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The effect of retirement on self-reported health: a gender comparison in Italy

Lucia Coppola and Daniele Spizzichino*

Abstract

The effect of retirement on health has been widely investigated in the literature, but the evidence on this issue is conflicting, and the debate surrounding it still open. This topic is of particular interest when expenditures for pensions and health care systems, and their potential interrelationship, are primary concerns for policy-makers. This is the case in ageing countries like Italy, where the recent pension reform, which included an increase in the minimum pension age, makes gaining an understanding of the potential consequences of retirement postponement for health even more relevant. Using EU-SILC longitudinal data, we investigate the effect of retirement on self-reported health in Italy from a gender perspective. We apply logistic regressions and propensity score matching to estimate the net effect of retirement on health after potential endogeneity is controlled for. The main results show that the self-reported health of men worsens shortly after retirement, while the self-reported health of women does not change.

1 Introduction

In an era characterised by the ageing of the population, two central concerns for policy-makers are (i) the burden on the pension system, and (ii) the burden on the health care system. Policies aimed at reducing costs in either of these two sectors should take into account the well-known retirement-health nexus. If retiring is expected to enhance the health of certain individuals, such as of people who have

* Lucia Coppola, Italian National Institute of Statistics (ISTAT), Rome, Italy

Daniele Spizzichino (corresponding author), Italian National Institute of Statistics (ISTAT), Viale Liegi 13, 00198, Rome, Italy
E-mail: daspizzi@istat.it

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physically demanding jobs (Sickles and Taubman 1986), postponing retirement may decrease the costs associated with providing pensions, but it may increase the costs associated with providing health care. Conversely, if retirement has a negative effect on individual health—by, for example, reducing mental activity or depriving individuals of the economic and social roles they are used to—postponing retirement may reduce costs for both pension and health care systems.

The relationship between retirement and health status has been widely investigated in the literature, but the debate about the effect of retirement on subsequent health outcomes is still open. Some studies have shown that retirement has a negative effect on health (Dave et al. 2008; Szinovacz and Davey 2004), while others have found either no evidence of such a negative effect (Ekerd 1987; Ekerdt and Bosse 1982; Van Solinge 2007; Coe and Lindeboom 2008) or even a positive effect (Bound and Waidmann 2007; Midanik et al. 1995; Kremer 1985).

Many scholars have pointed out the difficulties which can arise when attempting to distinguish between correlation and causality in the health-retirement link. Health and retirement decisions may affect each other, as poor health conditions may lead individuals to retire earlier (Dwyer and Mitchell 1999). These decisions may also be affected by individual observed and unobserved characteristics (Bound and Waidmann 2007; Anderson and Burkhauser 1985). If this is the case, unbiased estimates of the net effect of each experience on the other cannot be achieved unless the issue of the endogeneity of the two experiences is explicitly taken into account.

In this paper we investigate the effect of retirement on self-reported health in Italy, a country in which the ageing process is occurring at a faster pace than in most of the other EU countries (European Commission 2006). Moreover, Italy has recently undergone a pension system reform aimed at raising the minimum pension age and narrowing gender differences (European Commission 2013). In this context, therefore, gaining an understanding of the potential effect of retirement on subsequent health—and of gender differences in how this effect plays out—has even greater relevance. In particular, we ask whether the experience of retirement leads to an improvement in—or, conversely, a worsening of—self-reported health, and whether the effect differs between men and women. Retirement is associated with important changes in the life-styles and social roles of individuals (Aldwin 1990; Eisdorfer and Wilkie 1997). In a country characterised by gendered relationships (Pasqua 2002; Di Giulio and Pinnelli 2003), we expect to find that retirement represents the loss of an important social role for the male breadwinner, and thus has negative repercussions on the self-reported health of men. By contrast, women tend to be intensively engaged in family-related tasks throughout their life, even when they are working, and may therefore find it easier than men to adapt to a new life-style. We thus expect to find that the self-reported health of women does not worsen after retirement, and may even improve.

In Italy, relatively little research has so far been done on this issue. An earlier study which focused on the effect of health on retirement examined Italy, but in conjunction with other European countries (Hagan et al. 2009). Furthermore, to our knowledge, our paper represents a novelty in terms of the data and the methodological approach used.

Our analysis uses EU-SILC longitudinal data, which contain information on both occupational and health conditions and transitions, as well as on other relevant household and individual characteristics. First, we apply a logistic regression to provide a description of the relationship between different individual characteristics, including retirement, and self-reported health. We then use propensity score matching estimators of the average effect of retirement on retirees' health (Rosenbaum and Rubin 1983; Heckman et al. 1997), which, combined with the longitudinal information on changes in self-reported health, allow us to control for potential endogeneity.

The paper proceeds as follows: in Section 2 the general theoretical framework is reviewed, in Section 3 the data and the methods are described, in Section 4 the main results are presented, and in Section 5 we offer some concluding remarks.

2 The health-retirement nexus

When studying the relationship between retirement and health, an unbiased estimate of the real effect of each experience on the other can be achieved only if the interdependence of the two experiences is explicitly taken into account. In addition to affecting each other, retirement and health may also be simultaneously affected by other factors.

A large body of literature has been devoted to investigating the effect of health on the decision to retire and the timing of retirement, and the results of these studies clearly show that being in poor health can induce individuals to retire earlier (McGarry 2004; Hagan et al. 2009; Disney et al. 2006).

Less attention has been paid to the effect of retirement on subsequent health, and the existing evidence on this question has so far been mixed. On the one hand, some studies have shown that after people retire, their health worsens. One possible explanation for this effect is that retirement can be a stressful event (Rosow 1974), and it is indeed often listed on stress inventories (Aldwin 1990). Retirement stress has been linked to elevated suicide rates (Miller 1979), a diminished sense of wellbeing, and lowered morale (George and Maddox 1977). Furthermore, retirement often implies a weakening of the social networks the individual formed in the workplace, and is thus often associated with the loss of an important social role. Finally, work itself may be rewarding. In all such cases, continued employment would tend to have a positive effect on a person's mental or physical health (Bound and Waidmann 2007).

On the other hand, retirement may represent an escape from a stressful working life. After retirement, an individual's health might improve as he or she adopts a healthier lifestyle, which may, for example, include engaging in regular exercise (Midanik et al. 1995) or quitting smoking (Lange et al. 2007).

The conflicting evidence on this issue may be due in part to the heterogeneity of retirees in different countries: for example, cultural factors and institutionalised breadwinning expectations may contribute to the diffusion of more or less gender-equal roles (Yodanis and Lauer 2007), and may affect the social and economic opportunities/costs of entry into retirement.

Another potential reason for the conflicting findings is that the methodological approaches used to investigate the possible selection of individuals into retirement differ. Most studies either apply instrumental variables or control for confounding variables. The former tend to find a positive effect of retirement on health (Hessel 2012; Coe and Zamarro 2008; Bound and Waidmann 2007), whereas studies which control for confounding variables, such as regressions or matching estimators, tend to find negative effects (Dave et al. 2008). Notably, Behncke (2012) found evidence of a negative effect of retirement on health using both non-parametric instrumental variables and matching estimators; this suggests that the conflicting results may be due to population-specific heterogeneity rather than to the method of analysis.

In this paper, we first employ a logistic regression to provide an overview of the household and the individual characteristics associated with a change in health, and then apply matching estimators to assess the net effect of retirement on health, once the possible self-selection of individuals into retirement is controlled for. We disregard the IV approach because finding a valid instrument is not easy: the instrumental variable has to determine the decision to retire, it should not affect health, and it has to be uncorrelated with any other variable affecting the outcome of interest. In other words, because a valid instrument has to affect health only by affecting the decision to retire, the causal effect is identified through variation in the instrument (Caliendo and Hujier 2005). Moreover, if a valid instrument is available, we expect that our results will be consistent with those of the other methods implemented (Benhcke 2012).

As our health indicator we use self-reported health, a widely used global indicator of health status. The results of previous studies based on both quantitative and qualitative strategies confirm the reliability of overall perceived health as an indicator of an individual's health status (Lundberg and Manderbacka 1996), even after controlling for the individual's objective health. A large number of factors are important for self-perceived health. The strongest association has been found for physical, functional, and mental health; but socio-demographic, life-style, and behavioural factors also have an impact on subjective health (Bjorner et al. 1996).

2.1 The Italian framework and research hypotheses

The population of Italy is ageing rapidly, and at an even faster pace than elsewhere in Europe (European Commission 2006). According to recent projections, individuals aged 65 and over are expected to make up around the 32%–33% of the total population in 2056, up from 20% today (ISTAT 2011). Meanwhile, the working-age population (ages 15–64) is expected to decrease from 66% currently to 54% in 2056.

