THE EFFECTS OF RETIREMENT ON INDIVIDUALS' HEALTH OUTCOMES

Abstract

This study examines the effect of retirement on the elderly's health outcomes. The variables assessed are divided into direct health outcomes- allergy, asthma, cholesterol, diabetes, heart diseases, hypertension, accidents suffered, self-reported health status- and intermediate health outcomes- visits to the hospital, visits to the emergencies services, smoking and BMI. To overcome endogeneity concerns, we estimate a cross-sectional IV model. The paper exploits changes on the fiscal incentives faced by individuals at retirement. In particular, the proposed identification strategy has as instruments the implicit tax rate variation across cohorts and skill groups, as well as, the statutory retirement age (65+). The analysis concludes that retirement increases the probability of suffering from asthma and smoking, as well as, the likelihood of having diabetes and of using health care. At the same time, it decreases the probability of hypertension and cholesterol issues. In addition, since those individuals with the lowest education profile are the once experiencing bigger effects, the analysis shows an existing education gradient. We also observe heterogeneous response by gender.

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1. Introduction

For many OECD countries, ageing is one of the most relevant challenges to be faced by public authorities. The population age structure is a demanding topic not only because of the pension system sustainability – as a result of the increase in the dependency ratio (Bonoli & Shinkawa, 2006) - but also for its impact on the healthcare expenditure and long-term care viability (World Health Organization, 2015).

For that reason, policies affecting the oldest segments of the society are a relevant and popular topic of analysis. In particular, this paper focuses on the effect of retirement on health outcomes. The decision of retiring supposes a major change in the life of individuals, as it has a direct impact on their income levels and time availability. Furthermore, retirement also has an influence on the individuals' social activities and daily life behaviours (Peppers, 1976), as well as, on their levels of stress (Eibich, 2015), all of them imaginable having an effect on health status.

The potential health effects are not only interesting per se, but also because they can, at their turn, have repercussions in several other aspects. For instance, by raising the retirement age, and by assuming it to have a positive impact on the individuals' health, the existing population's ageing may fall under a compression of morbidity framework (Fries, 1980) and not under the expansion of morbidity (Gruenberg, 1977).This will imply that the adverse predictions regarding the increase in long-term care and in healthcare expenditure may be smoothed. Furthermore, the social security expenditure will result positively affected, especially for those pension schemes defined as pay-as-you-go systems. On the contrary, if as a result of extending the active labour period, negative health consequences appear, the short run enhancement in the pension system may be offset by an increase in healthcare spending.

The existing literature has studied the impact of retirement on health from several perspectives in terms of approaches used and analysed outcomes. It is so because there is not a single outcome for measuring health, but several; we can assess health with respect to chronic conditions, but also with respect to self-perceived health or, even, with respect to limitations on daily life activities. The underlying mechanism through which retirement affects these distinct outcomes may be different. For instance, a subjective measure like the self-perceived health status may experience positive effects from retirement. It is so especially during the honeymoon period (Atchley, 1976), - the moment when the individual feels enthusiastic and initiate new activities. On the other hand, chronic conditions may be worsened if individuals undertake more unhealthy behaviours once they retire, such as doing less exercise. Therefore, the suggested direction of the retirement impact may be different depending on the particularities of the analysis. This complicates the comparability across studies, since, although all of them aim to assess the effect of retirement on health, they are not doing so on the same outcome. In addition, to obtain general conclusions is even more difficult because the analysed sample – determined by the country, time period, individuals' profile, etc. - may have a relevant role on the results. Different populations are linked to distinct environments and socio-cultural characteristics, creating heterogeneous synergies and so retirement effects. Nevertheless, from the previous literature three main points can be summarized. Firstly, most of the studies have found a causal impact on self-perceived health, although whether it is positive or negative depends on the studies' specificities. Secondly, the causal link between retirement and objective health measures is more unclear. And thirdly, it seems that the more physically demanding the jobs are, the higher the positive effects of retirement on health status.

This paper adds to the existing literature a new set of evidence for the Spanish setting. We focus the attention on the so-called direct outcomes - chronic disease, accident rate and self-assessed health- and on the intermediate outcomes- BMI, smoking behaviours, and use of healthcare. In this way, the study allows a profound understanding of the retirement effects on objective measures and on behavioural changes. This scope is set with the aim of providing a deep understanding of the underlying mechanisms taking place at the retirement moment. For example, if the ratio of smokers is lowered at retirement, and at the same time we observe lower rates of respiratory afflictions, we can conclude the behavioural change to be the latent medium driving the health outcome. The same could be argued if we see an increase in the probability of having high BMI levels and of suffering from diabetes.

However, it is important to acknowledge the fact that the retirement decision is highly tightened to the health status of individuals. It is so because those feeling in the worse health state may be more likely to retire than healthier individuals. Therefore, the main challenge of our analysis is to solve this endogeneity issue. Otherwise, if endogeneity issues are not controlled, we could infer that retirement causes worse health outcomes, when, indeed, what we would be capturing is the fact that less healthy individuals are more likely to drop out from the labour market. In order to solve the endogeneity issue, and following the strategy of most existing literature, an instrumental variable approach is implemented. In particular, we exploit the heterogeneous fiscal incentive faced by individuals at the moment of their retirement decision; to do so we use two instruments, firstly a dummy that accounts for the 65 years threshold of the statutory retirement age, and secondly, the implicit tax rate (Garcia-Gomez et al., 2018). The ITAX captures the trade-off in fiscal terms of working one extra year. The source of exogenous variation on the fiscal incentives arises from the numerous policy reforms implemented on the pension system over the last thirty years. The use of the instruments allows us to conclude whether retirement has a causal effect on the individual's health. In particular, the aim of the analysis is to evaluate the retirement's impact on the probability of suffering from some of the most relevant chronic diseases- allergy, asthma, cholesterol, diabetes, heart diseases, and hypertension. As well as, whether retirement affects the probability of reporting poor health or of suffering an accident. We also pay attention to the retirement's effect on the likelihood of being overweight or obese, and on the probability of smoking. Finally, we assess the effect of retirement on the probability of using health care.

This research contributes to the current discussion taking place in Spain about the convenience of postponing the retirement age. This debate was originated as a result of the concerns regarding the pension system sustainability. After years of surpluses, the social security budget began to have deficits in 2009. The liquidity issues faced by the Spanish government have as an origin two main factors: firstly, the economic crisis that leads the country with high unemployment rates and a reduction on the social security system contributions. And secondly, the number of pensions in Spain is projected to increase by almost 50 per cent from 2017 to 2050. In addition, over the same period, life expectancy at age 65 is expected to increase by about two years. This would imply the dependency ratio to rise from 29 to 70 by 2050 (IMF, 2017). Consequently, the pay-as-you-go Spanish pension system is, on the one hand, reducing the revenues and, on the other hand, will face a major increase in the expenses levels. A symptom of the concerns raised by this situation is the legislative change that took place in 2011, when the retirement age was set to progressively increase from 65 to 67. In addition, in 2013, it was the first legislative change that was not parametric but structural. It introduced the so-called Sustainability Factor, which linked the initial pension to the evolution of the life expectancy. We consider this study to contribute to the judgements with respect to the health effects of retirement, and what can be expected from any present or future policy change. The analysis allows a better assessment of the trade-off taking place in the cost-benefit analysis; since the increase on the social benefit contributions may be offset by the explosion on the health care expenses, in the case of retirement enhancing individuals health states.

Furthermore, this paper becomes of relevance as the identification strategy makes the causal effect exclusively arguable for those individuals that do respond to the fiscal incentives. Thus, the accuracy of the estimates and conclusion with respect to the potential policy adjustment would be more precise than if average retirement effects were computed. In addition, most of the existing literature has used as a source of exogenous variation the retirement statutory age. However, we are able to obtain more variability by complementing the retirement age threshold (65+) with the fiscal incentives faced by individuals at the moment of retirement. As a result, we obtain a relatively stronger instrumental variable approach, and therefore the inferences become more reliable.

The paper is divided into the following sections. Firstly, Section 2 describes the theoretical framework. After that, Section 3 presents the data and Section 4 the identification strategy. Section 5 presents the results of the research question and sensitivity analysis. Finally, Section 6 exposes the discussion and conclusions of the work.

2. Theoretical Framework

Although the effect of retirement on health outcomes is a popular topic of analysis, the results and conclusion obtained across the literature are quite divergent. The magnitude and even the direction of the effects vary significantly across evidence. It is so as a result of the coefficients' being highly sensitive towards the identification strategy, as well as, towards the data, period of analysis and population assessed. For instance, while cross-sectional analysis using instrumental variables tend to show positive effects on the self- perceived health status (Shai,2017; Eibich, 2015; Johnton& Lee, 2008), panel data approaches tend to point out towards negatives effects (Behncke, 2012; Calvo et al., 2012; Dave et al, 2008). Since these last studies implement FE-IV, we consider more insightful their results relatively to the ones from quasi experimental designs on cross-sectional data. Nevertheless, until the moment, most of the existing evidence of retirement effects on health outcomes is based on cross-sectional analysis.

With respect to the population characteristics, there are several factors that can also have an impact on the obtained estimates. For instance, Mazzona & Peracchi (2012) acknowledged a regional gradient across countries, showing significant differences in cognitive function between Mediterranean countries and continental Europe. In addition, the labour market conditions are another relevant factor that makes comparability across studies over time difficult. In particular, it may be the case if we think about the evolution of physically demanding jobs. For instance, Shai (2018) and Godard (2016) showed a positive impact of retirement on health as a result of the reduction on the work-related risk and physical effort. Following this argument, one may think about the hypothesis that once technological advancements reach the industries, the relevance of physical labour is reduced, and so the impact of retirement. Therefore, over time, the same type of jobs may entitle very different physical requirements and so the consequences of retirement may change. Not only that, we also have to consider the morbidity transition towards chronic conditions, which may have an influence on the average health status and, indirectly, on retirement effects. Thus, due to the dependency of the results on the approach implemented and sample context, it is not clear the direction of the effect that could be expected for this paper research questions.

Furthermore, and in addition to the great degree of heterogeneity due to the research method, as well as, exploited data, the existing literature has focused on a vast and diverse number of outcomes. This fact makes the comparability across studies even more challenging. Research studies can be found with respect to cognitive capabilities, self-assess health, objective health indicators, health-related behaviours, health care utilization, among others. In order to make an overview of the existing evidence, we present a brief discussion of the main results for each of these outcomes. We focus on those studies that are able to argue causality because of the implementation of quasi-experimental approaches.

