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RETIREMENT AND HOUSEHOLD DECISIONS

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Abstract

This thesis considers survey data to evaluate the effect of retirement on household consumption and investment choices and on individual well-being.

The second chapter studies the causal effect of retirement on the marginal propensity to consume. An average contraction of -3.3 percentage points is measured and a heterogeneity of the effect is recognized with respect to the gender of the head of the household and the available liquidity.

The third chapter evaluates the causal effect of retirement on investment choices. Considering the Italian context in which white-collar workers receive a huge infusion of liquidity upon retirement, it is shown that new retirees subscribe to new and riskier types of investments. In particular, participation in the stock market increased by 8.9 percentage points and the purchase of real estate such as a residence increased by 7.4 percentage points.

The fourth chapter analyzes the consequences of retirement on individual well-being defined in terms of life satisfaction, quality of life and frailty index. Leaving the labor market has a beneficial effect on all components of well-being: life satisfaction increases by 2.8 percentage points, quality of life increases by 4.6 percentage points and the frailty index decreases by -7.4 percentage points. These variations are persistent, greater for those taking early retirement, for women and for those living in non-Mediterranean countries.

Chapter 1

Introduction

The OECD population is aging rapidly. The median age in 1990 was 33 years; thirty years later in 2020 it was 41 years and, according to projections, it will grow further in the coming years, reaching 47 years in 2050 (source: OECD Pensions at a glance 2021). This constant increase is linked to two factors: i) a contraction in the birth rate, and ii) a lengthening in life expectancy. A further consequence of these phenomena is the constant increase in the share of pensioners in the population. The old-age to working age ratio [1] has increased considerably over time: it was 20 percent in 1990, it was 30 percent in 2020 and, according to projections, it will be above 50 percent in 2050.

Aging is a major concern for policy makers because it puts public finances under pressure. In the last decade, many regulatory interventions were implemented aiming to postpone access to retirement and to reduce pension benefits. Some countries enacted even more radical regulatory interventions, changing the structure of the pension system, establishing a transition from a defined benefit system to a defined contribution benefit one. These reforms improved the sustainability of the social security systems but demographic trends are so pronounced that pension expenditure is now close to 10 percent of GDP in most of OECD countries.

The projections on the dynamics of aging and public finance motivate the interest in understanding if and how retirement affects the behavior of individuals. This thesis has exactly this goal and studies how consumption and investment choices and individual well-being vary upon retirement.

[1] The old-age to working-age demographic ratio is defined as the number of individuals aged 65 and over per 100 people of working age defined as those aged 20 to 64.

1.1 Structure of thesis

The thesis consists of three papers and a methodological appendix. All works are empirical and use survey data. In the first two projects, Italian data are used, while in the third, data from several countries are considered.

1.1.1 MPC at retirement

The first work is presented in the second chapter and aims to evaluate the causal effect of retirement on the marginal propensity to consume (hereafter MPC).

The motivations behind this study can be traced back to the importance of fiscal policies in the form of monetary transfers to families. This type of intervention, especially when dictated by exceptional conditions such as the financial crisis and the Covid-19 pandemic, is massive and sometimes favors certain segments of the population, such as retirees. Since the effectiveness of these interventions depends on how individuals react, it is necessary to understand whether people change their behavior when they enter retirement. The interest in this instant in time is connected to the results of a well-known literature which shows that household consumption decreases upon retirement.

This paper evaluates the causal effect of retirement on the consumption response to an unexpected, small, income shock. Using Italian data from the Survey on Households Income and Wealth, I study the effect of retirement on the marginal propensity to consume using a quasi-experimental method in which I compare working and retired people in the neighborhood of the pension eligibility cut-off.

I find that retirement causes a -3.3 percentage points drop in MPC. Furthermore, I collect evidence of a heterogeneity with respect to the gender of the head of the household and the economic condition of the family. While men show no change in MPC at retirement, women exhibit a drop of -5.1 percentage points in this figure. The presence or absence of liquidity restrictions affects the results: constrained families show a stable MPC, while non-constrained ones report a drop of -5.3 percentage points. I also find that retirement causes a drop in spending on non-durable consumption and food, by an amount respectively equal to -20.5 percent and -22.9 percent. All these results are not a symptom of a fall in utility but of a revision of expenses caused by changes in the family structure that occur upon retirement. Once expenditures are deflated using the OECD equivalence scale to account for economies of scale in consumption, the effects become insignificant. Therefore, the drops in spending do not seem to determine falls in utility.

This work brings together two streams of literature proposing a new analysis. The first line of research concerns the assessment of income shocks and how they affect consumption. Some papers highlight a significant heterogeneity in the responses with respect to liquidity, the propensity to save and the extent of the shock (i.e. Jappelli and Pistaferri (2014), Christelis, Georgarakos, Jappelli, Pistaferri, and Van Rooij (2019), Karger and Rajan (2020), Andreolli and Surico (2021)). The second line of literature concerns the so-called retirement

consumption puzzle, namely the presence of a drop in consumption at the time of retirement. It has been proven that this sudden change is not an indication of a loss of utility but rather of a revision process of expenses attributable to more prudent purchases and fewer needs. The analysis made in this thesis is new and aims to find a new source of heterogeneity in the MPC: the change of working status.

1.1.2 Retirement and investment decisions

The second work is presented in the third chapter and deals with the effect of retirement on household investment choices.

The reasons behind this study can be traced back to the fact that, compared to working people, retired people have greater wealth and face risks of a different nature. In fact, with retirement, the income risk disappears completely while other risks such as health and mortality intensify. It follows that workers and retirees face a different portfolio problem.

To study how investment decisions change at the time of retirement, I consider the Italian context as it represents a very interesting laboratory. The Italian system of law guarantees that public and private sector employees receive a sum of money at the end of their working activity. This sudden, large inflow of liquidity profoundly alters the level and the composition of the wealth of newly retired people who naturally need to re-balance their portfolios in response to this infusion. This external stimulus represents a unique possibility to track the portfolio allocation decisions of newly retired Italians. Using data from the Survey on Household Income and Wealth in the period 1993-2016, I compare people marginally above and below the labor pension eligibility requirements to measure the change in the participation decision regarding a number of financial and real assets around the time of retirement.

I find that senior citizens re-balance their portfolios considering a long term investment horizon: stock-market participation increases by 8.9 percentage points at retirement, home ownership increases by 7.4 percentage points upon retirement and the likelihood of carrying out home renovations jumps by 8.7 percentage points. Then I collect evidence to interpret the results, something necessary in the light of the complexity of the context considered. Indeed, other channels parallel to the receipt of the liquidity infusion, such as more leisure and/or the fall in the income risk, may explain the results collected. I collect evidence that supports the importance of the liquidity infusion in explaining the higher participation in the stock market. Considering a framework à la Vissing-Jorgensen (2003), in which the stock-market participation depends on a multiplicity of factors and is limited by the presence of entry costs, I show that leisure and the fall in the income risk play a null or minor role in the participation decision and that the infusion is the main driver. Changes in home-ownership at retirement are related to a matter of opportunities. In fact, the phenomenon seems to be driven by the choices implemented during the '90s, a period of time in which house prices were at their minimum. Therefore, also in this case, the liquidity infusion seems to be important. Investing in home renovation is connected to leisure. Homogeneity in the results suggests

that people, irrespective of their background, want to improve the quality of their houses at retirement, possibly because they are going to spend more time at home. Lastly, I study how home-ownership and stock-holding are related to each other and I find that the liquidity infusion increases the participation of both old and new-homeowners and the latter group exhibits an increase higher than the former.

Previous studies have either proposed stylized facts concerning the investment strategies of families as a whole without expanding on the issue of aging (Guiso and Sodini (2013); Arrondel, Bartiloro, Fessler, Lindner, Mathä, Rampazzi, Savignac, Schmidt, Schürz, and Vermeulen (2014)), or when studying the elderly, they have provided mainly descriptive results on housing and on the portfolio composition (Poterba, Venti, and Wise (2011); Coile and Milligan (2009)). Consequently, little or no causal evidence exists about the portfolio allocation decisions of the elderly. In this paper I implement a research design which may provide useful results on the participation decisions of the new retirees and may shed light on the reasons behind the investment strategies adopted by pensioners. Inferring the investment motives, and therefore the investment horizon considered, would allow us to better understand how retirees interpret the retirement phase: if in terms of a simple cake-eating problem or in terms of a more complex framework characterized by the multiplicity of motives for saving mentioned above.

1.1.3 Retirement and well-being

The third work - conceived and designed together with Martina Celidoni and Chiara Dal Bianco - is presented in the fourth chapter and deals with the consequences of retirement on individual well-being.

The reasons behind this study are related to the regulatory interventions implemented by governments in order to postpone entry into retirement. These maneuvers have had a positive impact on public finances, improving the sustainability of pension systems. However, it is less clear what the effect on individuals has been. To understand this one should know the effect of retirement on people's well-being. No theory can give an unequivocal prescription of the effect of retirement on the well-being of the individual. Indeed, on the one hand the *role theory* states that retirement involves a very important loss of identity which should lead to a reduction in subjective well-being; on the other hand the *continuity theory* states that new retirees may have the same or even higher subjective well-being because they may more than compensate for the loss of identity resulting from work by devoting more time to family, friends or other activities.

In this paper I evaluate the effect of retirement on the various components of well-being. In doing so I consider three different and complementary indicators of well-being: *i)* life satisfaction - which looks at satisfaction with what has been achieved in one's life -, *ii)* CASP-12 - which looks at the quality of life of the individual and his prospects -, and *iii)* frailty - a summary indicator of physical and mental health. To carry out this analysis, I use the information collected in the Survey of Health, Aging and Retirement in Europe from 17

different countries.

I find that retirement is unequivocally beneficial: it increases life satisfaction by 2.8 percentage points, quality of life by 4.6 percentage points and it reduces the frailty index by -7.4 percentage points. This effect is not constant over time, as it tends to fade slightly, but it is persistent. Additionally, I find that the effect of retirement can vary depending on the type of retirement exit chosen. In particular, the CASP-12 is affected by this aspect and it is noted that the retirement induced by early retirement eligibility generates a much more pronounced effect, equal to 9.7 percentage points, than that induced by old-age pension eligibility, equal to 3.1 percentage points. Lastly, the effect of retirement differs between men and women and between countries in different geographical areas. While men show at most a positive, transitory effect, women register a stable increase in their well-being when they retire. Finally, people living in Mediterranean countries show no change in well-being with retirement while those living in continental or northern European countries report significant increases in all three categories, life satisfaction, CASP-12 and health.

This work is placed in the literature that studies individual well-being during retirement. Previous research has defined well-being in different ways and this makes comparisons in the literature difficult. In order to overcome this limitation, generic and complementary measures of well-being are proposed in this paper. The effect of retirement is estimated statically and dynamically, similarly to what was done by A. Gorry, D. Gorry, and Slavov (2018). Furthermore, various new sources of heterogeneity are investigated such as the type of pension (i.e. statutory or early pension), gender and macro-area of residence.

1.1.4 Pension eligibility and the system of law

This fourth project is reported in the main appendix of the thesis.

This note deals with the calculation of the so-called *time to/since eligibility* to pension, a fundamental variable for correctly estimating the impact of retirement on a certain outcome. This variable measures the number of years that separates an individual from the moment of eligibility for retirement and its computation takes place by comparing an individual's age and seniority with the requirements established by law. Unfortunately, generalist surveys do not have accurate information about the work history of individuals and this makes the calculation difficult.

This report addresses the issues related to the computation of the *time to/since eligibility*. In particular, these notes propose guidelines for the calculation, compare computation methodologies that use different starting information, and indicate the best method to follow. These results are achieved considering the Italian context and using data from the Italian Survey on Household Income and Wealth (heterafter SHIW). This survey is full of information and allows me to measure the years of contributions in different ways, to calculate different types of *time to/since eligibility*, and to prove that the best eligibility is the one which makes use of self-reported data on contributions. Not all surveys have this piece of information. Data on contributions paid are often unreliable. A specific section of this note is devoted to

this issue. Using SHIW data, I propose a simple rule that allows me to recover a reliable measure of contributions paid from basic characteristics commonly contained in surveys. This imputation mechanism can be applied by those researchers who use datasets other than SHIW. Indeed, the researchers who want to study data on topics such as health, free time or daily expenses, have to use other data sources. These surveys rarely have accurate information on the contributions paid but, through the rule presented in this work, it is possible to overcome the problem.

Chapter 2

MPC at retirement

2.1 Introduction

Recent events such as the great recession, the sovereign debt crisis and the Covid-19 pandemic have highlighted once again how government interventions in the form of monetary transfers can stimulate the economy and alleviate the difficulties of some segments of the population. Interventions of this type are often massive: in response to the 2007 crisis, the US government allocated 100 billion dollars to support 130 million U.S. tax filers (Parker, Souleles, Johnson, and McClelland (2013)) and to alleviate the consequences of the Covid-19 pandemic it has allocated 300 billion dollars to support American families (Karger and Rajan (2020)). The effectiveness of these policies depends on how recipients react. These types of interventions complement a series of programs - such as tax incentives - normally adopted by government. A frequently protected category is that of retirees who are entitled to more advantageous tax deductions and special allowances such as those similar to "Publication 554" and "Schedule R" implemented in the United States of America. It follows that the over 65s may benefit from important tax advantages. It is therefore important to understand how these people actually respond to these incentives.

As individual choices vary throughout life and according to circumstances, so could responses to these interventions. The presence of a drop in spending upon retirement has been well documented. This literature, dealing with an issue known as the *retirement consumption puzzle*, has ascertained the existence of this phenomenon in the United States of America (Bernheim, Skinner, and Weinberg (2001), Aguiar and Hurst (2013)), in the United Kingdom (Banks, Blundell, and Tanner (1998)) and in Italy (Battistin, Brugiavini, Rettore, and Weber (2009)). In a review, Hurst (2008) reconciles this drop to the typical stability of consumption advocated by theory. He highlights how this fall is due to a reduction in work-related expenses, to greater accuracy in purchases and to a tendency to spend more time in home-production. Therefore, the collapse in spending is not necessarily associated with a reduction in utility. But what is the effect of retirement on the marginal propensity to consume?

In this paper I try to shed light on this topic, assessing how retirement affects the consumption response to income shock. I use Italian data from the Survey on Households Income and Wealth to study the effect of retirement on the marginal propensity to consume (hereafter MPC) using a quasi-experimental method in which I compare working and retired people in the neighborhood of the pension eligibility cut-off. I consider the waves of 2010 and 2016 in which the respondents self-report how much they would consume or spend were they to receive an unexpected windfall equal to their monthly income.

I find that retirement causes a -3.3 percentage points drop in MPC. Behind this overall effect there is a heterogeneity with respect to the gender of the head of the household and the economic condition of the family. While men show no change in MPC at retirement, women exhibit a drop of -5.1 percentage points in this figure. Furthermore, the presence or absence of liquidity restrictions affects the results: constrained families show a stable MPC, while non-constrained ones report a drop of -5.3 percentage points. I also find that retirement causes a drop in spending on non-durable consumption and food, by an amount respectively equal to -20.5 percent and -22.9 percent. These results are not a symptom of a fall in utility but of a revision of expenses caused by changes in the family structure that occur upon retirement. Once expenditures are deflated using the OECD equivalence scale, to account for economies of scale in consumption, the effects become insignificant. Therefore, the drops in spending do not seem to determine falls in utility.

The paper is structured as follows: Section 2 describes the literature of interest, Section 3 presents the data and the variables used, Section 4 shows the empirical strategy adopted and its results, Section 5 concludes.

2.2 Literature

The literature I consider is that which examines the consumption response to income shock. The link between changes in income and consumption basically depends on: *i)* the nature of the income shock - *expected or unexpected*, *ii)* the persistence of the shock - *transitory or permanent*.

Permanent income, life cycle and precautionary saving theories state that individuals use their savings to cope with fluctuations in income. In these contexts, consumption choices should vary little or not at all in the presence of an anticipated shock and regardless of the persistence of the income shock. On the contrary, sudden, un-anticipated changes in income can have repercussions on consumption: presumably small for transient shocks and larger for persistent shocks.

The applied literature on MPC can be divided into three branches [1]. The first one provides empirical tests on consumption through a quasi-experimental setting. The second is based on

[1]For a complete, systematic review of the literature consider Jappelli and Pistaferri (2017).

the income decomposition and covariance restrictions. The third moves directly from survey questions. I refer to the last branch of research, sometimes referred to as the *direct approach*.

Early studies have focused on the consequences of receiving *unexpected* sums. Bodkin (1959) uses data from the 1950 Bureau of Labor Statistics Survey of Consumer Expenditures to measure the effect of WWII veterans' life insurance payments on consumption. The average transfer was 175 US dollars, about 5 percent of the typical family's income. A very high MPC is detected: 0.72 for non-durable consumption and 0.97 for overall consumption. Kreinin (1961) examines data from the 1957-1958 Israeli Survey of Family Savings regarding lump-sum personal restitution payments from Germany. In this case the sum involved was considerable, roughly equal to the annual income of the typical Israeli family. The estimated MPC is much lower, equal to 0.16 in examining non-durable consumption and 0.17 for total consumption.

Other papers focus on the effects of *expected* income shocks, such as income tax refunds. Since the amount of this type of transfers depends on what happened the previous year, no change in consumption would be expected, according to the paradigm of the life cycle theory. Souleles (1999) collects the data of the consumer expenditure survey from 1980 to 1991 and carries out a so-called excess sensitivity test with respect to the receipt of the reimbursement. The total consumption response is estimated at 35-65 percent. Furthermore, liquidity constraints seem to play an important role in explaining individual behaviour. People with low liquidity increase their spending on food, those who do not face such constraints spend more on durable goods. Shapiro and Slemrod (2003) examine the effects on consumption of a reform of the Bush administration - June 7, 2001 - which provided for a reduction in taxes for ten years for an amount between 300 and 600 US dollars. A survey conducted in parallel with the Survey of consumers reveals that only 21.8 percent of respondents say they would spend most of the reimbursement. Contrary to the commonly expressed belief, poor individuals report a lower than average propensity to spend and, conversely, the high-income individuals - those with large financial assets - are more prone to spend. The fiscal reform of 2001 was also studied by means of microdata on consumption and the use of credit cards. Johnson, Parker, and Souleles (2006), using the random timing of the mailing rebate, find that the overall consumption does not significantly respond to the delivery of the check; however, non-durable consumption jumps strongly, showing an increase equal to 37 percent of the rebate. Agarwal, Liu, and Souleles (2007) show that households tend to temporarily improve their balance by repaying debts. A second analysis by Shapiro and Slemrod (2009) studies the effects of a new fiscal intervention, enacted by President Bush, aimed at supporting American families hit by the financial crisis. Only a fraction of the checks turned into actual spending, as only 19.9 percent of respondents reported that they mainly wanted to spend the money. A recent work by Karger and Rajan (2020) evaluates the spending behavior of American families who have received the Covid-19 Economic Impact Payments. This fiscal policy intervention involved 130 million families and resulted in an outlay of approximately 300 billion dollars. The collected data highlight a high average MPC, equal to 0.48, and a relevant heterogeneity.

In particular, households with a high income or a pronounced propensity to save show an MPC close to 20 percent, while households with limited economic resources show an MPC above 60 percent.

A new series of papers on *unexpected* shocks has considered *hypothetical* changes rather than actual changes. This line of research includes the work of Jappelli and Pistaferri (2014) who, using data from SHIW, find an inverse relationship between marginal propensity to consume and liquidity. The release of a new wave allows Jappelli and Pistaferri (2020) to show that the relationship detected in the data cannot be consistent with a framework with quadratic utility and heterogeneous time preferences but with a context with precautionary saving and liquidity constraints. Christelis, Georgarakos, Jappelli, Pistaferri, and M. Van Rooij (2019) study how consumption reacts to different income shocks. Using the CentER Internet questionnaire they ask people to reveal their reaction to hypothetical changes in income of different magnitudes and directions. In particular people are asked to reveal the reaction in terms of saving, debt repayment and consumption that follows a positive unexpected one-time bonus from the government equal to 1 or 3 monthly net incomes of the households. The same question is asked regarding a response to an unexpected one-time tax for the government. Regression analyses reveal that negative shocks to income cause consumption to vary more markedly than positive shocks. Regarding the amplitude of the shocks, positive (negative) and small variations produce a higher (lower) MPC than positive (negative) and large ones. Andreolli and Surico (2021) study the consumption response to unexpected transitory income gains of different sizes. The analysis is carried out using Italian SHIW data and it highlights how the responses in consumption differ according to the magnitude of the shock and the liquidity on hand. In particular, studying how the MPC varies between the different deciles of cash on hand, it is found that households with little liquidity have a high MPC from small shocks while households with a lot of liquid assets have a high MPC from large shocks.

I contribute to the literature by investigating a topic that has gone unnoticed: retirement. Verifying whether retirees behave differently from workers is a topic of policy interest. In fact, in order to pursue effective government interventions it is necessary to know the possible heterogeneity between the various segments of the population, and understanding the behavior of retirees is particularly relevant as more and more people fall into the over 65 age group. Furthermore, it is useful to point out that heterogeneity with respect to age is often a subject of debate since empirical analyses offer conflicting results. Karger and Rajan (2020) find a limited importance of the age factor on the MPC. Fagereng, Holm, and Natvik (2021), studying the responses in consumption resulting from lottery wins, show that the MPC decreases with age. In my study I try to understand if the possible differences with respect to age are actually driven by the change in employment status. In fact, the comparison between individuals is not made by age group but by employment status. With this idea in mind, I consider a sharp estimation strategy - a regression discontinuity design - that compares working people and retirees in the neighborhood of the pension eligibility cut-off.

2.3 Identification strategy

This paper aims to estimate the causal effect of retirement on the marginal propensity to consume. I now introduce the notation that is consistently used in the following sections and I illustrate the identification strategy adopted.

R is a binary indicator denoting the retirement status of the head of the household; it is equal to one for retired heads and null for those who work. Let S be the distance to/since the time of entitlement to the labour pension. This variable is assumed to be continuous and it is normalized around the time of eligibility (i.e. $S = 0$) and it assumes negative values before the entitlement and positive after it. Let $I(S \geq 0)$ be the corresponding eligibility status which denotes the achievement of the eligibility criteria for the labour pension. Individuals are eligible for retirement if and only if they satisfy that condition, namely if their score assumes non-negative values.

Let (Y_1, Y_0) be the two potential outcomes faced in the treated and non-treated statuses. In this paper, Y_1 and Y_0 represent the marginal propensity to consume for the head being retired and not being retired, respectively. The causal effect of interest (β) represents the change in the outcome due to the change in the retirement status of the head of the household. This effect could be computed taking the difference between the two potential outcomes: $\beta = Y_1 - Y_0$. Unfortunately, the two potential outcomes are never observable at the same time at individual level, since retiring reveals Y_1 but conceals Y_0.

However, the causal effect of interest can still be measured by examining the characteristics of the context of interest. The eligibility rule states that the probability of being retired is null for those who have a negative score and positive for those who have a score higher than or equal to zero. Therefore, at the threshold of $S = 0$ I observe a discontinuous change in the probability of being treated. This jump is however less than one, because the eligibility refers to both the voluntary and the mandatory pension schemes. In particular, for the cohorts of interest, who exhibit very stable careers, it usually happens that the eligibility to the early, voluntary pension scheme is achieved first and after a few years the eligibility to the statutory pension is reached. The discontinuity in the likelihood of retiring helps to solve the endogenous selection into retirement.

Under the assumption that no discontinuity would take place in the outcome in the absence of treatment, Battistin and Rettore (2008) show that the causal effect of interest could be computed locally considering the following equation:

$$E\{\beta | R = 1, S = 0^+\} = \frac{E\{Y|S = 0^+\} - E\{Y|S = 0^-\}}{E\{R|S = 0^+\}} \tag{2.1}$$

where $S = 0^+$ and $S = 0^-$ refer to individuals marginally above and marginally below the eligibility threshold.

However, the data available show that a fraction of people retire before having crossed the threshold of eligibility. This scenario is due to the presence of non-classical measurement errors in the running variable. This criticism is overcome assuming that the process generating

measurement errors is orthogonal to the process of interest and considering the following ratio:

$$\frac{E(Y|S=0^+) - E(Y|S=0^-)}{E(R|S=0^+) - E(R|S=0^-)}. \tag{2.2}$$

This implies that consistent estimates of the causal effect of retirement on the marginal propensity to consume can be recovered by a simple instrumental variable strategy where the eligibility status is used to tackle the endogenous nature of the retirement status.

2.4 Data and Measurement

The data of interest are from the Italian Survey on Household Income and Wealth (henceforth SHIW). This survey is carried out by the Bank of Italy every two years on a stratified random sample that is representative of the entire Italian resident population. I consider the information from the 2010 and 2016 waves and I treat the data as repeated cross-sections [2].

The exercise is carried out on the sub-sample of 3,480 household heads, either workers or labour pensioners who are no more than ten years away from the pension eligibility threshold. I set the head of the family to be the reference person of the household. Among the heads, 2,337 are male and 1,143 are female. Additional information on the sample selection and on the sample characteristics is provided in appendix 2.A of the paper.

2.4.1 Marginal propensity to consume

MPC is the outcome of interest and it is reported by the head of the family who answers the following hypothetical question:

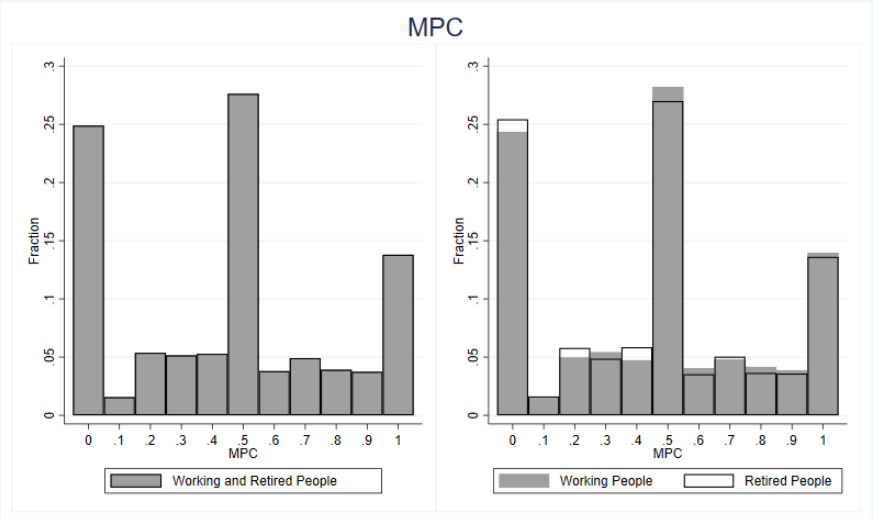
Imagine you unexpectedly receive a refund equal to the household's monthly income. How much of the sum would you save and how much would you spend? Indicate the percentage saved and the percentage spent.

As discussed in Jappelli and Pistaferri (2014), the question has several pros and cons. Among the favorable aspects there is the fact that exact percentages are required; this provides the complete sample distribution of the MPC and also avoids the risk that different people may interpret qualitative answers differently as "mostly spent" or "mostly saved". A further element in favor of the question is that the sum involved is equal to a certain share of the annual net income; this puts all individuals in front of the same problem while

[2]SHIW data are available in two versions: historical and annual. I use annual information with respect to demographic features and figures about working history. The historical archive is used to ensure harmonized measurement of economic variables. In 2020, the survey underwent methodological changes to improve the statistical coverage of indebted households and of high-income households. I could also have used this last wave but I preferred to consider only perfectly comparable samples.

a fixed sum, the same for all, could have been small for some people and large for others. The first limit concerns the fact that what is actually captured is the propensity to spend more than to consume; in accordance with Jappelli and Pistaferri (2014) and in Jappelli and Pistaferri (2020) I assume that the two concepts are equivalent and I will continue to use the acronym MPC. A second limitation is due to the fact that both surveys were conducted in the aftermath of two recessions, therefore it is not certain that these responses are fully compatible with those detectable in periods of stability or economic expansion. Finally, such a question may not have been well understood by respondents who therefore may not have answered accurately.

Figure 2.1: Marginal propensity to consume.



Notes: The figure reports the densities of the consumption response to a small income shock. The left graph refers to the full sample. The right graph refers to the groups of working and retired people.

Figure 2.1 shows the density of the MPC which exhibits some spikes at 0, 0.5 and 1, which means that those responding would be willing not to consume at all, to consume half or all of the proposed sum. The presence of these peaks could be linked to the difficulty in understanding the question; in particular some people may have answered fifty-fifty instead of the alternative, not included, "I don't know". In subsequent analyses, specific indicators will be introduced to signal belonging to these subgroups. The right panel in figure 2.1 highlights the differences between working people and retirees. Pensioners seem to report more frequently values lower than working people: there is a higher prevalence of zeros and a lower frequency of fifty-fifty and ones. Figure 2.5, in the appendix, shows that these features characterize the distributions of both survey years, although with different intensities. The dashed line in figures 2.4 and 2.5 shows that the average value of the marginal propensity to consume is equal to 0.447 in the overall sample, while for the two years it is equal to 0.456 and then to 0.435.

2.4.2 Retirement status

Retirement is the treatment of interest. A person is Retired if he/she receives a labour pension [3].

Table 2.1 contains descriptive statistics about the marginal propensity to consume distinguishing between working people and retirees.

Table 2.1: Retirement status and the marginal propensity to consume

MPC	Working	Retired	Total
WorkingStatus	0.454	0.441	0.447
Gender			
Man	0.446	0.451	0.449
Woman	0.468	0.420	0.444
Type of work			
Private Employee	0.457	0.439	0.447
Public Employee	0.463	0.442	0.453
Self-employed	0.432	0.446	0.438
Education			
Elementary	0.466	0.444	0.448
Lower Secondary	0.455	0.463	0.459
Upper Secondary	0.462	0.427	0.448
Tertiary	0.419	0.410	0.415
Meet needs			
Difficulties	0.481	0.497	0.489
Easily	0.426	0.389	0.407

Notes: The table reports basic statistics of the MPC by several individual characteristics.

The average value of the MPC for workers is equal to 0.454 while it is equal to 0.441 for pensioners and this difference is statistically significant. Men do not seem to report any change in MPC on leaving the world of work while women register a considerable reduction, moving from an average value of 0.468 to one of 0.420. Employees, in the private and public sectors, show a reduction in MPC with retirement; the same is not true for entrepreneurs and self-employed workers, who show a slightly increasing value. Generally, a low educational attainment corresponds to a high MPC, although the relationship is not monotonic and the

[3]It is worth noting that this definition does not distinguish between retirees who are actually retired and those who are still working. Although this second group of individuals is quite limited - only 571 people -, it is likely that the inclusion of these individuals in the group of those treated could mitigate the intensity of the coefficient, since retirement probably has only a partial effect on these people.

