not significantly different.

In the last column, considering the sample of retirees still employed at 1985, we added the career controls variable, which likely correlate with both pension age and CVD incidence. However, unless they also correlate with birth month, their inclusion should only improve the efficiency of the estimates, without affecting significantly the point estimate of the coefficient of interest. As additional controls, we included a full set of dummies for the sector of activity, the occupation, the total weeks of seniority contributions paid up to 52 years old (measured in year-equivalent terms) and the average annual wage, computed using all the job spells from 1985 to retirement. The inclusion of career controls did not alter significantly our main result and confirmed that retirement at older age is associated significantly to an increase in the incidence of CVD hospitalization, by around 2.4 percent point. The point estimate only reduced marginally in size with respect to the specification without additional controls, but it gained more precision, as showed by smaller confidence intervals overlapping with those of column

(2). The inclusion of additional controls improves the instrument performance in the first stage regression, as shown by a Kleibergen-Paap F-test equal to 122. Since the last specification performed better, and it controls for important individual characteristics, we adopted it as our preferred baseline regression.

ROBUSTNESS

Over the sample of retirees who were still at work in 1985, we run a series of sensitivity checks aimed at testing the robustness of our point estimate and the validity of our instrument. The results of these tests are provided in Table 3, where the first column reports the baseline results for comparison.

As a first robustness check, we changed the probability model, relaxing the assumption of linearity and fitting an IV probit model to the data (column 2). In this case, the marginal effect of pension age on CVD is 0.028, suggesting that higher pension age is associated to an increase in the probability of hospitalization for CVD of 2.8 percent points, an amount very close to the baseline estimated effect.

Table 3 Robustness of the Effect of Retirement Age on CVD Hospitalization to different specifications (TSLS)

	(1) Base	(2) IV Probit	(3) Overidentified	(4) Seasonality	(5) Discontinuity sample
	0.024*** (0.007,0.041)	0.028*** (0.075,0.258)	0.027*** (0.012,0.042)	0.031*** (0.011,0.050)	0.031** (0.006,0.055)
Z	Q1	Q1	Q2, Q3	Q1	Q1
F-test	122		74	92	53
J-test (p)			0.435		
#Obs.	50,854	50,854	50,854	50,854	10,168

*Notes: Each column presents IV estimate and robust 95%CI from separate regressions. All models include year and region of birth dummies, log of wage, years of contribution and sector of activity dummies. Qn is the instrument, dummy for being born in the n^{th} quadrimester; F-test stands for Kleibergen-Paap test. J-test stands for Sargan-Hansen J-test test. Legend: * p<.10, ** p<.05, *** p<.01*

In column (3), we exploited the possibility of using two instruments. Instead of the indicator for being born in the first four month of the year, we used separate dummies for individuals born in the second and the third quadrimester of the year. Results are almost unaffected. According to this specification, the incidence of CVD increased significantly by 2.7 percent points for any additional year of work. Since in this case we have used two instruments for one endogenous regressor, we could check the exogeneity of our instruments, by means of the Sargan-Hansen J-test test (1985). This is a test of overidentifying restrictions, which is consistent also in the presence of heteroskedasticity. The joint null hypothesis is that both the instruments are uncorrelated with the error term, under the assumption that at least one of them is actually exogenous[11]. The p-value of the J statistic is very high (0.435), suggesting that the null hypothesis of exogeneity cannot be rejected and improving our confidence in that the instrument is indeed valid.

We then assess whether seasonality influence our estimates by including among the controls the average monthly temperature at birth (Column 5) and we minimize the risk that unobservable factors (such as family background or exposure to different climates) are correlated with birth month by restricting the sample only to individuals born in the months of December and January (Column 6). One standard critique to the birth month instrument is actually that it might capture the effects of factors such as exposure to different climate, family background and schooling effects, which in turn are associated with a variety of later outcomes, including health (Buckles and Hungerman, 2013). It is indeed well established that early life conditions (Gluckman et al. 2008; Kelly et al. Bartley et al. 2012), as well as climate at birth, may have long lasting effects on future health (WHO 2012; Xu et al. 2012; Pezzoli et al. 2016). With regard to family characteristics, the concern arises from the observation of important seasonal changes in the socioeconomic characteristics of women giving birth. Buckles and Hungerman (2013) have shown that in USA better off mothers are more likely to give birth in non-winter months.