This description of the demographic context illustrates why policy-makers are concerned about covering pension and health care costs. Relative to today, in the future more retirees are expected to collect old-age pensions and benefits and for longer periods of time, and more elderly people are expected to need health care and long-term care services (European Commission 2006).

In this framework, understanding the relationship between retirement and health is of particular interest, because policies aimed at reducing the burden on the pension system may in turn affect the burden on the health care system. If retirement improves the health of the elderly, then an increase in the minimum pension age may reduce the potential gains from lower health care expenditures. If, however, retirement is associated with worse health, postponing it to a later age may simultaneously reduce both pension- and health care-related expenditures.

To reduce the economic burden on the pension system, Italy has recently implemented a pension reform aimed at increasing the minimum retirement age for both men and women, with a narrowing of the existing gender differences. From 2012 onwards the minimum retirement age for men is 66 years and three months. For women the retirement threshold depends on the sector of employment: in the civil service it is the same as the age for men, while in the private and self-employment sectors it is lower (62 years and three months and 63 years and nine months, respectively). The retirement age is set to increase gradually, reaching 66 in 2018 (European Commission 2013). Although the aim of the reform is to achieve greater gender equality in terms of old-age pensions and benefit rights, it is likely to have considerable repercussions for women. In Italy, men and women have different social and economic roles: men are expected to focus on earning an income and providing for the family, while women are expected to focus on family-related activities and care, even if they also have a job (Pasqua 2002; Di Giulio and Pinnelli 2003). Although these gender roles are becoming less rigid among the younger generations, they are still enforced among the older generations.

Because life expectancy, pension benefits, and socio-economic roles are highly gender-specific in Italy, we believe it is necessary to take a gender perspective when studying the potential effect of retirement on subjective health. Thus, our research hypotheses are formulated separately for men and for women, and our empirical analyses are performed separately by gender. As we have noted, a man is expected to be a traditional breadwinner, while an employed women is expected to reconcile her job commitments with caring for her family (Naldini and Saraceno 2011). Thus, we expect to find that retirement is a shock for men, who have to re-arrange their life-style and social roles after leaving the labour market; and a relief for women, who benefit from having more time and resources to devote to other activities.

Hypotheses 1: Among men, retirement could lead to a worsening of self-reported health in the short term, as it is a stressful event which requires men to re-organise their life-style and their roles.

Hypotheses 2: Retirement could lead to an improvement in women's self-reported health in the short term, as it provides women with more time and other individual resources.

If this is the case, the increase in the minimum pension age, as established by the pension reform, may lead to additional burdens being placed on the health care system by women, but not by men.

3 Data and methods

3.1 Data, sample selection, and health outcomes

Since 2004, the European Union Statistics on Income and Living Conditions (EU-SILC) survey has been collecting cross-sectional and longitudinal microdata on different dimensions of household and individual living conditions in Europe.[1] Although the main purpose of the EU-SILC is to provide comparable structural indicators to monitor poverty and social exclusion in the EU,[2] it also provides information on individual self-reported health and employment careers. This allows us to analyse the effect of retirement on health, controlling for other relevant household and individual characteristics, such as the presence of a long-standing illness or physical limitations in activities resulting from health problems,[3] marital status, educational level, job characteristics, household composition, and disposable income.

In most of the countries where it is conducted the survey relies on a rotational sample design based on four groups. Each year, the longitudinal release provides data on sampled individuals belonging to three independent panels (who are interviewed two, three, or four times). So far, five longitudinal releases are available (from 2004–2007 to 2008–2011). In each release, specific weights are provided to allow for estimates on two-year transitions, based on the pooling of three panels: i.e. as is shown in Figure 2, the transitions between t and $t + 1$ are based on the data in panels 1, 2, and 3 (Eurostat 2013).

To achieve a higher number of observations we have selected the last two years of each longitudinal release, and pooled together data belonging to the available

[1] The project was informally launched in 2003 in seven countries, but it started in Italy in 2004.

[2] The Europe 2020 strategy, which aims to reduce the number of people who are living in poverty and are socially excluded by 20 million by 2020, relies on EU-SILC data.

[3] Questions corresponding to self-reported health, long-standing illness, and limitations in activities due to health problems are part of the so-called minimum European health module (MEHM).

Figure 1:
EU-SILC sample design and longitudinal release

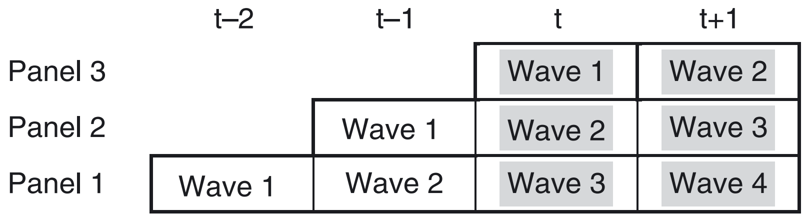

Table 1:
Transitions from employment between two consecutive years. Individuals between 55 and 74 years old, by years of transitions: sample size (*N*) and percentage (%)

	2006–2007		2007–2008		2008–2009		2009–2010		2010–2011		Pooled	
	N	%	*N*	%	*N*	%	*N*	%	*N*	%	*N*	%
Still empl.	1412	81.7	1392	82.4	1361	79.9	1428	83.7	1119	75.0	6712	80.7
Retired	224	13.0	210	12.4	241	14.1	171	10.0	255	17.1	1101	13.2
Inactive	92	5.3	87	5.2	102	6.0	107	6.3	118	7.9	506	6.1
Total	1728	100.0	1689	100.0	1704	100.0	1706	100.0	1492	100.0	8319	100.0

releases. The analyses are based on employed individuals (according to their self-reported activity status) between the ages of 55 and 74 at time t, which is the age range when most Italians enter retirement. The transition to retirement is measured by comparing the self-declared activity status at t and $t + 1$. Employed individuals at t may still be employed at $t + 1$, or have retired, or have become unemployed or inactive for any reason. No information is available about the reason for retiring (e.g. eligibility to collect an old-age or a disability insurance pension). In the selected sample, about 13% of the workers retire between t and $t + 1$, while 6% become inactive for other reasons, but with some variability across the years under study (Table 1).

3.2 Health change: an overview through logistic regression

Self-reported health status is measured by asking respondents to rate their overall health as ‘very good’, ‘good’, ‘fair’, ‘bad’, or ‘very bad’ (according to a scale ranging from one for ‘very good’ to five for ‘very bad’[4]). Individuals are classified

[4] The wording of the question is suggested by the World Health Organization (WHO): ‘How is your health in general?’.

according to the change in their health status between t and $t + 1$ as the same, better, or worse. This specific analysis focuses on the short-term effects of retirement, as it compares the self-reported health status between two points in time within which the retirement event is observed. The observed effects may be expected to fade with time, as individuals adjust their life-styles to their new social and family roles.

In order to provide a picture of the household and individual characteristics associated with changes in self-reported health, logistic regressions are estimated. Individuals who report that their health improved or worsened between t and $t + 1$ are compared to individuals who report no change.

In particular:

(i) Individuals who report being in worse health in $t + 1$ compared to t are regressed against those who report no change (in this case, only individuals at risk of a deterioration in their health are selected; i.e. those who say they are in 'very bad' health in t are excluded because they cannot have worse health at $t + 1$);
(ii) Individuals who claim their health improved in $t + 1$ compared to t are regressed against those who report no change (only individuals at risk of improving their health are selected, i.e. those who said they are in 'very good' health in t are excluded because they cannot have better health at $t + 1$).

We are therefore considering whether an individual's health has worsened or improved, but not the extent of the deterioration/improvement.

Clearly, our main focus is on the retirement effect, which is picked up through the transition from employment, either to retirement or to another inactivity status between t and $t + 1$.

The other control variables selected for the model estimates are as follows: age, being in a union (either marriage or consensual union), education, self-reported health at t, long-standing illness and limitations in activities due to health problems (and relative changes between t and $t + 1$), household size, region of residence, and equivalent disposable income at t. Job-related characteristics were tested but have not been included in the final models, as they were not shown to be significantly associated with changes in health. Eventually, the years of transition (i.e. the longitudinal release sample the units belong to) are controlled for.

Although several individual and household characteristics are controlled for, logistic regression may still provide a biased estimation of the retirement effect on health change because both the decision to retire and the change in health may be simultaneously affected by other factors which are not accounted for. In the next section, we explain the strategy used to estimate the net effect of retirement on health, once selection bias, due to observed and unobserved characteristics, is controlled for.