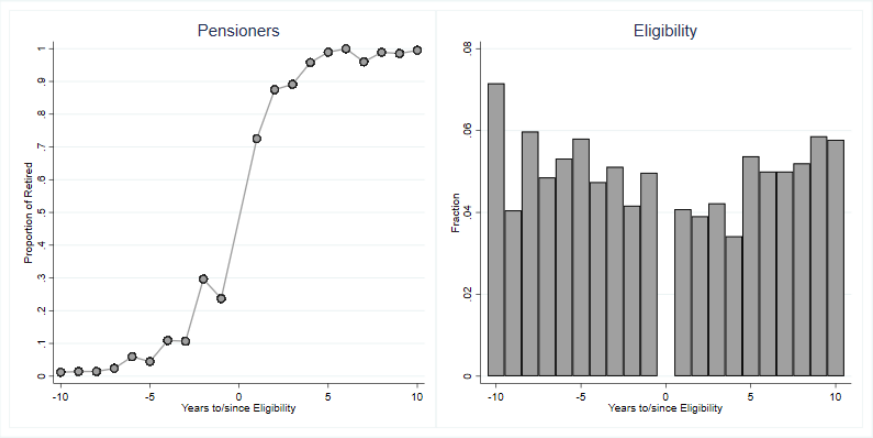
only group that shows a significant reduction in the MPC at retirement is that of those in possession of a lower secondary school diploma. Another interesting feature concerns the ease with which the needs of the family are satisfied: as the difficulty in covering the needs increases, the MPC increases. Furthermore, those who are unable to satisfy their needs show a slight increase in MPC with retirement while those who manage to achieve their desires report a substantial drop, from 0.426 to 0.389.

2.4.3 Pension eligibility

To appropriately compare people exposed to the treatment with those who are not, I need to rank the individuals according to a score that entirely determines the treatment assignment mechanism. This score is called years to/since eligibility and it is computed comparing the pension eligibility criteria, set by the system of law, with the characteristics accrued by the individuals. The system imposes requirements that differ by gender and type of employment. The legislation I refer to is that on the types of pension benefit that have an insurance nature and that are acquired at the end of the working activity. In Italy, there are two pensions of such a nature: the old-age pension (OP) and the early pension (EP). The first one is the standard benchmark. The second one is an early exit from the labor market and it is allowed once specific conditions are met. A score was calculated for each type of pension and it is equal to zero at the time of entitlement, it is negative before and positive after. After that, the overall score (S) is defined as: $S = max(S_{OP}, S_{EP})$.

The left panel of figure 2.2 shows a sudden increase in the proportion of labour pensioners at the cut-off ($S = 0$) that moves from 30 percent to 80 percent. As already mentioned by

Figure 2.2: Retirement status and pension eligibility.



Notes: The figure shows the retirement status and the time to/since eligibility. The left graph reports the fraction of retired people by year of eligibility. The right panel reports the densities of the time to/since eligibility.

previous studies, such as Battistin, Brugiavini, Rettore, and Weber (2009), the variation

is not from zero to one. The proportion of the retired is positive even before the time of eligibility because of the presence of measurement errors in the running variable and the fraction does not equal one immediately after entitlement because eligible people may wish to continue working. However, after two years from the entitlement, more than 90 percent of individuals are retired. As shown in figures 2.6 and 2.7 in the appendix, at the threshold the increase in the share of pensioners is of the same order of magnitude in both years of survey but presents some differences with respect to the type of window selected: the jump is much larger for early retirement over old age retirement, a symptom of the fact that people prefer to retire as soon as possible. The right panel of figure 2.2 depicts the score and it seems that people are not able to manipulate the treatment assignment clearly. This feature is visible also in the yearly distributions reported in figure 2.8 in the appendix. Figure 2.9 in the appendix compares the overall eligibility with those for early and old-age pensions. As was to be expected, there is a very strong similarity between the overall score and that of the early retirement.

2.4.4 Liquidity constraints

The literature has highlighted that the responses in consumption to transitory income shocks depend on the available assets (Zeldes (1989), Kaplan and Violante (2014) Hara, Unayama, and Weidner (2016)). Households with few liquid assets are defined as having liquidity constraints and show a high sensitivity of consumption to a transitory income shock. This category includes not only poor families but also rich ones who, however, possess predominantly illiquid assets and who have little liquidity and are usually referred to as wealthy hand-to-mouth.

The canonical distinction between poor and wealthy hand-to-mouth does not fit well with the context examined since it is difficult for the families examined to have liquid wealth close to zero and the majority have a significant portion of their wealth immobilized in their home. As a result, I propose a new liquidity constraint indicator. I make an index to highlight people who have insufficient liquidity to meet their needs. To do this I rely on particular questions contained in the questionnaire. A first query asks people to report the amount of money that would be sufficient for their household "to live reasonably comfortably but not in luxury" (i.e. hereafter money needed). Another question asks if the household's income is sufficient to make it to the end of the month. Using these pieces of information, a family is defined as constrained if: *i)* it records consumption lower than the money needed and if *ii)* its financial resources are such that it is difficult to make ends meet.

Table 2.2: Retirement status and liquidity constraints

Liquidity constraints	Working	Retired	Total
WorkingStatus	0.328	0.322	0.325
Gender			
Man	0.337	0.330	0.334
Woman	0.309	0.305	0.307
Type of work			
Private Employee	0.382	0.370	0.376
Public Employee	0.289	0.228	0.262
Self-employed	0.264	0.305	0.282
Education			
Elementary	0.625	0.496	0.522
Lower Secondary	0.435	0.390	0.413
Upper Secondary	0.279	0.207	0.250
Tertiary	0.136	0.084	0.114
Meet needs			
Difficulties	0.653	0.676	0.664
Easily	0.000	0.000	0.000

Notes: The table reports basic statistics of the presence of liquidity constraints by several individual characteristics.

Table 2.2 reports descriptive statistics regarding the presence of liquidity constraints in different segments of the population. Approximately one third of households is constrained in liquidity; the percentage does not vary much between men and women, nor between workers and pensioners. The higher the educational qualification, the lower the frequency of families exposed to this problem. However, among families with the same educational qualifications, those led by a retiree are less exposed to constraints than those led by a worker. Lastly, figure 2.10 in the appendix shows the share of liquidity-constrained households by percentile of total net income: the higher the income, the lower the share of bonded households.

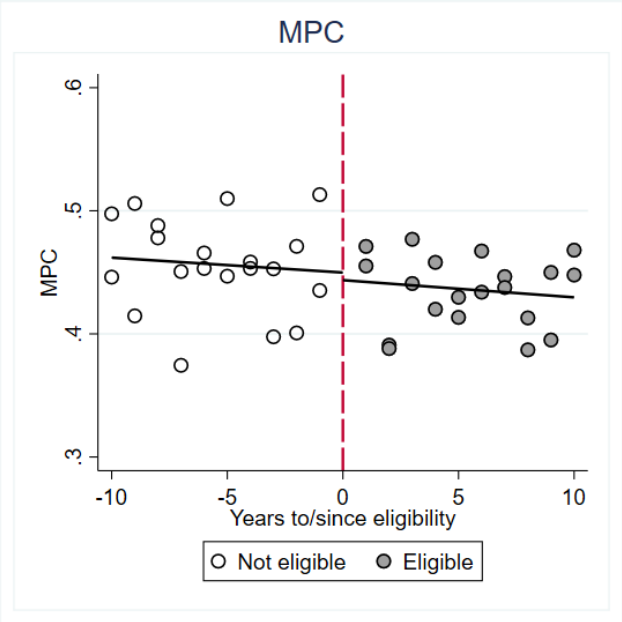
2.5 Empirical Analysis

In this section, results on the causal effect of retirement on MPC will be presented. As often proposed by the literature in the field, I provide graphical analysis and regression results.

2.5.1 Graphical Analysis

Figure 2.3 show the relationship between the marginal propensity to consume and the running variable (S). Each point represents the average MPC for a particular year of eligibility. For

Figure 2.3: RD plot: average MPC by year of eligibility.



Notes: The figure reports MPC by year of eligibility. Each dot represents the average marginal propensity to consume in a specific eligibility year. Empty dots depict ineligible people while coloured markers refer to eligible people. Each mass is interpolated with the fitted values of a linear regression. The red dashed line highlights the time of eligibility.

descriptive purposes I interpolate the masses of dots at the two sides of the cut-off using fitted values that come from linear regressions. Looking at small income shocks, people approaching retirement and new retirees exhibit very similar values of MPC; looking at raw data, the feature seems to be constant.

2.5.2 Regression analysis

The causal effect of retirement on the marginal propensity to consume is estimated parametrically, performing a fuzzy regression discontinuity design, namely carrying out an instrumental variable estimation in the neighborhood of the pension eligibility cut-off.

The model considered has the following structure:

$$Y_{i,t} = \tau + \beta_1 R_{i,t} + \gamma f(S_{i,t}) + X'_{i,t}\delta + \varepsilon_{i,t} \tag{2.3}$$

where the dependent variable $Y_{i,t}$ is the MPC for the head i at time t, $R_{i,t}$ is the retirement status of the head, $f(S_{i,t})$ is a function of the head's time to/since his eligibility, $X_{i,t}$ is a matrix that collects additional controls - such as a second order polynomial of the age of the head, dummies on the educational attainments of the head of the household, a binary indicator on the marital status of the head, dummies on the macro-area of residence, three dummies which take unitary value if a person declares one of the three pivotal values (i.e. MPC equal to 0, 0.5 or 1), and dummies on ability to meet needs - and τ a vector of year dummies. The endogenous nature of the retirement decision is tackled using the eligibility status as the instrument (i.e. $Z_{i,t} = I(S_{i,t} \geq 0)$). Consequently, the first stage of the estimation is the following:

$$R_{i,t} = \tau + \alpha_1 Z_{i,t} + \alpha_2 f(S_{i,t}) + X'_{i,t}\alpha_3 + \nu_{i,t} \tag{2.4}$$

The estimation is limited to a ten-year band from eligibility and I exclude observations at the threshold because the information provided may cover both pre- and post-retirement periods. The standard errors are clustered by type of work, eligibility and survey year.

2.5.3 Results

Table 2.3 shows the causal effects of retirement on the consumption response to a small income shock.

Table 2.3: Effect of retirement on MPC.

MPC	1	2	3	4	5
Retired	-0.033*	-0.022	-0.051*	-0.053**	0.027
	0.018	0.024	0.027	0.023	0.033
f(S)	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
N.Obs.	3480	2337	1143	2349	1131
N.Clusters	120	120	119	120	119
F First Stage	193	157	166	175	84

Columns: 1. full sample; 2. households headed by a man; 3. households headed by a woman; 4. households without liquidity constraints; 5. households with binding liquidity constraints.
Notes: The table reports the estimated causal effect of retirement on the consumption response to a small income change. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial of the age of the head, dummies on the educational attainments of the head of the household, a binary indicator on the marital status of the head, dummies on the macro-area of residence (North, Centre, South Italy), and three dummies which take unitary value if a person declares one of the three pivotal values (i.e. 0, 0.5 or 1). The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Column 1 shows the estimated effect considering the full sample. Retirement results in a decrease of -3.3 percentage points in the MPC. The effect is statistically significant and the first stage shows a good correlation between employment status and eligibility status. Columns 2 and 3 report a heterogeneity analysis based on the sex of the head of the family's financial resources. Households led by men report no change in their attitudes related to handling unexpected sums. On the contrary, families led by women report a significant contraction in expenses resulting from unexpected revenues, equal to -5.1 percent. Finally, in columns 4 and 5 I propose the results of analyses that study how the effect of retirement may differ depending on the absence or presence of liquidity constraints. Families that are not exposed to liquidity problems show a reduction of -5.3 percentage points in the MPC upon retirement. Conversely, those facing liquidity constraints behave similarly both before and after retirement.

2.5.4 Validation and falsification tests

I perform several tests to check the validity of our estimation.

Sensitivity. To test the sensitivity of the results I look at alternative model specifications in order to avoid any misspecified control function leading to the detection of spurious jumps. Figures 2.11 and 2.12 in the appendix report the causal effects of retirement on the MPC using different order polynomials in the time of eligibility. Results are consistent with the former ones both from a qualitative and a quantitative point of view. To check the stability of the estimates to different bandwidths, I repeat the analyses in the range from [-12,12] to [-8,8]. The estimated coefficients, reported in figures 2.13 and 2.14 in the appendix, have a similar magnitude and significance to those shown in table 2.3.

Balance test. To check the sample balance at the cut-off, I consider several predetermined demographic characteristics that, a priori, are not affected by the eligibility status and that are correlated with non observable factors linked to investment decisions. Tables 2.13, 2.14, 2.15, 2.16, 2.17 report a summary of the tests made. To give an immediate evaluation of the results of the tests I use the following symbols: $\surd$ means success (i.e. no effect of retirement on the predetermined characteristic), $\times$ means failure (i.e. significant effect of retirement on the individual feature at 5%). Characteristics such as age, educational attainments, and geographical area of residence remain perfectly stable around the cut-off. Other features such as marital status and family composition show some variations but these aspects will be dealt with in the next section.

Placebo test. To verify whether regression functions for treatment and control units are continuous at points other than the cut-off, I test the presence of jumps in the treatment distribution in points other than the eligibility cut-off. The results of these tests are reported in figures 2.15, and 2.16 in the appendix. No discontinuity is detected.

Robustness: High MPC. I repeat the analysis using an alternative outcome: a binary indicator that highlights those who have declared a marginal propensity to consume greater than the median value. The results are reported in table 2.18 in the appendix. The probability of registering a high MPC falls by -6.8 percentage points at the time of retirement. Women exhibit a fall greater than men, equal to -10.5 percentage points. Families who do not face liquidity constraints have a fall in MPC of -10.2 percentage points.

Robustness: Understanding. A possible concern refers to people's understanding of the survey question. To tackle this problem, similarly to what has been done in the literature, I consider the information provided by the interviewer, in particular that concerning the general level of understanding of the questions posed during the interview. The judgment assigned varies from 0 to 10. The analysis is then repeated on the subgroup of those who have at least sufficient evaluation (i.e. understanding$\geq$ 6). The results, shown in table 2.19 in the appendix, are in line with the previous ones: the marginal propensity to consume

falls by -3.7 percent in the overall sample, -4.4 percent for women and -5.2 percent for the unconstrained.

Robustness: External validity. Another problem relates to the fact that the answers provided may have been affected by an adverse macroeconomic scenario. To limit this problem, the analysis is repeated on the subgroup of people who report a normal level of consumption, thus eliminating those who report consumption that is unusually high or low compared to what they usually do. The results are shown in Table 2.20 in the appendix. Also in this case, retirement determines a fall in the marginal propensity to consume of -5.1 percentage points. Women and the unconstrained recorded reductions of -7.8 percent and -7.6 percent upon retirement.

Robustness: Definition of head of household. A different and more stringent definition of householder is proposed. Among those who answer the question, only the elder head of each household is examined. In this way I consider those who retired first or who will be the first to retire. This new definition determines a 15% reduction of the sample, now only 2.838 units. However, the results, reported in table 2.21 in the appendix, remain similar in both magnitude and statistical significance.

2.6 Interpretation

The analyses carried out have highlighted that retirement affects the marginal propensity to consume. In particular, considering small income changes, upon retirement MPC is reduced by -3.3 percentage points and the contraction is stronger for women and for those who are not subject to liquidity constraints.

Parallel to these phenomena, there are other changes in household accounts and spending behavior. As is well known, the replacement of labour income with a pension allowance causes a fall in monthly earnings. The average change is -24 percent, and is much more pronounced for women and liquidity limited families, at -39.3 percent and -34.5 percent respectively. As noted by a large literature, consumption also exhibits a negative variation. Spending on non-durable goods falls by -20.5 percent while spending on food drops by -22.9 percentage points. Once again the categories that show the most pronounced changes are those of women and those constrained in liquidity.

Table 2.4: Effect of retirement on income and consumption.

	1	2	3	4	5
Household level					
Total net income	-0.240**	-0.130	-0.393***	-0.133	-0.345**
	0.100	0.117	0.135	0.086	0.136
Money needed	-0.156**	-0.108	-0.187**	-0.159**	-0.162*
	0.071	0.084	0.092	0.075	0.094
Non-durable cons.	-0.205**	-0.107	-0.331***	-0.111	-0.289***
	0.085	0.094	0.122	0.070	0.107
Food cons.	-0.229***	-0.084	-0.392***	-0.213***	-0.182
	0.064	0.065	0.119	0.064	0.117

Columns: 1. full sample; 2. households headed by a man; 3. households headed by a woman; 4. households without liquidity constraints; 5. households with binding liquidity constraints.
Notes: The table reports the estimated causal effect of retirement on a multiplicity of economic features. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are three dummies which take unitary value if a person declares one of the three pivotal values (i.e. 0, 0.5 or 1) and year dummies. The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

It is interesting to highlight how the contractions in income and consumption are of comparable sizes and that they are only partly attributable to a revision of the resources necessary to maintain a decent standard of living (i.e. money needed). However, it has been highlighted by Hurst (2008) that a major review of spending behavior is made at the time of retirement: newly retired families shop more carefully and spend more time on home production. Unfortunately it is not possible to validate these channels as the SHIW data do not contain information regarding the composition of the consumption basket or the time spent on home-related activities.

In the following sections I will address other possible channels that may explain these figures. I am going to examine if and to what extent these results are due to changes in family composition, possible mismatches between pre-retirement expectations regarding the standard of living and and post-retirement conditions, and the receipt of the severance pay.

2.6.1 Cohabitation of parents and children

The family dynamics presented by Italian society are different from those of other European countries and do not match the normal assumption that children leave their parents as soon as they are of age. Indeed, the cohabitation lasts a long time. As documented by R. Alessie, Brugiavini, Weber, Desai, and McMahon (2004), about 30 percent of Italian

families have at least one child over 25 years old still at home. The reasons behind these dynamics can be different: from the desire for cohabitation, to the impossibility to leave the nest because of imperfections of the credit market, the lack of stable work, or the lack of economic independence. As regards the latter aspect, it is necessary to highlight how in the period of time examined there was high youth unemployment. As shown in table 2.22 in the appendix, the average unemployment rate was 20.7 percent, higher for women (22.2 percent) than for men (19.6 percent), and much higher in the south of Italy (32 percent).

However, anecdotal evidence suggests that the decision to cohabit is revised upon retirement of the head of the household. This is because, often, a large payment is received at the end of the working activity. It is generally believed, and also documented in Guiso and Jappelli (2002), that this sum is, at least in part, used to help the children, equipping them for independent life and facilitating their exit from the family.

The composition of the family has repercussions on daily expenses and, potentially, also on those resulting from extraordinary events such as a windfall. Therefore, in order to detect possible changes in the family's structure at the time of retirement, a series of regression analyses are proposed. Table 2.5 shows the results related to the full sample of interest and to different subgroups of people. As noted in Battistin, Brugiavini, Rettore, and Weber (2009) and Celidoni and Weber (2020), there is a contraction in the number of household components, in particular through the number of children over 25 years old.

Table 2.5: Effect of retirement on household's composition.

	1	2	3	4	5
Married	-0.141*	0.021	-0.234*	-0.110	-0.217*
	0.077	0.076	0.123	0.076	0.123
Family size	-0.330**	-0.093	-0.415*	-0.308*	-0.429*
	0.146	0.163	0.221	0.178	0.237
N.children	-0.209***	-0.122	-0.351***	-0.242**	-0.162
	0.074	0.099	0.128	0.096	0.151
N.parents	0.006	0.006	-0.007	-0.006	0.037
	0.030	0.037	0.053	0.038	0.049
N.relatives	-0.014	-0.017	-0.026	-0.025	0.009
	0.029	0.035	0.062	0.036	0.056

Columns: 1. full sample; 2. households headed by a man; 3. households headed by a woman; 4. households without liquidity constraints; 5. households with binding liquidity constraints.
Notes: The table reports the estimated causal effect of retirement on a multiplicity of demographic characteristics. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are three dummies which take unitary value if a person declares one of the three pivotal values (i.e. 0, 0.5 or 1) and year dummies. The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Consumption depends on the composition of the family: if this changes, it is very likely that expenses will do the same. To take this problem into account, it is possible to consider the sums spent at the per-capita level instead of the aggregate sums at the family level. To do this it is sufficient to use the OECD equivalence scale.

Table 2.6: Effect of retirement on hypothetical and actual consumption.

	1	2	3	4	5
Household level					
Hyp. consumption response	-0.247***	-0.148	-0.419***	-0.205***	-0.248*
	0.084	0.111	0.130	0.079	0.145
Per-capita level					
Hyp. consumption response	-0.137	-0.115	-0.273**	-0.104	-0.106
	0.095	0.116	0.110	0.087	0.151
Total net income	-0.130	-0.098	-0.246**	-0.032	-0.203*
	0.098	0.114	0.101	0.082	0.116
Money needed	-0.046	-0.075	-0.041	-0.058	-0.020
	0.066	0.077	0.078	0.074	0.093
Non-durable cons.	-0.096	-0.074	-0.185*	-0.010	-0.147
	0.084	0.099	0.099	0.075	0.103
Food cons.	-0.119**	-0.051	-0.246***	-0.113**	-0.040
	0.054	0.066	0.083	0.054	0.109

Columns: 1. full sample; 2. households headed by a man; 3. households headed by a woman; 4. households without liquidity constraints; 5. households with binding liquidity constraints.
Notes: The table reports the estimated causal effect of retirement on hypothetical income shocks and consumption responses. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial of the age of the head, three dummies which take unitary value if a person declares one of the three pivotal values (i.e. 0, 0.5 or 1) and year dummies. The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

This approach cannot be implemented on the MPC. However, the problem is circumvented by first obtaining the amounts of the hypothetical income shocks and of the sums that would hypothetically be spent. Normalization is then carried out on these new figures [4]. The

[4]The *hypothetical income shock* and the *hypothetical consumption response* are computed as:

$$\text{Hyp. income shock}_{it} = (1/12) * \text{Total Net Income}_{it}$$
$$\text{Hyp. cons. response}_{it} = \text{Hyp. income shock}_{it} * \text{MPC}_{it}$$

where the subscript i refers to the head and t to the survey year.
Figures 2.17 and 2.18 in the appendix show the distributions of the values of these variables. Some descriptive statistics follow. The amount of the hypothetical income shock varies from 200 euro to 27 thousand euro and

estimates contained in table 2.6 show that the consumption choices expressed in terms of equivalence per adult are much more in line with the prescriptions of the canonical life cycle model. The only group that shows variations is that of women who continue to register a drop in both hypothetical and actual consumption.

2.6.2 Retirement preparedness

The fall in the marginal propensity to consume in retirement could be linked to a misalignment between pre- and post-retirement expectations. Some families, due to short-sightedness or inability to implement effective savings strategies, may find themselves in retirement with insufficient resources and, consequently, may be more inclined not to consume an unexpected sum but rather put it aside to compensate for the mistakes of the past. This scenario is not infrequent; indeed, Lusardi and Mitchell (2007) pointed out how many (US) "households are unfamiliar with even the most basic economic concepts needed to make sensible saving and investment decisions". Unfortunately, these figures come precisely from those who would most need a good savings plan such as women who live longer than men, have shorter and more discontinuous careers, and earn lower wages (Lusardi and Mitchell (2008), M. C. Van Rooij, Lusardi, and R. J. Alessie (2012)).

Financial education in Italy is no better than that in the United States. However, the presence of a rather generous public pension system makes it less likely that large segments of the population will face a real problem of lack of resources. Nevertheless, the pension reforms that followed one another in the 2000s have gradually reduced the replication rates and encouraged the subscription of supplementary pension plans, delegating at least in part the planning of an adequate provision for old age.

It was pointed out that not all the fall in actual and hypothetical consumption is attributable to the exit of the children from the family unit. It therefore seems necessary to verify the existence of possible discrepancies between pre-retirement expectations and what is actually found in retirement. For this reason, a further study is carried out by evaluating the consequences of retirement on the saving capacity and on the expected and actual replication rates. Table 2.7 shows that people make accurate predictions about the size of the pension transfer they will receive; no disalignment is detected. Women show a slightly significant reduction in their saving capacity. Indeed, for this subgroup, there is a change of -17.1 percentage points in the probability of being able to set aside money at the end of the month.

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has an average value of approximately 3600 euro. In 25 percent of cases, this shock is not spent at all and the average response is around 1200 euro.

Table 2.7: Effect of retirement on retirement preparedness and saving possibilities.

	1	2	3	4	5
Replacement rate					
Public pension	-0.016	-0.041	0.054	0.020	-0.095
	0.073	0.092	0.082	0.090	0.072
Public+Private pension	-0.016	-0.039	0.054	0.021	-0.095
	0.073	0.093	0.082	0.090	0.072
Saving possibilities					
Savings>0	-0.045	0.008	-0.171*	0.006	-0.052
	0.069	0.088	0.091	0.079	0.119
Savings$=0$	0.047	-0.004	0.152*	0.020	0.010
	0.069	0.088	0.090	0.076	0.129
Savings<0	-0.001	-0.004	0.019	-0.026	0.042
	0.033	0.043	0.034	0.035	0.066

Columns: 1. full sample; 2. households headed by a man; 3. households headed by a woman; 4. households without liquidity constraints; 5. households with binding liquidity constraints.
Notes: The table reports the estimated causal effect of retirement on hypothetical income shocks and consumption responses. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial of the age of the head, three dummies which take unitary value if a person declares one of the three pivotal values (i.e. 0, 0.5 or 1) and year dummies. The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

2.6.3 Severance pay

The Italian system of laws establishes that employees, in the private or public sector, receive a lump sum when their working activity comes to an end. This type of transfer occurs whether through dismissal, resignation or retirement. The sum received depends on the years of service in the company or institution. Consequently, it is likely that those who have had uninterrupted careers would receive a large severance pay upon retirement. Self-employed workers and entrepreneurs are not covered by this type of benefit; however, even those people are likely to receive an inflow of liquidity from the sale of the business.

Jappelli and Pistaferri (2014) and Jappelli and Pistaferri (2020) demonstrated that there is an inverse relationship between marginal propensity to consume and available liquidity. This sudden flow of liquidity upon retirement could therefore explain the different consumption responses to income shock between working people and retirees. To verify this, let us investigate the presence of this liquidity effect by looking at whether, and to what extent,

deposits and financial assets show an increase with retirement.

Table 2.8 shows the results both for the sums expressed at the household level and at the per-capita level. There is no significant increase in retiree cash holdings. Therefore, it seems that the change in MPC is not attributable to this channel.

Table 2.8: Effect of retirement on liquidity on hand.

	1	2	3	4	5
Household level					
Deposit	-0.144	-0.142	-0.161	0.008	-0.333
	0.194	0.210	0.288	0.207	0.390
Financial wealth	-0.047	0.051	-0.205	0.254	-0.562
	0.240	0.291	0.333	0.235	0.430
Per-capita level					
Deposit	-0.034	-0.100	-0.023	0.100	-0.174
	0.194	0.215	0.286	0.199	0.381
Financial wealth	0.062	0.095	-0.072	0.343	-0.397
	0.239	0.293	0.324	0.231	0.418

Columns: 1. full sample; 2. households headed by a man; 3. households headed by a woman; 4. households without liquidity constraints; 5. households with binding liquidity constraints.
Notes: The table reports the estimated causal effect of retirement on hypothetical income shocks and consumption responses. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial of the age of the head, three dummies which take unitary value if a person declares one of the three pivotal values (i.e. 0, 0.5 or 1) and year dummies. The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

2.6.4 Discussion

Consumption theory predicts that individuals make consumption and saving decisions aimed at maintaining constant utility over time. My analyses have highlighted a drop in the marginal propensity to consume and in non-durable consumption which seems to go against these theoretical prescriptions.

In particular, examining the sample as a whole, there is a drop of -3.3 percentage points in the MPC and of approximately -20.5 percentage points in expenditure on non-durable goods. However, parallel to these variations there is a drop in the number of cohabiting children. If actual and hypothetical expenses are weighed according to the OECD scale of equivalence per adult, the retirement effect disappears and theory and data realign.

Retirement has different effects on men and women. While the former easily enter this new phase of life without any problem, the latter seem to go through a critical phase. In fact, a drop in income of almost -40 percent is accompanied by a contraction of -40 percent in actual and hypothetical consumption. The factor of the children leaving home halves the severity of these reductions but does not mend the rift with theory. As far as per-capita consumption is concerned, the fall is essentially attributable to spending on food and to the well-known tendency of new retirees to reconsider the contents of the consumption basket and to replace meals away from home with those at home. Unfortunately, the lack of data on these aspects means this explanation cannot be corroborated. The explanation of the hypothetical per capita consumption is more attributable to the significant reduction in per capita income in retirement and the consequent lower saving capacity of the newly retired. In fact, while men's saving habits remain unchanged when they retire, women save with greater difficulty. It would therefore seem likely that this group has a propensity to save a larger share of an unexpected sum.

The existence of liquidity constraints impacts individual choices. Those who are not subject to the constraints show a reduction of -5.3 percentage points in the MPC and a contraction in non-durable consumption which are, however, attributed to the usual changes in the composition of the family. The aspect that most characterizes the constrained is a substantial, and not entirely expected, fall in income. However, their consumption habits remain unchanged.

2.7 Conclusions

Using a fuzzy regression discontinuity design, I measure the causal effect of retirement on self-reported consumption response to a hypothetical, small income shock. I measure the change in consumption response to the income shock that accompanies retirement by exploiting the exogenous variation in eligibility for early and statutory pensions to correct for the endogenous nature of the retirement decision. The estimation is carried out under the identifying assumption that the MPC would be the same around the threshold for pension eligibility, if the individual did not retire.

The main result is that the marginal propensity to consume falls by -3.3 percentage points because of retirement. Additionally, I document a heterogeneity in the effect that involves gender and the presence of liquidity constraints: women exhibit a drop in MPC of -5.1 percentage points and non-constrained individuals report a fall in MPC equal to -5.3 percent.

As shown in previous studies, I also find that retirement causes a drop in spending on non-durable consumption and food, by an amount respectively equal to -20.5 percent and -22.9 percent. However, it is shown that these contractions in actual and hypothetical consumption are not a symptom of a fall in utility but of a revision of expenses caused by changes in the family structure that occur upon retirement. Once expenditures are deflated using the

OECD equivalence scale to account for economies of scale in consumption, the estimates become insignificant. The only group that is an exception to this transformation is that of families led by a female householder. While the fall in per capita consumption is due to the usual changes in spending habits and in home-production, the reduction in hypothetical consumption is attributable to the lower ability to save upon retirement resulting from a substantial drop in income which, although perfectly anticipated, encourages women save a larger share of windfall income. In conclusion, the distance between theory and data would seem to be reconciled.

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2.A Appendix: Data and Measurement

Table 2.9 gives the filtering criteria I apply to highlight the sub-sample of interest. The selection procedure is the following:

1. *Step 1:* For each family in the sample, I consider only the *head* of the household, defined as the person who is most informed of the characteristics and needs of the family;
2. *Step 2:* The individuals of interest are those who exhibit a certain attachment to the labour force, who are either working or retired. Consequently, I remove from the sample non-labour pensioners, disabled people and unemployed people. In particular, among the retirees, I choose only labour pensioners: people entitled to early or statutory retirement. To carry out our exercise, I need a collection of information about the head's characteristics such as: socio-demographic, economic features and his/her working history. All the units with missing characteristics are removed from the sample.
3. *Step 3:* Lastly, I keep people who are no more than 10 years away from the pension eligibility cut-off.

Table 2.9: Filtering criteria.

Sample	Step 1	Step 2	Step 3	Men	Women
	Count	Count	Count	Count	Count
2010	7951	4371	1941	1298	643
2016	7421	3801	1539	1039	500
N.Obs.	15372	8172	3480	2337	1143

Notes: The table reports the step-wise sample selection procedure. Step 1: number of heads. Step 2: number of households with useful information. Step 3: $S \in [-10, 10]$ and $S \neq 0$.