Even though these two different type of early life exposures (weather and family background) were present, we believe that in our context this would not led to a failure of the independence assumption. In fact, as shown by Figure 1, the instrument (being born in the first quadrimester) is mostly driven by the differences between people born in January and December. However, since January and December are contiguous months, they share very similar whether and climate conditions, as evident when looking at the average climate temperatures by months (see Figure 3). The seasonal pattern is well represented by a reverse-u, which is different from the quasi-linear relationship that we observed between pension age and birth month in our data. Hence, while January and December correspond to the two extremes of the pension age gradient, there is not correspondence of such discontinuity in the climate conditions, as January-December are actually contiguous and are among the coldest months of the year.

This reasoning can be extended also to the potential issue related to better-off mothers sorting into non-winter months, since both the months are indeed “winter months”. Furthermore, although we cannot exclude that a woman might prefer giving birth in a specific period of the year also in Italy[12]; it is unlikely for her to systematically target the month in which to give birth, especially for the advancement of medical science in the years 1933-1944.

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[11] Evidences in support of the instrument independence assumption, i.e. that the effect of birth month only affect CVD through the pension age not through other factors (e.g. weather conditions, family background and school entry age) is provided later.

[12] To the best of my knowledge, there are not yet evidences showing this.

Average temperature at birth are drawn from the Global Summary of the Month database (NOOA 2016). Since temperatures were available only for the city of Milano for the years of interest (1937-1944)[13], we decided to consider this variable as a proxy for Italy, in the absence of time series data for all the other regions. Although not very precise, the temperature data point is monthly- and year-specific, and it still provides an approximation of the evolution of monthly temperatures at the time the individuals of our sample were born. Moreover, the models always include regions fixed effects, hence accounting for differences which are due to exposure to different climate regions. The relevant average monthly temperature was operationalized as tertiles dummies[14]. The estimated coefficients increased in size and significance ($\hat{\beta}^{IV}_{seasonality} = 0.031, p < 0.01$) with the inclusion of weather controls, suggesting that if any, the baseline estimation was downward biased[15].

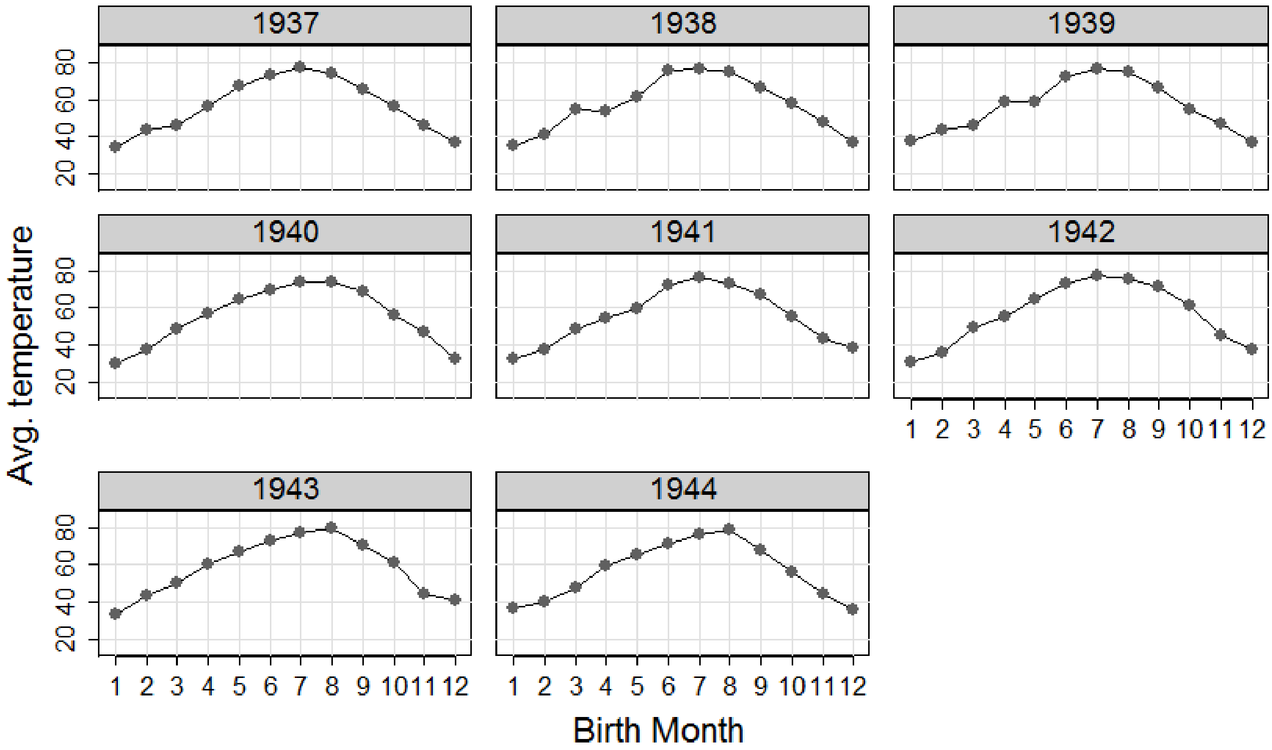
Then, following a very common practise in the birthdates instrument literature (Beuchert et al. 2016; Ponzo and Scoppa 2014; Elder and Lubotsky 2009 and Puhani and Weber 2007), last column of Table 3 displays the IV estimates obtained on the subsample of individuals born in January and December only. This represents another way of netting out the possible confounding effect of seasonality of whether conditions and family background, since the two months are indeed contiguous and by focusing on them only we are almost keeping constant unobservable factors that may indeed vary across seasons. In fact, around the invisible "cut-off" point determined by the administrative division between these two months, children are born in the same meteorological and cultural "season", since influence, deriving from parents with different socio-economic characteristics targeting different birth timing should be reduced. The "discontinuity sample" test confirmed strongly the main result. Although the sample size reduced to one fifth of the original size, the estimated coefficient remained positive and highly significant, and, interestingly, we obtained a very similar estimation of the coefficient than the one obtained with the inclusion of the control for temperature at birth, i.e. when we net out the effects of seasonality (columns 5 and 6 of Table 3), the estimated coefficient increased from 0.024 to 0.031. In conclusion, our robustness tests showed that the results presented in this section are consistent even when "season of birth" effects are controlled for.