3.3 Retirement effect with propensity score matching estimators

Different strategies of analysis, each of which has its own pros and cons, may be implemented when investigating the relationship between potentially endogenous phenomena (see Caliendo and Hujer (2005) for a detailed review). In this paper, we use propensity score matching on longitudinal data. This method allows us to control for bias due to both observed and (time-invariant) unobserved characteristics. When non-experimental data are available, propensity score matching simulates an experimental context in which a specific 'treatment' effect on an 'outcome' of interest can be estimated (see Caliendo and Kopeing (2005) for a detailed guidance). In our case, retirement is the treatment, and the change in health status (improvement/worsening) is the outcome. In principle, we would be interested in comparing the change in the retirees' health status with the change in health they would have experienced if they were still employed. This is clearly not possible. However, we cannot simply compare the change in health of the retirees with that of the still-employed, because the two population groups may be different: i.e. retirees may have characteristics which make them more or less likely to experience a change in health (selection bias). Broadly, the matching strategy overcomes this problem by comparing the outcome observed on the treated group to the outcome observed on a 'control group'. The control group is selected among the untreated and is composed of the individuals who are the most similar to those in the treated group. The treatment includes any kind of reason for retirement (e.g. eligibility to collect an old-age or a disability insurance pension). The control group is given by those still employed at time $t + 1$. The control group selection is made according to a set of characteristics observed before the treatment. In our case, the change in health observed among retirees is compared to that observed among the 'most similar' workers. If the control group is properly selected, the two groups are 'equivalent' and any difference in the outcomes they experience can be attributed to the treatment.

Let $D = 0$ and $D = 1$ denote the untreated and the treated, respectively; and $Y(0)$ and $Y(1)$ denote the outcomes observed in the absence and in the presence of the treatment, respectively. The parameter of interest is the so-called average treatment effect on the treated (ATT), and is defined as:

$$T_{ATT} = E(T|D = 1) = E[Y(1)|D = 1] - E[Y(0)|D = 1] \qquad (1)$$

where the treatment average effect on the treated is defined as the difference between the average outcome observed on the treated after the treatment ($E[Y(1)|D = 1]$) and the average outcome which would have been observed on the treated if they had not been treated ($E[Y(0)|D = 1]$). In our case, the outcomes represent the change in the individuals' health status after retirement and the change in the individuals' health status if they had not retired. The latter ($E[Y(0)|D = 1]$) is not observed and cannot be replaced by the outcome observed on the untreated ($E[Y(0)|D = 0]$) because the treated and the untreated are likely to differ even in the absence of treatment.

From (1) follows:

$$E[Y(1)|D = 1] - E[Y(0)|D = 0] = T_{ATT} + E[Y(0)|D = 1] - E[Y(0)|D = 0] \quad (2)$$

the difference between $E[Y(1)|D = 1] - E[Y(0)|D = 0]$ and T_{ATT} is the so-called 'selection bias'. Thus, T_{ATT} is identified only if $E[Y(0)|D = 1] - E[Y(0)|D = 0] = 0$; i.e. if the average outcome observed on the treated and the untreated is the same in absence of treatment. The conditional independence assumption (CIA) allows us to show (2) that given a vector of covariates X not affected by the treatment, the potential outcomes are independent of the treatment assignment. The CIA implies that selection bias is based on observed characteristics (X), and that all of the characteristics which may affect the treatment assignment and the outcome are observed. Since conditioning on numerous covariates may not be feasible, a balancing score is usually used (Rosenbaum and Rubin 1983). The propensity score (PS) is a possible balancing score which represents the probability that an individual will participate in a treatment, given the observed characteristics:

$$PS = P(D = 1|X) = P(X) \quad (3)$$

Eventually, the common support (CS) is required, according to which individuals with the same characteristics X have a positive probability of being treated and untreated (Heckman et al. 1999).

$$0 < P(D = 1|X) < 1 \quad (4)$$

Assuming the CIA and the CS, the propensity score matching estimator of the treatment effect on the treated is the mean difference in the outcome over the common support, weighted by the PS distribution of the treated:

$$T_{ATT\ (PSM)} = E_{P(X)|D=1}\{E[Y(1)|D = 1, P(X)] - E[Y(0)|D = 0, P(X)]\} \quad (5)$$

If longitudinal data are used and the outcome of interest measures a change which occurred among the same individuals, selection based on unobserved characteristics is also controlled for. Formally:

$$[Y(1)|D = 1] = [Y(1)_{t+1} - Y(0)_t|D = 1] \quad (6)$$

$$[Y(0)|D = 0] = [Y(0)_{t+1} - Y(0)_t|D = 0] \quad (7)$$

Let the outcome for an individual at time t be $Y_t = \pi_t + D_t^* Y(1)_t + (1 - D_t)^* Y(0)_t$ where π_t represents unobserved characteristics. If selection on the unobservable is time-invariant ($\pi_t = \pi_{t+1}$), the differences due to the unobservable are implicitly netted out in both (6) and (7). Thus, when the propensity score is combined with the longitudinal data, the selection bias due to both observed and (time-constant) unobserved characteristics is controlled for.

In estimating the propensity score, both the model and the covariates have to be properly selected. When the treatment is binary—that is the probability of being either treated or not treated has to be estimated—logit or probit models are chosen, and usually provide similar results. Both models have been tested, and generate almost the same results. The logit regression estimates are presented.

In choosing the covariates, it is important to note that the covariates have to affect both the treatment participation and the outcome; and that, according to the CIA, the outcome has to be independent of the treatment given the covariates. Moreover, because the covariates have to be unaffected by the treatment participation, they are measured before the treatment, and it is assumed that they will not be influenced by the anticipation of the participation. In our study, the propensity score matching is estimated separately for men and women, and several individual characteristics have been tested. In principle, we tried to select a parsimonious model, because over-parametrisation may increase the common support problem, and the inclusion of non-significant variables may increase the variance in the estimates (Caliendo and Kopeinig, 2005). Thus, we first select only the significant variables: (i) for a man these covariates are age (in five-year age bands), level of education, labour income, whether he is self-employed, whether his job is full- or part-time, and the years in which he made transitions (i.e. the longitudinal release the sampled individual belongs to); (ii) for a woman, the same covariates are used with the exception of education and work schedule, because these factors are non-significantly related to the probability of being treated. Although non-significant, self-reported health, long-standing illness, and limitations in activities due to health problems before retirement are also included as being of primary interest in our analysis. The risks of including covariates non-significantly related to the propensity for experiencing the outcome of interest after treatment are that more individuals may fall outside of the common support, and that the final estimator may have a higher variance. Estimates achieved by including or not including health-related variables are discussed to show that this is not the case. In both cases, all of the selected covariates show similar distributions between the treated and the matched untreated individuals.

Multiple matching algorithms have been tested, and we show the three which provide the best performance and the most similar results[5] (see section 4.2). In particular, radius matching allows us to impose a threshold for the maximum propensity score distance between each of the treated and the matched untreated, increasing the matching quality by avoiding bad matches (i.e. those among the treated and the untreated individuals with very different propensity scores). We set the threshold at 0.1 (i.e. the maximum distance between the treated and the untreated matched PS has to be lower than 0.1). Kernel and local linear regressions are also applied. These algorithms are non-parametric estimators which use the weighted averages of all of the individuals in the control group to construct the counterfactual outcome.

[5] Among the tested methods, the nearest neighbor, with and without replacement, has be disregarded because its performance is below that of the others, it provides less consistent estimates, and it has a higher variance.

4 Results

4.1 An overview of the household and the individual characteristics associated with self-reported health change

Logistic regressions are estimated separately for men and women. Table 2 shows the coefficients of worsening (model 1) and improving health between t and $t+1$ (model 2) for men. Table 3 shows the same estimates for women.

As expected, men employed at time t, and who retire before $t+1$, have a higher risk of a deterioration in self-reported health than men who are still employed at time $t+1$. In fact, compared to workers at $t+1$, retired men have a 80% higher risk of assessing a health deterioration at $t+1$.[6]

Interestingly, this result does not hold for women. When individuals leave the labour market, their job loses its centrality in their daily life, and they have to reallocate the time they previously spent in paid employment to alternative activities. This seems to have a negative impact on men but not on women. Possibly because women are traditionally engaged in other family-related tasks, they appear to be able devote their time and energy to other activities after leaving their job.

Retirement is not significantly related to an improvement in self-reported health for men, and contrary to our expectations, it is also not associated with an improvement in health for women.