Table 2.10 shows information about the head of the family. The head of the family is defined as the reference person of the family unit, namely the person primarily responsible for or most knowledgeable about the household budget. For each filtering step, the quota of male and female heads of household is reported. It is possible to note that in the initial sample (i.e. step 1) the share of male heads of households is very similar to that of female heads of households. The shares are close to 55 and 45 percent, respectively. Imposing filters on employment status and career history halves the sample size. In this new subgroup, the share of male heads of households is higher (i.e. 65 percent) than that of female heads of households (i.e. 35 percent). The sample is halved again when focusing only on those who are relatively close to the pension eligibility threshold (i.e. step 3). However, this further filtering does not alter the distribution by gender of the heads of families.

Table 2.10: Filtering criteria.

Sample	Step 1		Step 2		Step 3	
	Men	Women	Men	Women	Men	Women
	Share	Share	Share	Share	Share	Share
2010	0.55	0.45	0.68	0.32	0.67	0.33
2016	0.53	0.47	0.66	0.34	0.68	0.32
N.Obs.	15372	15372	8172	8172	3480	3480

Notes: The table reports the step-wise sample selection procedure. Fraction of male and female heads are shown for each set of filtering criteria imposed.

Table 2.11 shows descriptive statistics regarding the male and female heads of households present in the sample under investigation (i.e. step 3).

Table 2.11: Descriptive statistics.

Head	Man		Woman	
Variables	Mean	SD	Mean	SD
Male	1.000	0.000	0.000	0.000
Age	60.675	6.108	60.354	6.198
Diploma	0.437	0.496	0.465	0.499
Degree	0.123	0.329	0.140	0.347
Married	0.813	0.390	0.435	0.496
Active	0.536	0.499	0.530	0.499
Retired	0.499	0.500	0.491	0.500
Family Size	2.691	1.115	2.072	1.036
N.Children	0.800	0.916	0.529	0.780
Total Net Wealth	380.651	558.872	298.980	322.024
Total Net Income	45.451	28.446	40.130	23.758
Total Consumption	32.396	19.197	28.645	15.467
Max income recipient	0.804	0.397	0.840	0.367
Oldest in the couple	0.828	0.377	0.839	0.368
N.Obs.	2337		1143	

Notes: The table reports Mean/Percentage and Standard Deviation of several demographic and economic variables. Economic variables are expressed in thousands of euros and are deflated using 2016 CPI. The final sample of interest (i.e. Step3-sample) is divided by gender.

The two subgroups of male and female heads are similar with respect to multiple characteristics such as: age, educational qualification or employment status. The two subgroups differ with

respect to marital status and family composition. In particular, households headed by women are more frequently unmarried single households, while households headed by men are larger and more frequently defined as married couples with children. However, the greatest differences between the two groups are found with respect to the economic variables. Indeed, households headed by men are wealthier, have higher net incomes and report higher consumption than those shown by households headed by women. I then show the possible concordance between the definition of head of household chosen in this paper (i.e. reference person) with others frequently used. Indeed, the head of the family can also be defined as the highest income recipient or the elder in the couple. There is a high overlap between the adopted definition and the alternative definitions. In fact, in more than 80 percent of cases the reference person, whether male or female, is also the higher earner or the older in the couple.

Table 2.12: Descriptive statistics.

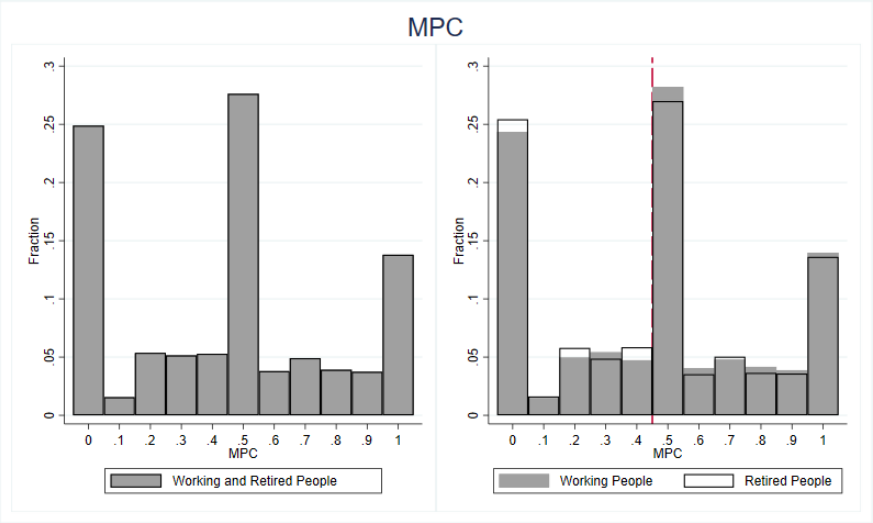
Sample	Step 1		Step 2		Step 3	
Variables	Mean	SD	Mean	SD	Mean	SD
Male	0.536	0.499	0.672	0.470	0.672	0.470
Age	60.200	15.832	60.985	10.967	60.570	6.139
Diploma	0.369	0.483	0.422	0.494	0.446	0.497
Degree	0.114	0.318	0.126	0.332	0.129	0.335
Married	0.579	0.494	0.668	0.471	0.689	0.463
Active	0.505	0.500	0.503	0.500	0.534	0.499
Retired	0.465	0.499	0.520	0.500	0.496	0.500
Family Size	2.361	1.244	2.451	1.179	2.488	1.128
N.Children	0.663	0.921	0.696	0.923	0.711	0.883
Total Net Wealth	262.742	498.371	334.713	597.044	353.827	495.210
Total Net Income	34.077	25.551	41.019	28.042	43.703	27.108
Total Consumption	25.832	16.269	29.723	17.527	31.164	18.140
N.Obs.	15372		8172		3480	

Notes: The table reports Mean/Percentage and Standard Deviation of several demographic and economic variables. Economic variables are expressed in thousands of euros and are deflated using 2016 CPI. I report three samples that refer to the three steps in the sample selection section.

Table 2.12 shows how the characteristics of the sample vary according to the filtering criteria. The final sample (step3-sample) is made up of households on average more highly educated, more often married, with more members and with greater wealth, income and expenses than those reported by the initial sample (i.e. step1-sample).

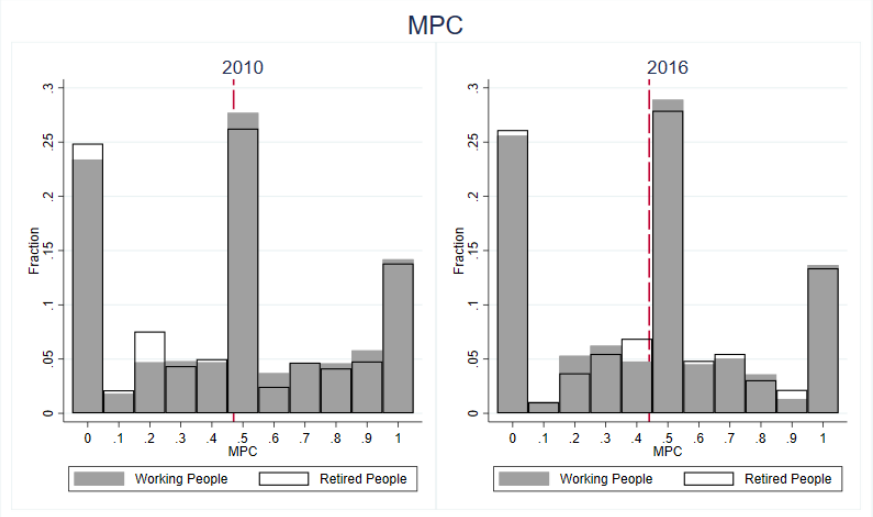
2.A.1 Marginal propensity to consume

Figure 2.4: Marginal propensity to consume.



Notes: The figure reports the densities of the consumption response to a small income shock. The left graph refers to the full sample. The right graph refers to the groups of working and retired people.

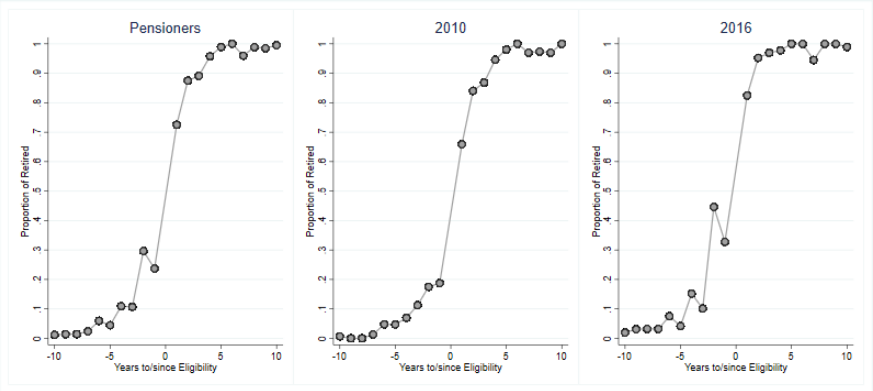
Figure 2.5: Marginal propensity to consume.



Notes: The figure reports the densities of the consumption response to a small and large income shock, distinguishing between working people and retirees. The left graph refers to the 2010 sample while the right graph refers to the 2016 sample.

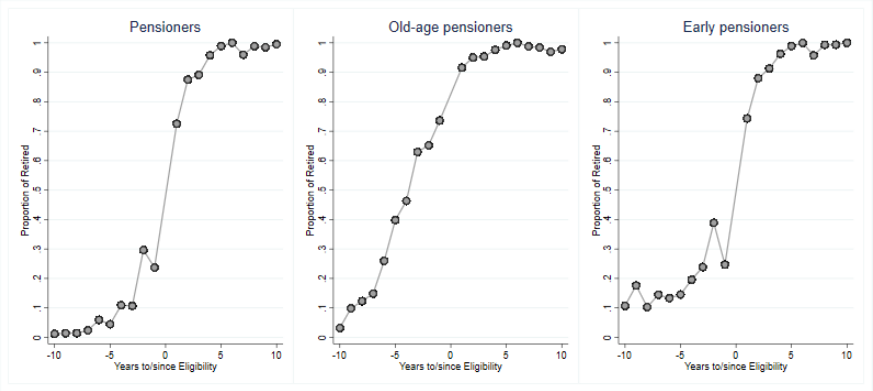
2.A.2 Retirement status

Figure 2.6: Retirement Status.



Notes: The figure reports the fraction of retired people by year of eligibility for the full sample of individuals, and in the 2010 and the 2020 waves of the survey.

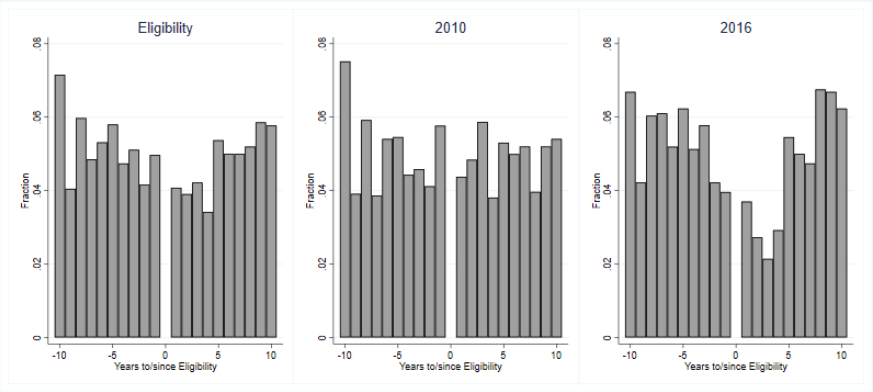
Figure 2.7: Retirement Status.



Notes: The figure reports the fraction of retired people by year of eligibility for the full sample of individuals, distinguishing by early and old-age pension.

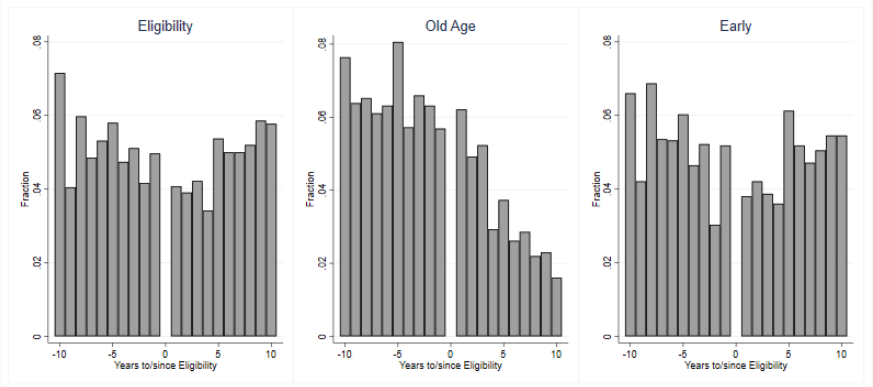
2.A.3 Pension eligibility

Figure 2.8: Pension eligibility.



Notes: The figure reports the densities of the time to/since eligibility for the full sample of individuals, and in the 2010 and the 2020 waves of the survey.

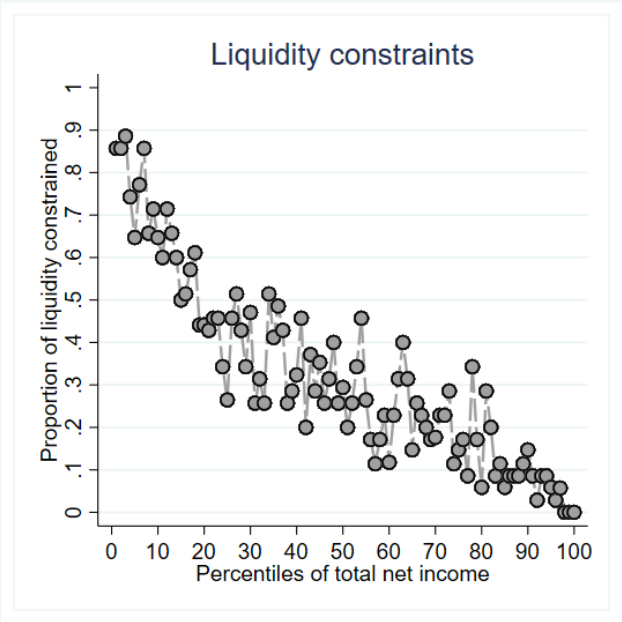
Figure 2.9: Pension eligibility.



Notes: The figure reports the densities of the time to/since eligibility for the full sample of individuals, distinguishing by old-age and early pension.

2.A.4 Liquidity constraints

Figure 2.10: Liquidity constraints.



Notes: The figure reports the proportion of liquidity constrained households by total net income percentile.

2.B Appendix: Empirical Analysis

Table 2.13: Validation and falsification tests: Sample Balance.

Variables	[-12,12]	[-11,11]	[-10,10]	[-9,9]	[-8,8]
Age	√	√	√	√	√
Diploma	√	√	√	√	√
Degree	√	√	√	√	√
Married	√	√	√	√	√
Family Size	×	×	×	√	√
N. Children	×	×	×	√	√
N. Parents	√	√	√	√	√
N. Relatives	√	√	√	√	√
Northern Area	√	√	√	√	√
Central Area	√	√	√	√	√
Southern Area	√	√	√	√	√

Notes: The table reports the estimated causal effect of retirement on socio-demographic features. The dependent variables are shown in the left column. The covariates are the retirement status, a first order polynomial in S with a different slope at the two sides of the threshold and year dummies. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). × is reported if retirement has an effect significant at 5%. Standard errors are clustered at type of work, eligibility and survey year.

Table 2.14: Validation and falsification tests: Sample Balance - Men.

Variables	[-12,12]	[-11,11]	[-10,10]	[-9,9]	[-8,8]
Age	√	√	√	√	√
Diploma	√	√	√	√	√
Degree	√	√	√	√	√
Married	√	√	√	√	√
Family Size	√	√	√	√	√
N. Children	√	√	√	√	√
N. Parents	√	√	√	√	√
N. Relatives	√	√	√	√	√
Northern Area	√	√	√	√	√
Central Area	√	√	√	√	√
Southern Area	√	√	√	√	√

Notes: The table reports the estimated causal effect of retirement on socio-demographic features. The dependent variables are shown in the left column. The covariates are the retirement status, a first order polynomial in S with a different slope at the two sides of the threshold and year dummies. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). × is reported if retirement has an effect significant at 5%. Standard errors are clustered at type of work, eligibility and survey year.

Table 2.15: Validation and falsification tests: Sample Balance - Women.

Variables	[-12,12]	[-11,11]	[-10,10]	[-9,9]	[-8,8]
Age	√	√	√	√	√
Diploma	√	√	√	√	√
Degree	√	√	√	√	√
Married	√	√	√	√	√
Family Size	×	√	√	√	√
N. Children	×	×	×	×	√
N. Parents	√	√	√	√	√
N. Relatives	√	√	√	√	√
Northern Area	√	√	√	√	√
Central Area	√	√	√	√	√
Southern Area	√	√	√	√	√

Notes: The table reports the estimated causal effect of retirement on socio-demographic features. The dependent variables are shown in the left column. The covariates are the retirement status, a first order polynomial in S with a different slope at the two sides of the threshold and year dummies. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). × is reported if retirement has an effect significant at 5%. Standard errors are clustered at type of work, eligibility and survey year.

Table 2.16: Validation and falsification tests: Sample Balance - No liquidity constraints.

Variables	[-12,12]	[-11,11]	[-10,10]	[-9,9]	[-8,8]
Age	√	√	√	√	√
Diploma	√	√	√	√	√
Degree	√	√	√	√	√
Married	√	√	√	√	√
Family Size	×	√	√	√	√
N. Children	×	×	×	√	√
N. Parents	√	√	√	√	√
N. Relatives	√	√	√	√	√
Northern Area	√	√	√	√	√
Central Area	√	√	√	√	√
Southern Area	√	√	√	√	√

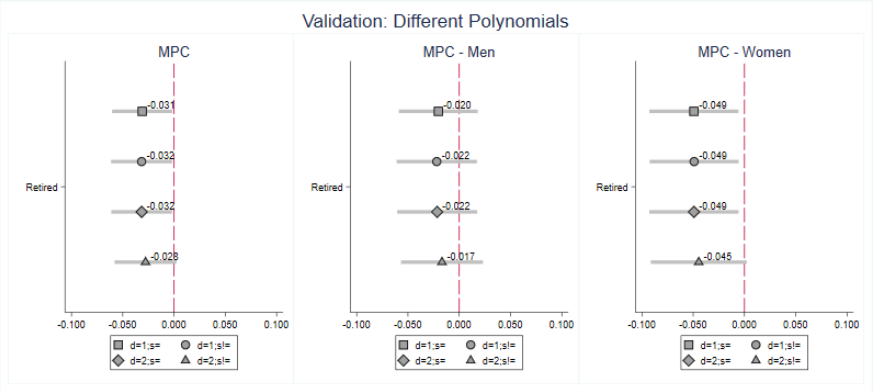
Notes: The table reports the estimated causal effect of retirement on socio-demographic features. The dependent variables are shown in the left column. The covariates are the retirement status, a first order polynomial in S with a different slope at the two sides of the threshold and year dummies. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). × is reported if retirement has an effect significant at 5%. Standard errors are clustered at type of work, eligibility and survey year.

Table 2.17: Validation and falsification tests: Sample Balance - With liquidity constraints.

Variables	[-12,12]	[-11,11]	[-10,10]	[-9,9]	[-8,8]
Age	√	√	√	√	√
Diploma	√	√	√	√	√
Degree	√	√	√	√	√
Married	√	√	√	√	√
Family Size	×	×	√	√	√
N. Children	√	√	√	√	√
N. Parents	√	√	√	√	√
N. Relatives	√	√	√	√	√
Northern Area	√	√	√	√	√
Central Area	√	√	√	√	√
Southern Area	√	√	√	√	√

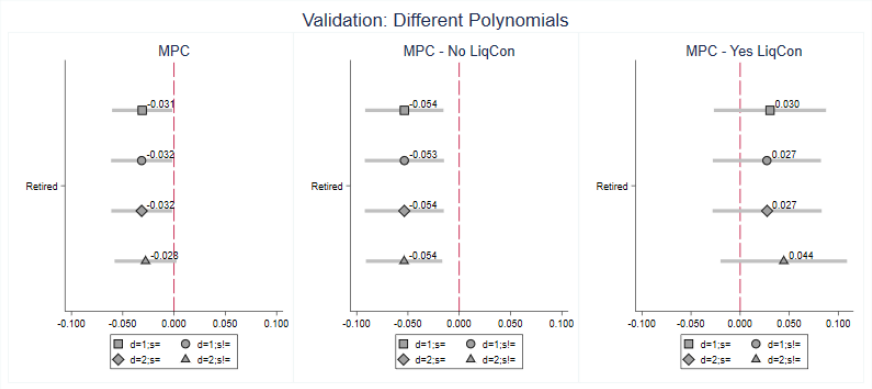
Notes: The table reports the estimated causal effect of retirement on socio-demographic features. The dependent variables are shown in the left column. The covariates are the retirement status, a first order polynomial in S with a different slope at the two sides of the threshold and year dummies. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). × is reported if retirement has an effect significant at 5%. Standard errors are clustered at type of work, eligibility and survey year.

Figure 2.11: Validation and falsification tests: Polynomial specification.



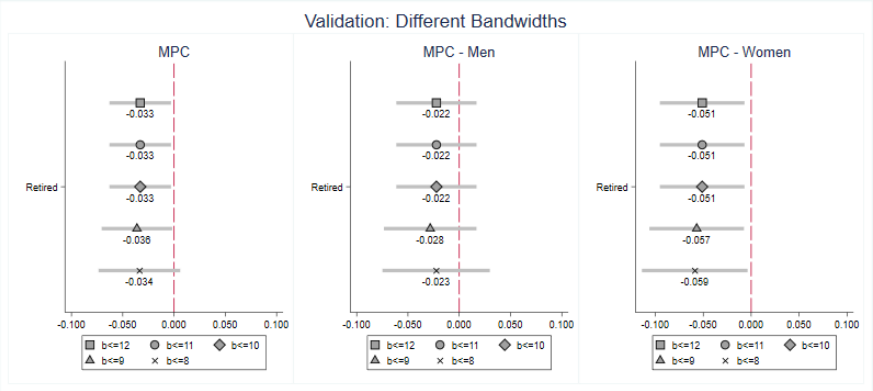
Notes: The figure reports the estimated causal effect of retirement on the MPC considering different polynomial specifications. Each graph shows the point estimates obtained from independent regressions using the following polynomial of S (i.e. f(S)). "Square" relates to a first order polynomial with same slope at the two sides of the cut-off, "circle" relates to a first order polynomial with different slopes at the two sides of the cut-off, "diamond" relates to a second order polynomial with same slope at the two sides of the cut-off, and "triangle" relates to a second order polynomial with different slopes at the two sides of the cut-off.

Figure 2.12: Validation and falsification tests: Polynomial specification.



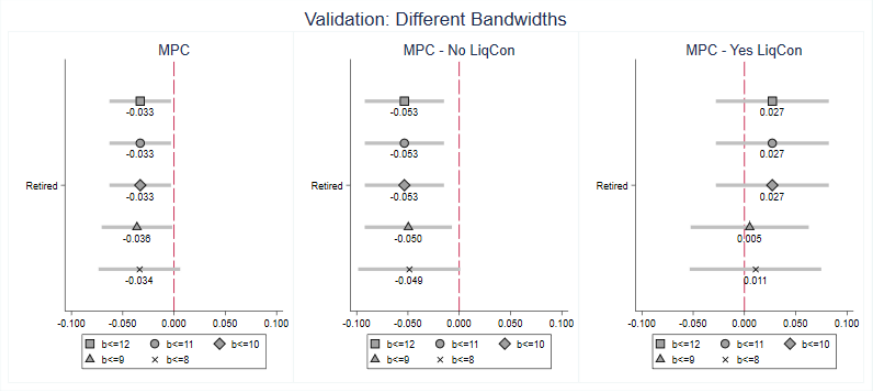
Notes: The figure reports the estimated causal effect of retirement on the MPC considering different polynomial specifications. Each graph shows the point estimates obtained from independent regressions using the following polynomial of S (i.e. f(S)). "Square" relates to a first order polynomial with same slope at the two sides of the cut-off, "circle" relates to first order polynomial with different slopes at the two sides of the cut-off, "diamond" relates to a second order polynomial with same slope at the two sides of the cut-off, and "triangle" relates to a second order polynomial with different slopes at the two sides of the cut-off.

Figure 2.13: Validation and falsification tests: Bandwidths of the estimation.



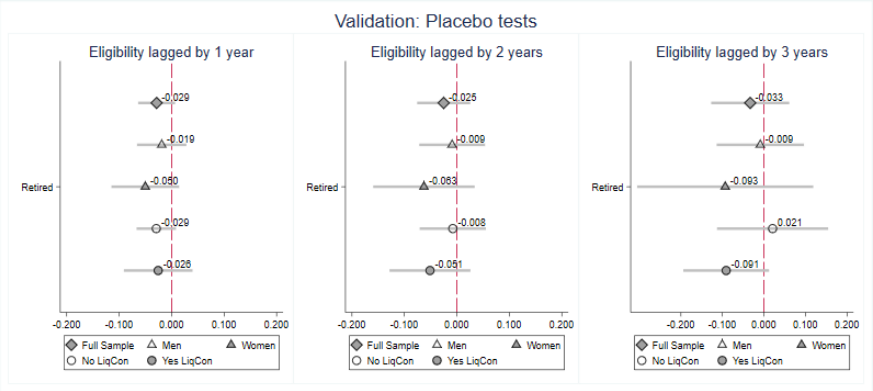
Notes: The figure reports the estimated causal effect of retirement on the MPC considering different bandwidths. Each graph shows the point estimate obtained from independent regressions on different groups of people using different bandwidths. Each marker refers to a bandwidth as follows: "square" refers to $S \in [-12, 12]$, "circle" refers to $S \in [-11, 11]$, "diamond" refers to $S \in [-10, 10]$, "triangle" refers to $S \in [-9, 9]$.

Figure 2.14: Validation and falsification tests: Bandwidths of the estimation.



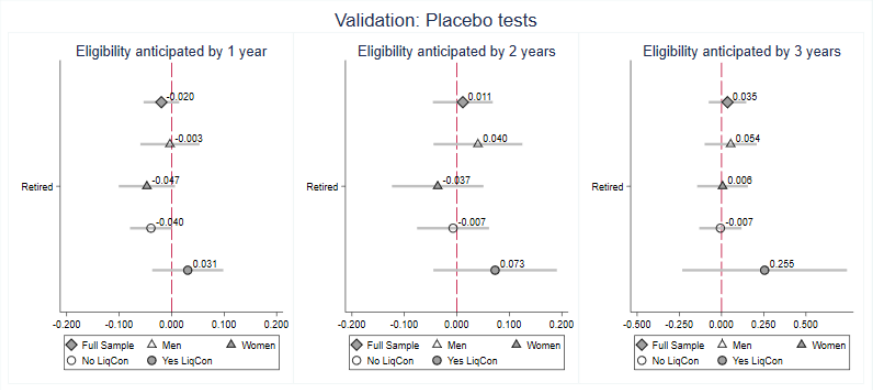
Notes: The figure reports the estimated causal effect of retirement on the MPC considering different bandwidths. Each graph shows the point estimate obtained from independent regressions on different groups of people using different bandwidths. Each marker refers to a bandwidth as follows: "square" refers to $S \in [-12, 12]$, "circle" refers to $S \in [-11, 11]$, "diamond" refers to $S \in [-10, 10]$, "triangle" refers to $S \in [-9, 9]$.

Figure 2.15: Validation and falsification tests: Placebo tests.



Notes: The figure reports the estimated causal effect of retirement on the MPC considering fictitious cut-offs. Each graph shows the point estimate obtained from independent regressions on different groups of people using different bandwidths. Each marker refers to a bandwidth as follows: "diamond" refers to the full sample, filled "triangle" refers to men, empty "triangle" refers to women, filled "circle" refers to non-liquidity constrained households, and empty "circle" refers to liquidity constrained households.

Figure 2.16: Validation and falsification tests: Placebo tests.



Notes: The figure reports the estimated causal effect of retirement on the MPC considering fictitious cut-offs. Each graph shows the point estimate obtained from independent regressions on different groups of people using different bandwidths. Each marker refers to a bandwidth as follows: "diamond" refers to the full sample, filled "triangle" refers to men, empty "triangle" refers to women, filled "circle" refers to non-liquidity constrained households, and empty "circle" refers to liquidity constrained households.

Table 2.18: Validation and falsification tests: Robustness test - High MPC.

$I(MPC \geq p50)$	1	2	3	4	5
Retired	-0.068**	-0.049	-0.105**	-0.102**	0.036
	0.033	0.043	0.054	0.043	0.059
f(S)	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
N.Obs.	3480	2337	1143	2349	1131
N.Clusters	120	120	119	120	119
F First Stage	193	157	166	175	84

Columns: 1. full sample; 2. households headed by a man; 3. households headed by a woman; 4. households without liquidity constraints; 5. households with binding liquidity constraints.

Notes: The table reports the estimated causal effect of retirement on a binary indicator which highlights the people who report an MPC higher than the median value. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial of the age of the head, dummies on the educational attainments of the head of the household, a binary indicator on the marital status of the head, dummies on the macro-area of residence (North, Centre, South Italy), and three dummies which take unitary value if a person declares one of the three pivotal values (i.e. 0, 0.5 or 1). The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 2.19: Validation and falsification tests: Robustness test - Good understanding.

MPC	1	2	3	4	5
Retired	-0.037*	-0.031	-0.044*	-0.052**	0.012
	0.019	0.025	0.025	0.024	0.032
f(S)	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
N.Obs.	3374	2261	1113	2310	1064
N.Clusters	120	120	119	120	118
F First Stage	186	154	159	163	78

Columns: 1. full sample; 2. households headed by a man; 3. households headed by a woman; 4. households without liquidity constraints; 5. households with binding liquidity constraints.
Notes: The table reports the estimated causal effect of retirement on the consumption response to a small income change. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial of the age of the head, dummies on the educational attainments of the head of the household, a binary indicator on the marital status of the head, dummies on the macro-area of residence (North, Centre, South Italy), and three dummies which take unitary value if a person declares one of the three pivotal values (i.e. 0, 0.5 or 1). The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 2.20: Validation and falsification tests: Robustness test - Normal consumption level.

MPC	1	2	3	4	5
Retired	-0.051**	-0.035	-0.078***	-0.076***	0.029
	0.020	0.027	0.030	0.023	0.042
f(S)	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
N.Obs.	2928	1960	968	2063	865
N.Clusters	120	120	118	120	118
F First Stage	192	152	158	196	59

Columns: 1. full sample; 2. households headed by a man; 3. households headed by a woman; 4. households without liquidity constraints; 5. households with binding liquidity constraints.

Notes: The table reports the estimated causal effect of retirement on the consumption response to a small income change. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial of the age of the head, dummies on the educational attainments of the head of the household, a binary indicator on the marital status of the head, dummies on the macro-area of residence (North, Centre, South Italy), and three dummies which take unitary value if a person declares one of the three pivotal values (i.e. 0, 0.5 or 1). The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 2.21: Validation and falsification tests: Robustness test - Heads first to retire.