[13] The database is very rich in data and geographical coverage, as for most of the countries in the world it collects a wide range of meteorological data. For Italy, only from more recent years (from 1950 onwards) all the major geographical areas are represented.

[14] The inclusion of the temperature as a continuous variable gave qualitatively the same result.

[15] The estimated coefficients of the temperature dummies suggested that, holding constant all the other factors, individuals born in the warmest months had higher likelihood of CVD hospitalization (estimates beta for the second tertile: 0.007, $p<0.05$; for the third tertile: 0.005, $p<0.13$).

Figure 3 Average temperature (F) by year and month of birth



Source: GSOM/GSOY (Global Summary of the Month/Global Summary of the Year) for the city of Milano. Available on line from NOOA National Centers for Enviromental Information at: http://www.ncdc.noaa.gov/cdo-web/ (Last access 26th October, 2016)

Finally, we discuss the last possible limitation of our instrument, due to the fact that birth month might influence health not only through higher pension age but also through a lower school performance whose negative effect might spread throughout the entire life. In fact, birth months has been widely shown to determines age at school entry due to single annual cut-off date (in Italy, schools start in September), and a vast literature investigates its potential effects on school performance and future labour market outcomes. Though results are mixed, the most common regularity is that children entering at school older obtain better performance than their younger peers do, due to a higher level of maturity and greater ability of concentration (Bedard and Dhuey, 2006). This general result holds also for Italy, where children who entered at school at younger age score substantially lower than their older peers at fourth and eighth grade and this gap persists at 15 years old and in the type of secondary school chosen (Ponzo and Scoppa, 2014). This is very relevant to us, since it is possible that this differential school performance might endures and displays its effects during the entire working career and determining a health differential. However, if any, the bias induced by entry age should attenuate the link between out instrument and health since it goes in the opposite direction. In fact, as shown by Ponzo and Scoppa (2014), children born in the final months of the year enter at school at lower age and their performance is significantly lower than that of students born in the early months. They also have significantly lower probability of choosing the Lyceum, the most academic oriented track. In contrast, in our study those born in the final months of the year result to be those “better-off”, with lower pension age and lower CVD incidence.

HETEROGENEITY ANALYSIS

In Table 4, we investigated the presence of heterogeneity in the association between retirement age and subsequent health. For this purpose, we have analysed the sample of retirees who were working after 1985, evaluating how the estimated coefficient associated to pension age varied between retirees who, before retirement, were employed in manual/non manual occupations, had a low/high average wage, and were working in secondary/service sectors[16].