The analysis shows that the control variable of long-standing illness is strongly associated with a worsening of self-rated health among men. Compared with men with no long-standing illness at time t and $t+1$, men who report having a long-standing illness at time $t+1$ are more likely to report a worsening of their subjective health at $t+1$ compared to time t. Similarly, a higher risk of reporting worsening health is observed among those who report having a long-standing illness at time $t+1$. A worsening of self-reported health is also observed among those who claim their long-standing illness disappeared over the analysed period. This could be due to the lingering effects of the previous illness. Similar results have been found for limitations in activities due to health problems. A worsening in self-reported health is generally observed when individuals report having limitations in activities due to health problems, or having developed limitations between t and $t+1$. Chronic conditions and a lack of functional self-sufficiency contribute significantly to perceptions of health. Furthermore, as changes in health are likely to depend on the initial health status, self-reported health at t is also controlled for: individuals in better health are more likely to report a worsening of self-reported health, while individuals in worse health are more likely to report an improvement.

Individual socio-economic status is positively associated with self-reported health. People who are relatively wealthy and highly educated are protected against a deterioration in health. Highly educated people may be inclined to seek out correct

[6] The risk is computed as exp (coef.), in this case exp (0.592) = 1.80.

Table 2:
Worsening and improvement in health among men. Logistic regression coefficients, standard errors and significance levels

	Model 1 Worse			Model 2 Better		
Variable (reference value)	**Coef.**	**s.e.**	**Sig.**	**Coef.**	**s.e.**	**Sig.**
Intercept	−3.216	0.730	***	0.775	0.758	
Change in the employment condition (employed-employed)						
Employed – retired	0.592	0.130	***	−0.140	0.154	
Employed – other condition	0.552	0.170	**	−0.285	0.221	
Age	−0.009	0.011		−0.009	0.012	
Union (in union – legal or consensual)						
Not in union	−0.037	0.144		−0.157	0.157	
Education (lower secondary education or less)						
Secondary education	−0.409	0.103	***	0.116	0.109	
Tertiary education	−0.730	0.140	***	0.464	0.140	**
Change in long-standing illness (no-no)						
Yes-yes	1.355	0.177	***	−0.687	0.187	***
Yes-no	0.473	0.202	*	0.146	0.159	
No-yes	1.432	0.141	***	−0.743	0.203	***
Change in limitations in activities (no-no)						
Yes-yes	1.509	0.195	***	−1.950	0.207	***
Yes-no	0.297	0.229		−0.320	0.152	*
No-yes	1.754	0.140	***	−1.702	0.215	***
Self-reported health (fair)						
Very good	4.599	0.212	***			
Good	2.329	0.162	***			
Bad	−0.458	0.317				
Self-reported health (fair)						
Good				−2.892	0.116	***
Bad				2.109	0.222	***
Very bad				3.897	0.572	***
Household size	−0.064	0.045		−0.027	0.048	
Geographical region (north)						
Centre	0.191	0.119		−0.106	0.124	
South	0.311	0.105	**	0.019	0.111	
Equivalised disposable income	−0.010	0.004	*	−0.005	0.005	
Equivalised disposable income – square	0.000	0.000		0.000	0.000	
Years of transitions 2006–2007						
2007–2008	0.063	0.136		0.132	0.139	
2008–2009	−0.015	0.139		0.139	0.139	
2009–2010	−0.383	0.146	**	−0.104	0.143	
2010–2011	0.454	0.139	***	0.809	0.152	***

Note: Sig.: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$.

Table 3:
Worsening and improvement in health among women. Logistic regression coefficients, standard errors and significance levels

	Model 1 Worse			Model 2 Better		
Variable (reference value)	**Coef.**	**s.e.**	**Sig.**	**Coef.**	**s.e.**	**Sig.**
Intercept	−3.645	1.139	**	0.881	1.170	
Change in the employment condition (employed-employed)						
Employed – retired	0.055	0.182		−0.370	0.194	
Employed – other condition	0.405	0.238		−0.240	0.249	
Age	0.007	0.018		−0.012	0.019	
Union (in union – legal or consensual)						
Not in union	0.123	0.163		−0.140	0.162	
Education (lower secondary education or less)						
Secondary education	−0.524	0.153	**	0.405	0.151	*
Tertiary education	−0.649	0.188	**	0.327	0.185	
Change in long-standing illness (no-no)						
Yes-yes	0.701	0.253	**	−1.317	0.248	***
Yes-no	0.433	0.276		0.210	0.201	
No-yes	1.253	0.202	***	−0.454	0.255	
Change in limitations in activities (no-no)						
Yes-yes	1.559	0.257	***	−1.405	0.250	***
Yes-no	0.334	0.283		0.033	0.201	
No-yes	1.746	0.199	***	−1.299	0.251	***
Self-reported health (fair)						
Very good	4.552	0.298	***			
Good	1.958	0.217	***			
Bad	−1.119	0.512	*			
Self-reported health (fair)						
Good				−2.883	0.161	***
Bad				1.568	0.283	***
Very bad				2.065	0.712	**
Household size	−0.040	0.067		−0.030	0.066	
Geographical region (north)						
Centre	0.032	0.163		0.078	0.158	
South	0.482	0.155	**	0.050	0.155	
Equivalised disposable income	−0.021	0.009	*	0.001	0.008	
Equivalised disposable income – square	0.000	0.000	*	0.000	0.000	
Years of transitions (2006–2007)						
2007–2008	−0.088	0.204		−0.353	0.198	
2008–2009	−0.120	0.206		−0.188	0.188	
2009–2010	−0.222	0.209		−0.171	0.192	
2010–2011	0.112	0.202		0.382	0.195	*

Note: Sig.: ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

information about prevention, while people who are wealthy may find it relatively easy to access health care, including care provided by expensive private services.

For the improvement in self-reported health (model 2), the coefficients estimates are in line with those observed for the deterioration in self-reported health. Men with better objective health and higher social status had more chances to improve their subjective health between t and $t + 1$.

For women (Table 3), most of the variables associated with a worsening or an improvement in self-reported health are the same as they are for men.

These results confirm our hypotheses for men but not for women. However, as was previously noted, the effect of the relationship between retirement and the change in health status may be biased if unobserved characteristics simultaneously affect the decision to retire and the change in the health status. The average treatment effect on the treated estimators will help to shed light on the association.

4.2 The effect of retirement on changes in self-reported health

For the sake of comparability with the logistic regression approach, propensity score matching[7] is carried out by gender, and separately for (i) individuals reporting the same or worse health at $t + 1$ compared to t, and (ii) individuals reporting the same or better health at $t + 1$ compared to t. The average treatment effect on the treated represents whether retirement led to a deterioration or an improvement in health among the two groups of retirees, respectively.

Table 4 shows the estimates of the propensity score to retire among individuals who report they have the same or worse health (Model 1) or the same or better health (Model 2), and among men and women, according to two sets of covariates: set A includes only significant variables (Model 1A and Model 2A, respectively, for men and women), and set B includes both significant and health-related variables (Model 1B and Model 2B).

The conditional independence assumption (CIA) requires that the outcome (worsening/improvement in health) is independent of the treatment assignment (retirement) given a set of covariates (Table 4) not affected by the treatment, and that all of the characteristics which affect the treatment assignment are observed. In our case, the selected covariates cannot be affected by the treatment because they are measured before retirement. The assumption that they are not affected by an anticipation of the treatment also seems reasonable because they are associated with decisions usually taken before retirement, such as decisions regarding investments in education and job characteristics. Most of the covariates are related to both outcomes (worsening/improvement in health, as in Tables 2 and 3) and the treatment (retirement, as in Table 4). The finding that health variables are not significantly related to the propensity to retire may be quite surprising, because the literature has

[7] Psmatch2 STATA module is used.