MPC	1	2	3	4	5
Retired	-0.033*	-0.014	-0.077**	-0.049**	0.017
	0.018	0.022	0.034	0.024	0.038
f(S)	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes	Yes	Yes
N.Obs.	2838	2091	747	1870	968
N.Clusters	120	120	115	120	118
F First Stage	161	120	173	168	67

Columns: 1. full sample; 2. households headed by a man; 3. households headed by a woman; 4. households without liquidity constraints; 5. households with binding liquidity constraints.

Notes: The table reports the estimated causal effect of retirement on the consumption response to a small income change. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial of the age of the head, dummies on the educational attainments of the head of the household, a binary indicator on the marital status of the head, dummies on the macro-area of residence (North, Centre, South Italy), and three dummies which take unitary value if a person declares one of the three pivotal values (i.e. 0, 0.5 or 1). The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

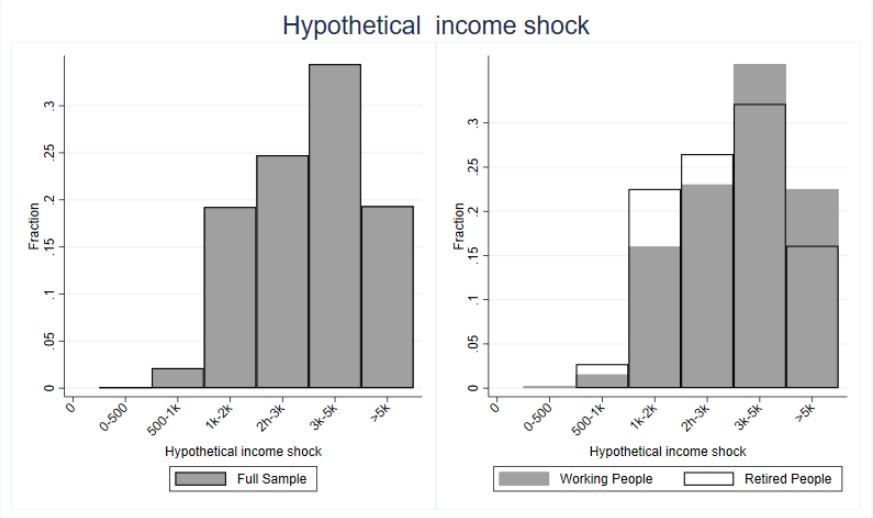
2.C Appendix: Interpretation

Table 2.22: Unemployment rate

	2010	2011	2012	2013	2014	2015	2016
Italy	15.8	15.9	20.0	23.3	24.5	23.2	22.5
North	10.5	10.3	13.4	15.9	16.5	15.6	14.3
Centre	14.2	14.6	18.4	20.3	22.1	20.5	20.1
South	25.4	25.5	30.9	36.1	38.0	36.1	35.9
Man	14.6	14.4	19.0	22.3	23.5	22.1	21.2
Woman	17.4	17.7	21.4	24.5	25.7	24.7	24.3

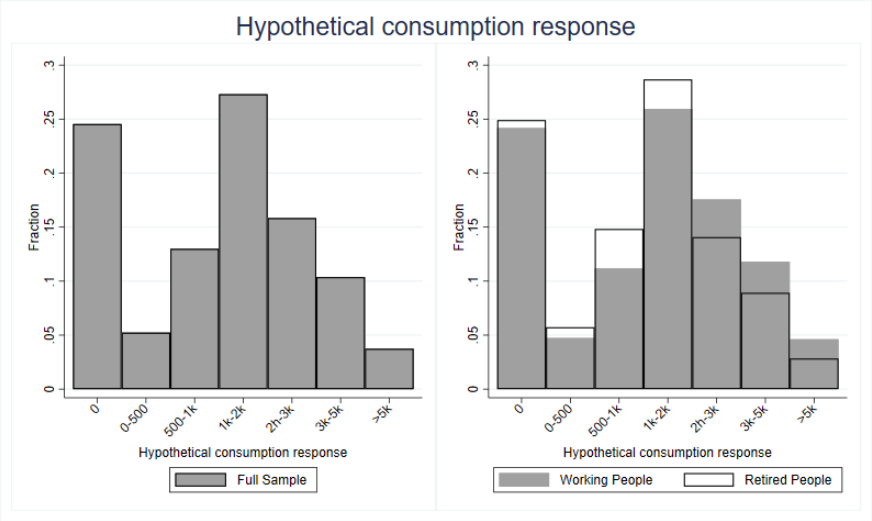
Notes: The table reports the average unemployment rate in Italy between 2010 and 2016 (source: ISTAT).

Figure 2.17: Hypothetical income shock.



Notes: The figure reports the densities of the hypothetical income shock. The left graph refers to the full sample. The right graph refers to the groups of working and retired people.

Figure 2.18: Hypothetical consumption response.



Notes: The figure reports the densities of the hypothetical consumption expenditure. The left graph refers to the full sample. The right graph refers to the groups of working and retired people.

Chapter 3

Retirement and investment decisions

3.1 Introduction

Elderly people hold a considerable amount of wealth. From the data of the latest wave of the European Household Finance and Consumption Survey (HFCS, 2017) it emerges that families led by a householder in the age group between 55 and 64, as well as those in the age group between 65 and 74, have a (median) net wealth of approximately 160 thousand euros, much higher than that held by the typical (median) family, which is around 99 thousand euros. A similar result also applies to financial assets alone; the (median) value reported by the previous two groups is between 16 thousand euros and 15 thousand euros, higher than the 10.3 thousand euros of the typical (median) family. Old people are rich and tend to get even richer. Indeed, it has been widely documented that high-income families and, more generally, couples continue to save during old age, increasing their stock of wealth until very late in life (De Nardi, French, and Jones (2009) and De Nardi, French, Jones, and McGee (2021)).

Elderly people face a very different portfolio problem from working people. The transition from work to retirement determines an abrupt change in the background. In fact, with retirement the risk to income disappears but uncertainty related to health status and life expectancy gradually worsens. Furthermore, the goal of leaving an inheritance to the partner and/or to children is presumably stronger among the elderly. Therefore, it is clear that working people and retirees face different frameworks and this is likely to affect portfolio choices.

However, the empirical literature produced so far has not highlighted this difference. Previous studies have either proposed stylized facts concerning the investment strategies of families as a whole without expanding on the issue of aging (Guiso and Sodini (2013); Arrondel, Bartiloro, Fessler, Lindner, Mathä, Rampazzi, Savignac, Schmidt, Schürz, and Vermeulen (2014)), or when studying the elderly, they have provided mainly descriptive results on housing and on the portfolio composition (Poterba, Venti, and Wise (2011); Coile and Milligan (2009)). Consequently, little or no causal evidence exists about the portfolio allocation decisions of the elderly. It is worth noticing that a causal analysis may shed light

on the reasons behind the investment strategies adopted by retirees. Inferring the investment motives, and therefore the investment horizon considered, would allow us to better understand how retirees interpret the retirement phase: if in terms of a simple cake-eating problem or in terms of a more complex framework characterized by the multiplicity of motives for saving mentioned above.

This paper points exactly in this direction. Using data from the Survey on Household Income and Wealth in the period 1993-2016, I carry out a causal analysis using a research design developed around the unique feature in the Italian pension system whereby many people receive a lump sum transfer when they retire. The Italian system of law guarantees that public and private sector employees receive a sum of money at the end of their working activity. This sudden, large inflow of liquidity profoundly alters the level and the composition of the wealth of newly retired people who naturally need to re-balance their portfolios in response to this infusion. This external stimulus represents a unique possibility to track the portfolio allocation decisions of newly retired Italians. Comparing people marginally above and below the labor pension eligibility requirements, I measure the change in the participation decision regarding a number of financial and real assets around the time of retirement.

I present several findings. First, stock-market participation increases by 8.9 percentage points at retirement. In the light of an average pre-retirement participation rate of 20 percent, this increase appears substantial and significant from an economic perspective. At the same time the newly retirees invest in real assets too. I register an increase in home ownership by 7.4 percent and a change of 8.7 percentage points in the decision to carry out building renovation. The house of residence is the most common asset; the average pre-retirement participation rate is above 78 percent. Therefore, also in this case the registered increase is substantial. These findings suggest that senior citizens re-balance their portfolios considering a long term investment horizon. Additionally, the elderly tend to diversify their portfolios toward riskier and less liquid assets.

Second, I collect evidence that supports the importance of the liquidity infusion in explaining the higher participation in the stock market. It is necessary to corroborate the interpretation of the results because of the complexity of the context considered. In fact, other channels parallel to the receipt of the liquidity infusion, such as more leisure and/or the fall in the income risk, may explain the results collected. Therefore, trying to assess the relative importance of these channels is of primary relevance. With respect to stocks, I consider a framework à la Vissing-Jorgensen (2003) in which the stock-market participation depends on a multiplicity of factors and it is limited by the presence of entry costs. Once I have shown the stability of the costs at retirement, I split the sample according to the size of the severance pay received and the extent of labor income uncertainty faced at work. This heterogeneity analysis reveals that the lump sum plays the major role. Changes in home-ownership at retirement are related to a matter of opportunities. In fact, the phenomenon seems to be driven by the choices implemented during the '90s, a period of time in which house prices were at their minimum. Therefore, also in this case, the liquidity infusion seems to be important.

Investing in home renovation is connected to leisure. Homogeneity in the results suggests that people, irrespective of their background, want to improve the quality of their houses at retirement, possibly because they are going to spend more time at home.

Third, I study how home-ownership and stock-holding are related to each other. Flavin and Yamashita (2011) and Cocco (2005) show that housing is a key factor in explaining the life-cycle investments in equities. In their models, stock-ownership is affected by the ratio between house value and total net wealth in such a way that the higher the ratio, the lower the liquidity available, the lower the investments in stocks. It follows that housing crowds out stocks. I perform a heterogeneity analysis on stock-holding by the time of home acquisition and I do not find any evidence of a crowding out effect. On the contrary, I find that the liquidity infusion increases the participation of both old and new-homeowners and the latter group exhibits an increase higher than the former.

The paper is structured as follows. Section 2 describes the institutional context. Section 3 provides details on the data used and the definition of the main variables of interest. Section 4 reports the empirical analyses on the causal effect of interest. Conclusions follow.

Related literature. The paper refers to four streams of research. The first one is about *portfolio allocation* decisions. Most studies present essentially descriptive results. Guiso and Sodini (2013),Campbell (2006), and Arrondel, Bartiloro, Fessler, Lindner, Mathä, Rampazzi, Savignac, Schmidt, Schürz, and Vermeulen (2014), using survey data, propose a series of stylized facts on the composition of the wealth of families. Unlike previous literature, this paper proposes causal estimates on investments made by a particularly important segment of individuals: retirees and those who are about to retire. An RD analysis highlights how newly retired people re-optimize their portfolios in the presence of an external stimulus. This analysis therefore highlights the objectives that are pursued during retirement.

A second stream of literature to which I refer is that related to the *stock-holding puzzle*. Theoretical prescriptions, based on expected utility models such as the one in Haliassos and Bertaut (1995), state that *expected utility maximisers should always be willing to invest an arbitrarily small amount in the asset offering a higher expected return.* However, individuals seem not to conform to this result. The explanation for this behavior may lie in a multiplicity of factors such as limited knowledge of the existence of certain financial instruments (Guiso and Jappelli (2005)), or the presence of costs associated with the participation (Vissing-Jorgensen (2003)), or from personal and psychological factors (Guiso, Sapienza, and Zingales (2008)). In this paper I focus on the existence of fixed costs at entry and I propose a test of the hypothesis that can be derived from a model à la Vissing-Jorgensen (2003). By dividing people on the basis of the severance pay received and the magnitude of the labor income uncertainty faced at work, I confirm that entry costs are a major issue for individuals and that the receipt of the severance pay is crucial in joining the equity market.

Another strand of literature that is considered is that relating to the savings of the retirees. Past research (De Nardi, French, and Jones (2009) and De Nardi, French, Jones, and McGee (2021)) has highlighted how the behavior of the elderly does not conform to

the canonical life-cycle model in which retirees gradually reduce their assets to finance their current expenses. On the contrary, various segments of the population tend to maintain unchanged or even to increase wealth for a large part of their old age. This is arguably driven by uncertainty about life expectancy, which hides within it the tension between the desire to consume the available resources and not wanting to remain in conditions of poverty in old age. Another reason that slows down the decumulation and generates precautionary savings is that connected with the possibility of having to face sudden large medical expenses. Finally, the desire to leave an inheritance to their family members plays a major role for couples and high-income singles. This literature provides a very detailed picture of the reasons behind late-in-life savings, however little is known about how these resources are invested. In this work I give some indications in this regard. New retirees re-balance their portfolios in favor of equities and homes, revealing an attitude toward risky assets and a long-term planning horizon.

A last stream of research considered is that relating to housing among the elderly. In the United States as well as in Europe, particularly in the Mediterranean countries, the home represents the largest share of wealth for most families. It is worth emphasizing that this type of asset has particular features because it represents both an investment and a consumption asset. A vast empirical literature has highlighted that housing wealth is particularly stable over time (Poterba, Venti, and Wise (2011); Coile and Milligan (2009)). Various explanations can be given for this result, such as: the desire to maintain constant (housing) consumption over time, interpreting property as a buffer against particularly serious shocks or as the most appropriate asset to satisfy the desire to leave a legacy to children. However, very little or nothing is as yet known about what happens at the time of retirement. This paper shows how access to retirement and the consequent receipt of the severance pay leads to an increase in home-ownership. Furthermore, in this context, projects of home renovations are extensively carried out. These results point towards households that aim to satisfy their housing needs, possibly looking for higher quality.

3.2 Identification strategy

This paper aims to estimate the causal effect of retirement on the participation decision in financial and real assets. I now introduce the notation that is consistently used in the following sections and I illustrate the identification strategy adopted.

R is a binary indicator denoting the retirement status of the head of the household; it is equal to one for retired heads and null for those who work. Let S be the distance to/since the time of entitlement to the labour pension. This variable is assumed to be continuous and it is normalized around the time of eligibility (i.e. $S = 0$) and it assumes negative values before the entitlement and positive after it. Let $I(S \geq 0)$ be the corresponding eligibility status which denotes the achievement of the eligibility criteria for the labour pension. Individuals are eligible for retirement if and only if they satisfy that condition, namely if their score

assumes non-negative values.

Let (Y_1, Y_0) be the two potential outcomes faced in the treated and non-treated statuses. In this paper, Y_1 and Y_0 represent the participation in a certain asset for the head being retired and not being retired, respectively. The causal effect of interest (β) represents the change in the outcome due to the change in the retirement status of the head of the household. This effect could be computed taking the difference between the two potential outcomes: $\beta = Y_1 - Y_0$. Unfortunately, the two potential outcomes are never observable at the same time at individual level, since retiring reveals Y_1 but conceals Y_0.

However, the causal effect of interest can still be measured by examining the characteristics of the context of interest. The eligibility rule states that the probability of being retired is null for those who have a negative score and positive for those who have a score higher than or equal to zero. Therefore, at the threshold of $S = 0$ I observe a discontinuous change in the probability of being treated. This jump is however less than one, because the eligibility refers to both the voluntary and the mandatory pension schemes. In particular, for the cohorts of interest, who exhibit very stable careers, it usually happens that the eligibility to the early, voluntary pension scheme is achieved first and after a few years the eligibility to the statutory pension is reached. The discontinuity in the likelihood of retiring helps to solve the endogenous selection into retirement.

Under the assumption that no discontinuity would take place in the outcome in the absence of treatment, Battistin and Rettore (2008) show that the causal effect of interest could be computed locally considering the following equation:

$$E\{\beta|R = 1, S = 0^+\} = \frac{E\{Y|S = 0^+\} - E\{Y|S = 0^-\}}{E\{R|S = 0^+\}} \tag{3.1}$$

where $S = 0^+$ and $S = 0^-$ refer to individuals marginally above and marginally below the eligibility threshold.

However, the data available show that a fraction of people retire before having crossed the threshold of eligibility. This scenario is due to the presence of non-classical measurement errors in the running variable. This criticism is overcome assuming that the process generating measurement errors is orthogonal to the process of interest and considering the following ratio:

$$\frac{E(Y|S = 0^+) - E(Y|S = 0^-)}{E(R|S = 0^+) - E(R|S = 0^-)}. \tag{3.2}$$

This implies that consistent estimates of the causal effect of retirement on the marginal propensity to consume can be recovered by a simple instrumental variable strategy where the eligibility status is used to tackle the endogenous nature of the retirement status.

3.3 Institutional context

3.3.1 Italian social security system

The Italian social security pension system is structured in three pillars: *i*) a compulsory public system, *ii*) a voluntary private system, and *iii*) a supplementary pension system. The public pension system has a pay-as-you go structure: the contributions that workers and companies pay to social security institutions are used to pay the pensions of those who have left work; therefore, no accumulation of financial reserves is envisaged to meet the payment of future pensions. The second and third pillars are voluntary, have a defined contribution structure, and are fully funded. The former can be arranged and managed on an individual or collective basis while the latter is usually subscribed individually. Means tested programs, such as social assistance pension and disability pension, complete the picture.

In the present work the interest is on the *labor pension*, namely a pension benefit that has an insurance nature and that is acquired at the end of the usual working activity. In particular, there are two pensions of such a nature: the *old-age pension* (hereafter OP) and the *early pension* (hereafter EP). The first one is the standard benchmark; a person receives this remittance at the end of his working activity when possessing the necessary requirements. The second type of pension is an early exit from the labor market and it is allowed once specific conditions are met. Even if the Institutions that take care of the management and the payment of these transfers may differ across occupations (private sector employees, public sector employees and the self-employed), in the great majority of cases the provision is managed by the national social security institute (INPS).

For more information on the Italian pension system, please refer to the appendix entitled "Pension eligibility and the system of law".

3.3.2 Liquidity infusion

The Italian system of law provides that workers, employed in the public or private sector, receive a liquidity infusion at the end of their working activity.

This mechanism was introduced in 1927 with a welfare purpose in order to give support to employees in the private sector dismissed without proper cause. However, as time went by, workers started receiving this sum of money more and more often at retirement as a premium rather than as a support for periods of unemployment. Therefore, law n. 297 of 1982 definitively established the so-called *severance pay*, a lump sum transfer paid at the end of the working activity that is guaranteed in any circumstance: dismissal, resignation, and working age limit.

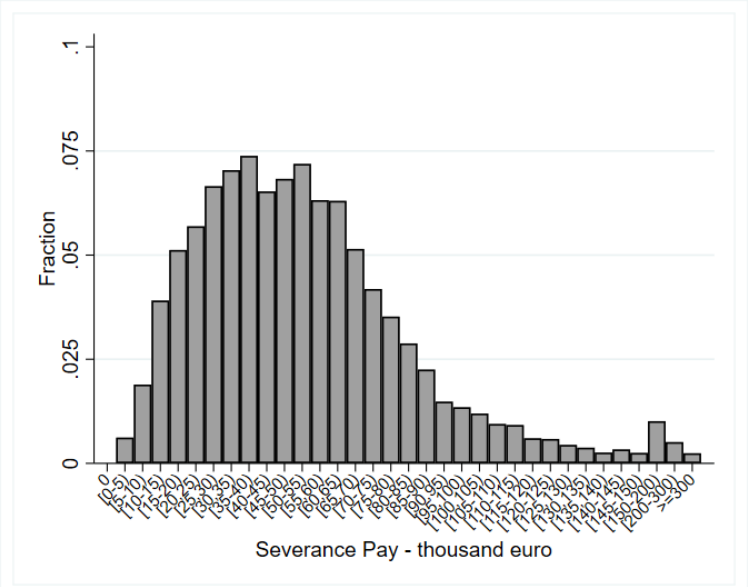
For workers hired before 31 December 2000 there are differences with respect to the type of lump sum received. People employed in the private sector receive the so-called TFR (*trattamento di fine rapporto*) while people employed in the public sector receive the so-called TFS (*trattamento di fine servizio).* In particular, according to the law, the TFR is calculated

by adding, for each year of service, a share approximately equal to one monthly salary (i.e. yearly wage divided by 13.5). These shares are accumulated by the firms which revalue them annually at a rate consisting of 1.5% on a fixed basis and 75% of the increase in the consumer price index. The computation of the TFS is different and more advantageous. In fact, the sum paid by the institutions is equal to 80% of the last monthly income multiplied by the number of years of service.

The survey considered collects information on the severance pay, but the data collection has two main limitations. The first problem is related to the type of question proposed to elicit this figure. Instead of using a retrospective question, it is asked whether, in the current year, transfers related to the end of the employment relationship have been received. This means that only those who retired in the interview year can answer the question. The second problem concerns misreporting. Only 13 percent of potential respondents (i.e. 189 people out of 1451 potential respondents) answer the question and only 8 percent of them report a value greater than zero.

As a result, I have chosen to estimate the potential severance pay using a variety of information contained in the questionnaire. It is necessary to underline that these estimates are only indicative as they are obtained under a series of assumptions on the employment history of individuals. However the values obtained are in line with anecdotal knowledge. The average value of the settlement received at the time of retirement is equal to 52 thousand

Figure 3.1: Severance pay at retirement



Notes: The figure provides information about the severance pay. The sums are expressed in thousands of euro and are deflated using the 2016 CPI.

euros, while the median value is 46 thousand euros. As shown in Figure 3.1, the potential

severance pay distribution is bell-shaped with a rather elongated right tail. Three-quarters of individuals receive a severance pay of less than 70 thousand euros while 99 percent of individuals receive a sum of less than 180,000 euros. Information about the computation of the severance pay is reported in the appendix of the paper.

3.4 Data and Measurement

The data of interest are from the Italian Survey on Household Income and Wealth (henceforth SHIW). This survey is carried out by the Bank of Italy every two years on a stratified random sample that is representative of the entire Italian resident population. I consider the data from the 1993 to 2016 waves, the widest time span with consistent information about retirement. I treat the data as repeated cross-sections. From a raw dataset of approximately 95 thousand observations I highlight the sample of interest imposing several filtering criteria. In particular, I only consider households headed by a man [1] , I remove families with incomplete information about their working history or about their economic features and I take into consideration only those employees or labor pensioners who are no more than ten years away from the pension eligibility threshold [2]. The final sample counts 13,262 people. Additional information on sample selection and sample characteristics is provided in appendix 3.B.

3.4.1 Outcomes

I define a set of complementary outcomes related to the possession of financial and real holdings. Indicators are specified to depict the phenomenon of *participation*. A person "participates" in a certain outcome Y if he holds that asset. On the contrary, a person "does not participate" if he does not invest in Y. Binary indicators are defined for the following asset categories:

- *Short Term Government Bonds* [3];
- *Long Term Government Bonds* [4];

[1] A clarification: in the present work I consider only the families that have a man as a reference person. This choice may seem restrictive but necessary because, as Battistin, Brugiavini, Rettore, and Weber (2009) pointed out, in the nineties, the number of working or retired women was small. Appendix 3.B provides more information about the sample selection criteria and the choice of the head of the household. Additionally, two robustness tests are proposed in which the main analyses are retraced considering both men and women.

[2] A clarification: the sample does not contain self-employed people, unemployed people or non-labor pensioners. Among those who work I keep only private and public employees. Among those who are retired I keep only those who receive a labor pension and who were employed as employees either in the private or in the public sector.

[3] Participation occurs if a person holds BOT and/or CTZ.

[4] Participation occurs if a person holds any of the following: CCT, BTP, BTPI, CTE or CTO.

- *Direct and Indirect Stock-holding* [5];
- *Main Residence*;
- *Other Housing* [6];
- *House Renovation* [7];

Figure 3.6 in the appendix shows how the average participation in financial and real assets has changed over time. The subscription of Italian Government Bonds has fallen across the years; in 1993 around 30 percent (10 percent) invest in short (long) term bonds while at the end of the period considered only 4.5 percent (5) participate in such assets. The fraction of stock-holders increases over time; initially only a few households (12 percent) hold stocks in their portfolios but the fraction of subscribers rapidly increases up to a third of the sample in the early 2000s and then it remains around 20 percent afterwards. Home ownership is widespread, in the early nineties (75 percent), and it becomes even more frequent in recent years with a participation above 85 percent. Other housing exhibits an unstable profile with bursts and falls within the range of 10 to 15 percent. Renovation of the main residence and other houses fluctuates between 14 and 22 percentage point showing a hump-shaped pattern: it increases until 2010 and decreases thereafter.

Figure 3.7 in the appendix shows the average participation in financial and real assets by total net wealth. It is clear that wealth has a propulsive role for both financial and real assets but with different intensities. The increase is almost monotonic for the great majority of the assets. For example, equity participation increases almost monotonically from one percent of the poorest to 57 percent of the richest. The ownership of the house of residence has a completely different profile. The percentage of homeowners goes from zero percent of the first decile, to 40 percent of the second decile, to 80 percent of the third decile until it becomes completely saturated shortly after.

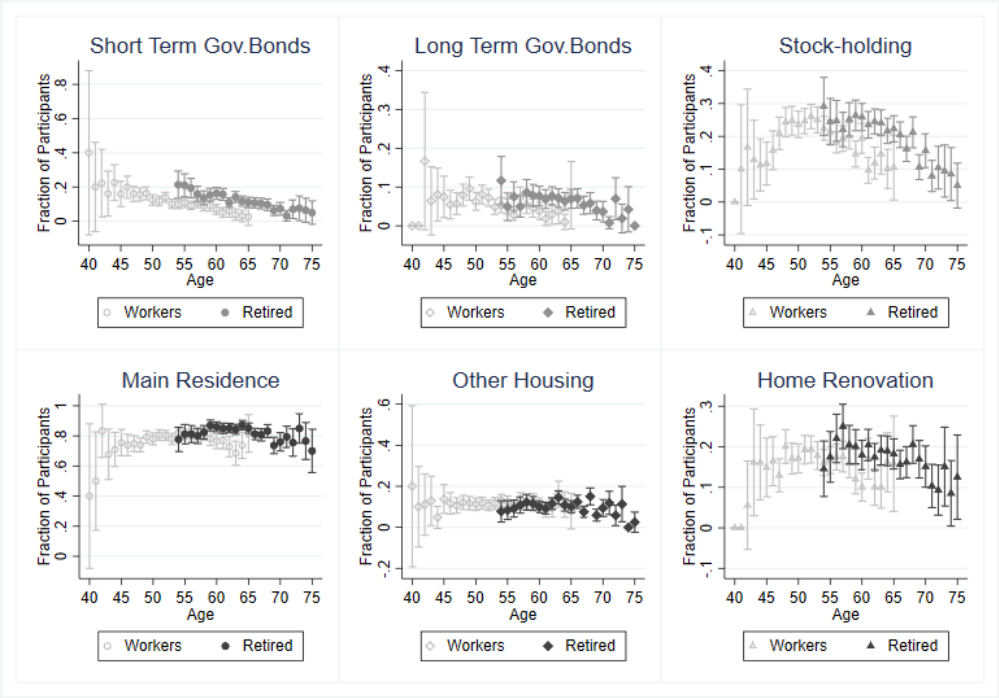
Figure 3.2 shows the participation rate in the various assets by year of age and employment status (i.e. worker or pensioner). In order to obtain more homogeneous profiles, the averages calculated on subgroups that were too small (i.e. bins that collected less than one percent of the distribution) were omitted. It is possible to find that retirees participate more frequently than workers in short-term government bonds, stocks and the first house. The profiles relating to long-term government bonds, property other than residential property and property renovation are less clear.

[5]Participation occurs if a person holds directly shares and equities of Italian firms and/or if he does so through funds or managed portfolios.

[6]Participation occurs if a person owns second houses.

[7]Participation occurs if a person spends money in renovation of the primary house or of other houses.

Figure 3.2: Participation rates by age.



Notes: The figure reports the average participation by year of age and working status. Each graph refers to a specific outcome. Empty dots refer to workers while coloured dots refer to retirees.

3.4.2 Pension Eligibility

To appropriately compare people exposed to the treatment to those who are not, I need to rank the individuals according to a score that entirely determines the treatment assignment mechanism. This score is called *years to/since eligibility* and it is computed comparing the pension eligibility criteria, set by the system of law, to the characteristics accrued by the individuals.

The legislation I refer to is related to the labor pension, a benefit that can be achieved following two possible routes: the *old-age pension* (OP) and the *early pension* (EP). The theoretical conditions have to be compared to the individuals' effective characteristics: chronological age and seniority. The former is easily measured while the latter is a trickier piece of information. I measure the accrued seniority using the answer to a specific query in the SHIW questionnaire that asks people to declare the contributions paid over time [8]. Even if this piece of information is hard to remember exactly and the reported value is affected

[8]The question of interest was introduced in 1995. Therefore, for 1993 I impute the declared years of contribution from the subsequent wave using the panel dimension of the sample. The same procedure applies in the subsequent waves for those (only a few) people who do not report the value.

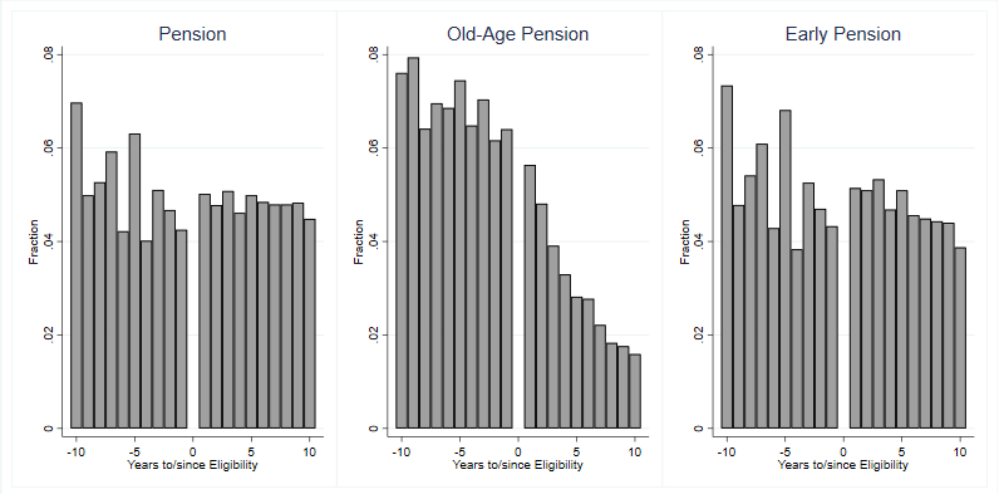
by a rounding phenomenon, there are reasons to believe that the error reduces approaching retirement. In fact, if people choose to exit from the labor market, they will look at retirement incentives comparing the wage earnings to the present value of the future retirement income. In order to do that a person has to be aware of the exact amount of contributions paid. Consequently, it is reasonable to believe that, when approaching entitlement, working/retired people know/remember this value exactly.

With these pieces of information, I proceed with the calculation of the score for the OP and the EP. Each score represents the number of years that a person needs to become eligible or the number of years since a person became entitled to a specific pension. These variables are equal to zero at the time of entitlement, they take negative values before the eligibility moment and positive values after. Then I define S, the overall score, looking at the route that is reached earlier. Therefore, it is computed as:

$$S = max(S_{OP}, S_{EP}) \tag{3.3}$$

and it switches from negative to positive values whenever a person meets the condition for at least one exit. Figure 3.3 shows the densities of S, S_{OP}, and S_{EP}.