The assessment of changes on cognitive capabilities had as an underlying benchmark not only the human capital theory but also the existence of two types of intelligence: the fluid intelligence, related to memory and abstract reasoning- which is lost over time- and the crystallized intelligence, determined by education and lifetime experiences. The main idea is that individuals can counterbalance the biological depreciation of mental capabilities through the engagement into intellectually challenging activities, which are more likely to be emplaced in the working environment. Therefore, once the person retires there is a drop in their daily mental exercise. This fact causes negative effects on his cognitive outcomes; known as the use-it-or-lose-it hypothesis (Rohwedder & Willis, 2010). Several papers have found such a result like Celidoni et al. (2017), Bonsang et al. (2012), Mazzonna & Peracchi, (2012) and Adam et al. (2007). However, to evaluate cognitive capabilities is not the only way to assess mental health outcomes. Kolodziej & García-Gómez (2017) paid attention to the depression condition. They found a very different result compared to the previous papers. In this case, to retire supposes a decrease in the number of depressive symptoms. They also showed a heterogeneous effect depending on the individuals' mental status starting-point.

In the case of self-reported health measures, Shai (2018), Johnston & Lee (2009) and Neuman (2008) showed a positive effect of retirement on subjective health, for the Israelites, the English, and the US citizens, respectively. Müller & Shaikh (2018) and Coe & Zamarro (2011) found the same direction of evidence for several European countries, via the assessment of the data set SHARE. Eibich (2015), explained three mechanisms through which retirement may positively affect self-perceived health: firstly a reduction of work-related pressure and stress, secondly an increase in the number of hours slept and thirdly an increase in the physical activity of newly retired people. However, adverse results of retirement on self-perceived health have been also observed. For instance, Calvo et al. (2012) and Dave et al. (2008), via fixed effects estimation on the Health and Retirement Study Survey (HRS), presented a negative impact of retirement on self-assess health for the American citizens. Moreover, Behncke (2012), also found a negative effect of retirement on English individuals by analysing three waves of the ELSA survey. Nevertheless, it is important to point out how the self-assessed health is an outcome that, although very popular in the literature, is susceptible to systematic divergences across groups (Salomon, 2009), reducing the consistency and comparability of the results. To avoid such drawbacks, analyses can be complemented with objective health measures, as was done by Johnston, & Lee (2009) and Neuman (2008), who did not find an effect on hypertension, heart conditions, diabetes, asthma or arthritis outcomes. In the same line of results, Ekerdt et al. (1984) found no significant impact of retirement on blood pressure or cholesterol. However, Horner & Cullen (2016) signalled towards an increase in the new retirees' risk of suffering from diabetes.

To further develop the evidence of the retirement's effect on health, several authors have taken one step forward, and have analysed changes in lifestyles that could, at their time, have an impact on health. For instance, Bertoni et al. (2018), through a differences and differences approach - taking advantage of a legislative change in Italy on the retirement age - showed that those individuals getting retired were more likely to engage in new physical activities; same conclusion was reached by Müller & Shaikh (2018), Kämpfren & Murer (2016), Celidoni & Rebba (2017) and Slingerland et al. (2007). In line with healthier habits resulting from retirement, Chung et al. (2007) showed how retired females reduced the number of eaten meals outside the home. Helldán et al. (2011) also found desirable food habits retired. Furthermore, Eibich (2015), Insler (2014) and Lang et al. (2007) showed a relation between retirement and a higher likelihood of quitting smoking. However, authors have also observed negative effects for some outcomes. Godard (2016) showed weight gains for those individuals that were previously working on physically demanding jobs. And, Robinson & Godbey (2010) observed an increase in the number of hours spent in front of the television.

Finally, there also exist analyses with respect to the potential behavioural changes in terms of health care utilization. Hallber et al. (2015) showed that early retirement for Swedish military officers reduced the number of inpatient care days. On the contrary, Caroli, et al. (2016) found a positive relationship between retirement and health care use for ten different European countries. In their analysis, the health care utilization increased due to the number of visits, as well as, due to the intensity of medical care. Stronger effects were showed for those individuals that were previously working at jobs demanding long hours worked, for that reason, the authors suggested that the increase in medical utilization may be driven by the decrease in the opportunity cost of time. Nevertheless, all the effects were only relevant for general practitioners and not for specialists. These results could be linked to the ones from Coe & Zamarro (2015), which showed the effectiveness of GP acting as gatekeepers for the retired individuals.

To conclude, because of the high degree of heterogeneity on the existing literature, it becomes very challenging to summarize the impact of retirement on health into a main idea or direction, and so, to expect beforehand a specific result for our analysis. As exposed, apart from the sample context, the impact depends on how the concept of health is measured. For that reason, we consider insightful to present a wide set of outcomes in order to show a complete vision of the retirement's health effects. This strategy allows us, on the one hand, to look for synergies across outcomes, and on the other hand, to compare our results with numerous papers.

3. *Data*

We use data from two different Spanish surveys: eight cross-sections (1987, 1993, 1995, 1997, 2001, 2003, 2006 and 2011) of the Spanish Health Survey- run by the health ministry- and one cross-section (2014) of the European health survey in Spain. The main specification uses a sample of 20,743 observations. Each observation presents numerous variables, these are related to the individual's health status and behavioural outcomes, his socioeconomic indicators and his employment status.

The analysed population is set by Spanish individuals between 55 and 69 years old, the point at which they are about to face the retirement decision. We must acknowledge the restrictions we impose on the data for consistency purposes. In particular, we set two constraints: on the one hand, those individuals above/below the age range or that have never worked are dropped out of the sample. And, on the other hand, observations with incomplete survey records - which did not present responses for all the outcomes - are removed from the sample. As a result of both restrictions, the number of observations shrinks from 136,396 to 28,104 with the first restriction, and from 28.104 to 20,743 with the second one. [1]

3.1 Retiree definition

The retiree definition accounts for those individuals that are either categorized as recipients of the old pension benefit or that are unemployed. To account for unemployed individuals is of relevance if we consider the high degree of transition taking place from unemployment to retirement in Spain. Consequently, for many individuals, the unemployment is a middle step between working and being formally retired (García-Pérez & Sánchez-Martín, 2015). It is so because of the legislation allowing unemployment to be a pathway into retirement for old individuals. Thus, the unemployed status in this age range is likely to be a permanent labour market's leave, and not a temporal one. So, if we understand the retirement condition as individuals exiting the labour market, this entitles the admittance of unemployed into the analysis for capturing the full impact of the labour market's way out. Furthermore, this definition has been used in other studies, like the one from Eibich (2015).

As a result of this definition, the data set is composed of 7,912 working individuals and by 12,831 individuals considered as retired, from which 1,895 are receiving an unemployment benefit. Table 1 displays the statistic for both groups. Retirees represent the 61.85% of our sample. As expected, their average age is almost 4 years higher- 63 years for retired versus an average of 59 years for working individuals. In addition, retirees tend to be less educated than their counterparts; there is a difference of around 6 percentage points favourable to the workers. There are also divergences with respect to the married condition. While 78% of the workers are married, it is only the 60% for retirees. This fact can be as a result of them being older and so more likely to have become widowers.

3.2 Outcomes of interest

Accounting for the fact that health is an extensive concept, we use a wide range of variables in order to get a better idea of the effect of retirement on health. The outcomes of interest are divided into two categories: on the one hand, direct health outcomes and, on the other hand, intermediate outcomes.

3.2.1 Direct outcomes

Following the strategy from Horner & Culler (2016), Johnton & Lee (2009) and Neuman (2008), we exploit objective health measures. In particular, we account for the prevalence of distinct chronic

[1] See Appendix A for further details on the number of observations per year.

diseases- allergy, asthma, cholesterol, diabetes, heart diseases and hypertension. Each condition is assessed independently. In addition, they are analysed in a jointly way, with a variable that accounts for the fact of individuals suffering from at least one of these diseases. In addition, a dummy for individuals having suffered an accident during the last year is also introduced. We consider this later outcome as relevant, as it allows us to see whether the potential health improvements are as a result of individuals avoiding work-related calamities.

However, we are aware that the specific diseases provide a narrow image of the overall health condition. For that reason, the individuals' self-assessed health status is introduced in our analysis for completeness. Baker et al. (2004) showed an existing relationship between subjective health and other health measures, like disease incidence. Thus, this measure contributes to a more precise picture of the individuals' well-being. Furthermore, the self-perceived health status has been extensively evaluated by the existing literature on the topic (Shai, 2018; Behncke, 2012; Coe & Zamarro, 2011), allowing a comparison of our results to previous evidence. In the survey, the respondents were faced with the question of how they would value their health state during the last twelve months. The scale ranged in the following way: 1.very good, 2.good, 3. regular, 4. bad and 5. very bad. To obtain the changes in the probability of a binary option, the data is collapsed to a two-point scale: being 1 if they considered their health as bad (categories 4 and 5) and 0 otherwise[2].

Table 1 shows the descriptive statistics for the different health outcomes. We can see how the chronic disease prevalence is higher for the retirees across all the afflictions. Particularly, asthma, hypertension and heart diseases are the ones presenting a higher gap between the working and the retired individuals. In addition, they also present worse self-reported health status. On the contrary, retirees seem to suffer from fewer accidents. This suggests that retirement is correlated with the individuals' health outcomes.

3.2.2 Intermediate outcomes

Previous literature has also focused on third outcomes that, although cannot be directly considered as health variables, their relationship with the individuals' health status makes them relevant for the analysis. For instance, it would be the case of health-related behaviours, such as smoking or exercise, as well as, risk factors like weight or sleeping hours.

2 Sensitivity test to this dummy definition were performed. We obtain consistent results to the presented definition.

From our perspective, there are two reasons that make these outcomes relevant to our research question. Firstly, they allow us to assess health-related behaviours that may be the ones driving the observable direct health developments (Eibich,2015). For instance, if people become more sedentary after retiring or they eat more unhealthy food -measured by having higher BMI levels- their risk of suffering from heart diseases or diabetes increases. Another example would be if they go more often to the general practitioner, as a result of them having more free time, the preventive care may help them to avoid these diseases. The second argument that supports the relevance of the intermediate outcomes is that they allow us to pay attention to the short run effects resulting from retirement. This is of particular importance since retirement may have a long-lasting effect on direct health outcomes that are not observable just right after getting out from the labour market. This implies that while the direct health effects are more likely to be accumulative over time (Heller-Sahlgren, 2017; Celidoni, 2017), behavioural changes like quitting smoking may have faster adjustments to the new condition. Therefore the intermediate outcome may allow us to see the short-term effects, and to infer potential long-term consequences to them. In such a way, we are able to overcome the constraints as a result of not having a panel data set.

We can divide the selected intermediate outcomes into personal conditions and health care utilization. With respect to personal condition, two factors are considered, the BMI of the individuals and their smoking habit. The weight of individuals is recorded into a kilograms scale, which, in hand with the height records, are collapsed to obtain BMI measures. Following the threshold used by WHO to consider a patient overweight, BMIs are translated into a dummy, being 1 for those BMI larger or equal to 25 and 0 otherwise. The same is done for a BMI of 30, in order to measure the obese condition. The relevance of accounting for the impact of retirement on the overweight or obese condition is clear since, apart from being risk factors, they become very accurate proxies for healthy habits in terms of exercise and food habits. Bertoni et al. (2018) already explored this link for the Italian case and they found a positive effect of retirement on exercise, and this on obesity. Therefore, to include this variable in our analysis allows us to assess whether it exist a comparable link for the Spanish setting. In addition, its interest arises because of BMI having an impact on chronic conditions, like diabetes, and on self-perceived health status. Moreover, in line with the exposed idea of short-term effect versus accumulative effect, the changes in terms of weight may be more immediate, and thus more likely to be observed.