Table 4:
Propensity score to retire among individuals reporting worse/same health conditions at time $t + 1$ compared to t (Model 1), and among individuals reporting better/same health conditions at time $t + 1$ compared to t (Model 2), by gender and two sets of covariates (A and B). Logistic regression coefficients, standard errors, and levels of significance

Men	Model 1 Worse/Same					
	Model 1A			Model 1B		
Variable (ref. value)	Coef.	s.e.	sign.	Coef.	s.e.	sign.
Intercept	−2.39	0.157	***	−2.21	0.337	***
Age (55–59)						
60–64	0.78	0.112	***	0.76	0.113	***
65–69	1.77	0.141	***	1.75	0.142	***
70–74	1.66	0.220	***	1.64	0.220	***
Education (lower secondary education or less)						
Secondary education	−0.32	0.111	**	−0.30	0.112	**
Tertiary education	−0.72	0.164	***	−0.69	0.165	***
Labour income	−0.01	0.003	**	−0.01	0.003	**
Self-employed						
Employee	0.48	0.104	***	0.47	0.104	***
Full-time						
Part-time	0.87	0.190	***	0.86	0.191	***
Years of transitions 2006–2007						
2007–2008	−0.02	0.147		0.00	0.148	
2008–2009	0.15	0.144		0.17	0.145	
2009–2010	−0.15	0.160		−0.13	0.161	
2010–2011	0.41	0.153	**	0.44	0.154	
Self-reported health (fair)						
Very good				−0.32	0.206	
Good				−0.19	0.121	
Bad				−0.10	0.306	
Long-standing illness (no)						
Yes				−0.06	0.144	
Limitations in activities (no)						
Yes				0.04	0.148	

	Model 2 Better/Same					
	Model 2A			Model 2B		
Variable (ref. value)	Coef.	s.e.	sign.	Coef.	s.e.	sign.
Intercept	−2.58	0.166	***	−2.11	0.341	***
Age (55–59)						
60–64	0.73	0.119	***	0.73	0.119	***
65–69	1.70	0.149	***	1.70	0.150	***
70–74	1.65	0.231	***	1.62	0.232	***
Education (lower secondary education or less)						
Secondary education	−0.20	0.115		−0.19	0.116	
Tertiary education	−0.68	0.172	***	−0.67	0.173	***
Labour income	−0.01	0.003	**	−0.01	0.003	**
Self-employed						
Employee	0.45	0.110	***	0.45	0.111	***
Full-time						
Part-time	0.81	0.201	***	0.78	0.203	***
Years of transitions 2006–2007						
2007–2008	0.09	0.155		0.10	0.155	
2008–2009	0.20	0.152		0.20	0.153	
2009–2010	0.00	0.164		0.00	0.166	
2010–2011	0.54	0.163	**	0.55	0.164	**
Self-reported health (fair)						
Good				−0.09	0.115	
Bad				−0.18	0.236	
Very bad				0.08	0.526	
Long-standing illness (no)						
Yes				−0.14	0.145	
Limitations in activities (no)						
Yes				−0.10	0.145	

Table 4:
Continued

Women	Model 1							Model 2					
	Worse/Same							Better/Same					
	Model 1A			Model 1B				Model 2A			Model 2B		
Variable (ref. value)	Coef.	s.e.	sign.	Coef.	s.e.	sign.	Variable (ref. value)	Coef.	s.e.	sign.	Coef.	s.e.	sign.
Intercept	−2.04	0.201	***	−1.47	0.403	***	Intercept	−2.19	0.201	***	−1.66	0.398	***
Age (55–59)							Age (55–59)						
60–64	1.34	0.136	***	1.36	0.137	***	60–64	1.21	0.139	***	1.20	0.140	***
65–69	1.28	0.232	***	1.33	0.234	***	65–69	1.02	0.246	***	1.03	0.247	***
70–74	1.37	0.334	***	1.32	0.336	***	70–74	1.53	0.351	***	1.51	0.353	***
Labour income	−0.03	0.006	***	−0.02	0.006	***	Labour income	−0.02	0.006	**	−0.02	0.006	**
Self-employed							Self-employed						
Employee	0.33	0.142	*	0.33	0.143	*	Employee	0.40	0.148	**	0.41	0.148	**
Years of transitions 2006–2007							Years of transitions 2006–2007						
2007–2008	−0.07	0.195		−0.07	0.197		2007–2008	−0.13	0.197		−0.15	0.199	
2008–2009	0.01	0.191		0.02	0.193		2008–2009	−0.07	0.187		−0.09	0.188	
2009–2010	−0.41	0.203	*	−0.40	0.206		2009–2010	−0.48	0.203	*	−0.50	0.205	**
2010–2011	0.43	0.186	*	0.44	0.189	*	2010–2011	0.41	0.182	*	0.40	0.185	**
Self-reported health (fair)							Self-reported health (fair)						
Very good				−0.15	0.271		Very good				0.10	0.144	
Good				−0.05	0.158		Good				−0.03	0.273	
Bad				−0.88	0.414		Bad				−0.49	0.787	
Long-standing illness (no)							Long-standing illness (no)						
Yes				−0.09	0.178		Yes				−0.05	0.171	
Limitations in activities (no)							Limitations in activities (no)						
Yes				−0.21	0.182		Yes				−0.28	0.172	

Note: Sig.: ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

Table 5:
Individuals on and off support among those reporting worse/same health conditions at time $t + 1$ compared to t (Model 1), and those reporting better/same health conditions at time $t + 1$ compared to t (Model 2), by gender, and two sets of matching covariates (A and B)

	On support		Off support		
Men	**Treated**	**Untreated**	**Treated**	**Untreated**	**Total**
Worse – Model 1					
Model 1A	558	3684	1	79	4322
Model 1B	555	3681	4	82	4322
Better – Model 2					
Model 2A	483	3591	4	104	4182
Model 2B	483	3595	4	100	4182
	On support		**Off support**		
Women	**Treated**	**Untreated**	**Treated**	**Untreated**	**Total**
Worse – Model 1					
Model 1A	335	1933	3	57	2328
Model 1B	336	1927	2	63	2328
Better – Model 2					
Model 2A	322	1974	2	15	2313
Model 2B	323	1978	1	11	2313

shown that individuals who are in poor health tend to retire earlier (McGarry 2004; Hagan et al. 2009; Disney et al. 2006). However, here we are modelling the propensity to retire soon after the health status has been observed (i.e. no later than one year). Since the retirement process may last longer than a few months or one year, the time of observation may be too short to catch the possible effects of health on retirement.

We impose the common support, i.e. individuals with the same characteristics must have a positive probability of being treated and untreated. Individuals who fall outside of the common support are disregarded, and the treatment effect is not estimated for them. Clearly, if there are too many of these individuals, the estimates may not be representative. In our analyses, just a few individuals are outside of the support, and their exclusion is unlikely to affect the representativeness of the results (Table 5).

Finally, the average treatment effect on the treated—that is, the average retirement effect on retirees in terms of worsening or improving health—is estimated. The results achieved if the propensity score is estimated using only significant covariates

Table 6A:
ATT estimate of reporting a worse or a better health status at time $t + 1$, using only significant matching variables (set A)

		Worse			Better		
	PSM algorithms	**est.**	**s.e.**	**sign.**	**est.**	**s.e.**	**sign.**
Men	Radius	0.077	0.020	***	−0.025	0.023	
	Kernel	0.074	0.021	***	−0.028	0.019	
	LLR	0.071	0.023	**	−0.029	0.021	
Women	Radius	0.016	0.024		−0.032	0.027	
	Kernel	0.012	0.027		−0.032	0.027	
	LLR	0.009	0.027		−0.028	0.026	

Note: Sig.: ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

are shown in Table 6A, while Table 6B shows the estimates achieved if the health-related characteristics are also used as matching variables[8]. In both cases, the effect of retirement is significant in determining a worsening in self-reported health for men but not for women. In addition, retirement is not associated with any improvement for either gender. When health-related variables are included in the propensity score estimation, the average retirement effect on retirees is stronger and the standard errors are similar. Furthermore, when the health-related variables are included, the increase in individuals who are off support is negligible, and the estimates variance is not bigger. Thus, the propensity score estimates achieved using both significant covariates and health-related characteristics are preferred.

Table 6B shows that retirement increases the risk of reporting a worse health status by about 8% for men. No statistically significant effect is observed in the other cases. These results are in line with the regression analysis, although the effect of retirement on worsening health status for men turns out to be much smaller. This suggests that the logistic regression discussed in the previous section overestimates the negative effect of retirement on health for men.

To assess the matching quality, we compare the mean values of covariates observed among the treated and the matched untreated group (Table 7A and 7B). For the sake of simplicity, the mean values are shown only for the propensity score estimates based on the full set of matching covariates (significant and health-related variables). The matching variables appear to be properly balanced in the two

[8] Standard errors are estimated using bootstrapping.

Table 6B:
ATT estimate of reporting a worse or a better health status at time *t* + 1, using significant and health-related matching variables (set B)

		Worse			Better		
	PSM algorithms	**est.**	**s.e.**	**sign.**	**est.**	**s.e.**	**sign.**
Men	Radius	0.084	0.016	***	−0.033	0.019	
	Kernel	0.085	0.023	***	−0.035	0.019	
	LLR	0.085	0.022	***	−0.035	0.020	
Women	Radius	0.015	0.023		−0.031	0.022	
	Kernel	0.010	0.024		−0.028	0.025	
	LLR	0.008	0.026		−0.028	0.025	

Note: Sig.: ***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

groups, with non-significantly different mean values, regardless of which matching algorithm is used.[9]

A sensitivity analysis is implemented to assess how much a possible unobserved variable may affect the treatment effect estimates (Becker and Caliendo 2007). As we noted in section 3.3, the use of longitudinal data allows us to control for selection due to time-constant unobserved characteristics. However, further bias due to time-varying unobserved characteristics may exist.