Figure 3.3: Years to/since eligibility.



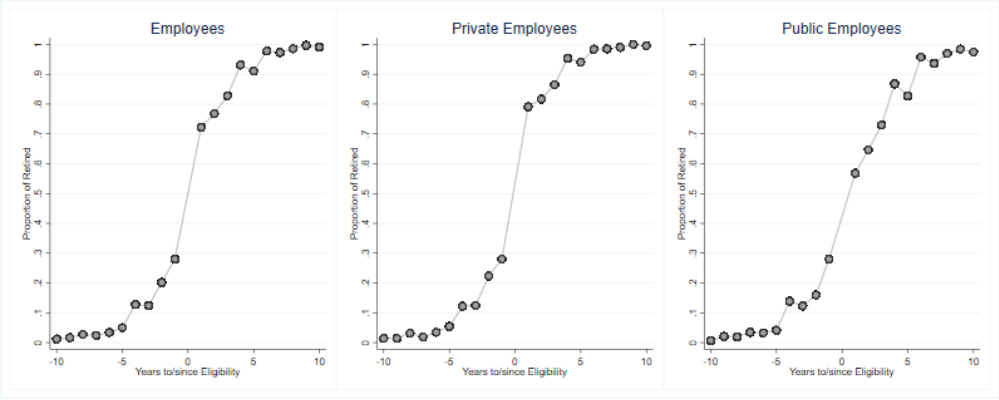
Notes: The figure shows the distributions of the time to/since of eligibility. Left figure shows S as computed in equation 3.3, central figure shows the years of eligibility for early pension (EP), and right figure shows the years of eligibility for old-age pension (OP).

3.4.3 Retirement Status

Retirement is the treatment of interest. A person is *Retired* if he receives a labor pension.

Figure 3.4 shows the fraction of retired people by year of eligibility and occupations. I

Figure 3.4: Treatment exposure.



Notes: The figure reports treatment exposure by year of eligibility. Each dot refers to the fraction of retired people in a specific year of eligibility. Left figure refers to the full sample, central figure refers to current/previous private sector employees, and right figure refers to current/previous public sector employees.

detect a sudden increase in the proportion of pensioners at the cut-off ($S = 0$) that moves from 30 percent to 70 percent. As already mentioned by previous studies, the variation is not from zero to one. The proportion of the retired is positive even before the time of eligibility because of the presence of measurement errors in the running variable and the fraction does not equal one immediately after entitlement because eligible people may wish to continue working. Private employees show the biggest bounce, with a fraction of the retired that moves from 0.3 to 0.8. Public employees exhibit smaller variations, respectively about 0.27 to 0.57. This figure is consistent with the lower incentive to retire as soon as possible in the public sector because the salary continues to increase throughout the working life. Additionally, this motive is even more pronounced for people who are under the (fully) definite benefit pension scheme (i.e. those who had more than 15 years of contributions at December 31st 1995) who will receive a pension computed on the basis of the last years' earnings.

3.5 Empirical Analysis

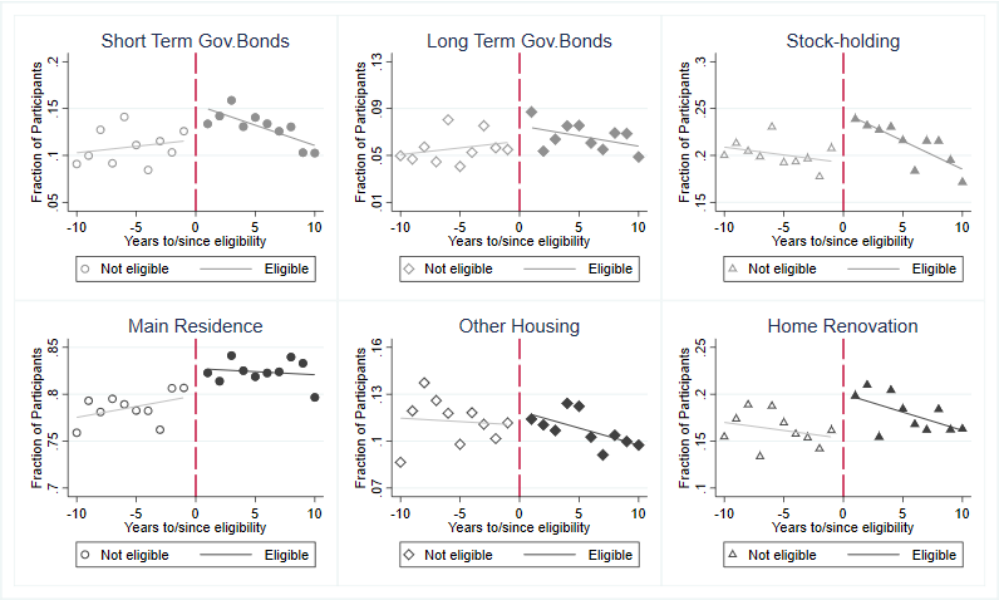
In this section, results on the causal effect of retirement on the participation in financial and real assets will be presented. As often proposed by the literature in the field, I provide graphical analysis and regression results.

3.5.1 Graphical Analysis

Figure 3.5 presents a set of plots investigating the relationship between the participation in a certain outcome and the running variable (S). Each point represents the fraction of holders for a particular year of eligibility. For descriptive purposes I interpolate the masses of dots at the

two sides of the cut-off using fitted values that come from linear regressions. The upper part

Figure 3.5: RD plot: average participation rate by year of eligibility.



Notes: The figure reports six graphs on the causal effect of retirement on financial and real investment decisions. Each marker is the average participation in a specific eligibility year. Empty markers depict ineligible people while coloured markers refer to eligible people. Each mass is interpolated with the fitted values of a linear regression. The red dashed line highlights the time of eligibility.

of figure 3.5 refers to financial assets; from left to right we see graphs related to short term and long term Government bonds and (direct and indirect) stock-holding. The lower part of the figure reports the pattern concerning real assets, in particular, from left to right, main residence, other housing and home renovations. The subscription rates for short term Italian Government bonds vary between 8 and 16 percent while those related to long term ones have a range between 4 and 9 percent. Both patterns change at retirement: they exhibit change in the slope with trends which move from increasing to diminishing; furthermore, short term bonds seem to jump at the time of eligibility. The fraction of stock-market participants is between 18 and 24 percentage points; the dynamic increases sharply at the time of eligibility maintaining its declining profile throughout the window of data. The bottom-left graph confirms widespread home-ownership around the time of retirement; the participation is very high, varying between 76 and 84 percent and exhibiting a clear jump at the cut-off. Other housing maintains its value around 12 percent, does not display a clear pattern and seems stable at the time of interest. As a further confirmation of the importance of real estate for the Italians, there is a net increase in the share of people who carry out building renovations at the time of retirement.

3.5.2 Regression analysis

To evaluate the causal effect of retirement on investment strategies I implement a *fuzzy* regression discontinuity design using a parametric approach. The approach is similar to that of Battistin, Brugiavini, Rettore, and Weber (2009). I carry out an instrumental variable estimation in the neighborhood of the pension eligibility cut-off (i.e. $S \in [-10, 10]$) excluding observations at the threshold (i.e. $S = 0$) because the outcomes may refer both to pre- and post-retirement periods.

The model considered has the following structure:

$$Y_{i,t} = \tau + \beta R_{i,t} + \gamma f(S_{i,t}) + \delta X_{i,t} + \varepsilon_{i,t} \tag{3.4}$$

where the dependent variable $Y_{i,t}$ is one of the outcomes of interest for the male head of the household i at time t, $R_{i,t}$ is his retirement status, $f(S_{i,t})$ is a function of the time to/since his eligibility, $X_{i,t}$ is a matrix that collects additional covariates such as a second order polynomial of the age of the head, dummies about the level of schooling of the head of the household, a binary indicator on the marital status of the head, dummies on the macro-area of residence (North, Centre, South of Italy), the number of occupations of the head, the age of completed education and dummies on how the family acquired its properties, and γ a vector of year dummies. The endogenous nature of the retirement decision is tackled using the eligibility status as the instrument (i.e. $Z_{i,t} = I(S_{i,t} \geq 0)$). Consequently, the first stage of the estimation is the following:

$$R_{h,t} = \tau + \alpha_1 Z_{i,t} + \alpha_2 f(S_{i,t}) + \alpha_3 X_{i,t} + \nu_{i,t} \tag{3.5}$$

3.5.3 Results

Table 3.1 reports the core results on the pooled sample of private and public employees.

Table 3.1: Effect of retirement on investment decisions.

	1	2	3	4	5	6
Retired	0.039*	0.016	0.089***	0.074***	0.007	0.088***
	0.021	0.019	0.025	0.026	0.014	0.027
f(S)	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	13262	13262	13262	13262	13262	13262
N.Clusters	240	240	240	240	240	240
F First Stage	524	524	524	524	524	524

Columns:
1. Short Term Government Bonds;
2. Long Term Government Bonds;
3. Direct and Indirect Stock-holding;
4. Main Residence;
5. Other Housing;
6. Home Renovation;

Notes: The table reports the estimated causal effect of retirement on the participation in financial and real assets. The window of the estimation is for $S \in [-10, 10]$. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial in S with a different slope at the two sides of the threshold, a second order polynomial in the age of the head, years of education of the head, indicator of the area of residence, and year dummies. Standard errors are clustered at eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

The receipt of the severance pay affects people's financial decisions. While the subscription of long term Government bonds remains stable, that of the short term bonds increases by 3.9 percentage points. The effect on shares is noticeable: stock-ownership increases by 8.9 percentage points. In the light of an average pre-retirement participation rate of 20 percent, this increase appears substantial and significant from an economic perspective. With respect to real assets, ownership of the house of residence increases by 7.4 percentage points while no effect is displayed with respect to other housing. The house of residence is the most common asset; the average pre-retirement participation rate is above 78 percent. Therefore, also in this case the registered increase is substantial. Families seem to be taking the opportunity of retirement to renovate their properties, either the main residence or other housing; the increase in the participation is 8.8 percentage points.

The riskiness and durable nature of the purchased assets suggests that retirees pursue a long-term investment strategy. This type of behavior seems consistent with life expectancy

at retirement. In fact, given that the average age on leaving the labor market is between 56 and 59 years and the corresponding life expectancy is between 78 and 83 years, it follows that the typical individual can expect to enjoy the rewards of his purchase for a period of at least 20 years.

3.5.4 Validation and falsification tests

I perform several tests to check the validity of my estimation.

Sensitivity. To test the sensitivity of the results, I carry out some robustness checks. First of all I look at alternative model specifications in order to avoid any misspecified control function leading to the detection of spurious jumps. Figure 3.8 in the appendix reports the causal effects of retirement on the outcomes of interest using different order polynomials in the time of eligibility. Results are consistent with the former ones both from a qualitative and a quantitative point of view. To check the stability of the estimates I consider the data in the windows between [-12,12] and [-8,8] and I interpolate them using the baseline model specification. The estimated coefficients, reported in figure 3.9 in the appendix, have similar magnitude and significance to those reported in table 3.1.

Balance test. To check the sample balance at the cut-off, I consider several predetermined demographic characteristics that, a priori, are not affected by the eligibility status and that are correlated with non observable factors linked to investment decisions.

Table 3.2: Validation and Falsification Tests - Sample Balance.

Variables	[-12,12]	[-11,11]	[-10,10]	[-9,9]	[-8,8]
Age	√	√	√	√	√
Married	√	√	√	√	√
Family Size	×	√	√	√	√
N. Children	×	×	×	×	√
Yrs. Education	√	√	√	√	√
Northern Area	√	√	√	√	√
Central Area	√	√	√	√	√
Southern Area	√	√	√	√	√

Notes: The table reports the estimated causal effect of retirement on socio-demographic features. The dependent variables are shown in the left column. The covariates are the retirement status, a first order polynomial in S with a different slope at the two sides of the threshold and year dummies. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). × is reported if retirement has an effect significant at 5%. Standard errors are clustered at eligibility and survey year.

Table 3.2 reports a summary of the tests made. I use symbols to give an immediate evaluation of the results of the tests: √ means success (i.e. no effect of retirement on the predetermined

characteristic), × means failure (i.e. significant effect of retirement on the individual feature at 5%). I detect few failures with respect to family size and number of children. However, a drop in the number of components of the family is consistent with the children leaving the nest and it has already been used by previous literature.

McCrary test. A crucial assumption in the RD design is the continuity of the score density around the cut-off. This condition implies that individuals do not have the ability to precisely manipulate their score and consequently their preferred treatment status. If this occurs then the number of observations just below and just above the threshold should be approximately the same. Therefore, figure 3.3 shows that there is no evidence of sorting around $S = 0$.

Placebo test. Then I test whether regression functions for treatment and control units are continuous at points other than the cut-off, namely, I check if there is no jump in the treatment distribution where there should not be. The results of these tests are reported in figures 3.10 and 3.11 in the appendix. Some significant effects are detected for fictitious cut-offs in S=1 and S=-1. Moving away from the original cut-off, the estimates become insignificant.

Robustness: household's composition. It is a well known fact that young Italian people stay with their parents for a long time, well beyond the age of twenty. This feature has many determinants; some of them may come from cultural factors, such as parents' desire for cohabitation, others are related to the economic conditions of the young, such as the difficulty of finding a secure job and/or the absence of adequate financial resources to leave the nest. However, table 3.2 shows that the household's composition changes at the time of retirement, in particular it reduces; an element that has already been found in the literature. Therefore, to have a reliable measurement of the causal effect of retirement on investment decisions we have to examine how the changes in outcomes and in the family size relate to each other. Battistin, Brugiavini, Rettore, and Weber (2009), who studied consumption expenditure at the time of retirement, tackled the issue making a transformation of the dependent variable of the model, namely expressing it in per capita terms. This approach cannot be followed in the present context; to gauge how changes in participation and variations in family composition are related, I propose analyses by sub-groups considering only the panel component of SHIW. The groups of interest are the following: *i)* the full sample of (panel) individuals), *ii)* the subgroup of those who have children, *iii)* the subgroup of those who have children and whose family did not register any change in the composition. Figure 3.12 in the appendix shows that the estimated causal effect does not differ across groups.

Robustness: sample selection. One potential criticism is that relating to the selection of the sample. In the analyses carried out, only male heads of families (i.e. the reference persons) were considered. As previously said, this choice was motivated by the low participation in the workforce of women especially in the nineties and early 2000s. This section examines the consequences of including women in the sample. Two robustness tests are proposed. In

the first, all the reference persons, both men and women, are taken for each family. In the second, the head of the household is defined as the person with the greatest length of service (i.e. the one who will be the first to be eligible for the pension). The results appear robust to the new specifications. From a qualitative point of view, there is full agreement: when Italians retire, they increase their participation in short-term government bonds, in shares, in the residence and in renovation of the properties in their possession. From a quantitative point of view, the intensity of the effects decreases as the relative weight of the women in the sample increases. This result is likely as women tend to have less continuous careers. It should also be remembered that the increase in the number of female heads of households is a phenomenon that mainly characterizes the latest waves, a period in which both the mechanisms for calculating severance pay and pensions are less favorable. The descriptive statistics and the results of the estimates are shown in tables 3.10 and 3.11 in the appendix.

3.6 Interpreting results

Up to now it has been assumed that the receipt of the severance pay was the only driver generating the new investment strategies of the newly retired. However, there may be other explanations for the results observed. Indeed, retirement involves a multiplicity of changes: an injection of liquidity, an increase in free time and the elimination of the risk on earned income. In this section, tests are carried out to verify the importance of these three phenomena.

3.6.1 Stock-holding

The increase in participation in the stock market may also be attributable to factors such as the increase in leisure, a change in the risk attitudes and the change in the labor income uncertainty.

Thanks to more free time, retirees might study to improve their knowledge of the financial markets and increasing their level of financial education. I measure confidence with financial concepts, processing the data collected from 2006 and 2010, using two queries concerning inflation and the various types of mortgage [9]. Then I test the stability of this figure in the neighborhood of the pension entitlement. Table 3.12 in the appendix shows that this

[9]The queries considered are the following.
Inflation: *Imagine leaving 1,000 euros in a current account that pays 1% interest and has no charges. Imagine that inflation is running at 2%. Do you think that if you withdraw the money in a year's time you will be able to buy the same amount of goods as if you spent the 1,000 euros today?*

1. *Yes;*
2. *No, I will be able to buy less;*
3. *No, I will be able to buy more;*
4. *Don't know;*
5. *No answer.*

feature is stable at retirement, suggesting that leisure seems to play no role in stock-market participation at retirement.

Investments in risky assets depend on the individuals' tastes for risk. Therefore, it is necessary to verify if retirement induces any variation in this trait. To do that I use the data between 2004 and 2016 in which this figure is consistently collected [10]. Then I test the stability of this trait at retirement and I find that it does not vary. Results are shown in table 3.13 in the appendix.

The other two reasons that could explain the increase in equity market participation may be the fall in income risk and the receipt of a lump sum. Separating these two channels is not easy, although a heterogeneity analysis across these two dimensions can be instructive. To do this, I consider a single period portfolio choice model with entry costs, à la Vissing-Jorgensen (2003), in which households with a certain amount of wealth can allocate their resources either to a risky asset or to a safe one. [11] To invest in the risky asset it is necessary to bear a fixed cost constituted by a monetary component, such as the fee that has to be paid to the financial intermediaries, and by a non monetary part, attributable to the time and effort necessary to take the investment decision. In such a framework, households choose the optimal share of risky assets to maximize their expected utility. The condition that determines the investor's decision is the following:

$$W \geq F\left(1 + \frac{\bar{r}}{\alpha^*(r^{ce} - \bar{r})}\right) = w$$

where W is the initial wealth of the individual, F is the fixed cost, $\bar{r}$ is the return of the safe asset, $(r^{ce} - \bar{r})$ the risk-adjusted equity premium, and α^* the optimal share of risky assets that depends on individual risk aversion and on the size of the background risk in income.

Mortgage: *Which of the following types of mortgage do you think would allow you from the very start to fix the maximum amount and number of instalments to be paid before the debt is extinguished?*

1. *Floating-rate mortgage;*
2. *Fixed-rate mortgage;*
3. *Floating-rate mortgage with fixed instalments;*
4. *Don't know;*
5. *No answer.*

[10] The query that elicits the individual's attitudes toward risk is the following:
In managing your financial investments, would you say you have a preference for investments that offer:

1. *very high returns, but with a high risk of losing part of the capital;*
2. *a good return, but also a fair degree of protection for the invested capital;*
3. *a fair return, with a good degree of protection for the invested capital;*
4. *low returns, with no risk of losing the invested capital.*

A person is defined as risk averse if he picks the last option.

[11] A description of the model is provided in the appendix.

This condition offers several testable theoretical results:

i) The greater the wealth (W), the more likely an investment in risky assets;

ii) The higher the fixed cost (F), the higher the threshold to overcome, the less likely the participation;

iii) The lower the optimal share of risky assets (α^*), the harder it is to participate.

In the light of the previous tests, it is clear that only W and α vary at the time of retirement. The level of wealth (W) increases due to receipt of the severance pay, and the share of risky assets (α^*) is likely to increase because of the fall in background risk. Therefore, I divide the sample by the sizes of the lump sum and the level of background risk (assuming that the background risk in the private sector is higher than the one in the public sector).

Table 3.3: Interpretation: stocks.

	1	2	3	4	5	6	7
Retired	0.086***	0.028	0.090*	0.149**	0.100	0.198	0.340*
	0.025	0.035	0.054	0.064	0.090	0.132	0.180
f(S)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	13262	2632	2262	3927	847	1106	1859
N.Clusters	240	236	235	235	235	234	229
F First Stage	528	314	250	261	45	47	29

Columns:
1. Full sample;
2. Infusion= $[0, 30k]$ and High Background Risk;
3. Infusion= $[30k, 50k]$ and High Background Risk;
4. Infusion= $[50k, 500k]$ and High Background Risk;
5. Infusion= $[0, 30k]$ and Low Background Risk;
6. Infusion= $[30k, 50k]$ and Low Background Risk;
7. Infusion= $[50k, 500k]$ and Low Background Risk.

Notes: The table reports the estimated causal effect of retirement on the participation in stocks. The window of the estimation is for $S \in [-10, 10]$ in the window 2004-2016. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial in S with a different slope at the two sides of the threshold, a second order polynomial in the age of the head, years of education of the head, indicator of the area of residence, and year dummies. Standard errors are clustered at eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

The results, reported in table 3.3, show a limited heterogeneity across the level of background risk. For a predetermined level of background risk, those who receive a low lump sum do not participate in shares while those who receive a large sum substantially increase

the participation in stocks. Therefore, it seems that the main driver of the increase in stock-ownership is due to the liquidity infusion.

3.6.2 Housing

A house is both an investment and a consumption asset. Therefore, a variety of reasons can be hidden behind its purchase. Among the many, two are of major importance: the increase in free time and the receipt of the lump sum. To provide indications on the relative importance of the two channels, I perform several heterogeneity analyses partitioning the sample.

Table 3.4: Interpretation: main residence.

	1	2	3	4	5	6	7
Retired	0.078***	0.099**	0.089*	0.075	0.147***	0.060	0.017
	0.026	0.045	0.052	0.046	0.044	0.046	0.037
f(S)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	13262	3479	3368	5786	4757	4727	3778
N.Cluster	240	238	237	237	80	80	80
F First Stage	528	301	239	246	143	432	216

Columns:
1. Full sample;
2. Infusion= $[0, 30k]$;
3. Infusion= $[30k, 50k]$;
4. Infusion= $[50k, 500k]$;
5. Year=[1993-2000];
6. Year=[2002-2008];
7. Year=[2010-2016].

Notes: The table reports the estimated causal effect of retirement on the ownership of the main residence. The window of the estimation is for $S \in [-10, 10]$. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial in S with a different slope at the two sides of the threshold, a second order polynomial in the age of the head, years of education of the head, indicator of the area of residence, and year dummies. Standard errors are clustered at eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

First of all I explore the possible differences across the size of the infusion received. Table 3.4 shows that no substantial difference is found between those who received a small and a large settlement. This could be due to the fact that home ownership plays a primary role in the collective imagination. Then I check how investment strategies have evolved over time considering three windows of data: *i)* the years between 1993 and 2000 are related to

important changes in the European Union culminating in the introduction of the euro, *ii)* the second period begins in 2002 and ends in 2008, the year of the financial crisis, and *iii)* the last period, between 2010 and 2016, focuses on the sovereign debt crisis and its consequences. Interestingly, the jump in home-ownership seems to be entirely driven by the choices taken in the Nineties which show a jump of 14.7 percentage points while there are no significant increases in subsequent periods. This result casts doubt on the importance of free time on this type of investment. This marked difference in behavior seems to be associated with a question of purchase opportunities. Indeed the value of real estate was particularly low before the adoption of the euro. This piece of evidence seems to support the thesis that it is the infusion of liquidity that drives the investment. However, it must be recognized that other factors, difficult to detect, such as the desire to get closer to one's children or the lack of the need to be close to one's office, could play a role.

Lastly, a similar heterogeneity analysis is performed with respect to the renovation of properties owned. Table 3.5 shows how the increase in restructuring costs is not attributable to the receipt of the severance pay. Indeed, both those who received a small infusion and those who received a large one respond in a similar way.

Table 3.5: Interpretation: home renovation.

	1	2	3	4	5	6	7
Retired	0.088***	0.147***	-0.024	0.161***	0.035	0.122***	0.097**
	0.028	0.043	0.046	0.058	0.057	0.044	0.043
f(S)	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	13262	3479	3368	5786	4757	4727	3778
N.Cluster	240	238	237	237	80	80	80
F First Stage	528	301	239	246	143	432	216

Columns:
1. Full sample;
2. Infusion= $[0, 30k]$;
3. Infusion= $[30k, 50k]$;
4. Infusion= $[50k, 500k]$;
5. Year=[1993-2000];
6. Year=[2002-2008];
7. Year=[2010-2016].

Notes: The table reports the estimated causal effect of retirement on the participation in home renovation. The window of the estimation is for $S \in [-10, 10]$. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial in S with a different slope at the two sides of the threshold, a second order polynomial in the age of the head, years of education of the head, indicator of the area of residence, and year dummies. Standard errors are clustered at eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Therefore, it seems that these projects are mainly motivated by leisure: because people are going to spend a substantial amount of time at home, they want to improve the quality of their properties.

3.6.3 Housing and Stocks

Cocco (2005) studies portfolio choice in the presence of housing. His model considers fixed costs at entry to the equity market and it shows how ownership of the house of residence has a decisive influence on the behavior of individuals. This type of asset can limit participation in the stock market as new homeowners, given their scarce liquidity, prefer to abstain from the stock market and put off participation till later. Furthermore, he shows how the house price risk tends to lower the relative share of shares in the financial portfolio.

To test whether home-ownership crowds out stocks, I divide the sample into two groups considering the timing of the purchase of the house of residence.

Table 3.6: Effect of retirement on stock-ownership by the timing of home-ownership.

	1	2	3
Retired	0.089***	0.075**	0.133***
	0.025	0.036	0.040
f(S)	Yes	Yes	Yes
Covariates	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes
N.Obs.	13262	9659	3603
N.Clusters	240	240	240
F First Stage	524	379	311

Columns:
1. Full sample;
2. Old Homeowner;
3. New Homeowner.

Notes: The table reports the estimated causal effect of retirement on the participation in stocks. The window of the estimation is for $S \in [-10, 10]$. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial in S with a different slope at the two sides of the threshold, a second order polynomial in the age of the head, years of education of the head, indicator of the area of residence, and year dummies. Standard errors are clustered at eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

A first group is made up of homeowner workers and retirees who bought the property before retiring. A second group is made up of non-homeowner workers and retirees who invested a part of the severance pay in the primary house. Table 3.6 reports the estimated causal effect of retirement on stock-ownership for the two groups. At retirement, new homeowners have a greater increase in participation in the stock market (i.e. 13.3 percent) with respect to people who already owned the house of residence (i.e. 7.5 percent). This result is only partially in contrast to what the Cocco model predicts. Indeed, a sufficiently high severance pat could allow people to participate in both assets.

3.7 Conclusions

Using a fuzzy regression discontinuity design, I measure the causal effect of retirement on the investment strategies of new retirees. The analysis is developed around the unique feature of the Italian pension system whereby private and public employees receive a lump sum at the time of retirement. This liquidity infusion induces them to re-optimize their portfolios and reveals their investment horizon in view of old age.

Using micro data from the Survey on Household Income and Wealth from 1993 to 2016, I measure the change in the participation decision in financial and real assets upon retirement by exploiting the exogenous variation in eligibility for early and statutory pensions to correct for the endogenous nature of the retirement decision. The estimation is carried out under the identifying assumption that the investment choices would be the same around the threshold for pension eligibility, if the individual did not retire.

The main result is that holdings in risky and illiquid assets increase significantly upon retirement. In particular, participation in stocks increases by 8.9 percentage points, residential home ownership increases by 7.4 percentage points and the carrying out of home-owned renovation projects increases by 8.8 percentage points. These findings suggest that new retirees consider a long-term investment horizon.

Subsequently, by dividing the sample into subgroups, I examine to what extent these investments are induced by the liquidity infusion or by other factors such as greater free time or the absence of income risk. Through an empirical test built around the model of Vissing-Jorgensen (2003) it is shown that participation in the stock market depends primarily on the extent of the liquidity infusion. The increase in home ownership can be attributed, at least in part, to the receipt of the severance pay. Indeed, although on the one hand no substantial differences emerge between those who receive a small or large severance pay, on the other hand it is clear that this type of choice was made in a period of time in which house prices were particularly low and in which the infusion of liquidity could facilitate the purchase of real estate. However, it cannot be excluded that the purchase of the residence may depend on other factors - which are difficult to measure - such as the desire to be closer to one's children or grandchildren or the lack of need to live close to the workplace. The tendency to renovate owned properties is observed for a large part of the time horizon considered and

characterizes both those who have received a small and a large severance pay. In light of the greater amount of time one will spend at home, the investment motive would appear related to the desire to live in more comfortable properties.

Lastly, a connection between participation in the stock market and the real estate market is detected. Contrary to the belief that home-ownership crowds out stocks, the data show that the people who bought homes at retirement are also more likely to participate in the stock market than those who bought homes while working.

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3.A Appendix: Institutional context

Severance pay is the sum of annual salary installments set aside over time.

To accurately estimate the severance pay received, it would be necessary to know for each employment carried out: the sector of employment, the average monthly salary, the length of service. Unfortunately, the available data are not so detailed. Information regarding past occupations is scarce. Consequently some assumptions are necessary.

A completely static career environment is assumed: no salary progression or mobility between employment sectors. This means that, regardless of when an individual is observed, it is assumed that he has always worked/will continue to work in the same job and has always received/will continue to receive the same salary. The latter assumption is credible for blue-collar workers, who show no significant wage increases over time, and acceptable for simple white collar workers, who show modest wage progression.

It is necessary to know the number of years spent in the last job. For those who are still at work, it is assumed that they will continue to work until they turn 65. If they have never changed jobs, the number of years of employment is equal to the sum of the annual contributions paid plus the difference between the age of 65 and their current age. If they have changed jobs, self-reported information on the starting year of their last employment is used and it is assumed that they will continue in that role until they turn 65. Calculation differences also emerge for those who are retired. If they have only had one job, I look at the number of contributions paid. If they have had multiple jobs, the age at the start of the last job is looked at and compared with the retirement age. Not everyone reports this information. The missing values are imputed through a regression model.

Once all the information has been collected, the severance pay is estimated as the product of the average salary for the years of employment.

3.B Appendix: Data and Measurement

Table 3.7 informs on the filtering criteria I apply to highlight the sub-sample of interest. The selection procedure is the following:

1. *Step 1:* For each family in the sample, I consider only the households headed by a male *head*, defined as the person primarily responsible for or most knowledgeable about the household budget;
2. *Step 2:* The individuals of interest are employees who exhibit a certain attachment to the labour force, who are either working or retired. Consequently, I remove from the sample non-labour pensioners, disabled people, unemployed people and self-employed people. In particular, among the retirees, I choose only labour pensioners: people entitled to early or statutory retirement. To carry out our exercise, I need a collection of information about the head's characteristics such as: socio-demographic, economic features and his/her working history. All the units with missing characteristics are removed from the sample.
3. *Step 3:* Lastly, I keep people who are no more than 10 years away from the pension eligibility cut-off.

Table 3.7: Filtering criteria.

Sample	Raw	Step 1	Step 2	Step 3
	Count	Count	Count	Count
1993	8089	6000	1786	726
1995	8135	6048	3836	1480
1998	7147	5411	3331	1250
2000	8001	5327	3406	1301
2002	8011	5038	3277	1275
2004	8012	4885	3277	1182
2006	7768	4896	3274	1129
2008	7977	4934	3269	1141
2010	7951	4335	2808	1020
2012	8151	4457	2885	942
2014	8156	4236	2761	948
2016	7421	3901	2539	868
N.Obs.	94819	59468	36449	13262

Notes: The table reports the step-wise sample selection procedure. Step 1: number of heads. Step 2: number of households with useful information. Step 3: $S \in [-10, 10]$ and $S \neq 0$.