With respect to smoking – recorded into 4 categories: 1. daily smokers, 2. habitual Smoker 3. no longer smoker and 4. never smoke. –the survey data is also translated into a dummy variable, being 1 for categories 1 and 2, and 0 otherwise. Again, it is clear the importance of smoking habits potentially having an impact on health outcomes such as respiratory conditions, and so being an underlying mechanisms taking place on the observable direct health outcomes.

Regarding the health care utilization, two different dummies are created: one accounting for the individuals visiting the hospital in the last year, and the other one, for them using the emergency services at some point during the last 12 months. Authors such as Caroli et al (2016) and Coe & Zamarro (2015) have paid attention to the impact of retirement on health care used. Several factors make their analysis insightful for the research question. The main one is that retirement supposes an increase of the available free time, consequently, individuals' opportunity cost towards going to the hospital or to the doctor significantly decreases, and so their incentives to do so raise. If this hypothesis is true, we can think that they may be receiving more preventive care, which eventually may have an impact on their perceived health status or even on the prevalence of the diseases. In addition, most of the political debate taking place with respect the convenience of extending the retirement age is only focusing the attention on its direct effect on the pension system sustainability. However, if retirement also produces the use of health care to increase, by extending the working life, society would not only benefit from a stronger pension system but also from savings on the healthcare expenditure.

Table 1 presents divergent intermediate outcomes across retired and working individuals. Retirees are less likely to smoke, more likely to be overweighed and obese, as well as, having a larger health care utilization. These factors suggest a link between retirement and the intermediate outcomes.

Table 1. Descriptive statistics by groups

			Retirees	Workers
			Mean (Std. Dev)	Mean (Std. Dev)
Characteristics		Age	63.470 (4.046)	59.372 (3.432)
		Gender	0.607	0.623
		Education High school University	 0.098 0.156	 0.151 0.219
		Married	0.607	0.782
Outcomes	Direct	Allergy	0.100	0.098
		Asthma	0.095	0.048
		Cholesterol	0.306	0.260
		Diabetes	0.142	0.085
		Heart Diseases	0.141	0.074
		Hypertension	0.403	0.287
		SAH	2.610	2.323
		Poor health h	0.154	0.076
		Accident	0.067	0.071
	Intermediate	BMI	27.319 (4.239)	26.871 (3.894)
		BMI25	0.698	0.666
		BMI30	0.227	0.184
		Smoking	0.261	0.307
		Hospital visits	0.106	0.074
		Emergency visits	0.221	0.167
Instruments		ITAX	0.452 (0.598)	-0.021 (0.476)
		>65 years	0.474	0.078
Number of observations			12,831	7,912
Percentage of the sample			61.85%	38.15%

4. Empirical approach

The aim of this paper is to estimate the effect of retirement on the individuals' health status. In absence of endogeneity issues, and after controlling for the distinct sample covariates (X_i), equation (1) captures the effect of retirement on the distinct health outcomes (H_{it}) via β_1:

$$H_i = \beta_o + \beta_1 retirement_i + \beta_2 X_i + u_i \qquad (1)$$

However, to obtain unbiased estimates, an OLS regression requires the error term to be unrelated to the independent variable, in this case, retirement. Such an assumption is unlikely to hold in this scenario i.e. the decision of retiring is tightened to the individuals' health, physical and cognitive conditions. This endogeneity concern can be in terms of omitted variable bias, and in terms of reverse causality. With respect to the omitted variable bias, an example of it can be the individuals' temporal discounts rates. In the case of an individual presenting high temporal discounts rates, the unobservable preferences towards present may have an impact on some of the analysed outcomes (H_{it}) such as smoking or high BMIs. At the same time, time preferences affect the individual's willingness to retire[3]. Thus, the preferences towards time may mislead our conclusion. We would be concluding towards a positive causal effect of retirement on smoking when what we will be observing would be the individual's preferences. The other source of endogeneity is in terms of simultaneity between retirement and the health outcomes. This implies that the impact is not unidirectional but bidirectional. For example, in the case of an individual suffering from severe chronic conditions, we can think about daily-life restriction making them more likely to retire. But, at the same time, retirement can also have an impact on the chronic conditions, which is the direction of impact we like to assess in this paper.

For that reason, and in order to isolate the causal effect of retirement on health outcomes, most of the existing literature have used quasi-experimental designs. In particular, to solve the endogeneity concerns, the majority of the previous research has used an instrumental variable design. This method exploits the fact that the independent variable ($retirement_i$) is partially affected by a third factor, which at the same time is not related to the relevant outcomes (H_i). In such a way, the authors are able to obtain exogenous variation on retirement that can be used to explore the causal link between it and the health outcomes. Most of the literature has used the differences in the legal retirement age across countries as an instrument (Heller-Sahlgren 2017; Mazzonna & Peracchi, 2012; Coe & Zamarro, 2011). For these authors, the divergences on the age thresholds across countries allowed them to exploit variability in the retirement moment that was not related to the health status. Nevertheless, such method has as an underlying premise the comparability of the population's characteristics and health outcomes between regions, a factor that may not hold. For instance, we can observe significant differences in life expectancies for the OECD countries (OECD 2018, Life expectancy at birth indicator), which indeed present rather similar working and retirement patterns. This concern has been already acknowledged in previous papers, like the one from Mazzonna & Peracchi (2012), where they found a North-South gradient for some health outcomes.

For that reason, our analysis presents a slightly different strategy. Firstly, the study is for one specific country -Spain- avoiding in this way the intrinsic social and cultural differences between observations. And secondly, the variability required for the IV approach comes from on two different sources: the exogenous variation in the fiscal incentives to retire because of legislative reforms, and on

[3] In this statement there is the underlying assumption that the individual obtains more utlity from leisure than from work.

the 65 years threshold. Using these two instruments we are able to obtain exogenous variability on retirement in the first stage. And this variation is used in the second stage to estimate the causal impact using the following specification:

$$H_i = \beta_o + \beta_1 \overline{retirement_i} + \beta_2 age_i + \beta_3 gender_i + \beta_4 education_i + \beta_5 married_i + region_i + year_i + u_i \quad (2)$$

where H_i are the different outcomes of interest. We consider them in terms of disease prevalence, self-assessed health status, accidents suffered, BMI of the individuals, smoking behaviour, and use of healthcare. In addition, the regression includes controls for the individuals' profile in terms of age, gender, education and marital status[4]. Furthermore, we control for the local labour market characteristics and for the economic cycle- region and year. The variable region aims to control for the heterogeneity across Spanish areas[5] and the variable year accounts for the distinct waves of the survey. We control for the time trend because population's morbidity and labour market conditions have evolved over time, especially since our data covers a period of 27 years.

Finally, point out that, as the sample is composed by a collection of single time observation - individuals were not followed over time - the estimates retrieved are only regarding the effect of retirement on the probability of the outcomes, but not on the change of those probabilities. To be able to argue changes on probabilities, we need a panel data sample, not available for the Spanish setting to our knowledge.

4.1 Instruments

In this section we expand the details of the first stage and instruments used. As explained, we aim to solve the existing endogeneity issue through the implementation of two instruments. On the one hand, we exploit the variability on the fiscal incentives to retire ($ITAX_{gt}$), and on the other hand, the 65 years threshold - the statutory retirement age. Taking into account both sources of exogenous variability on retirement, we formalize the first stage of the instrumental approach as:

$$retirement_i = \beta_o + \beta_1 ITAX_{gt} + \beta_2 age > 65_i + \beta_3 X_i + u_i \quad (3)$$

The first instrument, the implicit tax rate ($ITAX_{gt}$), measures the fiscal burden faced by the individual at the moment of the retirement decision, i.e. individuals are confronted with the choice of

[4] We have decided to introduce age in a linear way, since the introduction of it in a quadratic form implies the coefficient to be close to 0 and no significant.

[5] The so called Comunidades Autonomas. Formed by 17 Autonomous Regions and two Autonomous Cities.

whether to work an extra year or not. The measure compares gains and losses from social security wealth and earnings from working one year longer for each typical worker. The exogenous variability arises from the heterogeneous adjustments on the fiscal incentives to retire over time as a result of the multiple legislative reforms occurred in the country.

In our analysis, we use the $ITAX_{gt}$, computed by Garcia-Gomez, et al. (2018). Their estimates present the implicit tax rate over time and by individual profile, allowing their match to our cross-sectional data set. The authors formalized the equation for the $ITAX_{gt}$ as:

$$ITAX(\mathrm{R}, g) = -\frac{\mathrm{SSW}_{t+1}(R,g) - \mathrm{SSW}_t(R,g)}{Y_{t+1,\mathrm{g}}} \tag{4}$$

where, at age R, the present discount value of lifetime social security wealth[6] is divided by the after-tax earning obtained during the additional year of work. The impact of the fiscal burden on the retirement decision is determined by the sign of the numerator. It is so since the decision of extending the working period one extra year, implies two distinct effects: on the one hand, an increase in the individual contribution to social security and thus a positive impact in the annual benefit, on the other hand, it implies that the pension is received one year less. Individuals have incentives to retire when $ITAX_{gt}$ is positive as it supposes that the difference in their lifetime social security wealth is smaller than zero. Thus, the gain in terms of additional benefits over the remaining years is smaller than the forgone pension of that extra year of work. The opposite holds in case of $ITAX_{gt}$ being negative.