Rosenbaum bounds (Rosenbaum 2002) are estimated[10] for significant ATT estimates only (i.e. the effect of retirement on the worsening of health among men) when the full set of matching covariates is used (see Table 6B). Our goal is to assess how big the effect of non-constant unobserved characteristics on the ATT estimates has to be to make the ATT estimates non-significant. Since we have estimated a positive treatment effect, we are interested in the bounds under the assumption that we have overestimated the retirement effect on men's health worsening (i.e. Q_mh+ in Table 8). The LLR estimate becomes non-significant for small values of Γ (say 1.15, 1.2), while radius and Kernel estimates are no longer significant for high levels of Γ (say 1.4); this suggests that the hypothetical bias due to non-constant unobserved characteristics has to be relatively large to make our estimates non-significant.

[9] The only significant difference between the treated and the untreated individuals is observed in the first age bound (55–59) when the radius matching algorithm is used. Further age classifications have been tested as single-year age classifications, and in any case the ATT estimates are very similar. We prefer five-year age classification because it provides better PSM estimates, and fewer individuals are off support.

[10] Mhbound STATA module is used.

Table 7A:
Health worsening – mean values of matching covariates in the treated and the untreated control group by matching estimator and gender

Man worse	Radius						Kernel						LLR					
	Mean			t-test		V(T)/	Mean			t-test		V(T)/	Mean			t-test		V(T)/
Variable	Treated	Control	%bias	t	p > |t|	V(C)	Treated	Control	%bias	t	p > |t|	V(C)	Treated	Control	%bias	t	p > |t|	V(C)
Age 55–59	0.39	0.46	−15.6	−2.54	0.011	0.96	0.389	0.422	−6.8	−1.11	0.267	0.97	0.389	0.380	1.9	0.31	0.76	1.01
Age 60–64	0.32	0.30	4.7	0.76	0.446	1.04	0.321	0.311	2	0.33	0.741	1.02	0.321	0.357	−8	−1.27	0.21	0.95
Age 65–69	0.22	0.18	11.8	1.73	0.085	1.17	0.220	0.200	5.5	0.79	0.429	1.07	0.220	0.198	6.2	0.89	0.38	1.08
Age 70–74	0.07	0.06	5.9	0.86	0.389	1.2	0.070	0.066	1.9	0.27	0.787	1.06	0.070	0.065	2.5	0.36	0.72	1.08
Lower secondary edu.	0.61	0.57	8.9	1.48	0.14	0.97	0.609	0.601	1.6	0.27	0.79	0.99	0.609	0.629	−4	−0.68	0.50	1.02
Secondary education	0.28	0.30	−4.9	−0.83	0.408	0.96	0.279	0.287	−1.7	−0.3	0.765	0.98	0.279	0.247	7	1.23	0.22	1.08
Tertiary education	0.11	0.13	−5.9	−1.07	0.285	0.86	0.112	0.111	0.1	0.01	0.989	1	0.112	0.124	−3.5	−0.65	0.52	0.91
Labour income	21.30	22.67	−5.6	−1.38	0.166	0.7	21.298	21.324	−0.1	−0.03	0.978	0.88	21.298	20.835	1.9	0.51	0.61	0.95
Self-employed	0.55	0.55	0.5	0.08	0.935	1	0.548	0.552	−0.8	−0.14	0.889	1	0.548	0.559	−2.2	−0.36	0.72	1
Part-time	0.09	0.08	5	0.73	0.465	1.14	0.090	0.090	−0.1	−0.01	0.992	1	0.090	0.094	−1.5	−0.21	0.84	0.97
Years of trans. 06–07	0.21	0.21	−0.1	−0.02	0.984	1	0.207	0.210	−0.7	−0.11	0.912	0.99	0.207	0.220	−3.1	−0.51	0.61	0.96
Years of trans. 07–08	0.21	0.21	−0.8	−0.13	0.897	0.99	0.209	0.211	−0.4	−0.06	0.95	0.99	0.209	0.213	−0.9	−0.15	0.88	0.99
Years of trans. 08–09	0.24	0.23	1.5	0.25	0.8	1.02	0.240	0.241	−0.2	−0.04	0.971	1	0.240	0.245	−1.3	−0.21	0.83	0.98
Years of trans. 09–10	0.15	0.16	−3.6	−0.62	0.535	0.93	0.148	0.149	−0.2	−0.04	0.967	1	0.148	0.126	5.7	1.05	0.30	1.14
Years of trans. 10–11	0.20	0.19	2.8	0.45	0.652	1.04	0.196	0.190	1.6	0.25	0.8	1.02	0.196	0.196	0	0	1.00	1
Very good health	0.07	0.07	−0.6	−0.1	0.923	0.98	0.070	0.066	1.4	0.25	0.801	1.05	0.070	0.077	−2.7	−0.46	0.65	0.91
Good health	0.59	0.62	−5.1	−0.84	0.402	1.02	0.593	0.604	−2.3	−0.37	0.709	1.01	0.593	0.569	4.8	0.79	0.43	0.98
Fair health	0.31	0.28	5.9	0.95	0.344	1.05	0.306	0.297	2.1	0.34	0.735	1.02	0.306	0.315	−2	−0.32	0.75	0.98
Bad health	0.03	0.03	0.1	0.02	0.982	1.01	0.031	0.033	−1.3	−0.2	0.838	0.94	0.031	0.038	−4.4	−0.66	0.51	0.82
Long-standing illness	1.82	1.83	−2.6	−0.42	0.671	1.04	1.816	1.822	−1.6	−0.26	0.793	1.03	1.816	1.807	2.4	0.38	0.70	0.96
Limitations in activities	1.81	1.82	−2.8	−0.45	0.654	1.04	1.807	1.811	−1.1	−0.18	0.861	1.02	1.807	1.800	1.9	0.3	0.76	0.97

Table 7A: Continued

Woman worse	Radius						Kernel						LLR					
	Mean			t-test		V(T)/	Mean			t-test		V(T)/	Mean			t-test		V(T)/
Variable	Treated	Control	%bias	t	p > |t|	V(C)	Treated	Control	%bias	t	p > |t|	V(C)	Treated	Control	%bias	t	p > |t|	V(C)
Age 55–59	0.49	0.54	−10.8	−1.3	0.194	1	0.49	0.50	−4	−0.49	0.627	1	0.49	0.50	−3.2	−0.39	0.70	1
Age 60–64	0.38	0.34	7.7	0.9	0.367	1.04	0.38	0.36	2.8	0.32	0.746	1.01	0.38	0.37	1.4	0.16	0.87	1.01
Age 65–69	0.10	0.08	4.4	0.51	0.61	1.12	0.10	0.09	2.4	0.28	0.781	1.06	0.10	0.08	4.7	0.54	0.59	1.13
Age 70–74	0.04	0.04	3.1	0.35	0.723	1.13	0.04	0.04	0.3	0.03	0.976	1.01	0.04	0.05	−1.7	−0.18	0.85	0.94
Labour income	16.22	16.65	−3.5	−0.56	0.579	0.93	16.22	16.16	0.5	0.08	0.937	1.01	16.22	15.76	3.8	0.63	0.53	1.17
Self-employed	0.70	0.69	0.5	0.07	0.946	1	0.70	0.70	0.1	0.02	0.987	1	0.70	0.69	1.3	0.17	0.87	0.99
Years of trans. 06–07	0.21	0.21	0.3	0.04	0.968	1	0.21	0.21	−1.5	−0.2	0.844	0.98	0.21	0.22	−2.2	−0.28	0.78	0.97
Years of trans. 07–08	0.18	0.19	−1.9	−0.25	0.803	0.97	0.18	0.20	−2.9	−0.38	0.708	0.96	0.18	0.16	6	0.82	0.42	1.12
Years of trans. 08–09	0.21	0.21	−0.5	−0.06	0.951	0.99	0.21	0.21	−1.5	−0.2	0.843	0.98	0.21	0.21	−2.2	−0.28	0.78	0.97
Years of trans. 09–10	0.15	0.17	−5.3	−0.73	0.466	0.9	0.15	0.15	0.4	0.05	0.957	1.01	0.15	0.15	1.5	0.22	0.83	1.03
Years of trans. 10–11	0.25	0.22	7.1	0.88	0.377	1.09	0.25	0.23	5.5	0.68	0.499	1.07	0.25	0.26	−2.9	−0.35	0.72	0.97
Very good health	0.07	0.07	−1.2	−0.16	0.873	0.96	0.07	0.07	−0.8	−0.1	0.92	0.97	0.07	0.07	2.3	0.31	0.76	1.08
Good health	0.61	0.62	−2.5	−0.32	0.752	1.01	0.61	0.62	−1.6	−0.2	0.842	1.01	0.61	0.58	6.8	0.86	0.39	0.97
Fair health	0.29	0.27	3.9	0.49	0.624	1.04	0.29	0.29	1.4	0.18	0.856	1.01	0.29	0.33	−8.7	−1.08	0.28	0.93
Bad health	0.02	0.03	−1.2	−0.17	0.868	0.92	0.02	0.02	1.9	0.28	0.783	1.15	0.02	0.02	0	0	1.00	1
Long-standing illness	1.81	1.81	−1	−0.12	0.902	1.02	1.81	1.81	−0.3	−0.04	0.97	1	1.81	1.80	1.5	0.2	0.85	0.98
Limitations in activities	1.79	1.80	−3.8	−0.48	0.63	1.06	1.79	1.80	−2.9	−0.37	0.713	1.04	1.79	1.79	−2.2	−0.28	0.78	1.03