Table 3.8 shows why I chose to focus on male householders. For each filtering step, the quota of male and female heads of households is reported. It is possible to note that in the

initial sample (i.e. step 1), the heads of families are men in 63 percent of cases and women in the remaining 37 percent. It is necessary to highlight that the distribution between male and female heads has evolved over time. In the 1990s, three quarters of the heads of households were men, while in the latest surveys there is a fair balance between men and women.

Table 3.8: Filtering criteria.

Sample	Step 1		Step 2		Step 3	
	Men	Women	Men	Women	Men	Women
	Share	Share	Share	Share	Share	Share
1993	0.74	0.26	0.85	0.15	0.88	0.12
1995	0.74	0.26	0.82	0.18	0.85	0.15
1998	0.76	0.24	0.83	0.17	0.87	0.13
2000	0.67	0.33	0.77	0.23	0.81	0.19
2002	0.63	0.37	0.72	0.28	0.78	0.22
2004	0.61	0.39	0.71	0.29	0.77	0.23
2006	0.63	0.37	0.73	0.27	0.76	0.24
2008	0.62	0.38	0.71	0.29	0.74	0.26
2010	0.55	0.45	0.63	0.37	0.65	0.35
2012	0.55	0.45	0.64	0.36	0.67	0.33
2014	0.52	0.48	0.61	0.39	0.66	0.34
2016	0.53	0.47	0.61	0.39	0.65	0.35
Total	0.63	0.37	0.71	0.29	0.76	0.24
N.Obs.	59531	35351	36488	14760	13269	4280

Notes: The table reports the step-wise sample selection procedure. Fraction of male and female heads are shown for each set of filtering criteria imposed.

Imposing filters on employment status and career history halves the sample size. In this new subgroup, the share of male heads of households is equal to 71 percent while that of female heads is equal to 29 percent. These results are due to the imposition of filters relating to participation in the labor market. In the nineties women have a low attachment to work, indeed they are breadwinners only in 15-18 percent of cases. However, the situation has evolved over time and these inequalities have diminished, indeed in the last two surveys the split between male and female heads is 60 to 40. The sample is halved again when focusing only on those who are relatively close to the pension eligibility threshold (i.e. step 3). However, this further filtering does not substantially alter the overall distribution by gender of the heads of families. However, in the 1990s, the share of female heads of households was dramatically low. In the first three surveys there are between 100 and 250 women, these numbers are too small to obtain reliable estimates. For this reason, in the main analysis, I decided to consider only men.

Table 3.9: Descriptive statistics.

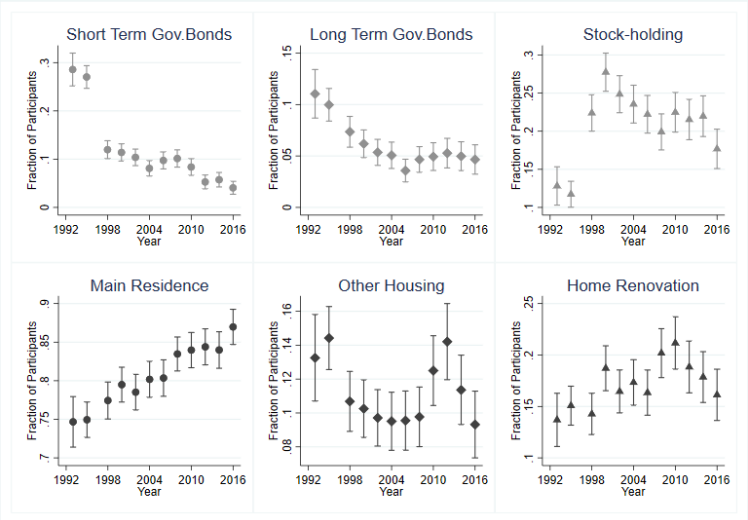
Sample	Step 1		Step 2		Step 3	
Variables	Mean	SD	Mean	SD	Mean	SD
Male	1.000	0.000	1.000	0.000	1.000	0.000
Age	55.964	14.874	56.697	14.651	58.251	6.742
Diploma	0.353	0.478	0.360	0.480	0.347	0.476
Degree	0.099	0.299	0.088	0.283	0.086	0.280
Married	0.817	0.386	0.829	0.376	0.871	0.335
Active	0.561	0.496	0.513	0.500	0.500	0.500
Retired	0.422	0.494	0.464	0.499	0.479	0.500
Family Size	2.879	1.253	2.853	1.214	3.018	1.175
N.Children	0.943	1.035	0.924	1.011	1.050	1.001
Total Net Wealth	284.590	526.134	227.694	229.805	258.506	242.631
Total Net Income	39.355	30.639	38.374	21.592	42.524	23.277
Total Consumption	28.836	17.672	28.377	14.861	30.555	15.813
N.Obs.	59531		36449		13262	

Notes: The table reports Mean/Percentage and Standard Deviation of several demographic and economic variables. Economic variables are expressed in thousands of euros and are deflated using 2016 CPI. I report three samples that refer to the three steps in the sample selection section.

Table 3.9 shows how the characteristics of the sample vary according to the filtering criteria. The final sample (step3-sample) is made up of households on average more educated, more often married, with more members and with greater wealth, income and expenses than those reported by the initial sample (i.e. step1-sample).

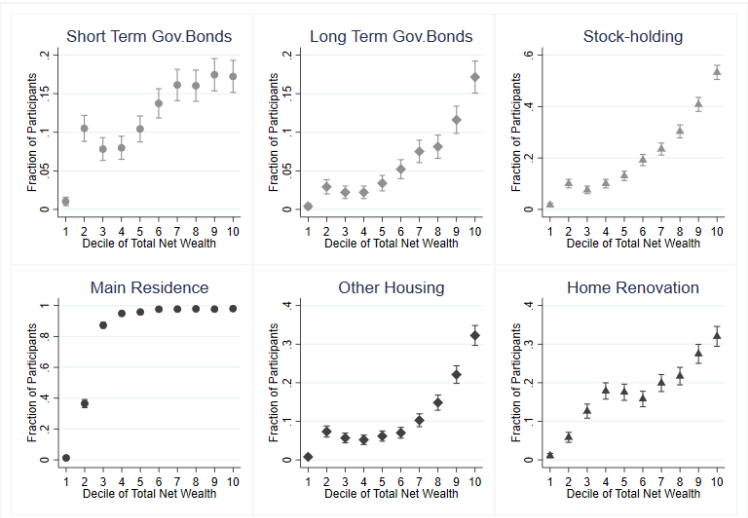
3.B.1 Outcomes

Figure 3.6: Participation rates by survey year.



Notes: The figure reports the average participation by survey year.

Figure 3.7: Participation rates by decile of total net wealth.



Notes: The figure reports the average participation by decile of total net wealth.

3.C Appendix: Empirical Analysis

Figure 3.8: Validation and falsification tests: Sensitivity to the functional form.

Notes: The figure contains six graphs which report the estimated causal effect of retirement on the participation in financial and real assets. Each marker in each figure refers to a specific polynomial form: "square" first order polynomial with same slope at the cutoff, "circle" first order polynomial with different slope at the cutoff, "rhomboid" second order polynomial with same slope at the cutoff, "triangle" second order polynomial with different slope at the cut-off.

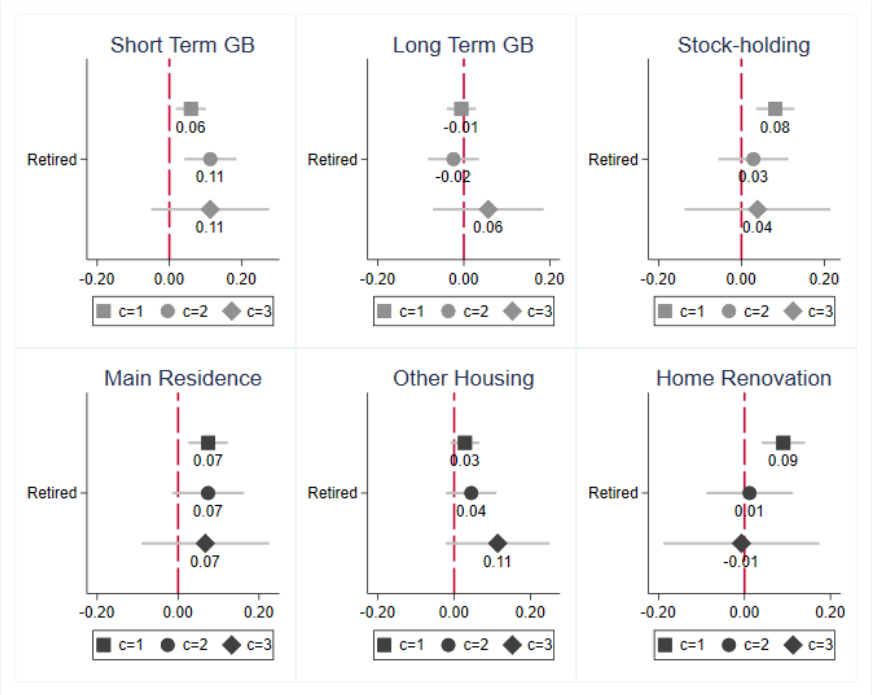
Figure 3.9: Validation and falsification tests: Sensitivity to the bandwidth.

Notes: The figure contains six graphs which report the estimated causal effect of retirement on the participation in financial and real assets. Each marker in each figure refers to a different bandwidth.

Figure 3.10: Validation and falsification tests: Placebo test.

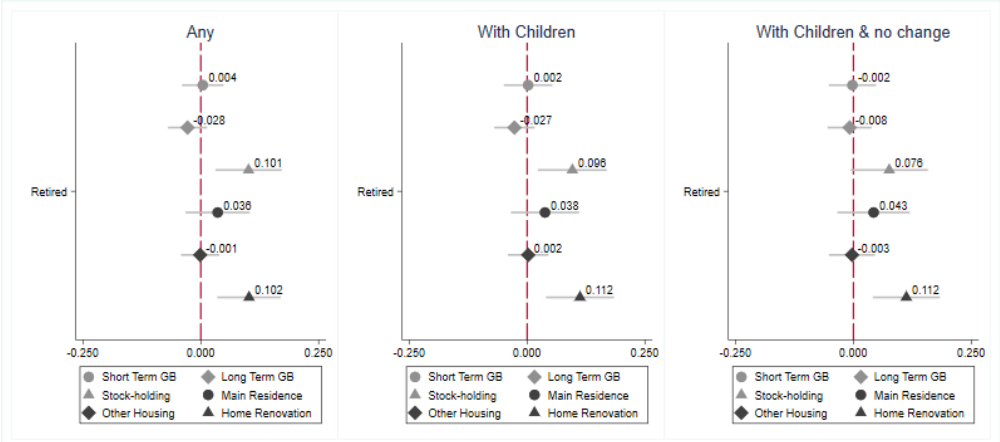
Notes: The figure contains six graphs which report the estimated causal effect of retirement on the participation in financial and real assets considering a fictitious threshold. Each marker in each figure refers to a different alternative threshold: "square" cut-off=-1, "circle" cut-off=-2, "rhomboid" cut-off=-3.

Figure 3.11: Validation and falsification tests: Placebo test.



Notes: The figure contains six graphs which report the estimated causal effect of retirement on the participation in financial and real assets considering a fictitious threshold. Each marker in each figure refers to a different alternative threshold: "square" cut-off=1, "circle" cut-off=2, "rhomboid" cut-off=3.

Figure 3.12: Validation and falsification tests: Robustness - Household's composition.



Notes: The figure contains three graphs which report the estimated causal effect of retirement on the participation in financial and real assets. Each marker refers to an independent regression.

Table 3.10: Validation and Falsification Tests: Robustness - Sample selection.

	1	2	3	4	5	6
Retired	0.038**	0.008	0.073***	0.060***	0.007	0.069***
	0.019	0.017	0.022	0.021	0.011	0.023
f(S)	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	17494	17494	17494	17494	17494	17494
N.Clusters	480	480	480	480	480	480
F First Stage	699	699	699	699	699	699

Columns:
1. Short Term Government Bonds;
2. Long Term Government Bonds;
3. Direct and Indirect Stock-holding;
4. Main Residence;
5. Other Housing;
6. Home Renovation;

Notes: The table reports the estimated causal effect of retirement on the participation in financial and real assets. The sample considered is the one in which the head is defined as the SHIW reference person, therefore it could be either a man or a woman. The window of the estimation is for $S \in [-10, 10]$. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial in S with a different slope at the two sides of the threshold, a second order polynomial in the age of the head, years of education of the head, indicator of the area of residence, and year dummies. Standard errors are clustered at eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 3.11: Validation and Falsification Tests: Robusteness - Sample selection.

	1	2	3	4	5	6
Retired	0.043**	0.000	0.059**	0.058**	0.007	0.060**
	0.019	0.017	0.024	0.023	0.011	0.024
f(S)	Yes	Yes	Yes	Yes	Yes	Yes
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	15220	15220	15220	15220	15220	15220
N.Clusters	480	480	480	480	480	480
F First Stage	686	686	686	686	686	686

Columns:
1. Short Term Government Bonds;
2. Long Term Government Bonds;
3. Direct and Indirect Stock-holding;
4. Main Residence;
5. Other Housing;
6. Home Renovation;

Notes: The table reports the estimated causal effect of retirement on the participation in financial and real assets. The sample considered is the one in which the head is defined as the person in the household with the longest working career, therefore it could be either a man or a woman. The window of the estimation is for $S \in [-10, 10]$. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial in S with a different slope at the two sides of the threshold, a second order polynomial in the age of the head, years of education of the head, indicator of the area of residence, and year dummies. Standard errors are clustered at eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

3.D Appendix: Interpretation

Table 3.12: Effect of retirement on financial literacy.

Financial Literacy	1
Retired	-0.047
	0.065
f(S)	Yes
Covariates	Yes
Year Dummies	Yes
N.Obs.	2984
N.Clusters	60
First Stage F	355

Notes: The table reports the estimated causal effect of retirement on Financial Literacy. The outcome is computed using SHIW data waves from 2006 to 2010. The dependent variable is equal to the count of correct answers. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial in S with a different slope at the two sides of the threshold, a second order polynomial in the age of the head, years of education of the head, indicator of the area of residence, and year dummies. The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 3.13: Effect of retirement on risk aversion.

Risk Aversion	1
Retired	-0.034
	0.050
f(S)	Yes
Covariates	Yes
Year Dummies	Yes
N.Obs.	6578
N.Clusters	140
F First Stage	436

Notes: The table reports the estimated causal effect of retirement on Risk Aversion. The outcome is computed using SHIW data waves from 2004 to 2016. The dependent variable is a binary indicator for being risk averse. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial in S with a different slope at the two sides of the threshold, a second order polynomial in the age of the head, years of education of the head, indicator of the area of residence, and year dummies. The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

3.E Appendix: Portfolio choice model

Consider a single period portfolio choice model. Households possess a certain amount of *wealth* (W) that can be allocated in two assets: one *risky* ($\tilde{r}$) and one *safe* ($\bar{r}$). However, in order to invest in risk assets it is necessary to bear a fixed cost F constituted by a monetary component, such as the fee that has to be paid to the financial intermediaries, and by a non monetary part, attributable to the time and effort necessary to take the investment decision. Households choose the optimal share of risky assets (α^*) to maximize their expected felicity from wealth and have a utility function that is monotonically increasing and concave.

The maximization problem is the following:

$$Max_\alpha E\{U((W-F)(\alpha\tilde{r}+(1-\alpha)\bar{r}))\}$$

deriving with respect to α we get:

$$E\{U'((W-F)(\alpha\tilde{r}+(1-\alpha)\bar{r}))(W-F)(\tilde{r}-\bar{r})\}=0$$

With a positive risk premium and initial wealth higher than the participation cost, the optimal share of risky asset (α^*) is strictly positive. Given α^*, the investor will buy risky assets if the expected utility from having a diversified portfolio is higher than the one obtaining from investing exclusively in the safe asset. This condition can be expressed as follows:

$$E\{U((W-F)(\bar{r}+\alpha^*(\tilde{r}-\bar{r})))\}\geq U(W\bar{r})$$

Replacing the right hand side with its certainty equivalent we get:

$$U((W-F)(\bar{r}+\alpha^*(r^{ce}-\bar{r}))\geq U(W\bar{r})$$

then knowing that the utility is monotonically increasing in its argument, it follows that:

$$\begin{aligned}(W-F)(\bar{r}+\alpha^*(r^{ce}-\bar{r}))&\geq W\bar{r}\\(W-F)(\alpha^*(r^{ce}-\bar{r}))&\geq F\bar{r}.\end{aligned}$$

The left hand side of the relationship can be interpreted as the net benefit from investing $\alpha*(W-F)$ euro in the risky asset, while the right hand side represents the cost avoidable by not investing in riskier securities. Therefore, individuals will participate if the net benefit is higher than the cost and in particular, rearranging the terms, if:

$$W\geq F\left(1+\frac{\bar{r}}{\alpha^*(r^{ce}-\bar{r})}\right)=w.$$

Therefore, an individual participates if his level of initial wealth (W) is higher than the threshold (w). We see that: i) the higher the fixed cost (F), the higher the threshold to overcome, ii) the higher the risk-adjusted premium ($r^{ce}-\bar{r}$), the lower the cutoff, iii) the higher the optimal share (α^*), the less easy it is to participate, and iv) because α^* is a function of the risk attitudes of the individuals: the higher the relative risk aversion, the lower the optimal share, the harder it is to participate.

Chapter 4

Well-being and retirement

4.1 Introduction

In recent decades, OECD countries have registered a fall in birth rates and an improvement in life expectancy both at birth and at retirement. These phenomena determined a substantial increase in the share of retirees in the overall population [1] [2]. The combined action of these demographic trends and the generosity of pension systems put public finances under pressure. Consequently, governments reacted by implementing reforms aimed at improving the sustainability of social security systems and shortening the retirement phase by making eligibility criteria more stringent.

Although these interventions have improved public finances through an increase in revenues linked to the greater supply of work, and to a reduction in costs due to lower pension payments, it is not entirely clear what the effect has been on individuals' well-being. No theory can give an unequivocal prescription of the effect of retirement on the well-being of the individual. Indeed, the *role theory* states that work is a strongly characterizing factor of a person's identity. Indeed, although retirement involves the elimination of the tensions and stress caused by work, it also determines the loss of one of the greatest sources of individual gratification. On the other hand, the *continuity theory* states that individual well-being depends on a

[1] This work was conceived and designed together with Martina Celidoni and Chiara Dal Bianco. I am grateful for their help in preparing the data and for the fruitful discussions we had. The empirical analysis was conducted by me. Responsibility for interpretation of the data, as well as for any errors, is mine alone.

[2] In 1980, a newborn had a life expectancy of 73.7 years in the United States and 73.3 years in the United Kingdom. Nowadays, life expectancy in these two countries is respectively equal to 78.7 and 81.2 years. Similarly, in the two countries, the life expectancy at retirement has also improved. At 65 years of age, a man (woman), might expect to live 14.1 (18.3) years if American and 12.6 (16.6) years if British. Nowadays, an American man (woman) can expect to live for 18.1 (20.6) years while a British person may count on living for 18.8 (21.1) years. With respect to the share of retirees in the total population, this ratio is equal to 15.2 percent in the United States and equal to 18 percent in the United Kingdom.

multiplicity of factors and that an individual's satisfaction depends not only on work but also on the family and friendship relationships he/she maintains. Being no longer part of the working population could be compensated for by the intensification of contacts with others.

In this paper I evaluate the effect of retirement on the various components of well-being In doing so I consider three different and complementary indicators of well-being: *i)* life satisfaction - which looks at satisfaction with what has been achieved in one's life -, *ii)* CASP-12 - which looks at the quality of life of the individual and his prospects -, and *iii)* frailty - a summary indicator of physical and mental health. To carry out this analysis, I use the information collected in the Survey of Health, Ageing and Retirement in Europe relating to wave 2 and waves 4 to 7 for 17 euro area countries. In order to properly address the endogenous nature of retirement, I consider the variability in employment status induced by early and old-age pension eligibility. Furthermore, to prevent the estimated coefficient from being affected by the role of an unobserved time invariant heterogeneity I carry out a 2sls fixed effect estimation.

My contribution is threefold. First, I show that retirement has a beneficial effect on individuals' well-being, increasing life satisfaction by 2.8 percentage points, quality of life by 4.6 percentage points and reducing the frailty index by -7.4 percentage points. This effect is not constant over time, as it tends to fade slightly, but it is persistent. This finding is in partial contrast to the view that retirement is characterized by a honeymoon phase and a decay phase.

Second, the effect of retirement can vary depending on the type of retirement exit you choose. In particular, the CASP-12 is affected by this aspect and it is noted that the retirement induced by early retirement eligibility generates a much more pronounced effect, equal to 9.7 percentage points, than that induced by old-age pension eligibility, equal to 3.1 percentage points.

Third, the effect of retirement differs between men and women and between countries of different geographical areas. While men show at most a positive, transitory effect, women register a stable increase in their well-being when they retire. Finally, people living in Mediterranean countries show no change in well-being with retirement while those living in continental or northern European countries report significant increases in all three categories, life satisfaction, CASP-12 and health.

The paper is structured as follows: Section 2 describes the data and the variables used, Section 3 presents the empirical strategy adopted and its results, Section 4 concludes.

Related literature. I add to a vast literature that examined the consequences of retirement. It has been shown that crossing the border of retirement has extensive repercussions on different dimensions of individual well-being affecting individual choices (Battistin, Brugiavini, Rettore, and Weber (2009), Hurst (2008)), habits (Celidoni, Dal Bianco, Rebba, and Weber (2020)), and health (Rohwedder and Willis (2010), Celidoni, Dal Bianco, and Weber (2017)). In particular I contribute to the research on subjective well-being which has provided mixed results also due to the heterogeneity in the outcomes used and the estimation

strategies adopted. Horner (2014) using SHARE [3], ELSA [4] and HRS [5] data, implemented an instrumental variable strategy and found some slight evidence in favor of a beneficial effect of retirement on subjective well-being. Bonsang and Klein (2012), using GSOEP [6] data, studied the effect of voluntary and involuntary retirement on a collection of outcomes related to satisfaction. Using a fixed effect estimation, they showed that voluntary retirement does not affect overall life satisfaction but it does affect satisfaction with health, income and free time. A. Gorry, D. Gorry, and Slavov (2018), considering HRS data, implemented an instrumental variable strategy and found a significant positive effect of retirement on life satisfaction and health. Kesavayuth, Rosenman, and Zikos (2016), using BHPS data [7], estimated an instrumental variable fixed effect model and found a significant effect of early retirement on overall life satisfaction for both men and women. Johnston and Lee (2009), studying an annual cross-section of the HSE [8] and performing a regression discontinuity design analysis shows that retirement has a positive effect on mental health and on subjective measures of health.

A first issue I address is that of the definition of the outcome of interest. Multiple measures of well-being have been used in the past and this does not facilitate comparisons between different works. Thanks to the wealth of the dataset at my disposal, I am able to define general and complementary measures of well-being which can therefore provide a more complete indication of the phenomenon of interest.

In the literature, three types of papers are specified: those that study the overall effect of retirement (i.e. Latif (2011), Bonsang and Klein (2012), Kesavayuth, Rosenman, and Zikos (2016)), those that measure its immediate effect (i.e. Johnston and Lee (2009)), and those that instead differentiate between short- and long-term effects (i.e. A. Gorry, D. Gorry, and Slavov (2018), Sohier, Van Ootegem, and Verhofstadt (2021)). In the present work two approaches are followed using a rigorous estimation methodology. This paper is similar to what was done in A. Gorry, D. Gorry, and Slavov (2018) as regards the model of interest but differs with respect to the definition of the outcomes and with respect to the dataset used. Another work with connection points is the one by Sohier, Van Ootegem, and Verhofstadt (2021), who, not having reliable tools at their disposal, adopt fixed effects as their preferred strategy. In the present paper, fixed effects estimation is combined with that of instrumental variables.

Finally, analyses of heterogeneity with respect to the type of pension have rarely been carried out. In this paper, thanks to the calculation of the eligibility to early and statutory

[3]SHARE: Survey of Health, Ageing, and Retirement in Europe.

[4]ELSA: English Longitudinal Survey of Ageing.

[5]HRS: Health and Retirement Study data.

[6]GSOEP: German Socio-Economic Panel.

[7]BHPS: British Household Panel Survey.

[8]HSE: Health Survey for England.

retirement, I distinguish the consequences of the two types of pensions. Only Sohier, Van Ootegem, and Verhofstadt (2021) assessed the heterogeneity between genders and between countries and found very weak traces of the phenomena. In this paper there is a marked difference between men and women and between geographical areas.

4.2 Data and Measurement

The data of interest are from the Survey of Health, Ageing and Retirement in Europe (henceforth SHARE). This survey is carried out in 28 European countries and Israel and it collects information about health, demographic and economic features of people aged 50 and older. The analysis of interest is performed on a sample of 17 countries and considering the data collected in wave 2 and in waves from 4 to 7. The original sample consists of more than 250,000 observations. However, the exercise is carried out on a subgroup of 80,000 individuals identified by imposing a collection of filtering criteria. In particular, attention is restricted to those who are workers or pensioners, aged between 50 and 75 years of age and who have taken part in at least two consecutive interviews. For a more accurate description of the filtering criteria, please refer to appendix 4.A.

4.2.1 Well-being

In order to grasp the different facets of well-being, three diverse and complementary outcomes are considered. The first is *life satisfaction*, which is measured through a question that asks you to evaluate - from 0 to 10 - your level of satisfaction with what you have achieved in your life. The higher the score reported, the higher the life satisfaction. The second is an indicator of the quality of vision called *CASP-12*. This variable evaluates the individual's satisfaction with respect to four domains: control, autonomy, self-realization and pleasure. The interviewee answers a series of 12 questions revealing his degree of agreement or disagreement with respect to the statements that investigate his quality of life and his feelings. A score from 1 to 4 is assigned to each answer provided. The final indicator is equal to the sum of the scores and, in a range of values between 12 and 48, the higher the value, the greater the quality of life. Finally, since the literature has shown that retirement is often associated with a process of mental or physical deterioration, a synthetic indicator of health is considered that measures aging from a biological point of view. This indicator makes it possible to identify the so-called fragile people who are more exposed to health problems. The concept of *frailty*, vague and unclear in the past, has now found a clear definition: "a state of increased vulnerability to stressors due to age related decline in physiologic reserve across neuromuscular, metabolic, and immune systems". Frailty is a multidimensional phenomenon and therefore the measurement criteria are hard to find. As pointed out by Fisher (2005) there are two major approaches: *i)* the frailty phenotype by Fried, Tangen, Walston, Newman, Hirsch, Gottdiener, Seeman, Tracy, Kop, Burke, et al. (2001), and *ii)* the frailty index by Mitnitski,

Mogilner, and Rockwood (2001) and Mitnitski, Mogilner, MacKnight, and Rockwood (2002). The first approach divides people based on physical characteristics alone while the second is a more comprehensive measure that also includes psychological aspects and disabilities. In order to have the most complete measurement possible, the second method is adopted. The frailty indicator is calculated as the standardized sum of deficits afflicting an individual. In this case, the higher the indicator, the lower the individual's health. The appendix contains more information on defining and calculating the outcomes of interest.

Table 4.1 contains descriptive statistics of the three outcomes of interest. The individuals in the sample are relatively satisfied with their lives and have a rather high quality of life. In fact, the average values of these characteristics are respectively equal to 7.87 and 38.64. Individuals also enjoy moderate health: the average value of the frailty index is equal to 0.07. By dividing the sample on the basis of employment status and comparing the subgroup means, it seems that workers have significantly greater well-being than retirees.

Table 4.1: Well-being.

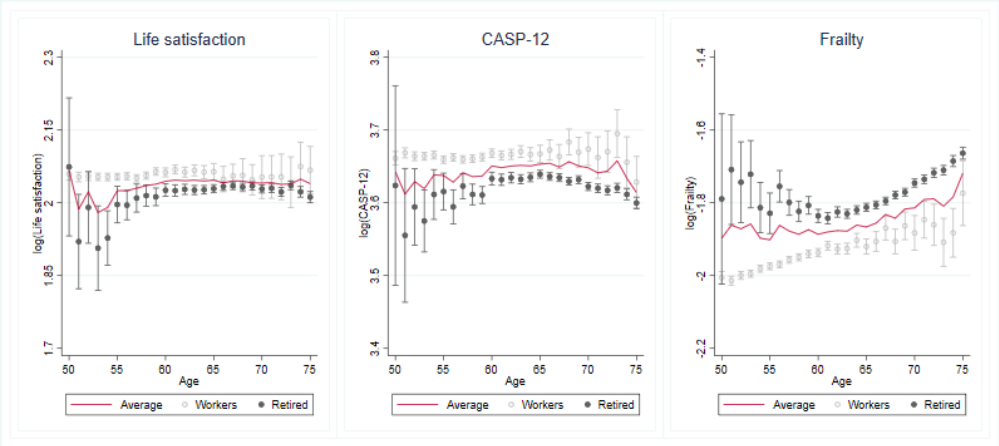
Outcome	Working	Retired	Total	t-test
	Mean	Mean	Mean	
Life satisfaction	7.97	7.79	7.87	√
CASP-12	39.39	38.08	38.64	√
Frailty	0.05	0.08	0.07	√

Notes: The table shows the average values of the outcomes by working status.

Figure 4.4 in the appendix shows the distributions of the three outcomes. The life satisfaction and CASP-12 distributions have a bell-like shape with a more pronounced left tail. 75 percent of individuals have a life satisfaction greater than or equal to 7 and a CASP-12 greater than or equal to 35. The frailty index is distributed as a gamma density function. Three quarters of the sample have an indicator lower than 0.08 while those who fall in the last percentile have an indicator higher than 0.3. The distributions of working people are superimposed on those of retirees. Irrespective of the outcome considered, workers boast a better condition than pensioners.

Figure 4.1 shows the relationship between well-being and age. The red lines show the trend of the average calculated on the overall sample. Life satisfaction appears substantially stable. The quality of life is also quite stable and shows a slightly concave shape. The trend of the frailty index is markedly convex. Behind these average trends it is detected again the differences found between workers and pensioners with the former having a greater well-being than the latter.

Figure 4.1: Well-being.



Notes: The figure shows the evolution of outcomes with age. The red line shows the mean value of the outcome by year of age while the markers represent the mean value by age and occupational status.