The key element that allows us to use $ITAX_{gt}$ as an instrument is that its evolution over time is not the same across individuals. And thus we observe variability at two levels: on the one hand, $ITAX_{gt}$ is different in terms of individuals profiles (g) with respect to gender, skill levels, marital status and age, And, on the other hand, the $ITAX_{gt}$ for the same profile is different over time depending on the legislative reform that took place. Among other legislative adjustments, in 1997 the number of required contributed years was increased from 8 to 15. In 2011 it was introduce a progressively increase on the statutory retirement age from 65 to 67. And in 2013 the sustainability factor was emplaced in order to link the pension system to the population life expectancy[7]. The identification strategy relies on the fact that because of the numerous reforms on the social security benefits and entitlements, the incentives

[6] Garcia-Gomez, et al. (2018) defines the social security wealth as $\mathrm{SSW}_t(R,g) = \sum_{a=R,T} B_{t,a}(\mathrm{R},\mathrm{g})\sigma_{t,a}\beta^{a-R}$ .It is computed for an individual type g, and depends on his annual benefits $B_{t,a}(R,g)$, his survival probability $\sigma_{t,a}$, and the discount rate factor β^{a-R}

[7] See Appendix B for further details on the social security system reforms

faced by individuals were exogenously adjusted in a non-homogenous way, and so the individuals' willingness to retire. In addition, the implicit tax rate has been calculated for the different individual profiles and not for any specific individual of the sample. Therefore, no interaction is possible between the $ITAX_{gt}$ values and the unobserved characteristics of the individuals

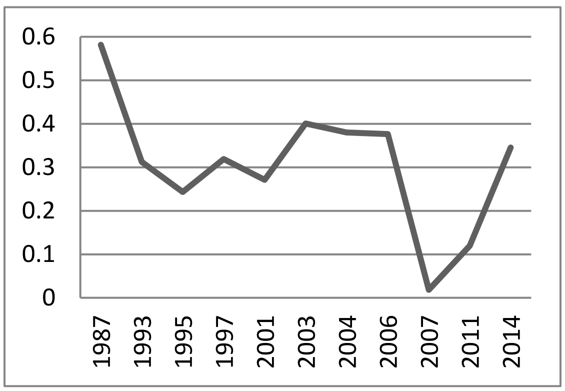
The estimates by Garcia-Gomez et al. (2018) on the implicit tax rate faced by individuals ranged from -8.100 to 1.869. When matching these values with the cross-sectional data of our study, the range of values is shirks to -3.421 and 1.710[8]. Furthermore, the retiree's group presents an average implicit tax rate of 0.452, whereas the workers have a value of -0.021[9]. Therefore the statistics are in line with the reasoning of the identification strategy implemented. It shows how those retired individuals face a positive burden of the tax, while those working bear a negative one, i.e. for them is worthy to keep active in the labour force. For example, we can observe, how for more recent cohorts, the lowest skilled individuals tend to experience higher incentives to keep working than at the beginning of the analysed period. For instance, a married male aged 60 in 1897 faced an implicit tax rate of 0.159 whereas, in 2014, the burden was –0.315. Therefore, he was encouraged by law -in an exogenous way to the other determinants- to extend his working lifetime.

The variation over time on the fiscal incentives can be observed in Figure 1, which displays the average evolution of the $ITAX_{gt}$ due to the distinct reforms. As not only the sign but also the magnitude of the fiscal burden is relevant for the individual incentives, we can see how on average there has been a reduction on the incentive to retire – the implicit tax rate tend to become closer to 0. Nevertheless, Figure 1 does not allow us to see how the different profiles (g) have faced distinct evolutions on their incentives to retire, a key element on our identification strategy. For that reason, Figure 2 presents the values of $ITAX_{gt}$ by ages and by educational levels. In Figure 2.a we can observe how, for instance, individuals aged 55 face a negative $ITAX_{gt}$ over time, which implies that they have fiscal incentives to remain active in the labour market. On the contrary, individuals aged 69 are the ones facing the higher incentives to become retirees. More insightful for our analysis is to pay attention to those individuals aged 60. In this case, between 1993 and 2001, they faced fiscal incentive to keep working, but from 2003 to 2011, and due to the legislative changes, they have had the incentives to drop out from it.

[8] The reduction on the values range is a result of dropping out multiple years for which no data was available in our cross-sectional set, as well as, because some cohorts for some itax's profiles do not present any observation in our sample.
[9] See Appendix A for further details on the evolution of the average implicit tax rate by groups.

Figure 2.b presents the evolution over time for individuals having primary school, high school and university studies. Those individuals having the highest educational level are the ones having less fiscal incentives to retire. It is so since they present a significant gap between their wage and the pension to be perceived. On the contrary, and following the opposite argument, those individuals having the lowest educational level are the ones having higher incentives to retire. Furthermore, Figure 2.b also presents the divergent evolution across educational levels over time, which creates the exogenous variability required for our instrument. For example, from 2006 on, individuals with primary education experienced a higher reduction on their incentive to retiree compared to people with university studies.

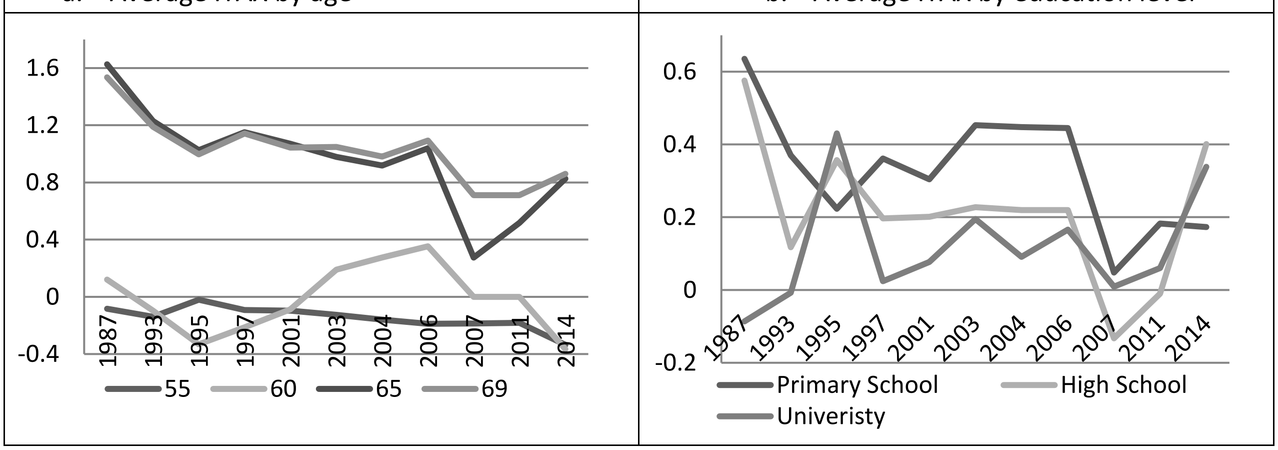
Figure 1. Average Implicit Tax Rate over time



Note: graph constructed matching the analysed sample to the estimates from Garcia-Gomez, et al. (2018) on the $ITAX_{gt}$ for the Spanish setting.

Figure 2 Average Implicit Tax rate over time by individuals' profile

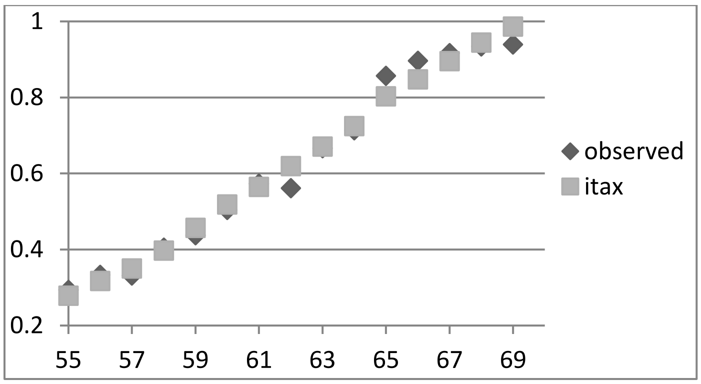
a. Average ITAX by age | b. Average ITAX by education level



Note: Note: graph constructed matching the analysed sample to the estimates from Garcia-Gomez, et al. (2018) on the Implicit Tax Rate for the Spanish setting.

Finally, the instrument is adequate in terms of relevance if the implicit tax rate is able to create exogenous variability into the retirement variable. Figure 4 displays the actual probability of retiring by age, as well as, the predicted probability of doing so when the implicit tax rate is used as an explanatory variable[10]. We can be seen how $ITAX_{gt}$ presents predictions on the retired condition that are quite in line with the actual outcomes observed. This fact gives a good starting point for the use of the implicit tax rate in the identification strategy. Finally, by using the implicit tax rate as an instrument, the study is measuring the impact of retirement exclusively for those individuals that respond to the fiscal adjustments. And therefore any further inference towards the whole population average retirement impact would not be accurate.

Figure 4. Trends in the probability of getting retired by age



In addition, for completeness of the identification strategy, we introduce a second instrument in (3). It is a dummy accounting for the 65 years threshold – the statutory legal age for retirement - which produces an exogenous jump on the likelihood of the same (Figure 5). In it, the prediction of retired has been computed using the estimates from a linear probability regression. We define as a dependent variable retirement, as an independent a dummy for the 65 years threshold, and a set of covariant accounting for age, gender, marital status, education, time trend and region trend.

Although individuals are entitled to early retirement from age 62 if they adopt this option they suffer from a penalization on their pension benefit. At age 65, it is no longer considered an early retirement - no deduction takes place on the pension benefit. Consequently, from that moment on, individuals are more willing to retire. In this way, it is created the observed discontinuity at 65 years old. To account for this breakpoint - via a dummy - constitutes a valid instrument since it is an arbitrary jump. Furthermore, in Table 2 we see how, around the 65 years, it exists a statistically significant difference in the probability of being retired. This fact reinforces the intuition of it being a proper instrument. Authors such as Shai (2018) and Bertoni et al. (2018) have taken advantage from age

[10] We compute the prediction of retirement using the estimates from an OLS speciation. This regression has as a dependent variable retirement, as independent the $ITAX_{gt}$ values form Garcia-Gomez et al. (2018), and a set of covariant accounting for age, gender, marital status, education, time trend and region trend.

thresholds; this, one the one hand, validates our method, and on the other hand, allows us to compare our results with the existing ones. Besides, the analysis of exogeneity for the 65 years dummy is also fulfilled since it refers to an arbitrary threshold, not related to the individuals' peculiarities.

Figure 5. Trends in the probability of getting retired around 65 years thresholds

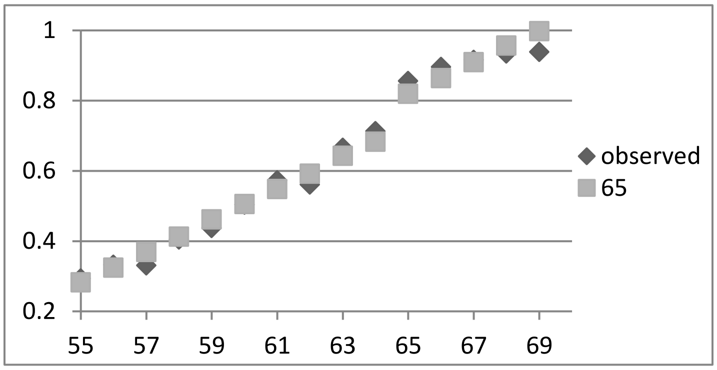


Table 2. Two-sample t-test for the difference in retirement around the threshold (age>= 64 to age<=66)

	Observations	Mean	Std. Err.	Std. Dev	[95% Coenf. Interval]
Working Retired	1,544 2,784	0.713 0.876	0.011 0.006	0.452 0.329	0.691 , 0.736 0.863 , 0.888
Combined	4,328	0.818	0.005	0.385	0.806 , 0.829
Diff		-1.161	0.011		-0.185 , -0.138
Diff=mean (0) – mean (1)					t= -13.539
H0: diff = 0					Degrees of freedom = 4326
Ha: diff < 0		Ha: diff !=0			Ha: diff > 0
Pr (T<t) = 0.000		Pr (|T|>|t|) = 0.000			Pr (T<t) = 1.000

To conclude, Table 3 displays the results obtain on the first stage of the IV approach. We see both instruments to significantly affect retirement, and the coefficients magnitude to be relatively equal. Furthermore, we observe the first stage to have an F-statistic larger than 10, which ensures the robustness of the instruments in terms of its relevance, i.e. the implicit marginal tax rate and the statutory retirement age are able to create exogenous variability on the retirement variable. Lastly, notice how for the instrumental variable to be efficient the analysed data has to be big enough, a condition fulfilled since the sample is formed by 20,743 individuals.