Table 4 Heterogeneity analysis of the Effect of Retirement Age on CVD Hospitalization (TSLS)

	Low wage	High wage	Manual	Non Manual	Secondary	Services
	0.044** (0.005,0.084)	0.014 (-0.003,0.031)	0.041*** (0.017,0.065)	-0.002 (-0.026,0.021)	0.028*** (0.009,0.047)	0.009 (-0.023,0.042)
Instrument	Q1	Q1	Q1	Q1	Q1	Q1
First stage β	0.183***	0.375***	0.251***	0.326***	0.299***	0.254***
F-test	23	138	69	54	105	28
#Obs.	25,427	25,427	34,400	16,454	34,694	15,646
CVD incidence	0.068	0.064	0.067	0.064	0.065	0.069

*Notes: Each column presents IV estimate and robust 95%CI from separate regressions. All models include year and region of birth dummies, log of wage, years of contribution and sector of activity dummies. Q1 is the instrument, dummy for being born in the first quadrimester; F-test is the Kleibergen-Paap test for weak identification. Legend: * p<.10, ** p<.05, *** p<.01*

From Table 4 it emerges a sharp socio-economic gradient of the effect of retirement age on health. Indeed, the detrimental effect of retiring one year later is completely borne by the retirees who, during their career, were employed in low wage jobs, in manual occupations and in the secondary sector. Among these socio-economic groups, retirement at older age is associated to an even higher growth in the incidence of CVD hospitalization than the one found in the overall population. Among the poorest half of the sample and manual workers, the estimated coefficients are similar. For these segments of the population, the increase in the incidence of CVD hospitalization was on the range of 4.1-4.4 percentage points, corresponding to a more than 60 per cent increase. When we stratify between sectors, the point estimate was closer to the effect found on the full sample ($\hat{\beta}^{IV}_{secondary}$=0.028, p<0.01), possibly because the “secondary sector” is a broad level of disaggregation, which pools together manual and non-manual, as well as low and high wage earners. It is worth to notice that the instrument was highly relevant for all the categories and interestingly the strength of the association of birth month with pension age was lower among the workers with lower socio-economic status, as proxied by earning lower than the median and being occupied in a manual job. The

[16] The secondary sector was defined as manufacturing, constructions, transportations and mining activities. Low and high wage were defined according to the median.

heterogeneity in the relevance of the instrument might arise because in general, lower qualified workers have more "bumpy" careers, and school-to-work and labour market transitions are less straightforward due to higher school dropout and periods of unemployment or inactivity.

6. Discussion

The result of a positive effect of retirement age on the incidence of CVD hospitalization is in line with Bound et al. (2007)[17] who, considering UK, found a significant temporary reduction in the probability of risk factors for CVD (excessive waist circumference, elevated triglyceride level, low levels of HDL cholesterol, high blood pressure, and elevated fasting blood glucose)[18] immediately after state pension age. However, our finding is in contrast with most of the previous literature investigating CVD outcomes (Bamia et al. 2008; Behncke 2012; Morris 1994; Moon et al. 2012; Dave et al. 2008). Several methodological differences[19] can explain this divergence in the results. The most relevant is possibly the different study design adopted to address the problem of endogeneity. Bamia et al. (2008), Morris (1994), Moon et al. (2012) and Dave et al. (2008) did not adopt a quasi-natural experiment set-up and their preferred specification relied on the control for confounding factors at baseline. All these studies found that retirement is associated to higher probability of CVD, but the problem of endogeneity in the retirement choice was not addressed. Behncke (2012), who studied UK and adopted more than one methodology, found a higher risk of CVD associated to retirement when estimating a propensity score matching model, but the result turned to be null when she replicated the analysis instrumenting retirement with age-specific retirement incentives. Finally, the positive and significant effect established by Dave et al. (2008) among US retirees vanished when the analysis was constrained to the individuals with a health insurance before and after retirement.

According to our results, the association between higher retirement age and CVD health deterioration varies substantially between different strata of the population. We showed a significant ($p<0.01$) increase in CVD incidence associated to delayed retirement among blue-collars, low median wage and secondary sector employees, while among non-manual, high median wage and service sector workers retiring one year later had a null effect. Hence, the harmful consequences of higher pension age are closely linked to the "quality" and to the "quantity" of work exposures before retirement. Retirees exposed to more disadvantageous

[17] Bound (2007) analyses in a RDD fashion the discontinuity in age-specific trend before and after 65 years old, the UK pension eligibility age for men in the period under study.

[18] The presence of three out of the five cardiovascular diseases factors (excessive waist circumference, elevated triglyceride level, low levels of HDL cholesterol, high blood pressure, and elevated fasting blood glucose) is classified as metabolic syndrome (Bound et al. 2007).