4.2.2 Pension eligibility

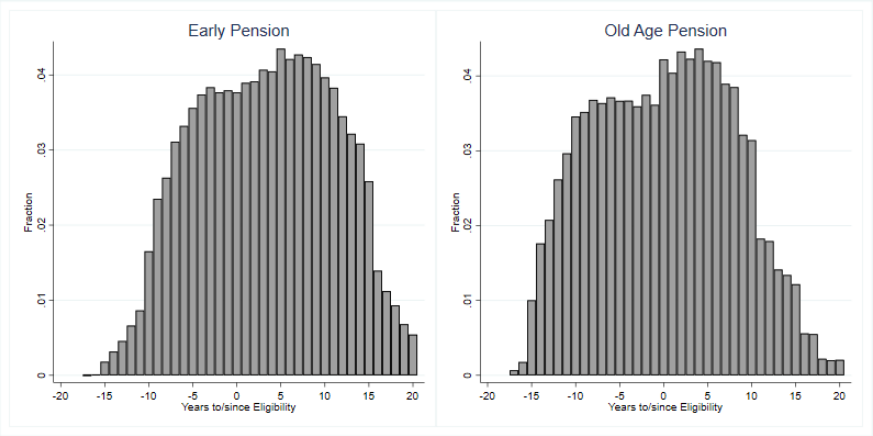
To address correctly the endogenous nature of retirement and therefore to be able to compare correctly workers and retirees, I use age specific retirement incentives prevailing in the different social security systems as the instrument for retirement. Based on the regulatory criteria of each country I calculate a score called time to/since eligibility which measures the number of years that separate an individual from the moment of eligibility for retirement [9]. In particular, two types of retirement are considered: *i)* the old-age pension scheme, the normal exit from the world of work once the age is reached, and *ii)* early retirement, an early exit guaranteed upon fulfilling certain conditions. A score is then calculated for each retirement scheme (i.e. (S_{OP}, S_{EP})) which is equal to zero at the time of entitlement, it is negative before and positive after. Figure 4.2 shows that the densities are smooth around the cut-off.

4.2.3 Retirement status

Retirement is the treatment of interest. A person is Retired if he receives a pension. Retirement is defined as an absorbing status, so a working retiree is counted as a retiree. Figure 4.3 shows an increase in the proportion of pensioners by year of eligibility.

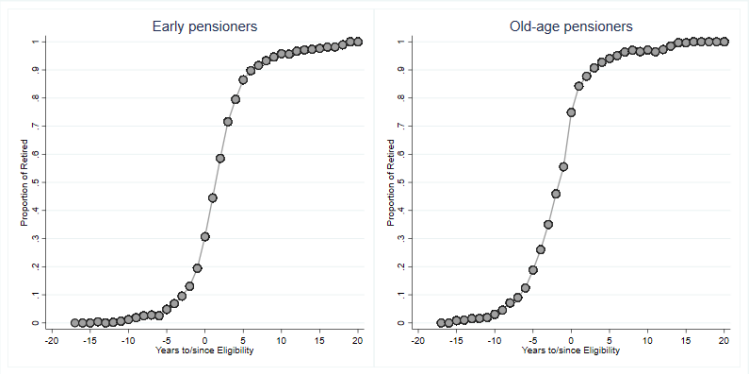
[9]To compute the eligibility to early and old-age pensions I used the eligibility criteria reported in Gruber, Wise, et al. (1999), Gruber and Wise (2001), Wise (2012), and by the Mutual Information System on Social Protection (MISSOC) database and Social Security Administration (SSA) data on 'Social Security Programs throughout the World'. Further details are reported in the appendix.

Figure 4.2: Time to/since eligibility.



Notes: The figure shows the distributions of the time to/since of eligibility. Left figure shows the years of eligibility for early pension (EP), while right figure shows the years of eligibility for old-age pension (OP).

Figure 4.3: Retirement status.



Notes: The figure reports the fraction of retirees by year of eligibility for early and old-age pension schemes.

4.3 Empirical Analysis

This section describes the estimated regression model and subsequently the results obtained.

4.3.1 Empirical strategy

I wish to capture the effect of retirement on different measures of well-being. To do that I estimate the following equation:

$$log(y_{it}) = \alpha + \beta R_{it} + X'_{it}\gamma + e_i + u_{it} \tag{4.1}$$

where y_{it} is one of the outcomes of interest for individual i at time t, R_{it} is his/her retirement status and X'_{it} is a vector of individual time-varying characteristics such as age and marital status, and e_i and u_{it} are the time invariant and the time varying components of the error term. The endogenous nature of the retirement decision is tackled using the eligibility statuses for early and old-age pension (i.e. $I(S_{it}^{EP} \geq 0)$, and $I(S_{it}^{EP} \geq 0)$) and the time invariant unobserved heterogeneity is purged out applying a fixed effect approach. Therefore the model is estimated through a 2sls fixed effect.

In order to distinguish between the short-term and long-term effects of retirement, the following model is estimated:

$$log(y_{it}) = \alpha + \beta_1 R_{it}^{ST} + \beta_2 R_{it}^{LT} + X'_{it}\gamma + e_i + u_{it} \tag{4.2}$$

where R_{it}^{ST} is a binary indicator which captures the short term effect of retirement and highlights people retired for no more than 4 years and R_{it}^{LT} captures the long term effect of retirement and highlights people retired for at least five years. The instrument set used is composed of two binary indicators for being eligible from no more than four years and of two other binary indicators for being eligible for at least five years to early and old age pension schemes. This model is also estimated using 2sls fixed effect [10].

4.3.2 Results

Table 4.2 shows the effect of retirement on individual well-being. The columns respectively show: life satisfaction, CASP-12, and frailty. Retirement has an unequivocally beneficial effect: it increases life satisfaction by 2.8 percentage points, quality of life - measured through the CASP-12 - by 4.6 percentage points and overall health through a reduction in the frailty index by -7.4 percentage points. Pension eligibility and retirement are highly correlated and the first stage shows a high F statistic equal to 89. The effect of retirement on life satisfaction and frailty is homogeneous with respect to the two exits from the labor market (i.e. the p-value of the Sargan test is higher than 0.10). On the other hand, retirement has a different effect on CASP-12 depending on whether it is early or mandatory. In fact, as shown in table 4.8 in the appendix, retiring early through access eligibility determines an increase of 9.7 percentage points of the CASP-12, while that induced by the old-age pension only by 3.1 percentage points.

[10]The effect of retirement was also estimated using the 2sls and controlling for additional covariates such as wave fixed effects, country fixed effects and individual time invariant characteristics. Tables 4.6 and 4.7 report 2sls estimates and compare them with 2sls fixed effect estimates. There are quite evident differences in the estimated coefficients. The 2sls approach offers coefficients that are small and not statistically different from zero; on the contrary, the 2sls fixed effect method - although it only considers the "within" variability - is able to offer meaningful and statistically significant estimates. These differences seem to suggest a better ability of the 2sls fixed effect method to satisfy the assumption of instrument exogeneity, eliminating the possible correlation with unobserved time invariant factors.

Table 4.2: Effect of retirement on Well-being.

Well-being	1	2	3
Retired	0.028*	0.046***	-0.074***
	0.016	0.012	0.025
Covariates	Yes	Yes	Yes
N.Obs.	80350	80460	80460
N.Clusters	218	218	218
Hansen J	0.223	0.012	0.180
F First Stage	89	89	89

Columns: 1. log(Life satisfaction); 2. log(CASP-12); 3. log(Frailty).
Notes: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.3 shows a distinction between a short-term and a long-term effect of retirement. This model therefore has two endogenous variables: being retired for no more than four years (i.e. short-term effect), and being retired for at least five years (i.e. long-term effect). It is important to distinguish between these two effects since the literature often speaks of the honeymoon effect of retirement, i.e. an immediate benefit followed by a worsening of the condition. The results collected are only partially in favor of this thesis. The coefficients shown are all unequivocally positive. However, the magnitude of the coefficients decreases over time. As far as life satisfaction is concerned, retirement has an immediate positive effect, equal to an increase of 3.6 percentage points, which tends to disappear after five years. The quality of life improves significantly in retirement, registering an increase of 5.4 percentage points in the first four years. This effect decreases slightly over time, reaching a value of 3.6 percentage points. Perhaps the most surprising result is the one concerning the frailty index. There is an immediate reduction of -9.0 percentage points which is maintained over time, stabilizing at -6.8 percentage points.

Table 4.3: Effect of retirement on Well-being.

Well-being	1	2	3
Retired, short term	0.036**	0.054***	-0.090***
	0.016	0.012	0.026
Retired, long term	0.026	0.036***	-0.068***
	0.018	0.012	0.026
Covariates	Yes	Yes	Yes
N.Obs.	80350	80460	80460
N.Clusters	218	218	218
Hansen J	0.511	0.127	0.339
F First Stage	88	88	88
F First Stage	149	149	149

Columns: 1. log(Life satisfaction); 2. log(CASP-12); 3. log(Frailty). *Notes*: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

4.3.3 Validation and falsification tests

In this section, robustness tests are presented.

Robustness: specification of age effects. The goal is to estimate the effect of retirement on individual well-being. To get a correct measurement of the coefficient it is necessary to include the age of the individual in the model and therefore to separate the effect of retirement from that of age. The correct specification of the trend in the age of the individual is particularly important when one wants to separate the short-term and long-term effect of retirement. The logarithm of age was included in the main models; now alternative specifications are considered in order to control the stability of the retirement effect. Tables 4.9, 4.10, 4.11, 4.12, 4.13 and 4.14 in the appendix show the test results. Although the size of the retirement effect - both overall and in the short and long term - is not excessively affected by the different specification of the trend, the coefficients tend to lose significance when a third degree polynomial is considered.

Robustness: specification of short term and long term effects. Equation 4.2 separates the retirement effect into a short-term effect and a long-term one depending on whether a person has been retired for no more than four years or for at least five years. Table 4.15 shows the results obtained considering a different short-term and long-term specification. In this

case, the short-term effect is measured on those who have been retired for no more than three years and the long-term effect on those who have been retired for at least four years. The estimated coefficients are very similar to those shown in table 4.3: both the short-term and long-term effects are positive and significant. The results obtained using this definition are even more inconsistent with the hypothesis of a honeymoon effect: in fact, the long-run coefficients are often greater than the short-run ones.

Robustness: specification of the outcomes. As a further test of robustness, the outcomes of interest are defined in an alternative way. Instead of considering the logarithm of the outcomes, binary indicators are examined which highlight those who report a value of well-being higher than the median. The results are reported in tables 4.16 and 4.17 in the appendix. Also in this case, retirement has a beneficial effect, increasing the probability of having a value of well-being above the median. Similarly to what was seen previously, the probability of manifesting this value decreases slightly over time but still tends to remain positive and significant.

4.3.4 Heterogeneity analysis

Heterogeneity analyses are now presented. The original sample is split on the basis of gender and then country of residence. The previously presented regression models are estimated on these subgroups.

Table 4.18 in the appendix reports the results of retirement on various outcomes for men and women. Retirement has no effect on the life satisfaction of men but increases that of women by 5.2 percentage points. Quality of life improves for both subgroups by values around 4.4-5 percent. Health improves for both men and women with the latter showing a more pronounced effect, equal to -8.5 percent, compared to men, who stand at -7.2 percent. The results of the dynamic analyses are presented in table 4.19 in the appendix. Overall, retirement has a beneficial effect on well-being, transient for men and persistent for women who record only a slight decrease over time. The low value of the p-value of the Hansen J test indicates, for women, the presence of a heterogeneity in the effect of retirement by type of exit from the labor market. As indicated by the coefficients shown in table 4.20 in the appendix, women who retire early recorded a substantial increase in the quality of life.

A second heterogeneity analysis is performed with respect to the country of residence. Mediterranean or southern European countries are distinguished from those of continental or northern Europe. Tables 4.21 and 4.22 in the appendix report the results. It is interesting to note that retirement does not alter individual well-being in Mediterranean countries [11] while it has a persistent beneficial effect on people living in northern countries. Again, early or

[11] It should be noted that the first stage F relating to the Mediterranean countries does not always reach sufficiently high values. Therefore the results, especially those in table 4.21, must be interpreted with caution.

mandatory retirement has different effects on life quality as measured by the CASP-12. Once again, as shown in table 4.23 in the appendix, early retirement has a more pronounced effect than compulsory retirement.

4.4 Conclusions

The ongoing aging process in OECD countries and the difficulties of public finances have prompted governments to implement a series of reforms aimed at reducing the duration of retirement, making the access criteria more stringent and thus postponing the retirement age. These maneuvers have improved the finances of the states, however it is not clear if and how they may have influenced individual well-being.

In order to give an answer to this question, an attempt was made to evaluate the effect of retirement on individuals' well-being using the information collected by SHARE on a sample of approximately 80,000 individuals residing in 17 countries. The research question was investigated trying to describe individual well-being in a comprehensive way, looking at it from different points of view and considering complementary outcomes. In particular, the following measures were used: *i)* life satisfaction, a measure that looks at the past and at how satisfied one is with what has been achieved, *ii)* the CASP, an indicator of the quality of life that looks at current autonomy and the future of the individual, and *iii)* the frailty index, a synthesis indicating the person's health.

The endogenous nature of retirement was addressed by exploiting the pension access criteria in the various countries considered and by defining a set of tools which establishes eligibility for the pension. Through a 2sls estimate it has been shown that retirement has a beneficial cross-sectoral effect on individual well-being. In fact, life satisfaction, CASP-12 and frailty all show a significant improvement with access to retirement. Furthermore, this improvement is often persistent over time. In fact, although it tends to decrease with retirement, the results obtained do not seem to have a transitory nature.

Several heterogeneity analyses are proposed. The first dimension explored concerns the method of accessing the pension. Retirement induced by eligibility for early or old age pensions produces the same effects on life satisfaction and health. However, there are significant differences in quality of life. In fact, taking early exit from the labor market raises the CASP-12 by 9.7 percentage points while forced retirement improves the CASP-12 by only 3.1 percentage points. A second dimension of heterogeneity is that connected with sex. While men show at most a positive and transitory effect, women register a stable increase in their well-being when they retire. Finally, significant differences are also found between countries. In particular, retirement has no effect on individual well-being in Mediterranean countries but has a positive and persistent effect on residents of continental and northern European countries.

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4.A Appendix: Data and Measurement

Table 4.4 shows the filtering criteria I apply to highlight the sub-sample of interest. The selection procedure is the following:

1. *Step 1:* From the raw sample I consider only individuals living in: Austria, Germany, Sweden, Netherlands, Spain, Italy, France, Denmark, Greece, Switzerland, Belgium, Israel, Czech Republic, Poland, Luxembourg, Portugal, and Estonia;
2. *Step 2:* The individuals of interest are those who exhibit a certain attachment to the labour force, who are either working or retired. Consequently, I keep only working people and retirees aged between 50 and 75 years of age. To carry out our exercise, I need to collect information about the individual's characteristics such as: socio-demographic, economic features and his/her working history. All the units with missing characteristics are removed from the sample;
3. *Step 3:* Lastly, I keep people who participate for at least two consecutive waves.

Table 4.4: Filtering criteria.

Sample	Raw	Step 1	Step 2	Step 3	Men	Women
Wave	Count	Count	Count	Count	Count	Count
2	22025	11516	5630	2671	1305	1366
4	47730	33418	22071	16175	7409	8766
5	56382	42381	27902	21856	10437	11419
6	60814	41760	26622	22844	10892	11952
7	71432	31874	18041	16914	8421	8493
N.Obs.	258383	160949	100266	80460	38464	41996

Notes: The table reports the step-wise sample selection procedure. Step 1: number of individuals in the selected countries of interest. Step 2: number of individuals with useful information. Step 3: panel sample.

Table 4.5 shows how the characteristics of the sample vary according to the filtering criteria. The final sample (step3-sample) is made up of households on average older, more educated, more often married, more frequently divorced, less likely to be widowed, and with a similar number of children with respect to the final sample (i.e. step1-sample). Not considering people over the age of 75 means that the final sample contains fewer pensioners and more workers than the initial sample. Average life satisfaction and CASP-12 are not affected by the application of filters. The final sample shows an average value slightly higher than the initial one. The mean value of the frailty index is significantly lower in the final sample than in the initial one.

Table 4.5: Descriptive statistics.

Sample	Step 1		Step 2		Step 3	
Variables	Mean	SD	Mean	SD	Mean	SD
Male	0.483	0.500	0.482	0.500	0.478	0.500
Age	66.531	10.132	63.101	6.955	63.049	6.707
Diploma	0.292	0.455	0.321	0.467	0.336	0.472
Degree	0.240	0.427	0.271	0.445	0.284	0.451
Married	0.718	0.450	0.755	0.430	0.754	0.431
Divorced	0.091	0.288	0.103	0.304	0.106	0.308
Widowed	0.137	0.344	0.084	0.278	0.081	0.273
N.Children	2.345	1.172	2.305	1.097	2.303	1.086
Working	0.337	0.473	0.424	0.494	0.428	0.495
Retired	0.663	0.473	0.576	0.494	0.572	0.495
Life satisfaction	7.676	1.772	7.790	1.650	7.867	1.561
CASP-12	37.609	6.189	38.330	5.808	38.640	5.635
Frailty	0.088	0.084	0.073	0.070	0.070	0.065
N.Obs.	160949		100266		80460	

Notes: The table reports Mean/Percentage and Standard Deviation of several individual features.

Life satisfaction. Life satisfaction is measured through the following question:

On a scale from 0 to 10 where 0 means completely dissatisfied and 10 means completely satisfied, how satisfied are you with your life?

CASP-12. CASP-12 is measured from the answers elicited through a series of questions. The interviewee answers each question by choosing from the following alternatives: often, sometimes, rarely, never. Each response is assigned a score from 1 to 4 depending on whether the response indicates a lower or higher quality of life. The CASP-12 indicator is then calculated as the sum of the scores assigned to the answers.

The list of questions is introduced by the following statement:

I will now read a list of statements that people have used to describe their lives or how they feel. We would like to know how often, if at all, you experienced the following feelings and thoughts over the past four weeks: often, sometimes, rarely, or never.

The queries are the following:

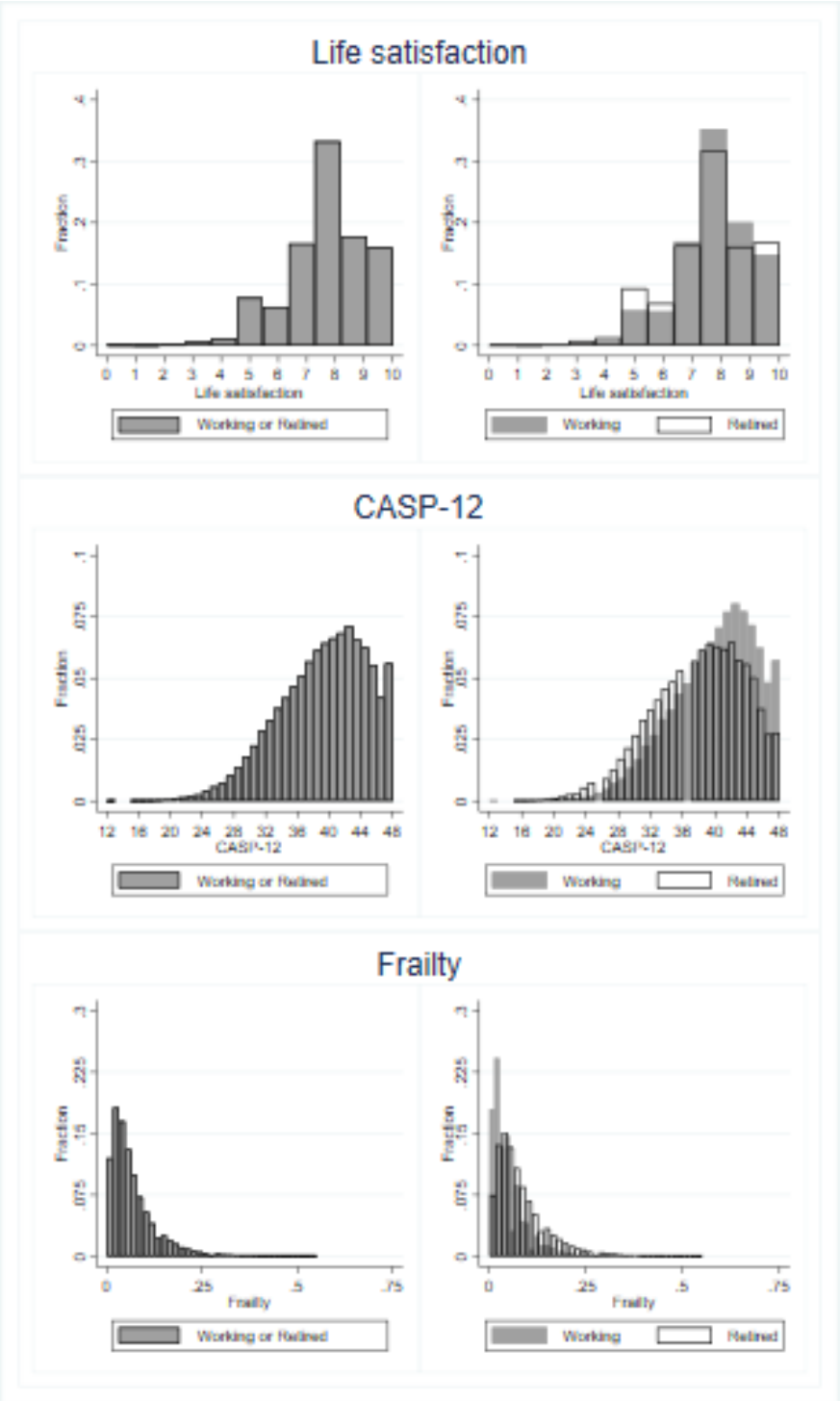
- *How often do you think your age prevents you from doing the things you would like to do?*

- *How often do you feel that what happens to you is out of your control?*
- *How often do you feel left out of things?*
- *How often do you think that you can do the things that you want to do?*
- *How often do you think that family responsibilities prevent you from doing what you want to do?*
- *How often do you think that shortage of money stops you from doing the things you want to do?*
- *How often do you look forward to each day?*
- *How often do you feel that your life has meaning?*
- *How often, on balance, do you look back on your life with a sense of happiness?*
- *How often do you feel full of energy these days?*
- *How often do you feel that life is full of opportunities?*
- *How often do you feel that the future looks good for you?*

Frailty. I consider 60 potential deficits that are related to physical health and mental health. The information is taken from the SHARE data and is related to the following domains:

- *Cognitive function.* Three binary indicators on the self-assessed ability to read, the self-assessed ability to write and of performing poorly a memory test.
- *Mental health.* A binary indicator signalling the presence of depression.
- *Physical health.* A binary indicator informative about reporting a very bad health status, a binary indicator about having limitations with activities, 14 indicators of reporting chronic diseases, 22 indicators of having a particular type of cancer, 12 indicators of having specific symptoms of bad health, a binary indicator of having a critical BMI, 10 indicators of having mobility limitations, 6 indicators of having limitations in activities of daily living, 7 indicators of having limitations in instrumental activities of daily living, a binary indicator of reporting bad hearing, a binary indicator of low grip strength.

Figure 4.4: Well-being.



Notes: The figure shows the distribution of individual well-being in the full sample and by working status.

4.A.1 Eligibility

To compute the eligibility to early and old-age pensions I used the eligibility criteria reported in Gruber, Wise, et al. (1999), Gruber and Wise (2001), Wise (2012), and by the Mutual Information System on Social Protection (MISSOC) database and Social Security Administration (SSA) data on 'Social Security Programs throughout the World'. The criteria for access to early (ER) and old-age (OA) pensions in the countries considered are shown below.

- *Austria:* ER: 60 for men and 55 for women until 2001. From 2001, early retirement depends on year of birth but men with at least 45 contribution years and women with at least 40 contribution years were unaffected by the increase in the early retirement age (ERA). From 2001 to 2005, for men born up to and including 1942, ERA is 61, then it is 62 from 1943 onwards. As of 2005 for men born in 1943-1944 ERA is 62, for those born between 1945 and 1947 it is 63, for those born between 1948 and 1950 it is 64 and 65 for men born after 1950. From 2001 to 2005 for women it is 56 for those born in 1947, 57 for those born from 1948 to 1951, 58 for those born from 1952. As of 2005 for women born between 1948 and 1949 ERA is 57, for those born between 1950 and 1952 it is 58, for those born between 1953 and 1955 it is 59 and 60 for women born after 1955. OA: 65 for men and 60 for women.
- *Germany:* ER: For men, no early retirement until 1973, 60 from 1973 until 2005, and 63 from 2006. For women, no early retirement until 1962, 60 from 1962. OA: 65 for all until 2012; 67 from 2012.
- *Sweden:* ER: No early retirement until 1963. 60 from 1963 to 1997; 61 from 1998. OA: 67 for both men and women until 1995; 65 from 1995.
- *Netherlands:* ER: No early retirement until 1975. 60 from 1975, for both men and women. OA: 65 for both men and women until 2017 and 66 from 2018.
- *Spain:* ER: 64 until 1982, 60 from 1983 to 1993, and 61 from 1994 – for both men and women. OA: 65 for both men and women.
- *Italy:* ER: From 1965 to 1995, early retirement was possible at any age with 35 years of contributions (25 years in the public sector) for both men and women; as of 1996, it was step-wise increased up to age 60 for both the private and public sectors (61 for the self-employed). Since 2012, it is 62 for both men and women. OA: The old-age retirement was 60 (65 in the public sector) for men and 55 (60 in the public sector) for women from 1965 to 1993. Several consecutive reforms (1992, 1995 and 1998) increased the old-age retirement to 65 for men and 60 for women, with step-wise increments from 1994. The old-age retirement was 66 from 2012 and 67 from 2019 for men; for women, it was 65 in 2012, 66 from 2013 (it has been possible to retire at 62 since 2012, 63 since 2013, 65 since 2016 and 66 since 2018 in the private sector, and at 63 since 2012, 64 since 2013 and 66 since 2018 for the self-employed). The old-age retirement is 67 for both men and women from 2019.

- *France:* ER: No early retirement until 1963. 60 from 1963 to 1980; 55 since 1981. OA: 65 until 1983 and 60 from 1983 to 2010; since 2011, 60 for those born up to 1952, 61 for those born between 1953 and 1954, and 62 for those born since 1955.
- *Denmark:* ER: 60 for both men and women. OA: 67 until 2004, 65 from 2004, 66 since 2020 – for both men and women.
- *Greece:* ER: 60 for both men and women until 2012, 62 since 2013. OA: For women, 60 until 2012, 65 in 2013, and 67 since 2014. For men, 65 until 2012 and 67 from 2013 onward.
- *Switzerland:* ER: No early retirement until 1997 for men and until 2001 for women. Then, 64 for men from 1997 to 2000 and 63 since 2001; 62 for women from 2001. OA: 65 for men; for women, 63 until 1964, 62 since 1964 to 2000, 63 from 2001 to 2004, and 64 from 2005.
- *Belgium:* ER: No early retirement until 1966. For men, 60 afterwards; for women, 55 until 1987 and 60 since 1987. For both men and women, 61 in 2014, 62 in 2016. OA: 65 for men; for women, 60 until 1997, 61 from 1997 to 1999, 62 from 2000 to 2002, 63 from 2003 to 2005, 64 from 2006 to 2008, and 65 since 2009.
- *Israel:* ER: No early retirement. OA: 65 for men and 60 for woman up to 2004. From 2005 to 2009, 66 for men and 61 for women. 67 for men and 62 for women from 2009 onward.
- *Czech Republic:* ER: Early retirement is possible up to two years before normal retirement age. OA: For men 60 from 1961 to 2002, 61 from 2003 to 2008, 62 from 2009 to 2015, 63 since 2016. For women, old-age retirement depends on the number of children.
- *Poland:* ER: 60 for women and 65 for men. OA: 55 for women and 60 for men.
- *Luxembourg:* ER: For both men and women, 65 the same as OA up to 1992. 57 for men from 1993 onward. 60 for women from 1993 onward. OA: 65 for both men and women.
- *Portugal:* ER: No early pension before 1999. For both men and women, 55 since 2011, 57 from 2012, 55 from 2015, and 60 since 2017. OA: 65 for men. For women, 62 until 1993, 63 from 1993 to 1995, 64 from 1996, 65 from 1999. For both men and women, 66 since 2012.
- *Estonia:* ER: 60 for men and 55 for women until 2003. From 2004, early retirement age increased gradually for women: 56 from 2004, 57 from 2007, 58 from 2010, 59 from 2013, and 60 since 2016. OA: 63 for men; for women, 58 before 2004, 59 from 2004 to 2007, 60 in 2008 and 2009, 61 from 2010, 62 from 2013, and 63 since 2016.

4.B Appendix: Empirical Analysis

4.B.1 Results

Table 4.6: Effect of retirement on Well-being, 2sls vs 2sls FE.

Well-being	1	2	3	4	5	6
Retired	-0.013	0.028*	0.010	0.046***	-0.004	-0.074***
	0.027	0.016	0.016	0.013	0.027	0.025
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	80376	80376	80460	80460	80460	80460
N.Clusters	218	218	218	218	218	218
F First Stage	142	89	142	89	142	89

Columns: In each column different outcomes are considered. Specifically: 1 and 2. log(Life satisfaction; 3 and 4. log(CASP-12); 5 and 6. log(Frailty).
Notes: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls (col. 1, 3, 5) and a 2sls fixed effect (col. 2, 4 6). The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates in columns 1, 3 and 5 are wave dummies, dummies on the country of residence, binary indicators about gender and educational attainment, log(age) and binary indicators on the marital status. The covariates in columns 2, 4 and 6 are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.7: Effect of retirement on Well-being.