Table 3. First-Stage regression summary statistics

	Coefficient	Std. Error	t	p-value	
ITAX	0.073	0.011	6.38	0.000	
Age>65	0.050	0.009	5.36	0.000	
	R-sq	Adjusted R-sq	Partial R-sq	F(2, 20,808)	Prob>F
Retirement	0.2625	0.2613	0.0054	55.544	0.000

5. Results

5.1 Main results

Table 4 displays the outcomes for the different specifications for the direct health effects and Table 5 does the same for the intermediate outcomes. Each variable presents the coefficients for both, the OLS and the IV estimates using both instruments at the same time. We use robust standard errors in all the specifications.

Table 4&5 also present the results of the endogeneity test for the retirement variable. In the case of the test to be significant, that implies retirement to be endogenous and, thus, to be convenient the use of instrumental variables in order to control for it. On the contrary, if the test is not significant the OLS coefficients are the ones preferred, for efficiency reasons. In our results, we find mixed results, whereas asthma, cholesterol, heart diseases, hypertension, poor health and smoking are endogenous, it is not the case for allergy, diabetes, accident, BMI25, BMI30, hospital visits and emergency visits. For these latest outcomes, for which we prefer the OLS, the ones presenting significant coefficients at 5% level are diabetes, hospital visits and emergency visits. In particular, to be retired increases by 2.6 percentage points the likelihood of suffering from diabetes. The retiree status also increases by 2.9 percentage points and by 4.6 percentage points the probability of having been to the hospital or to the emergency services respectively.

In the case of cholesterol, heart diseases, hypertension and poor health once it is controlled for endogeneity, the sign of the retirement coefficient change from positive to negative. This implies that, while the OLS suggested a positive impact of retirement on the probability of suffering from the distinct conditions, the IV specification points towards a negative effect of retirement on that probability. This change in the sign of the coefficients may imply that those individuals suffering from worse health outcomes move out from the labour market to a higher extent than their healthier peers. This suggests that due to the reverse causality the OLS estimates are biased. To be retired imply a decrease in the probability of suffering from hypertension and from cholesterol of 33.4 percentage points and 27 percentage points respectively. It also implies the probability of smoking to increase by 32.2 percentage points and of asthma by 20.8 percentage points. Thus, the observed effect on respiratory issues may be partially related to this intermediate outcome.

In table 4&5 we can also evaluate the relevance of the selected control variables, i.e. the other factors that may determine the individuals' health. For instance, the direction of the impact of age is highly dependent on the analysed outcome. Furthermore, the magnitude of age is relatively small for all the variables, as it was the case for Coe & Zamarro (2015). It may be as a result of the narrow scope of the analysed ages. By only having individuals from 55 to 69, we cannot expect a substantial impact of age on the outcomes. In addition, being married- which is introduced as a proxy for social support- does not seem to have a relevant impact on the chronic conditions. However, it reduces the likelihood of presenting worse self-perceived health status and of suffering an accident, whereas, at the same time, it increases the likelihood of being overweighed. So it seems that social support may play a role in those outcomes more linked to behavioural patterns than for the objective health measures. With respect to education, the more educated the individuals are, the less likely to suffer from chronic afflictions, and to be overweighed or obese. Finally, for most of the outcomes, gender has a relevant effect on the probability of the same.

Table 4. Results for the direct health outcomes

	Allergy		Asthma		Cholesterol		Diabetes		Heart diseases		Hypertension		Any of the diseases		Poor Heath		Accidents	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Retired	0.004 (0.005)	-0.026 (0.067)	0.036*** (0.0049	0.208** (0.065)	0.012 (0.007)	-0.270** (0.102)	0.026*** (0.005)	-0.021 (0.073)	0.041*** (0.005)	0.002 (0.073)	0.015* (0.007)	-0.334** (0.105)	0.047*** (0.008)	-0.125 (0.101)	0.074*** (0.005)	-0.507 (0.079)	-0.010* (0.004)	-0.075 (0.005)
Gender	-0.058*** (0.005)	-0.057*** (0.005)	0.007* (0.004)	0.008* (0.004)	-0.031*** (0.007)	-0.031*** (0.007)	0.037*** (0.005)	0.037*** (0.005)	0.051*** (0.005)	0.0051*** (0.005)	-0.015* (0.007)	-0.017* (0.007)	-0.008 (0.007)	-0.009 (0.007)	-0..036*** (0.005)	-0.036*** (0.005)	-0.040*** (0.004)	-0041*** (0.004)
Age	-0.001* (0.001)	0.000 (0.003)	0.001** (0.000)	-0.007* (0.003)	0.002 (0.001)	0.016* (0.005)	0.003*** (0.001)	0.005 (0.004)	0.005*** (0.001)	0.007 (0.003)	0.012*** (0.001)	0.029*** (0.005)	0.010*** (0.001)	0.018*** (0.0005)	-0.003*** (0.001)	0.004 (0.004)	0.000 (0.000)	0.003 (0.003)
High School	0.005 (0.007)	0.002 (0.010)	-0.022*** (0.005)	-0.004 (0.009)	-0.029** (0.010)	-0.059*** (0.015)	-0029*** (0.010)	-0.034** (0.010)	-0.009 (0.007)	-0.014 (0.010)	-0.042*** (0.010)	-0.078*** (0.015)	-0.044*** (0.011)	-0.062*** ('0.015)	-0.037*** (0.007)	-0.51*** (0.011)	-0.005 (0.006)	-0.012 (0.008)
University	0.011 (0.006)	0.006 (0.012)	0.028*** (0.004)	0.000 (0.011)	-0.018 (0.009)	-0.062*** (0.019)	-0.052*** (0.006)	-0.059*** (0.013)	0.001 (0.006)	-0.006 (0.013)	-0.048*** (0.009)	-0.103*** (0.019)	-0.040*** (0.009)	-0.068*** (0.018)	-0.059*** (0.006)	-0.079*** (0.014)	-0.002 (0.005)	-0.012 (0.010)
Married	0.000 (0.005)	-0.002 (0.007)	0.001 (0.004)	0.012* (0.006)	0.006 (0.007)	-0.013 (0.010)	-0.006 (0.005)	-0.010 (0.007)	-0.002 (0.005)	-0.004 (0.007)	0.020** (0.007)	-0.003 (0.010)	0.018* (0.007)	0.007 (0.010)	-0.012** (0.006)	-0.020** (0.088)	-0.013** (0.004)	-0.017** (0.006)
Region	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Time trend	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Constant	0.173*** (0.034)	0.101 (0.164)	0.023 (0.030)	0.433** (0.154)	0.006 (0.050)	-0.663** (0.246)	-0.111** (0.037)	-0.223 (0.176)	-0.249*** (0.036)	-0.345* (0.167)	-0.537*** (0.050)	-1.363*** (0.253)	-0.176*** (0.051)	-0.583* (0.245)	0.329*** (0.039)	0.020 (0.189)	0.092** (0.028)	-0.060 (0.133)
Endogeneous F(1, 20,808) (p.value)	0.204 (0.651)		7.501 (0.006)		8.259 (0.004)		0.421 (0.516)		5.308 (0.008)		12.368 (0.000)		3.016 (0.082)		2.844 (0.091)		1.422 (0.233)	
N	20,743																	

Note: Significance levels: ***p<0.01, **p<0.05, *p<0.1. Robust standard errors. Outcomes for which IV is the relevant specifiation: asthma,cholesterol, hyperthension, any of the diseases, poor health and smoking. For the rest of outcome OLS is the preferred specification for efficiency reasons.

Table 5. Results for the intermediate health outcomes

	Smoking		BMI25		BMI30		Hospital		Emergencies	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Retired	0.023** (0.007)	0.322** (0.099)	-0.007 (0.008)	-0.077 (0.102)	0.010 (0.007)	0.075 (0.091)	0.029*** (0.005)	0.017 (0.066)	0.046*** (0.007)	-0.025 (0.088)
Gender	0.202*** (0.006)	0.204*** (0.006)	0.108*** (0.007)	0.108** (0.007)	-0.002 (0.006)	-0.001 (0.006)	0.010* (0.004)	0.010* (0.004)	-0.039*** (0.006)	-0.039*** (0.006)
Age	-0.012*** (0.001)	0.027*** (0.0005)	0.003** (0.001)	0.006 (0.005)	0.001 (0.001)	-0.002 (0.005)	0.001 (0.000)	0.001 (0.003)	-0.002* (0.001)	0.002 (0.004)
High School	0.023* (0.010)	0.054*** (0.014)	-0.097** (0.011)	-0.104*** (0.015)	-0.072*** (0.009)	-0.065*** (0.013)	-0.006 (0.006)	-0.007 (0.009)	-0.025** (0.009)	-0.032* (0.013)
University	0.012 (0.009)	0.059** (0.018)	-0.133*** (0.010)	-0.144*** (0.019)	0.110*** (0.007)	-0.100*** (0.016)	-0.004 (0.006)	-0.006 (0.012)	-0.038*** (0.008)	-0.049** (0.016)
Married	-0.032*** (0.007)	-0.012 (0.009)	0.041*** (0.008)	0.036*** (0.010)	-0.002 (0.007)	0.002 (0.009)	0.003 (0.005)	0.002 (0.006)	0.001 (0.007)	-0.003 (0.009)
Region	X	X	X	X	X	X	X	X	X	X
Time Trend	X	X	X	X	X	X	X	X	X	X
Constant	1.281*** (0.047)	1.989*** (0.241)	0.397*** (0.052)	0.231 (0.246)	0.123** (0.046)	0.278 (0.219)	0.072* (0.035)	0.043 (0.159)	0.263*** (0.046)	0.097 (0.215)
Endogeneous F(1, 20,808) (p.value)	10.105 (0.001)		0.483 (0.486)		0.520 (0.470)		0.035 (0.851)		0.639 (0.424)	
N	20,743									

Note: Significance levels: ***p<0.01, **p<0.05, *p<0.1. Robust standard errors. Outcomes for which IV is the relevant specifiation: asthma,cholesterol, hyperthension, any of the diseases, poor health and smoking. For the rest of outcome OLS is the preferred specification for efficiency reasons.