[19] Other differences are, for example, that for none of the mentioned studies the outcome considered was CVD hospitalization, but rather it was mortality for CVD (Bamia et al. 2012, Morris1994) and self-reported CVD (Moon et al.2012; Dave 2008, Behncke 2012). Apart from Bamia (2008), in all these studies retirement was operationalized as a binary treatment. Finally, these studies included also different reasons for retirement, beyond occupational retirement.

working conditions face higher CVD risks as a result of retiring at older age. Our findings are broadly speaking consistent with the vast literature on the socio-economic health inequalities (Brunner and Marmot 1999; Pollit et al. 2005) and point to conclusions similar to the studies of Westerlund (2009), Matthews (2014) and Kalousova et al. (2015). By using data from the Gazel cohort study (Westerlund et al 2009), SHARE (Kalousova et al. 2015) and the English Longitudinal Study of Ageing (Matthew 2014) these authors found that retirement is protective for health among workers in low quality jobs only, where quality of job was defined as jobs with high exposure to physical work or psychosocial factors. Also Mazzonna and Peracchi (2016) found that, by exploiting pension eligibility variation between and within European countries, the negative effect of retirement on cognitive ability disappears when focusing on people who worked in more physically demanding occupations. For these individuals, retirement has an immediate beneficial effect on both self-rated health and cognitive abilities.

What emerged in our study suggests that potentially harmful occupational hazards transmit further beyond the borders of work, as they impair also future health through a continuity of exposures that combine, cumulate and interact throughout the work life (Blane 1999; Blane et al. 2013). Coherently with the behavioural and pathogenic pathways for CVD (Marmot et al. 1997; Brunner 1997; Brunner et al. 2006; Perk et a. 2012), the biological plausibility of our findings might origin in the psychosocial risk factors associated with work. High physical demands, low control over own work, irregular shifts, negative emotion of hostility, anger and isolation are all crucial psychosocial risk factors which can trigger unhealthy behavioural consequences (e.g. food choices, smoking, drinking, sedentary lifestyle, sleep disturbances). These behavioural reactions in turn are known to activate or accelerate pathogenic mechanisms that are involved in cardiovascular diseases (e.g. autonomic dysfunction, sympathetic-adrenal-medullary activation, inflammatory and homeostatic processes, hypothalamic pituitary-adrenocortical-activation, and metabolic dysfunction) (Perk et al. 2012, p.40). Hence, retirement might benefit individuals' health directly because of the "relief" from poor psychosocial work conditions, and indirectly through the engagement in healthier lifestyle, as suggested by recent empirical literature (Lang et al. 2007, Engberg et al. 2012, Eibnich 2015). For example, Eibnich by adopting an RDD design with GSOEP data, after showing a strong positive effect of retirement on several health indicators, investigated a set of possible underlying mechanisms. He found that this association is mediated by decrease smoking, increase in sleep duration, increase in physical activity (gardening and repairs) and relief from work-related strain. This is highly relevant to our study, since smoking, sedentary life, high weight, poor sleeping are all well-known modifiable risk factors for CVD, as suggested by international guidelines both in Europe (Perk et a. 2012) and USA (LIoyd-Jones et al. 2010).

7. Summary and conclusions

This article analysed the effect of pension age on the incidence of hospitalization for cardiovascular diseases at the age of 68-70 years, using a large administrative Italian database that combines archives on social security records and hospitalizations for workers of the private sector. We focused on the 1937-1944 cohorts of males who were employed or self-employed in the private sector and who retired via occupational retirement. We adopted on instrumental variable identification strategy to overcome the problem of endogeneity of retirement exploiting the discontinuity in retirement age induced by month of birth. In fact, as results of highly standardized labour market transitions due to a specific annual cut-off dates, persons born early in a year are shown to be older at retirement for a given cohort. To the best of our knowledge, this is the first time that the birth-month instrument is proposed to study the effect of retirement on health.

Our results point to a significant detrimental effect of postponing retirement on the incidence of new coronary and stroke events. Delaying retirement by one year rises CVD hospitalization at 68-70 years old by 2.4 percentage points ($p<0.01$), holding constant years, region of birth and work-related characteristics before retirement, i.e. occupation, sector of activity, years of contribution at 52 years old and average wage. However, striking heterogeneities exist between socio-economic groups, as it turned out that the detrimental effect of higher pension age was entirely borne by the retirees who were employed in manual occupations, in the secondary sector and with low wages before retirement ($\hat{\beta}^{IV}_{low\,wage}$=0.044, $p<.05$; $\hat{\beta}^{IV}_{manual}$=0.041, $p<.01$; $\hat{\beta}^{IV}_{industry}$=0.028, $p<.01$). This differential vulnerability to the extension of working life speak to the crucial role played by job quality and the influence of work-related physical and psychosocial risks on the ability to work at older age.