Table 7B:
Health improvement- mean values of matching covariates in the treated and the untreated control group by matching estimator and gender

	Radius						Kernel						LLR					
Man better	**Mean**			**t-test**		**V(T)/**	**Mean**			**t-test**		**V(T)/**	**Mean**			**t-test**		**V(T)/**
Variable	**Treated**	**Control**	**%bias**	**t**	**p > |t|**	**V(C)**	**Treated**	**Control**	**%bias**	**t**	**p > |t|**	**V(C)**	**Treated**	**Control**	**%bias**	**t**	**p > |t|**	**V(C)**
Age 55–59	0.41	0.49	−16.6	−2.52	0.012	0.97	0.41	0.44	−7.2	−1.09	0.276	0.98	0.41	0.41	−0.9	−0.13	0.90	1
Age 60–64	0.31	0.29	4.2	0.64	0.525	1.04	0.31	0.30	2.4	0.37	0.712	1.02	0.31	0.29	4.2	0.63	0.53	1.04
Age 65–69	0.21	0.16	13.5	1.88	0.061	1.21	0.21	0.19	5.9	0.79	0.428	1.08	0.21	0.22	−2.4	−0.31	0.76	0.97
Age 70–74	0.07	0.06	6.8	0.93	0.355	1.24	0.07	0.07	1.5	0.2	0.84	1.05	0.07	0.08	−2.9	−0.37	0.71	0.93
Lower secondary edu.	0.59	0.55	7.4	1.15	0.248	0.98	0.59	0.58	1.3	0.2	0.84	1	0.59	0.59	−0.8	−0.13	0.90	1
Secondary education	0.30	0.31	−2.8	−0.44	0.657	0.98	0.30	0.31	−1.1	−0.18	0.857	0.99	0.30	0.29	1.8	0.28	0.78	1.02
Tertiary education	0.11	0.14	−6.6	−1.11	0.268	0.85	0.11	0.11	−0.3	−0.05	0.958	0.99	0.11	0.12	−1.2	−0.2	0.84	0.97
Labour income	21.65	23.12	−6	−1.33	0.185	0.7	21.65	21.79	−0.6	−0.13	0.895	0.88	21.65	21.48	0.7	0.18	0.86	1.08
Self-employed	0.55	0.55	−0.8	−0.13	0.898	1	0.55	0.55	−1.4	−0.22	0.822	1	0.55	0.53	2.5	0.39	0.70	1
Part-time	0.08	0.07	7	0.98	0.326	1.23	0.08	0.08	2.1	0.29	0.774	1.06	0.08	0.06	8.7	1.24	0.22	1.3
Years of trans. 06–07	0.21	0.21	−1.1	−0.17	0.868	0.98	0.21	0.21	0	0	0.999	1	0.21	0.22	−3	−0.47	0.64	0.96
Years of trans. 07–08	0.21	0.21	−1.5	−0.24	0.812	0.98	0.21	0.21	−1.3	−0.21	0.837	0.98	0.21	0.20	2.5	0.4	0.69	1.04
Years of trans. 08–09	0.23	0.23	1.7	0.25	0.8	1.02	0.23	0.23	0.4	0.06	0.954	1	0.23	0.23	0.5	0.08	0.94	1.01
Years of trans. 09–10	0.17	0.18	−2.9	−0.47	0.64	0.95	0.17	0.17	−0.6	−0.1	0.918	0.99	0.17	0.16	2.7	0.44	0.66	1.05
Years of trans. 10–11	0.19	0.17	4.1	0.61	0.541	1.07	0.19	0.18	1.7	0.25	0.8	1.03	0.19	0.20	−2.8	−0.41	0.68	0.96
Good health	0.50	0.53	−5.7	−0.88	0.379	1	0.50	0.51	−2.5	−0.39	0.696	1	0.50	0.49	0.4	0.06	0.95	1
Fair health	0.43	0.41	5.1	0.78	0.433	1.02	0.43	0.42	2.5	0.39	0.699	1.01	0.43	0.44	−2.5	−0.39	0.70	0.99
Bad health	0.06	0.06	1.1	0.17	0.868	1.04	0.06	0.06	0.1	0.01	0.989	1	0.06	0.06	1.8	0.27	0.79	1.07
Very bad health	0.01	0.01	1	0.14	0.891	1.09	0.01	0.01	0.1	0.01	0.992	1.01	0.01	0.00	6.8	1.14	0.26	2.48
Long-standing illness	1.77	1.79	−3.4	−0.51	0.608	1.05	1.77	1.78	−1.4	−0.21	0.834	1.02	1.77	1.75	7.2	1.05	0.29	0.92
Limitations in activities	1.76	1.78	−4.3	−0.66	0.511	1.06	1.76	1.77	−2.4	−0.36	0.717	1.03	1.76	1.74	4.5	0.67	0.50	0.95

Table 7B: Continued

Woman better	Radius						Kernel						LLR					
	Mean			t-test		V(T)/	Mean			t-test		V(T)/	Mean			t-test		V(T)/
Variable	Treated	Control	%bias	t	p > |t|	V(C)	Treated	Control	%bias	t	p > |t|	V(C)	Treated	Control	%bias	t	p > |t|	V(C)
Age 55–59	0.52	0.59	−13.7	−1.62	0.105	1.03	0.52	0.54	−4.7	−0.55	0.583	1.01	0.52	0.52	0	0	1	1
Age 60–64	0.35	0.31	9.9	1.15	0.253	1.07	0.35	0.34	3.3	0.38	0.702	1.02	0.35	0.35	0	0	1	1
Age 65–69	0.08	0.07	4.2	0.49	0.621	1.13	0.08	0.07	3.5	0.4	0.686	1.11	0.08	0.07	6.3	0.76	0.45	1.22
Age 70–74	0.04	0.03	6.4	0.72	0.475	1.32	0.04	0.04	−0.7	−0.07	0.941	0.97	0.04	0.06	−9.1	−0.89	0.37	0.75
Labour income	17.05	17.58	−4.2	−0.59	0.558	1.02	17.05	17.00	0.4	0.05	0.956	1.14	17.05	17.31	−2	−0.29	0.77	1.09
Self-employed	0.72	0.71	1.6	0.2	0.842	0.98	0.72	0.72	0.8	0.1	0.918	0.99	0.72	0.68	9	1.12	0.26	0.93
Years of trans. 06–07	0.23	0.23	1.3	0.16	0.87	1.02	0.23	0.24	−0.9	−0.11	0.915	0.99	0.23	0.24	−0.7	−0.09	0.93	0.99
Years of trans. 07–08	0.17	0.17	−1	−0.13	0.894	0.98	0.17	0.17	−0.6	−0.08	0.938	0.99	0.17	0.18	−2.4	−0.31	0.76	0.96
Years of trans. 08–09	0.21	0.21	−0.5	−0.06	0.951	0.99	0.21	0.21	−1.6	−0.2	0.84	0.98	0.21	0.21	−0.8	−0.1	0.92	0.99
Years of trans. 09–10	0.15	0.17	−6.7	−0.91	0.366	0.87	0.15	0.15	−0.9	−0.12	0.904	0.98	0.15	0.13	4	0.57	0.57	1.1
Years of trans. 10–11	0.25	0.22	6.6	0.8	0.427	1.08	0.25	0.23	3.9	0.47	0.64	1.05	0.25	0.25	0	0	1	1
Good health	0.53	0.54	−1.9	−0.24	0.814	1	0.53	0.53	0.1	0.01	0.993	1	0.53	0.49	7.5	0.94	0.35	1
Fair health	0.40	0.39	0.8	0.11	0.916	1	0.40	0.40	−0.5	−0.06	0.951	1	0.40	0.42	−5.1	−0.64	0.52	0.98
Bad health	0.07	0.07	2.4	0.29	0.775	1.08	0.07	0.07	0.9	0.1	0.919	1.03	0.07	0.09	−6.4	−0.73	0.47	0.84
Very bad health	0.01	0.01	−0.7	−0.08	0.935	0.92	0.01	0.01	0	0	0.999	1	0.01	0.00	4	0.58	0.56	1.99
Long-standing illness	1.77	1.78	−1.4	−0.18	0.861	1.02	1.77	1.77	0.7	0.08	0.933	0.99	1.77	1.76	3	0.37	0.71	0.96
Limitations in activities	1.72	1.75	−4.9	−0.61	0.542	1.05	1.72	1.73	−0.3	−0.04	0.966	1	1.72	1.69	7.9	0.95	0.34	0.93