5.2. Heterogeneous effects

This section analyses the heterogeneous impact of retirement across skill levels. The intuition is that the underlying mechanisms taking place on the retirement causal effect are different depending on the individuals' profile in terms of education level. For instance, the internal motivation towards working is likely to be higher for highly educated individuals than for lower educated, thus they may be less elastic to the adjustments on the fiscal incentives. Consequently, by aggregating all the skill levels in the same regression, some accuracy of the estimates may be lost even after controlling for education level.

Table 6 displays the results for three separate regressions per education level[11]. Firstly point out how for primary school, in magnitude terms, the coefficients obtained are quite similar to the ones presented for the whole sample. For example, for individuals having complete at most primary school level, to retire increases their probability of having hypertension by 31.4 percentage points whereas for the overall sample the increase is by 33.4 percentage points. We can also see how for them to be retired increases by 3.4 percentage points the likelihood of having been to the hospital, compared to the 2.9 percentage points for the whole sample. However, it is important to highly the relative weight of this category in the whole sample regression, a factor that may influence this relation - individuals having primary school almost represent the 70% of it[12]. High school (iii) and University (iv) account for less than a fifth of the sample, each one of them. In their case, no significant effects at 5% are found[13]. Furthermore, while for primary school sample (ii) the F-statistic is improved compared to the main specification (i), it is not the case for (iii) and (iv); for these categories the F-statistic is below 10, this fact raises concerns with respect to the strength of the instrument on this subsample.

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[11] The same assessment was also undertaken via the introduction of an interaction effect between retirement and a dummy for the educational level (0 for primary school, 1 otherwise). We obtain the same overall conclusion.

[12] This fact may be as a result of the sample containing cohorts raised during the Franco dictatorship, historical moment that presented fewer opportunities in terms of education possibilities. This hypothesis gains feasibility since later cohorts present more equal educational proportions.

[13] Because of the sample size concerns, a regression was run adding both samples – high school and university. No significant changes were observed.

Table 6. Retired coefficient by education level

		Whole sample		Separate regressions					
		(i)		(ii)		(iii)		(iv)	
				Primary School		High School		University	
		OLS	IV	OLS	IV	OLS	IV	OLS	IV
Direct Health Outcomes	Allergy	0.004 (0.005)	-0.026 (0.067)	0.011* (0.006)	-0.003 (0.062)	-0.008 (0.014)	-0.046 (0.191)	-0.010 (0.013)	-0.465 (0.622)
	Asthma	0.036*** (0.0049	0.208** (0.065)	0.044*** (0.005)	0.204** (0.065)	0.023** (0.009)	0.143 (0.138)	0.014 (0.009)	0.512 (0.471)
	Cholesterol	0.012 (0.007)	-0.270** (0.102)	0.011 (0.009)	-0.247** (0.095)	0.005 (0.020)	-0.662 (0.339)	0.023 (0.018)	0.013 (0.722)
	Diabetes	0.026*** (0.005)	-0.021 (0.073)	0.029*** (0.006)	-0.015 (0.069)	0.018 (0.013)	0.139 (0.212)	0.016 (0.011)	0.670 (0.668)
	Heart diseases	0.041*** (0.005)	0.002 (0.071)	0.047*** (0.006)	0.011 (0.066)	0.036** (0.012)	0.238 (0.197)	0.026* (0.012)	-0.430 (0.649)
	Hypertension	0.015* (0.007)	-0.334** (0.105)	0.014 (0.009)	-0.314** (0.101)	-0.003 (0.020)	-0.144 (0.286)	0.024 (0.017)	-0.078 (0.615)
	Any of the diseases	0.047*** (0.008)	-0.125 (0.101)	0.058*** (0.009)	-0.108 (0.097)	0.011 (0.022)	-0.257 (0.302)	0.025 (0.018)	0.263 (0.623
	Poor health	0.074*** (0.005)	-0.057 (0.079)	0.091*** (0.007)	-0.065 (0.079)	0.036** (0.014)	-0.112 (0.192)	0.043*** (0.011)	-0.204 (0.516)
	Accident	-0.010* (0.004)	-0.075 (0.055)	-0.011* (0.005)	-0.020 (0.050)	-0.022 (0.012)	-0.010 (0.152)	0.004 (0.010)	-1.018 (0.749)
Intermediate Outcomes	Smoking	0.023** (0.007)	0.322** (0.099)	0.021* (0.008)	0.330*** (0.095)	-0.044 (0.019)	0.024 (0.257)	0.050** (0.017)	0.586 (0.751)
	BMI25	-0.007 (0.008)	-0.077 (0.102)	-0.007 (0.009)	-0.132 (0.096)	-0.029 (0.021)	-0.309 (0.308)	0.009 (0.019)	-0.192 (0.712)
	BMI30	0.010 (0.007)	0.075 (0.055)	0.017* (0.008)	0.092 (0.087)	-0.039* (0.017)	0.265 (0.258)	0.015 (0.014)	-1.154 (0.939)
	Hospital	0.029*** (0.005)	0.017 (0.066)	0.034*** (0.006)	-0.027 (0.063)	0.007 (0.013)	0.040 (0.176)	0.031** (0.011)	-0.418 (0.578)
	Emergencies	0.046*** (0.007)	-0.025 (0.088)	0.049*** (0.008)	0.012 (0.083)	0.035 (0.018)	0.008 (0.254)	0.034* (0.015)	-0.099 (0.652)
F-statistic F(2, 20,708)		55.544		60.652		6.154		1.345	
Number of Observations		20,743		14.536		2,468		3,739	
Percentage of the sample		100%		70.08		11.90%		18.03%	

Note: Significance levels: ***p<0.01, **p<0.05, *p<0.1. Robust standard errors. Outcomes for which IV is the relevant specifiation: asthma,cholesterol, hyperthension, any of the diseases, poor health and smoking. For the rest of outcome OLS is the preferred specification for efficiency reasons.

In Table 7 separate regressions are set for males and females[14]. The relevance of two different specifications comes from the idea of different labour market opportunities taking place for women and men. For instance, one may think that, although both individuals could have primary studies, men are much likely to end up working in more physically demanding jobs than women, for example, we may think about a miner versus a cleaner[15]. As a result of this, their incentive to retire and their elasticity towards the fiscal burden may present different patterns. In addition, there are social norms that predispose women to be more willing to remain at home, or earn less money than their partners, and thus they may be more inclined to take advantage of the retirement possibility. So, even after introducing a control variable for gender, to estimate a single coefficient may not be enough.

[14] The same assessment was also undertaken via the introduction of an interaction effect between retirement and a dummy for gender. We obtain the same overall conclusion.

[15] The cross-sectional data used does not provide us with information about the specific job performed; we only have information regarding their educational level. Therefore, we cannot control for this fact, and then it becomes even more relevant to set two separated models by gender.

For both regressions (ii) and (iii), the instrument relevance is ensured as the F-statistics continues to be larger than 10. However, for females, with the exception of hospital and emergency visits, no coefficient is significant at 5%. On the contrary, for males, asthma and diabetes also keep being statistically significant at 5%. Furthermore, while females seem to experience to a greater extent the effect of retirement on the increase of their health care use, males do so for the increase on the probability of suffering from asthma and diabetes. For the whole sample (i) to be retired increases the probability of suffering from asthma by 20.8 percentage points, whereas for the males sample the effect is an increase of 21.1 percentage points. The magnitude of the effect moves from 2.6 to 3.4 percentage points for the increase on the probability of diabetes. Thus, whereas for females, retirement entitles behavioural responses in terms of health care use, it seems that for male the impact is linked to direct health outcomes. This conclusion may be in line with the hypothesis of males undertaking more physically demanding jobs; as we observe negative effects on chronic conditions after retirement, when potentially, their activity levels may have been significantly reduced.

Table 7. Retired coefficient by gender

		Whole sample		Separate regressions			
		(i)		(ii)		(iii)	
				Female		Male	
		OLS	IV	OLS	IV	OLS	IV
Direct Health Outcomes	Allergy	0.004 (0.005)	-0.026 (0.067)	0.005 (0.009)	-0.170 (0.174)	0.004 (0.006)	0.042 (0.070)
	Asthma	0.036*** (0.0049	0.208** (0.065)	0.020*** (0.006)	0.151 (0.122)	0.042*** (0.006)	0.211** (0.081)
	Cholesterol	0.012 (0.007)	-0.270** (0.102)	0.007 (0.012)	-0.196 (0.228)	0.018 (0.009)	-0.299* (0.118)
	Diabetes	0.026*** (0.005)	-0.021 (0.073)	0.017* (0.008)	-0.104 (0.153)	0.034*** (0.007)	0.037 (0.090)
	Heart diseases	0.041*** (0.005)	0.002 (0.071)	0.017* (0.007)	-0.050 (0.137)	0.058*** (0.007)	0.029 (0.089)
	Hypertension	0.015* (0.007)	-0.334** (0.105)	0.011 (0.012)	-0.515* (0.250)	0.023* (0.009)	-0.218 (0.119)
	Any of the diseases	0.047*** (0.008)	-0.125 (0.101)	0.014 (0.012)	-0.121 (0.219)	0.069*** (0.010)	-0.115 (0.120)
	Poor health	0.074*** (0.005)	-0.057 (0.079)	0.059*** (0.009)	-0.256 (0.187)	0.083*** (0.007)	0.039 (0.089)
	Accident	-0.010* (0.004)	-0.075 (0.055)	0.000 (0.008)	-0.197 (0.144)	-0.015** (0.005)	0.018 (0.058)
Intermediate Outcomes	Smoking	0.023** (0.007)	0.322** (0.099)	0.019* (0.009)	0.448* (0.183)	0.013 (0.010)	0.190 (0.121)
	BMI25	-0.007 (0.008)	-0.077 (0.102)	0.023 (0.013)	-0.023 (0.228)	-0.021* (0.009)	-0.007 (0.117)
	BMI30	0.010 (0.007)	0.075 (0.055)	0.012 (0.011)	0.018 (0.199)	0.012 (0.008)	0.147 (0.108)
	Hospital	0.029*** (0.005)	0.017 (0.066)	0.036*** (0.007)	0.062 (0.139)	0.024*** (0.006)	-0.009 (0.080)
	Emergencies	0.046*** (0.007)	-0.025 (0.088)	0.045*** (0.011)	0.058 (0.201)	0.045*** (0.008)	-0.061 (0.102)
F-statistic		55.544		11.315		40.778	
Number of Observations		20,743		7,981		12,762	
Percentage of the sample		100%		38.47%		61.52%	

Note: Significance levels: ***p<0.01, **p<0.05, *p<0.1. Robust standard errors. Outcomes for which IV is the relevant specifiation: asthma,cholesterol, hyperthension, any of the diseases, poor health and smoking. For the rest of outcome OLS is the preferred specification for efficiency reasons.