In conclusion, postponing retirement might entail severe health consequences for vulnerable categories of workers. The burden of ill health, which is already heavier among older workers in demanding occupations (Burr et al., 2017), seems to be further aggravated by increased cardiovascular diseases associated to retiring at older age. Policies aiming at rising statutory pension age should carefully take into account their health implications, as they might lead to higher health inequalities and unintended distributional consequences. In fact, workers in low quality jobs, not only receive less during their working life because employed in less paying jobs, but they also enjoy for shorter time their pensions, due to reduced healthy life expectancy.

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9. APPENDIX

Table A 2.1 First stage regression of the TSLS Estimate of **Table 2**:
Reduced form effect of birth month on pension age

	(1) All retirees	(2) Employed after 1985	(3) Employed after 1985
Being Born in the first quadrimester (Q1)	0.185***	0.210***	0.278***
Year of Birth (Reference Category 1937)			
1938	-0.336***	-0.309***	-0.174***
1939	-0.571***	-0.652***	-0.374***
1940	-0.926***	-0.956***	-0.523***
1941	-1.108***	-1.213***	-0.618***
1942	-1.147***	-1.239***	-0.645***
1943	-1.274***	-1.435***	-0.723***
1944	-1.271***	-1.474***	-0.782***
Region of birth (Reference Category: North-West)			
North-East	0.500***	0.929***	0.444***
Centre	2.672***	3.371***	1.529***
South	4.347***	4.893***	1.874***
Islands	4.428***	5.173***	1.944***
Sector of activity (Reference Category: Primary)			
Manufactory			-0.377**
Energy			-0.308
Construction			0.961***
Real Trade			0.222
Hotel and Restaurants			0.920***
Transports and Communications			0.334*
Finance			0.946***
Real estate, research, IT			0.634***
Public administration			1.201***
Education			1.263***
Health			1.334***
Other services			0.702***
Missing			0.691***
Occupation (Reference category: Blue collar)			
White collar			0.714***
Managers			2.071***
Log Earnings			-0.324***
Insured Years at 52			-0.436***
_cons	57.731***	56.410***	72.856***
Kleibergen-Paap Wald statistic	38	29	122
#Obs.	94,521	50,854	50,854

*Notes: Each column presents separate regressions. SE are robust. Legend: * p<.10, ** p<.05, *** p<.01*

Table A 2.2 Second stage regression of the TSLS Estimate of **Table 2**:
Effect of pension age on CVD hospitalization incidence at 68-70 years old

	(1) All employees	(2) Employed at 1985	(3) Employed at 1985
Pension Age	0.029***	0.032**	0.024***
Year of Birth (Reference Category 1937)			
1938	0.011**	0.01	0.005
1939	0.01	0.013	0.001
1940	0.025**	0.025*	0.007
1941	0.024**	0.032**	0.008
1942	0.031**	0.039**	0.015**
1943	0.027**	0.031*	0.003
1944	0.02	0.028	0
Region of birth (Reference Category: North-West)			
North-East	-0.019***	-0.033***	-0.014***
Centre	-0.079***	-0.115***	-0.045***
South	-0.120***	-0.146**	-0.035**
Islands	-0.122***	-0.153**	-0.035**
Sector of activity (Reference Category: Primary)			
Manufactory			0.022
Energy			0.044
Construction			-0.01
Real Trade			0.009
Hotel and Restaurants			0.006
Transports and Communications			0.015
Finance			-0.007
Real estate, research, IT			0.003
Public administration			-0.014
Education			-0.018
Health			-0.017
Other services			0
Missing			0.016
Occupation (Reference category: Blue collar)			
White collar			-0.018***
Managers			-0.052**
Log Earnings			0.009**
Insured Years at 52 years old			0.010***
_cons	-1.609***	-1.730**	-1.706***
Instrument	Q1	Q1	Q1
Kleibergen-Paap test	38	29	122
#Obs.	94,521	50,854	50,854

Notes: Each column presents separate regressions. SE are robust. Legend: * p<.10, ** p<.05, *** p<.01