Table 8:
Mantel–Haenszel bounds by matching algorithm for a worsening of health among men

	Radius				Kernel				LLR			
Gamma	**Q_mh+**	**Q_mh−**	**p_mh+**	**p_ mh−**	**Q_mh+**	**Q_mh−**	**p_mh+**	**p_mh−**	**Q_mh+**	**Q_mh−**	**p_mh+**	**p_mh−**
1	4.577	4.577	0.000	2.40E-06	4.577	4.577	0.000	2.40E-06	2.554	2.554	0.005	0.005329
1.05	4.083	5.075	0.000	1.90E-07	4.083	5.075	0.000	1.90E-07	2.221	2.890	0.013	0.001927
1.1	3.613	5.551	0.000	1.40E-08	3.613	5.551	0.000	1.40E-08	1.903	3.210	0.029	0.000664
1.15	3.165	6.008	0.001	9.40E-10	3.165	6.008	0.001	9.40E-10	1.599	3.516	0.055	0.000219
1.2	2.737	6.447	0.003	5.70E-11	2.737	6.447	0.003	5.70E-11	1.308	3.810	0.095	0.000069
1.25	2.327	6.871	0.010	3.20E-12	2.327	6.871	0.010	3.20E-12	1.030	4.093	0.151	0.000021
1.3	1.935	7.281	0.027	1.70E-13	1.935	7.281	0.027	1.70E-13	0.763	4.365	0.223	6.30E-06
1.35	1.557	7.677	0.060	8.10E-15	1.557	7.677	0.060	8.10E-15	0.506	4.628	0.307	1.80E-06
1.4	1.194	8.061	0.116	3.30E-16	1.194	8.061	0.116	3.30E-16	0.258	4.882	0.398	5.30E-07
1.45	0.844	8.433	0.199	0	0.844	8.433	0.199	0	0.019	5.127	0.492	1.50E-07
1.5	0.505	8.795	0.307	0	0.505	8.795	0.307	0	0.065	5.365	0.474	4.00E-08
1.55	0.178	9.147	0.429	0	0.178	9.147	0.429	0	0.288	5.596	0.387	1.10E-08
1.6	0.038	9.490	0.485	0	0.038	9.490	0.485	0	0.504	5.820	0.307	2.90E-09
1.65	0.346	9.824	0.365	0	0.346	9.824	0.365	0	0.713	6.037	0.238	7.80E-10
1.7	0.644	10.150	0.260	0	0.644	10.150	0.260	0	0.916	6.249	0.180	2.10E-10
1.75	0.933	10.468	0.175	0	0.933	10.468	0.175	0	1.113	6.455	0.133	5.40E-11
1.8	1.215	10.779	0.112	0	1.215	10.779	0.112	0	1.305	6.656	0.096	1.40E-11
1.85	1.489	11.084	0.068	0	1.489	11.084	0.068	0	1.492	6.852	0.068	3.70E-12
1.9	1.756	11.382	0.040	0	1.756	11.382	0.040	0	1.674	7.043	0.047	9.40E-13
1.95	2.016	11.674	0.022	0	2.016	11.674	0.022	0	1.851	7.230	0.032	2.40E-13
2	2.270	11.960	0.012	0	2.270	11.960	0.012	0	2.024	7.412	0.021	6.20E-14

In sum, the average retirement effect on retirees' estimates partially supports our research hypotheses when the observed and the unobserved heterogeneity between retirees and the still-employed are explicitly taken into account. It is clear that retirement affects men and women differently. Leaving their job is often a shock for men, who report a worsening of their subjective health over the short term. This is generally not the case for women, who are less likely to experience retirement as a negative event, possibly because they are more likely to be fully engaged in other demanding activities, often related to family care. We also expected to find that retirement would be associated with a subjective improvement in health among women, as they gained access to more free time and other individual resources. While this is not shown to be the case, the finding that retirement has no effect on women's self-reported health may suggest that they can more easily re-arrange their life-style in the short term.

5 Conclusions

With the population of Italy ageing rapidly, concerns have been raised about the cost of maintaining the country's pension and health care systems. Recently, following a wide-ranging debate on pension reform, the minimum pension age was increased. The goal of this reform is to reduce the pension burden by requiring people to postpone retirement. The reform affects women in particular, as the minimum retirement age for women is expected to become the same as that for men in the next few years. However, the relationship between retirement and individual health suggests that the changes implemented in the pension system may in turn lead to additional burdens for the health care system: if retirement is associated with improvements in health, then postponing retirement may lead to an increase in health-related expenditures; if, however, retirement is associated with worse health, then the health care system may benefit from the postponement of retirement. For these reasons, understanding the real effect of retirement on health is of primary interest in this context.

Nonetheless, disentangling the real effect of retirement from that of health is challenging, because the two experiences can affect each other: as being in poor health is usually associated with earlier retirement, individuals who retire early may differ systematically from those who retire later (self-selection). Moreover, the decision to retire and a change in health status may be simultaneously determined by the same individual's observed and unobserved characteristics. Different statistical methods can be implemented to identify the net effect of retirement on health, each of which has its own pros and cons. In this paper, we first provided an overview of the household and individual characteristics associated with the change in health status using logistic regression. We then referred to the propensity score matching estimator, which allowed us to estimate the effect of retirement on health.

By comparing health conditions in the two following years, we have been able to capture the short-term effect of retirement, which may be due to an adjustment to new social and economic roles. When individuals leave the labour market, their job loses its centrality in their daily life, and they have to reallocate the time previously spent in paid employment to alternative activities. As Italy is characterised by traditional gender roles, with men being expected to provide for the family, we hypothesised that men's health would worsen after they retired. Meanwhile we expected to find that retirement is less traumatic for women because they are more used to devoting their time to other demanding activities, such as domestic tasks or family care, and they may more easily adapt to the new life-style, by, for example, investing more time in family-related activities. Thus, we posited that women would report better health after retirement, because they would have more time and resources available for their non-work-related tasks and commitments. However, both the regressions and the propensity score matching estimators show that retirement is not associated with an improvement in self-reported health for either men or women. Instead, we find a deterioration in self-reported health for men, but not for women.

We see the gender differences in the retirement effect on self-reported health as being a consequence of the socio-cultural implications retirement has for men and women. However, adjusting to life after retirement may simply require greater effort and more time for men than for women. If this is the case, then the negative effect of retirement on self-reported health may fade away over a longer period of observation for men, as well as for women. Extending the analyses to examine longer term effects (e.g. two or three years) may provide us with some evidence to support this hypothesis. It is worth noting that an extension of the period of observation may affect the reliability of the results by reducing the size of the sample available for the analyses. However, (Sahlgren 2013), taking into account both the effect of retirement and the number of years spent in retirement, has pointed out the short-term impact of retirement on health is somewhat uncertain, while 'the longer-term effects are consistently negative and large'.

Our results suggest that the health care system may benefit if men postpone retirement. Among women, who have been more affected by the recent pension reform, we find no evidence of an improvement in health status after retirement. Thus, it appears that health care expenditures are not affected by these changes in the pension system. However, the recent changes may themselves have affected the retirement-health relationship. Thus, in the near future additional work is needed to re-analyse this association.

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