5.3. Sensitivity Analysis

5.3.1. The implicit tax rate used

In this section we test the consistency of our estimates with respect to the values of the implicit tax rate used. The $ITAX_{gt}$ compares gains and losses from social security wealth and earnings from working one year longer. Garcia-Gomez et al (2018) defined the working earnings by profiles linking them to the educational level; low earnings profile for those individuals having at most primary education, medium earnings profile for high school, and high earnings profile for university level. In order to obtain estimates for the earnings profile, the authors exploit administrative data from the US Current Population Survey (CPS), the German Socio-Economic Panel (GSOEP) and the Italian pension system, and they construct the so-called synthetic earnings profile. At the same time, the authors also derive the estimates of the $ITAX_{gt}$ in the case of considering the Spanish specific earnings profile.

For the main speciation, we select the $ITAX_{gt}$ values that were estimated using a synthetic earnings profile. However, Garcia-Gomez et al (2018) acknowledge the synthetic earnings profile to overestimate the social security wealth of the low and medium earners before reaching the statutory retirement age. This implies the values of the $ITAX_{gt}$ to be slightly lower for the synthetic values compared to the Spanish ones. This section aims to contrast the IV coefficients in the case of using the $ITAX_{gt}$ values from the Spanish earning profile with the synthetic ones.

Table 8 presents the estimates for both cases. The F-statistic remains to be greater than 10, and it is even slightly improved compared to the main speciation. The comparison of the coefficients is only of relevance for those outcomes that were found to be endogenous and so that the IV approach is the efficient approach to implement - asthma, cholesterol, hypertension, any of the diseases, poor health and smoking.

In terms of statistical significance, the relevance of the outcomes is unchanged. However, the magnitudes of the coefficients change on a small scale. In the case of asthma and hypertension the size of the effect is reduced, whereas for cholesterol and smoking it increases. For instance, in the main specification to be retired increases the probability of suffering from asthma by 20.8 percentage points, in the analysis using the $ITAX_{gt}$ computed for the Spanish earning profile the causal effect is an increase of 19.1 percentage points. For cholesterol the magnitude of the impact moves from a reduction on the burden of the disease of 27 to 29.9 percentage points. Consequently, the coefficients retrieved for our analysis seem to be consistent with the $ITAX_{gt}$ values used.

Table 8. Retired coefficient by $ITAX_{gt}$ used

		OLS	IV	
			Synthetic ITAX	Spanish ITAX
Direct Health Outcomes	Allergy	0.004 (0.005)	-0.026 (0.067)	-0.038 (0.065)
	Asthma	0.036*** (0.0049	0.208** (0.065)	0.191** (0.061)
	Cholesterol	0.012 (0.007)	-0.270** (0.102)	-0.299* (0.097)
	Diabetes	0.026*** (0.005)	-0.021 (0.073)	0.015 (0.071)
	Heart diseases	0.041*** (0.005)	0.002 (0.071)	-0.010 (0.069)
	Hypertension	0.015* (0.007)	-0.334** (0.105)	-0.276** (0.099)
	Any of the diseases	0.047*** (0.008)	-0.125 (0.101)	-0.098 (0.095)
	Poor health	0.074*** (0.005)	-0.057 (0.079)	-0.026 (0.075)
	Accident	-0.010* (0.004)	-0.075 (0.055)	-0.102 (0.053)
Intermediate Outcomes	Smoking	0.023** (0.007)	0.322** (0.099)	0.335*** (0.096)
	BMI25	-0.007 (0.008)	-0.077 (0.102)	-0.032 (0.096)
	BMI30	0.010 (0.007)	0.075 (0.055)	0.067 (0.088)
	Hospital	0.029*** (0.005)	0.017 (0.066)	0.011 (0.064)
	Emergencies	0.046*** (0.007)	-0.025 (0.088)	-0.027 (0.085)
F-statistic		-	55.544	59.971
Number of observations		20,743		

Note: Significance levels: ***p<0.01, **p<0.05, *p<0.1. Robust standard errors. Outcomes for which IV is the relevant specification: asthma,cholesterol, hyperthension, any of the diseases, poor health and smoking. For the rest of outcome OLS is the preferred specification for efficiency reasons.

5.3.2. Instruments used

This section assesses, in an independent way, the performance of the two instruments used. The aim is to disentangle their isolated impact on the first stage of the instrumental approach and, consequently, on the coefficients of the second stage. Table 9 presents the estimates obtained in the main specification and allow us to compare these to the ones introducing the instrument in a separately way - (iii) and (iv). For all the cases the relevance of the distinct instruments is ensured as the F-statistic is bigger than 10. By using the instruments in an isolated way, there is no coefficient that turns out to be significant that was not already so in the main speciation; on the contrary, we lose some of the significant effects, especially for the case of 65+

Furthermore, Table 9 suggests that we are able to explain more variation with ITAX than with 65+. Consequently, this section illustrates the comparative advantage of our study - which introduces the concept of fiscal incentive as a source of exogenous variation- compared to the previous literature. The fact that ITAX is relatively stronger instrument than 65+ implies that we obtain smaller standard errors and so more accurate inferences. Nevertheless, because of the jump observed at 65 years old (Section 4), we considered that to introduce the dummy for the age threshold was an opportunity to take advantage of in order to exploit to the maximum the possibilities offered by the available data.

Table 9. Retired coefficient by the instrument used

		OLS	IV with two instruments	IV with a single instrument	
				ITAX	65+
		(i)	(ii)	(iii)	(iv)
Direct Health Outcomes	Allergy	0.004 (0.005)	-0.026 (0.067)	-0.059 (0.091)	0.000 (0.077)
	Asthma	0.036*** (0.0049	0.208** (0.065)	0.349*** (0.085)	0.098 (0.071)
	Cholesterol	0.012 (0.007)	-0.270** (0.102)	-0.315* (0.134)	-0.234* (0.119)
	Diabetes	0.026*** (0.005)	-0.021 (0.073)	0.001 (0.089)	-0.038 (0.088)
	Heart diseases	0.041*** (0.005)	0.002 (0.071)	-0.044 (0.090)	0.037 (0.084)
	Hypertension	0.015* (0.007)	-0.334** (0.105)	-0.405** (0.136)	-0.279* (0.124)
	Any of the diseases	0.047*** (0.008)	-0.125 (0.101)	-0.124 (0.124)	-0.126 (0.120)
	Poor health	0.074*** (0.005)	-0.057 (0.079)	-0.139 (0.107)	0.008 (0.087)
	Accident	-0.010* (0.004)	-0.075 (0.055)	-0.132 (0.072)	-0.030 (0.064)
Intermediate Outcomes	Smoking	0.023** (0.007)	0.322** (0.099)	0.540*** (0.138)	0.151 (0.108)
	BMI25	-0.007 (0.008)	-0.077 (0.102)	-0.235 (0.130)	0.046 (0.120)
	BMI30	0.010 (0.007)	0.075 (0.055)	-0.111 (0.114)	0.221* (0.109)
	Hospital	0.029*** (0.005)	0.017 (0.066)	-0.039 (0.085)	0.061 (0.077)
	Emergencies	0.046*** (0.007)	-0.025 (0.088)	-0.047 (0.114)	-0.007 (0.104)
F-statistic		-	55.544	66.032	40.121
Number of observations		20,743			

Note: Significance levels: ***p<0.01, **p<0.05, *p<0.1. Robust standard errors. Outcomes for which IV is the relevantspecifiation: asthma,cholesterol, hyperthension, any of the diseases, poor health and smoking. For the rest of outcome OLS is the preferred specification for efficiency reasons.

5.3.3. Definition of retirement

In this section, we check for the robustness of the coefficients with respect to the definition of retirement. In this case, we compare the main results - which included unemployed individuals- with the sample only accounting for those individuals receiving an old age pension benefit. In this way, the sample is reduced from 20,743 observations to 18,848. In Table 10, we can see how, although the instrument remains to be strong, the predictive power of the same is worsened. Nevertheless, the magnitude and significance level of the coefficients remain being quite similar to the main specification. Yet, it is noticeable that this result may be due to the low relative weight of the unemployed on the overall sample, i.e. they only represented the 9% of the whole sample.

Table 10. Retired coefficient by sample used

		Main results		Restricted Sample	
		OLS	IV	OLS	IV
Direct Health Outcomes	Allergy	0.004 (0.005)	-0.026 (0.067)	0.004 (0.005)	-0.065 (0.083)
	Asthma	0.036*** (0.0049	0.208** (0.065)	0.039*** (0.005)	0.187* (0.081)
	Cholesterol	0.012 (0.007)	-0.270** (0.102)	0.020* (0.008)	-0.274* (0.126)
	Diabetes	0.026*** (0.005)	-0.021 (0.073)	0.034*** (0.006)	-0.094 (0.092)
	Heart diseases	0.041*** (0.005)	0.002 (0.071)	0.053*** (0.006)	-0.019 (0.089)
	Hypertension	0.015* (0.007)	-0.334** (0.105)	0.021* (0.008)	-0.421** (0.135)
	Any of the diseases	0.047*** (0.008)	-0.125 (0.101)	0.055*** (0.008)	-0.183 (0.128)
	Poor health	0.074*** (0.005)	-0.057 (0.079)	0.084*** (0.006)	-0.107 (0.098)
	Accident	-0.010* (0.004)	-0.075 (0.055)	0.012* (0.005)	-0.067 (0.068)
Intermediate Outcomes	Smoking	0.023** (0.007)	0.322** (0.099)	0.011 (0.008)	0.272* (0.121)
	BMI25	-0.007 (0.008)	-0.077 (0.102)	-0.009 (0.008)	-0.061 (0.127)
	BMI30	0.010 (0.007)	0.075 (0.055)	0.010 (0.007)	0.096 (0.113)
	Hospital	0.029*** (0.005)	0.017 (0.066)	0.036*** (0.005)	0.000 (0.082)
	Emergencies	0.046*** (0.007)	-0.025 (0.088)	0.048*** (0.007)	-0.067 (0.110)
F-statistic		-	55.544	-	36.964
Number of Observations		20,743		18,848	

Note: Significance levels: ***p<0.01, **p<0.05, *p<0.1. Robust standard errors. Outcomes for which IV is the relevant specification: asthma,cholesterol, hyperthension, any of the diseases, poor health and smoking. For the rest of outcome OLS is the preferred specification for efficiency reasons.

5.3.4. Errors specification

In this section, we undertake the analysis of the error term clustered at the year of survey. It is a relevant assessment since we obtain the sample from nine cross-sections of health surveys. Therefore there may be some degree of correlation taking place at the survey level affecting uniformly the whole sample for that year. We can argue two main sources of common error. On the one hand, it may be as a result of the format of the survey, in terms of the extension of the same, order of the questions or method for interviewing the subjects. And on the other hand, as the analysed period is almost thirty years, it may be also that the population's morbidity and self-assessed health expectations varied over time, along with the access to healthcare facilities. For this reason, the errors are explored by clustering them at the year level (ii) instead of defining robust standard errors (i).

We can obtain two conclusions from Table 11: firstly, although weaker, the instruments remain being relevant. And, secondly, when this specification is set, it implies the errors to become larger, thus the coefficients lose to a great extent their significance level. Nevertheless, compared to (i) only cholesterol is no longer significant.

Table 11. Retired coefficient by type of error specification used

		(i) Robust Standard error		(ii) Clustered errors at the year level	
		OLS	IV	OLS	IV
Direct Health Outcomes	Allergy	0.004 (0.005)	-0.026 (0.067)	0.004 (0.007)	-0.026 (0.065)
	Asthma	0.036*** (0.004)	0.208** (0.065)	0.036** (0.011)	0.208** (0.078)
	Cholesterol	0.012 (0.007)	-0.270** (0.102)	0.012 (0.012)	-0.270 (0.139)
	Diabetes	0.026*** (0.005)	-0.021 (0.073)	0.026* (0.009)	-0.021 (0.082)
	Heart diseases	0.041*** (0.005)	0.002 (0.071)	0.041* (0.017)	0.002 (0.055)
	Hypertension	0.015* (0.007)	-0.334** (0.105)	0.015 (0.008)	-0.334** (0.079)
	Any of the diseases	0.047*** (0.008)	-0.125 (0.101)	0.047 (0.027)	-0.125 (0.088)
	Poor health h	0.074*** (0.005)	-0.057 (0.079)	0.074** (0.022)	-0.057 (0.082)
	Accident	-0.010* (0.004)	-0.075 (0.055)	-0.010 (0.005)	-0.075 (0.068)
Intermediate Outcomes	Smoking	0.023** (0.007)	0.322** (0.099)	0.023 (0.018)	0.322* (0.133)
	BMI25	-0.007 (0.008)	-0.077 (0.102)	-0.007 (0.011)	-0.077 (0.112)
	BMI30	0.010 (0.007)	0.075 (0.055)	0.010* (0.004)	0.075 (0.103)
	Hospital	0.029*** (0.005)	0.017 (0.066)	0.029* (0.010)	0.017 (0.059)
	Emergencies	0.046*** (0.007)	-0.025 (0.088)	0.046*** (0.009)	-0.025 (0.076)
F-statistic		-	55.544	-	11.929
Number of Observations		20,743			

Note: Significance levels: ***p<0.01, **p<0.05, *p<0.1. Outcomes for which IV is the relevant specifiation: asthma,cholesterol, hyperthension, any of the diseases, poor health and smoking. For the rest of outcome OLS is the preferred specification for efficiency reasons.

6. Discussion and Conclusions

This analysis complements the previous literature that shows an existing strong correlation between retirement and health status (Shai, 2018; Bertoni et al. 2018; Bonsang et al. 2012 Coe & Zamarro 2011). However, we cannot argue causality until the endogeneity concerns are solved. We do so by implementing an instrumental variable approach. After which, we conclude retirement to have a causal impact on four of the six chronic conditions. In particular, while retirement decreases the probability of individuals suffering from cholesterol and hypertension, it increases the likelihood of having asthma and diabetes.

More striking, and conflicting to most of the existing literature, is the fact that no causal effect is found for the self-assessed health levels. However, although most of the papers have shown causality between retirement and self-reported health, the direction of the effect is contradictory between evidence and highly dependent on the structure of the analysed data. While cross-sectional analyses tend to find that retirement causes better self-perceived health (Shai, 2018; Eibich, 2015; Coe & Zamarro,2011), strategies exploiting panel data tend to show negative effects (Calvo et al. 2012; Behncke, 2012; Dave et al. 2008). This circumstance makes ambiguous the conclusion of a clear effect; fact that is in line with our results of non-significant causal effect for retirement on poor self-rated health. In addition, subjective measures are highly tightened to socio-cultural factors and so to the analysed country. To our knowledge, most of the existing evidence for a single country are based on Anglo-Saxon settings, thus, no benchmark to with compare our results is available. In addition, self-assess health status may suffer from justification bias, i.e. those individuals retired may overvalue their poor health in order to legitimize their condition. Finally, the last direct health outcome that was assessed, accidents, turn out not to be significantly affected by retirement at 5% level. This implies that the hypothesis presented of retirement positively affecting health due to a reduction in the number of work-related accidents is rejected.

Moreover, with respect to the intermediate outcomes, we find causal relationship for smoking, hospital and emergency visits, but not for BMI. Our estimates conclude retirement to increase the probability of smoking. Surprisingly, this result contradicts previous evidence that either found a higher probability of quitting smoking after retirement (Eibich, 2015; Insler,2014; Lang et a. 2007), or found no causal relationship (Skogen & Knudsen, 2016; Celidoni, M., & Rebba, 2017). Yet, the previous results are from different countries, so the sociocultural differences may be the origin of the discrepancy between results. We also show retirement to increase the likelihood of individuals using health care; to be retired increases the probability of going to the hospital and using the emergency services.

With respect to the overweight or obese condition, they are not significantly affected by retirement. Nevertheless, it is also true that the coefficients suggested more educated individuals presenting a lower likelihood of suffering from weight issues because of retirement. This circumstance, together with the evidence from Godard (2016) - which showed weight gains for those retired individuals that were previously working on physically demanding jobs - points towards the drawback of not being able to control for the type of job, and only controlling for educational levels. Thus, further research is required to assess its relevance. In addition, numerous studies distinguish between voluntary and involuntary retirement (Mosca & Barrett, 2016; Dorn & Sousa-Poza, 2010). The reason is that behavioural responses may be very different across the two groups, and so the consequences of retirement. Unfortunately, in our dataset, there is no information available to differentiate between these two groups. Nevertheless, because of the exact nature of our instrument – the fiscal incentive faced by individuals at the retirement decision- we may think that the effect we are capturing is more in line with the impact of voluntary retirement than with the involuntary one.

We can raise several conclusions from this analysis; one of them is that the condition of retiree increases the likelihood of suffering from asthma by 20.8 percentage points and of smoking by 32.2 percentage points. Therefore, one can suggest a link between the increase in smoking and the respiratory issues, although further analysis would be required to present any strong judgment. To be retired also increases by 2.6 percentage points the probability of suffering from diabetes. At the same time, retirement decreases the probability of having cholesterol by 27 percentage points and of suffering from hypertension by 33.4 percentage points. However, and surprisingly, no effect is observed on BMI levels. Thus, we cannot argue the reductions in the burden of the diseases to be as a result of lower obesity or overweight rates. An alternative explanation is that the observed reduction is caused because of retirees being more likely to take drugs to tackle these chronic issues (Puig-Junoy et al., 2014), and not because of them reducing the risk factors in terms of weight. Nevertheless, with the available data, we cannot check this hypothesis, and it has to be left for future research. In addition, retirement increases the probability of going to the hospital by 2.9 percentage points and to use the emergency services by 4.6 percentage points. It can be thought that the size of the effect may have been different if other variables were analysed. This may be the case if, instead of using hospital and emergencies visits, the impact was assessed on the general practitioners that may present higher elasticity rates on their demand. However, because of data constraints, such evaluation was not possible, yet it could be an interesting scope for future research.

In addition, our analysis shows low educated to be the ones responding the most to the retiree condition, as well as, to the fiscal incentives. This fact becomes insightful in terms of future adjustments on the legislative benchmark. It is also the case for the observed heterogeneous response by gender; as retirement seems to differently affect both genders, in terms of outcomes and magnitudes.

Finally, the fact that the identification strategy limits the causal inferences to a single country –Spain- and to those individuals responding to the financial adjustments implies two consequences: on the one hand, a positive point, since the narrow targeting of the studied group, makes any inference very precise, and avoids the collapse of too much information into a single coefficient. Moreover, it also represents a comparative advantage with respect to previous studies that only had the statutory retirement age as a source of exogenous variation. But, on the other hand, it also supposes a drawback in terms of making more challenging the transferability and comparability of the outcomes obtained. In addition, the analysed sample presents very particular characteristics on their educational profiles, i.e. a significant part of the individuals are low skilled due to the historical context. Therefore, there may be the threat that, even in the Spanish context, the estimates and conclusion could potentially not hold for later cohorts, as the average education level has been increasing over time.

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Appendix A.

Statistics

Table 1. Number of observations per year

		1987	1993	1995	1997	2001	2003	2004	2006	2007	2011	2014	TOTAL
Before the restrictions	Total observations	17,542	12,810	3,956	4,040	14,193	11,278	3,798	12,863	10,641	37,075	8,200	**136,396**
	Treated Observations	5,951	4,405	1,583	1,602	4,888	4,461	1,492	5,535	4,763	17,834	7,774	**60,288**
	Control Observations	11,591	8,405	2,373	3,438	9,305	6,817	2,306	7,328	5,878	19,241	426	**76108**
After the restrictions	Total observations	2,616	2,027	313	346	1,269	1,900	617	2,089	1,731	6,971	864	**20,743**
	Treated Observations	1,451	1,190	220	252	898	1,123	377	1,309	1,083	4,112	816	**12,831**
	Control Observations	1,165	837	93	94	371	777	240	780	648	2,859	48	**7,912**

Figure 1. Evolution of the average implicit tax rate over time by groups

Note: graph constructed matching the analysed sample to the estimates from Garcia-Gomez, et al. (2018) on the Implicit Tax Rate for the Spanish setting.

Appendix B

Legislative reforms

Table 1. Legislative Adjustments of the pension system

	Old-age pension	Unemployment insurance	Disability insurance
1985	Increase minimum years contribution from 8 to 15 Increase the number of contributive years to compute the pension from 2 to 8		
1984		Special provision for 55+	
1985			Tightening eligibility criteria
1989		Extension special provision to 52+	
1990			Introduction means-tested for the non-contributory pensions Tightening eligibility and generosity sickness benefit
1997	Increase the number of contributed years to compute pension from 8 to 15 in 2002 The formula becomes less generous 1pp lower penalty for early retirement if 40+ contributed years		Organizational changes Complementarity work & non-contributory benefits
1998			Stricter controls
2002	ER increase to 61 years (previously 60 is first contribution prior to 1967) Possible to combine the pension & work The incentive to retire after 65	52+ can combine unemployment benefits with earnings	
2004			Stricter controls
2007	Reduction per year penalty early retirement if 33+ Increase incentive to retire after 65	52+ if unemployment benefit will receive a higher old-age pension	
2008			Introduction potential & accrual contributed years
2011	Increase statutory retirement age from 65 to 67 (gradual 2013-2027) Early retirement increase to 63 (involuntary) and 65 (voluntary) Reduction per year penalty early retirement if 33+ contributive years Increase incentive to retire after statutory age		
2012		Replacement rate reduced	
2013	Introduction sustainability factor New scheme to combine pension & work		

Source: Summary adapted from Figure 2. of Trends in Employment and Social Security Incentives in the Spanish Pension System: 1980-2016, by Garcia-Gomez et al. 2018