Well-being	1	2	3	4	5	6
Retired, short term	0.006	0.036**	0.026	0.054***	-0.044*	-0.090***
	0.029	0.016	0.017	0.012	0.025	0.026
Retired, long term	-0.040	0.026	-0.019	0.036***	0.044*	-0.068***
	0.029	0.018	0.016	0.012	0.026	0.026
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	80376	80376	80460	80460	80460	80460
N.Clusters	218	218	218	218	218	218
F First Stage	135	88	135	88	135	88
F First Stage	142	149	142	149	142	149

Columns: In each column different outcomes are considered. Specifically: 1 and 2. log(Life satisfaction; 3 and 4. log(CASP-12); 5 and 6. log(Frailty).
Notes: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls (col. 1, 3, 5) and a 2sls fixed effect (col. 2, 4 6). The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates in columns 1, 3 and 5 are wave dummies, dummies on the country of residence, binary indicators about gender and educational attainment, log(age) and binary indicators on the marital status. The covariates in columns 2, 4 and 6 are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.8: Effect of retirement on CASP-12, differences between pension schemes.

log(CASP-12)	1	2	2
Retired	0.046***	0.097***	0.031**
	0.012	0.023	0.015
Covariates	Yes	Yes	Yes
N.Obs.	80460	80460	80460
N.Clusters	218	218	218
Hansen J	0.012		
F First Stage	89	54	95

Columns: In each column different sets of instruments are considered. Specifically: 1. eligibility status for early retirement and eligibility status for old-age retirement; 2. eligibility status for early retirement; 3. eligibility status for old-age retirement.
Notes: The table reports the estimated causal effect of retirement on CASP-12 implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

4.B.2 Validation

Table 4.9: Validation and falsification tests: Robustness test - Effect of retirement on life satisfaction, different polynomial of age.

log(Life satisfaction)	1	2	3	4
Retired	0.028*	0.031*	0.023	0.010
	0.016	0.016	0.016	0.021
log(Age)	0.158***			
	0.027			
Age		0.002***	0.015***	-0.050
		0.000	0.004	0.055
Age^2			-0.000***	0.001
			0.000	0.001
Age^3				-0.000
				0.000
Covariates	Yes	Yes	Yes	Yes
N.Obs.	80350	80350	80350	80350
N.Clusters	218	218	218	218
Hansen J	0.223	0.175	0.472	0.487
F First Stage	89	89	89	62

Columns: In each column different polynomials of age are considered. Specifically: 1. log(Age); 2. First order polynomial of age; 3. Second order polynomial of age, 4. Third order polynomial of age.
Notes: The table reports the estimated causal effect of retirement on life satisfaction implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a specific polynomial of age and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.10: Validation and falsification tests: Robustness test - Effect of retirement on quality of life, different polynomial of age.

log(CASP-12)	1	2	3	4
Retired	0.046***	0.051***	0.039***	0.031**
	0.012	0.012	0.012	0.014
log(Age)	-0.003			
	0.026			
Age		-0.000	0.017***	-0.022
		0.000	0.003	0.038
Age^2			-0.000***	0.000
			0.000	0.001
Age^3				-0.000
				0.000
Covariates	Yes	Yes	Yes	Yes
N.Obs.	80460	80460	80460	80460
N.Clusters	218	218	218	218
Hansen J	0.012	0.012	0.172	0.181
F First Stage	89	89	89	62

Columns: In each column different polynomials of age are considered. Specifically: 1. log(Age); 2. First order polynomial of age; 3. Second order polynomial of age, 4. Third order polynomial of age. *Notes*: The table reports the estimated causal effect of retirement on CASP-12 implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a specific polynomial of age and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.11: Validation and falsification tests: Robustness test - Effect of retirement on frailty, different polynomial of age.

log(Frailty)	1	2	3	4
Retired	-0.074***	-0.075***	-0.063***	-0.043
	0.025	0.024	0.024	0.031
log(Age)	0.917***			
	0.050			
Age		0.015***	-0.003	0.099
		0.001	0.005	0.073
Age^2			0.000***	-0.002
			0.000	0.001
Age^3				0.000
				0.000
Covariates	Yes	Yes	Yes	Yes
N.Obs.	80460	80460	80460	80460
N.Clusters	218	218	218	218
Hansen J	0.180	0.505	0.801	0.768
F First Stage	89	89	89	62

Columns: In each column different polynomials of age are considered. Specifically: 1. log(Age); 2. First order polynomial of age; 3. Second order polynomial of age, 4. Third order polynomial of age. *Notes*: The table reports the estimated causal effect of retirement on frailty implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a specific polynomial of age and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.12: Validation and falsification tests: Robustness test - Effect of retirement on life satisfaction, different polynomial of age.

log(Life satisfaction)	1	2	3	4
Retired, short term	0.036**	0.040**	0.027	0.012
	0.016	0.016	0.016	0.020
Retired, long term	0.026	0.029	0.023	0.002
	0.018	0.018	0.017	0.025
log(Age)	0.177***			
	0.034			
Age		0.003***	0.015***	-0.077
		0.001	0.004	0.061
Age^2			-0.000***	0.001
			0.000	0.001
Age^3				-0.000
				0.000
Covariates	Yes	Yes	Yes	Yes
N.Obs.	80350	80350	80350	80350
N.Clusters	218	218	218	218
Hansen J	0.511	0.435	0.726	0.794
F First Stage	88	83	65	60
F First Stage	149	139	125	86

Columns: In each column different polynomials of age are considered. Specifically: 1. log(Age); 2. First order polynomial of age; 3. Second order polynomial of age, 4. Third order polynomial of age.
Notes: The table reports the estimated causal effect of retirement on life satisfaction implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a specific polynomial of age and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.13: Validation and falsification tests: Robustness test - Effect of retirement on quality of life, different polynomial of age.

log(CASP-12)	1	2	3	4
Retired, short term	0.054***	0.057***	0.040***	0.027*
	0.012	0.012	0.012	0.014
Retired, long term	0.036***	0.040***	0.033***	0.014
	0.012	0.013	0.012	0.015
log(Age)	0.038			
	0.028			
Age		0.000	0.016***	-0.067
		0.000	0.003	0.041
Age^2			-0.000***	0.001*
			0.000	0.001
Age^3				-0.000**
				0.000
Covariates	Yes	Yes	Yes	Yes
N.Obs.	80460	80460	80460	80460
N.Clusters	218	218	218	218
Hansen J	0.127	0.092	0.166	0.237
F First Stage	88	83	65	60
F First Stage	149	139	125	86

Columns: In each column different polynomials of age are considered. Specifically: 1. log(Age); 2. First order polynomial of age; 3. Second order polynomial of age, 4. Third order polynomial of age.
Notes: The table reports the estimated causal effect of retirement on CASP-12 implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a specific polynomial of age and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.14: Validation and falsification tests: Robustness test - Effect of retirement on frailty, different polynomial of age.

log(Frailty)	1	2	3	4
Retired, short term	-0.090***	-0.082***	-0.062**	-0.044
	0.026	0.026	0.026	0.031
Retired, long term	-0.068***	-0.074***	-0.066***	-0.039
	0.026	0.025	0.024	0.034
log(Age)	0.875***			
	0.053			
Age		0.015***	-0.004	0.112
		0.001	0.006	0.082
Age^2			0.000***	-0.002
			0.000	0.001
Age^3				0.000
				0.000
Covariates	Yes	Yes	Yes	Yes
N.Obs.	80460	80460	80460	80460
N.Clusters	218	218	218	218
Hansen J	0.339	0.686	0.959	0.888
F First Stage	88	83	65	60
F First Stage	149	139	125	86

Columns: In each column different polynomials of age are considered. Specifically: 1. log(Age); 2. First order polynomial of age; 3. Second order polynomial of age, 4. Third order polynomial of age.
Notes: The table reports the estimated causal effect of retirement on frailty implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a specific polynomial of age and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.15: Validation and falsification tests: Robustness test - Effect of retirement on Well-being, different definition of short term and long term effects.

Well-being	1	2	3
Retired, short term	0.024**	0.039***	-0.044***
	0.012	0.009	0.017
Retired, long term	0.034**	0.036***	-0.067***
	0.016	0.011	0.022
Covariates	Yes	Yes	Yes
N.Obs.	80350	80460	80460
N.Clusters	218	218	218
Hansen J	0.376	0.042	0.462
F First Stage	62	62	62
F First Stage	84	84	84

Columns: In each column different outcomes are considered. Specifically: 1. log(Life satisfaction); 2. log(CASP-12); 3. log(Frailty).
Notes: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.16: Validation and falsification tests: Robustness test - Effect of retirement on Well-being, different outcomes.

Well-being	1	2	3
Retired	0.086**	0.146***	0.067
	0.038	0.041	0.046
Covariates	Yes	Yes	Yes
N.Obs.	80460	80460	80460
N.Clusters	218	218	218
Hansen J	0.086	0.106	0.692
F First Stage	89	89	89

Columns: In each column different outcomes are considered. Specifically: 1. I(log(Life satisfaction)$>$ $p(50)$); 2. I(log(CASP-12)$>$ $p(50)$); 3. I(log(Frailty)$>$ $p(50)$). *Notes*: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.17: Validation and falsification tests: Robustness test - Effect of retirement on Well-being, different outcomes.

Well-being	1	2	3
Retired, short term	0.094**	0.164***	0.091*
	0.039	0.042	0.047
Retired, long term	0.062*	0.117***	0.036
	0.037	0.042	0.047
Covariates	Yes	Yes	Yes
N.Obs.	80460	80460	80460
N.Clusters	218	218	218
Hansen J	0.258	0.428	0.926
F First Stage	88	88	88
F First Stage	149	149	149

Columns: In each column different outcomes are considered. Specifically: 1. I(log(Life satisfaction)$>$ $p(50)$); 2. I(log(CASP-12)$>$ $p(50)$); 3. I(log(Frailty)$>$ $p(50)$). *Notes*: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

4.B.3 Heterogeneity

Table 4.18: Effect of retirement on Well-being by gender.

Well-being	log(Life satisfaction)		log(CASP-12)		log(Frailty)	
	Men	Women	Men	Women	Men	Women
Retired	0.008	0.052**	0.044**	0.050***	-0.072**	-0.085***
	0.024	0.021	0.019	0.016	0.036	0.031
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	38409	41941	38464	41996	38464	41996
N.Clusters	103	115	103	115	103	115
Hansen J	0.393	0.395	0.179	0.018	0.275	0.424
F First Stage	36	68	36	68	36	68

Columns: In each column different outcomes are considered. Specifically: 1 and 2. log(Life satisfaction); 3 and 4. log(CASP-12); 5 and 6. log(Frailty).
Notes: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.19: Effect of retirement on Well-being by gender.

Well-being	log(Life satisfaction)		log(CASP-12)		log(Frailty)	
	Men	Women	Men	Women	Men	Women
Retired, short term	0.018	0.055**	0.053***	0.054***	-0.092***	-0.092***
	0.023	0.022	0.018	0.016	0.036	0.034
Retired, long term	0.008	0.046*	0.032	0.039***	-0.054	-0.084***
	0.024	0.025	0.020	0.015	0.038	0.032
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	38409	41941	38464	41996	38464	41996
N.Clusters	103	115	103	115	103	115
Hansen J	0.266	0.698	0.640	0.034	0.143	0.777
F First Stage	47	51	47	51	47	51
F First Stage	69	96	69	96	69	96

Columns: In each column different outcomes are considered. Specifically: 1 and 2. log(Life satisfaction); 3 and 4. log(CASP-12); 5 and 6. log(Frailty).
Notes: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.20: Effect of retirement on Well-being for women.

log(CASP-12)	1	2	3	4
Retired	0.110***	0.037**		
	0.029	0.016		
Retired, short term			0.094***	0.043**
			0.024	0.017
Retired, long term			0.055***	0.034**
			0.021	0.017
Covariates	Yes	Yes	Yes	Yes
N.Obs.	41996	41996	41996	41996
N.Clusters	115	115	115	115
F First Stage	29	89	48	77
F First Stage			84	137

Columns: In each column different sets of instruments are considered. Specifically: 1. eligibility status for early retirement; 2. eligibility status for old-age retirement; 3. eligibility status for early retirement; 4. eligibility status for old-age retirement.
Notes: The table reports the estimated causal effect of retirement on CASP-12 implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.21: Effect of retirement on Well-being by geographical position.

Well-being	log(Life satisfaction)		log(CASP-12)		log(Frailty)	
	South	North	South	North	South	North
Retired	-0.013	0.041**	0.036	0.049***	-0.025	-0.090***
	0.036	0.018	0.029	0.013	0.055	0.028
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	21257	59093	21296	59164	21296	59164
N.Clusters	77	141	77	141	77	141
Hansen J	0.208	0.436	0.405	0.008	0.214	0.368
F First Stage	20	68	20	68	20	68

Columns: In each column different outcomes are considered. Specifically: 1 and 2. log(Life satisfaction); 3 and 4. log(CASP-12); 5 and 6. log(Frailty).
Notes: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.22: Effect of retirement on Well-being by geographical position.

Well-being	log(Life satisfaction)		log(CASP-12)		log(Frailty)	
	South	North	South	North	South	North
Retired, short term	-0.002	0.050***	0.045	0.057***	-0.056	-0.104***
	0.032	0.018	0.030	0.013	0.051	0.030
Retired, long term	-0.013	0.038*	0.022	0.040***	-0.024	-0.083***
	0.034	0.020	0.029	0.013	0.053	0.029
Covariates	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	21257	59093	21296	59164	21296	59164
N.Clusters	77	141	77	141	77	141
Hansen J	0.515	0.701	0.924	0.055	0.362	0.643
F First Stage	70	54	70	54	70	54
F First Stage	120	97	120	97	120	97

Columns: In each column different outcomes are considered. Specifically: 1 and 2. log(Life satisfaction); 3 and 4. log(CASP-12); 5 and 6. log(Frailty).
Notes: The table reports the estimated causal effect of retirement on different measures of well-being implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table 4.23: Effect of retirement on Well-being for northern countries.

log(CASP-12)	1	2	3	4
Retired	0.107***	0.034**		
	0.025	0.015		
Retired, short term			0.092***	0.044***
			0.019	0.014
Retired, long term			0.059***	0.029*
			0.017	0.016
Covariates	Yes	Yes	Yes	Yes
N.Obs.	59164	59164	59164	59164
N.Clusters	141	141	141	141
F First Stage	35	75	42	59
F First Stage			87	145

Columns: In each column different sets of instruments are considered. Specifically: 1. eligibility status for early retirement; 2. eligibility status for old-age retirement; 3. eligibility status for early retirement; 4. eligibility status for old-age retirement.
Notes: The table reports the estimated causal effect of retirement on CASP-12 implementing a 2sls fixed effect. The retirement status is instrumented with the eligibility status to early and old-age pension. The covariates are a log(age) and binary indicators on the marital status. Standard errors are clustered at cohort, wave and gender. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Conclusions

The papers that compose this thesis aim to evaluate the consequences of retirement on household decisions. The projects examine data from the Italian Survey on Household Income and Wealth and from the Survey of Health, Aging and Retirement in Europe in order to understand how retirement affects consumption, investment choices and individuals' well-being.

The thesis has three main contributions. First, from the analysis of the Italian data, I show that retirement determines a reduction of -3.3 percentage points in the mean propensity to consume and that behind this effect there is a significant heterogeneity with respect to the gender of the head of the household and the economic condition of the family. Similarly to what is shown by spending on non-durable consumption and on food, the reduction in the consumption response to the income shock does not lead to any reduction in the utility of individuals. Indeed, this contraction is explained by changes in family composition upon retirement: the factor of children leaving home enables families to spend less and provides an incentive to save a greater share of a positive income shock.

Second, through the study of the Italian context, in which employees receive a significant infusion of liquidity at the time of retirement, I show that new retirees review their investment choices towards a riskier portfolio, increasing the subscription of risky assets. In particular, retirement results in an increase of 8.9 percentage points in the share of stock market participation, of 7.4 percentage points in the share of home owners and of 8.7 percentage points in the probability of renovating the properties owned. The first two effects are essentially attributable to the infusion of liquidity while the third, not being linked to the size of the severance pay and the reduction in background risk, seems to be connected to the desire to have more comfortable properties in view of greater free time.

Third, a Europe-wide analysis shows that retirement is unequivocally beneficial to individuals' well-being. The change in employment status determines an increase of 2.7 percentage points in life satisfaction, of 4.7 percentage points in the quality of life measured by the CASP-12, and a contraction of the frailty index of -6.9 percentage points, implying a corresponding improvement in general health. These changes are persistent in nature as people retired for no more than four years and people retired for at least 5 years show similar effects. Retirement benefits differ according to the exit from the labor market, as early retirement has a more pronounced effect than the statutory retirement, according to the sex of the

individual, with women showing the greatest variations, and according to the country of residence, with the non-Mediterranean countries showing the most significant variations.

Appendix A

Pension Eligibility and the system of law

A.1 Introduction

A vast literature examines the consequences of retirement on various aspects of life: from consumption choices (Battistin, Brugiavini, Rettore, and Weber (2009)), to habits (Celidoni, Dal Bianco, Rebba, and Weber (2020)), to physical health (Bertoni, Maggi, and Weber (2018)), to cognitive abilities (Celidoni, Dal Bianco, and Weber (2017)). These analyses are usually carried out using data collected in generalist surveys because they are able to provide information on many individual characteristics.

To evaluate the effect of retirement on a certain outcome, it is not enough to compare workers and retirees since the choice to leave the labor market is that of the individual him/herself. The effect of retirement on the phenomenon of interest is usually calculated by examining the exogenous variability in pension eligibility to correct for the endogenous nature of the retirement decision. To follow this estimation strategy it is necessary to calculate a variable called *time to/since eligibility*. This variable measures the number of years that separates an individual to/from the moment of eligibility for retirement. The calculation of this variable takes place by comparing an individual's age and seniority with the requirements established by law. Unfortunately, generalist surveys do not have accurate information about the work history of individuals and this makes the calculation difficult.

This report addresses the issues related to the computation of the *time to/since eligibility*. In particular, these notes propose guidelines for the calculation, compare computation methodologies that use different starting information, and indicate the best method to follow. These results are achieved considering the Italian context and using data from the Italian Survey on Household Income and Wealth (hereafter SHIW). This survey is full of information and allows me to measure the years of contributions in different ways, to calculate different types of *time to/since eligibility*, and to prove that the best eligibility is the one which makes use of self-reported data on contributions. Not all surveys have this piece of information.

Data on contributions paid are often unreliable. A specific section of this note is devoted to this issue. Using SHIW data, I propose a simple rule that allows me to recover a reliable measure of contributions paid from basic characteristics commonly contained in surveys. This imputation mechanism can be applied by those researchers who use datasets other than SHIW. Indeed, the researchers who want to study data on topics such as health, free time or daily expenses have to use other data sources. These surveys rarely have accurate information on the contributions paid but, through the rule presented in this work, it is possible to overcome the problem.

The paper is structured as follows. Section 2 shows the econometric framework considered and introduces the notation that will be used throughout the work. Section 3 summarizes the Italian pension system and is supplemented by a rich appendix. Section 4 presents an eligibility calculation rule that compares individual characteristics to legal requirements. Through the use of this rule different types of eligibility are calculated and, through a rigorous comparison, the superiority of one method over another is attested. Section 5 shows how it is possible to limit the gap between the two measurements by applying a simple correction mechanism. Section 6 concludes.

A.2 Analytical framework

The notation that is consistently used in the following sections is now introduced.

R is a binary indicator denoting the retirement status of the head of the household; it is equal to one for retired heads and null for those who work. Let S be the distance to/since the time of entitlement to the labour pension. This variable is assumed to be continuous and it is normalized around the time of eligibility (i.e. $S = 0$) and it assumes negative values before the entitlement and positive after it. Let $I(S \geq 0)$ be the corresponding eligibility status which denotes the achievement of the eligibility criteria for the labour pension. Individuals are eligible for retirement if and only if they satisfy that condition, namely if their score assumes non-negative values.

Let (Y_1, Y_0) be the two potential outcomes faced in the two following statuses: Y_1 represents the outcome for the head being retired and Y_0 represents the outcome for the head not being retired. The causal effect of interest (β) represents the change in the outcome due to the change in the retirement status of the head of the household. This effect could be computed taking the difference between the two potential outcomes: $\beta = Y_1 - Y_0$. Unfortunately, the two potential outcomes are never observable at the same time at individual level, since retiring reveals Y_1 but conceals Y_0.

However, the causal effect of interest can still be measured by examining the characteristics of the context of interest. The eligibility rule states that the probability of being retired is null for those who have a negative score and positive for those who have a score higher than or equal to zero. Therefore, at the threshold of $S = 0$ I observe a discontinuous change in the probability of being treated. This jump is however less than one, because the eligibility refers

to both the voluntary and the mandatory pension schemes. In particular, for the cohorts of interest, who exhibit very stable careers, it usually happens that the eligibility to the early, voluntary pension scheme is achieved first and after a few years the eligibility to the statutory pension is reached. The discontinuity in the likelihood of retiring helps to solve the endogenous selection into retirement.

Under the assumption that no discontinuity would take place in the outcome in the absence of treatment, Battistin and Rettore (2008) show that the causal effect of interest could be computed locally considering the following equation:

$$E\{\beta|R=1,S=0^+\}=\frac{E\{Y|S=0^+\}-E\{Y|S=0^-\}}{E\{R|S=0^+\}} \tag{A.1}$$

where $S=0^+$ and $S=0^-$ refer to individuals marginally above and marginally below the eligibility threshold.

However, the data available show that a fraction of people retire before having crossed the threshold of eligibility. This scenario is due to the presence of non-classical measurement errors in the running variable. This criticism is overcome assuming that the process generating measurement errors is orthogonal to the process of interest and considering the following ratio:

$$\frac{E(Y|S=0^+)-E(Y|S=0^-)}{E(R|S=0^+)-E(R|S=0^-)}. \tag{A.2}$$

This implies that consistent estimates of the causal effect of retirement on the marginal propensity to consume can be recovered by a simple instrumental variable strategy where the eligibility status is used to tackle the endogenous nature of the retirement status.

A.3 Italian social security system

The Italian social security pension system is structured in three pillars: *i*) a compulsory public system, *ii*) a voluntary private system, and *iii*) a supplementary pension system. The public pension system has a pay-as-you go structure: the contributions that workers and companies pay to social security institutions are used to pay the pensions of those who have left work; therefore, no accumulation of financial reserves is envisaged to meet the payment of future pensions. The second and third pillars are voluntary, have a defined contribution structure, and are fully funded. The former can be arranged and managed on an individual or collective basis while the latter is usually subscribed individually. Means tested programs, such as social assistance pension and disability pension, complete the picture.

In the present work the interest is on the *labor pension*, namely a pension benefit that has an insurance nature and that is acquired at the end of the usual working activity. In particular, there are two pensions of such a nature: the *old-age pension* (hereafter OP) and the *early pension* (hereafter EP). The first one is the standard benchmark; a person

receives this remittance at the end of his working activity when possessing the necessary requirements. The second type of pension is an early exit from the labor market and it is allowed once specific conditions are met. Even if the Institution that takes care of the management and the payment of these transfers may differ across occupations (private sector employees, public sector employees and the self-employed), in the great majority of cases the provision is managed by the national social security institute (INPS).

In recent decades, the social security system has shown deficits, due to the generosity of transfers and the progressive aging of the population. As a result, numerous regulatory interventions have taken place over time aimed at reducing the inequalities in treatment and guiding a transition from the *definite benefit* regime to a *notionally contribution benefit* one.

The evolution of the criteria for accessing the pension are summarized in figures A.1 and A.2, respectively for men and women. A more detailed description is provided in the following subsections. The criteria established are reported in colored tables. The cells that contain the rules effectively used are coloured in white, those which show the criteria replaced by subsequent legislation are coloured in gray.

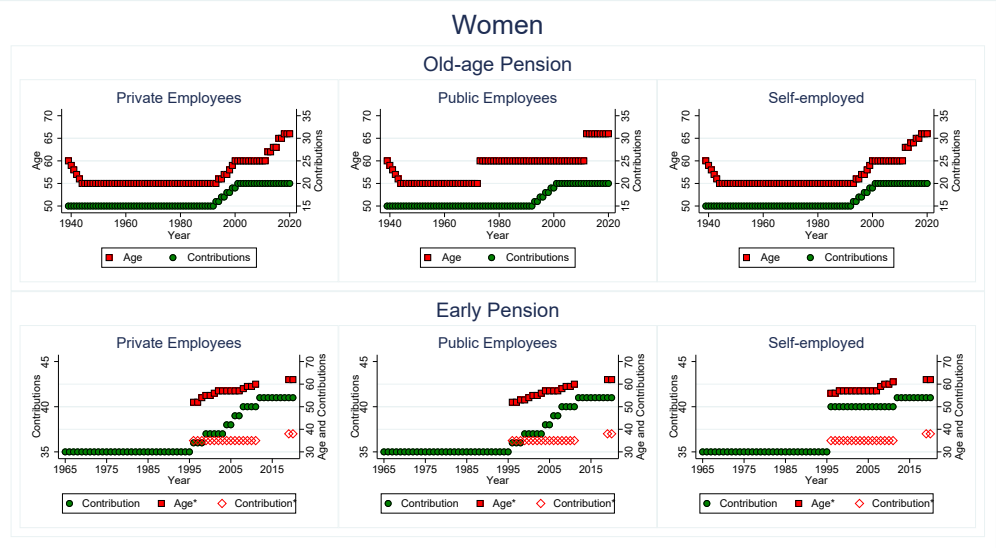
Figure A.1: Eligibility criteria for men.

Notes: The figure reports the evolution of the minimum requirement to be entitled to the old-age pension (upper part) and early pension (lower part). Left figure refers to private sector employees. Central figure refers to public sector employees. Right figure refers to the self-employed. The conditions marked with an asterisk must hold jointly.

A.3.1 Law n. 636, 1939

The Italian pension system was originally characterized as a funded system: the contributions paid by workers were invested by INPS and, upon retirement, the pension was equivalent to the contributions paid plus a rate of return.

Figure A.2: Eligibility criteria for women.



Notes: The figure reports the evolution of the minimum requirement to be entitled to the old-age pension (upper part) and early pension (lower part). Left figure refers to private sector employees. Central figure refers to public sector employees. Right figure refers to the self-employed. The conditions marked with an asterisk must hold jointly.

This law introduces some amendments to the provisions on compulsory insurance for invalidity and old age and other insurances such as those due to illness, unemployment or maternity. Article 9, paragraph 1 contains the core of the intervention. It states that eligibility is achieved at the age of 60 (55) for male (female) workers if they have at least 15 years of contributions [1]. Article 39 establishes the gradual introduction of the new provisions through a transitory discipline. The age for eligibility gradually decreases from 65 (60) years old for men (women) to 60 (55) in five years [2].

Table A.1 summarizes the content of the law.

[1]Law n. 636, 1939, Article 9, paragraph 1: *'L'assicurato ha diritto alla pensione: al compimento del 60 anno di eta' per gli uomini e del 55 anno di eta' per le donne quando siano trascorsi almeno quindici anni dalla data iniziale dell'assicurazione e risultino versati o accreditati in di lui favore almeno:'* 15 anni di contributi.

[2]Law n. 636, 1939, Article 39, paragraph 1: *'Le disposizioni di cui all'art. 9, n. 1, relative alle condizioni di eta' per il diritto alla pensione entreranno in vigore' il 1 gennaio 1944-XXII. Prima di tale data l'assicurato ha diritto alla pensione di vecchiaia al compimento dell'eta' di 64, 63, 62, 61 anno, se uomo, e di 59, 58, 57, 56 anni, se donna, rispettivamente nel 1940, 1941, 1942 e 1943, ferme restando le condizioni di assicurazione e di contribuzione stabilite dall'art. 9, n. 1.'...*

Table A.1: Law n. 636 (1939)

OP	Man		Woman	
	Age	Contr.	Age	Contr.
1939	65	15	60	15
1940	64	15	59	15
1941	63	15	58	15
1942	62	15	57	15
1943	61	15	56	15
1944	60	15	55	15

Notes: Old-age Pension requirements.

A.3.2 Law n. 218, 1952

With the introduction of this law, the funded system is abandoned in favor of an unfunded one in which the pension paid to the retired is directly related to the amount of contributions paid by the workers.

Law n. 153, 1969 establishes the complete transition to a pay-as-you-go system in which the pension transfer is no more linked to the amount of contributions paid but to the salary received at the end of the working activity.

Initially, the introduction of the pay-as-you-go system was beneficial because the high number of workers ensured a sufficient amount of contributions to cover pension expenditure. Subsequently, the slowdown in growth, the aging of the population and the subsequent reduction in employment, forced a change of direction toward a notional contribution benefit system.

A.3.3 Law n. 903, 1965

This law establishes the *Early Pension*. Article 13 grants the possibility of leaving the labor market early in the presence of 35 years of contributions [3].

A.3.4 Law n. 336, 1970

This law is often called as *Legge dei combattenti* and its dispositions are complemented by Law 355, 1974. This act gives a bonus to former combatant civilian employees. If they

[3]Law n. 903, 1965, article 13: *'Gli iscritti alle assicurazioni obbligatorie, di cui al precedente articolo 1, hanno diritto alla pensione a qualunque eta', purche' possano far valere 35 anni di effettiva contribuzione.'*

request, they can obtain a seven-year bonus of contributions (ten if mutilated by war) [4].

Law 355, 1974 sets the conditions for retirement. People who decide to exert the right can retire after July 1975. The access to retirement is achieved (twice a year) in groups by 10% of the applicants. The Bank of Italy data do not provide sufficient information to code this case, consequently I am forced to ignore this circumstance.

A.3.5 Law n. 1092, 1973

This law is a comprehensive text of the rules on the retirement benefits of state employees (as defined in article 1 of the law [5]). Article 4 aligns the access to the statutory retirement imposing 65 years of age (with 15 years of accrued seniority) [6]. Article 42 establishes the access to a "normal" pension with 20 years of contributions. This regulation creates the so-called *Baby Pensioners*, namely those who retired (following this prescription) after only twenty years of working activity. However, I have to specify that, contrary to what is usually thought, baby pension and early pension are two distinct things. In my opinion, this disposition does not affect the criteria to get the EP that require 35 years of seniority. [7].

A.3.6 Decree n. 503, 1992

Decree n. 503 (1992), called the Amato Reform, is the first intervention that makes substantial changes to the Italian Pension System. As regards the conditions of access to the pension, this decree modifies the criteria for the OP.

Article 1 raises the minimum age to 65 years of age for men and to 60 years of age for women. Table A attached to the law shows the transitory discipline to be adopted [8]. I report

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[4]Law n. 336, 1970, article 3: *'...sia ai fini del compimento dell'anzianita' necessaria per conseguire il diritto a pensione, sia ai fini della liquidazione della pensione e dell'indennita' di buonuscita o di previdenza, un aumento di servizio di sette o, se trattasi di mutilati o invalidi di guerra o vittime civili di guerra, di dieci anni.'*

[5]Law n. 1092, 1973, article 1: *'Sono dipendenti statali, agli effetti del presente testo unico, gli impiegati civili e gli operai dello Stato nonche' i magistrati ordinari, amministrativi e della giustizia militare, gli avvocati e i procuratori dello Stato, gli insegnanti delle scuole e degli istituti di istruzione statali e i militari delle Forze armate e dei Corpi di polizia.'*

[6]Law n. 1092, 1973, article 4: *'Gli impiegati civili di ruolo e non di ruolo sono collocati a riposo al compimento del sessantacinquesimo anno di eta'; gli operai sono collocati a riposo al compimento del sessantacinquesimo anno di eta', se uomini, e del sessantesimo anno di eta', se donne.'*

[7]Law n. 1092, 1973, article 42: *'...Nei casi di dimissioni, di decadenza, di destituzione e in ogni altro caso di cessazione dal servizio, il dipendente civile ha diritto alla pensione normale se ha compiuto venti anni di servizio effettivo. ...'*

[8]Decree n. 530, 1992, article 1, paragraph 1: *'Il diritto alla pensione di vecchiaia a carico dell'assicurazione generale obbligatoria per l'invalidita', la vecchiaia ed i superstiti dei lavoratori dipendenti e' subordinato al compimento dell'eta' indicata, per ciascun periodo, nella tabella A allegata.'*

the information in the following table A.2 (i.e. Table A of the law).

Table A.2: Decree n. 530 (1992)

OP	Man	Woman
	Age	Age
1.1.1994 - 30.6.1995	61	56
1.7.1995 - 31.12.1996	62	57
1.1.1997 - 30.6.1998	63	58
1.7.1998 - 31.12.1999	64	59
1.1.2000	65	60

Notes: Old-age Pension requirements.

Article 2 contains the new contribution requirements. The minimum amount of contributions to be paid is increased from 15 to 20 years. In this case too a transitory regime is set. The gradual introduction of the new requirements is shown in the following table A.3 (i.e. Table B of the law) [9].

Table A.3: Decree n. 530 (1992)

OP	Man	Woman
	Contr.	Contr.
1.1.1993 - 31.12.1994	16	16
1.1.1995 - 31.12.1996	17	17
1.1.1997 - 31.12.1998	18	18
1.1.1999 - 31.12.2000	19	19
1.1.2001	20	20

Notes: Old-age Pension requirements.

Remark: As stated in article 2 paragraph 3, the new criteria do not apply to those who have already gained the right, whether they are retired or not [10].

Decree n. 530, 1992, article 1, paragraph 2: *'Il limite di eta' previsto per l'applicazione delle disposizioni contenute nell'articolo 6 della legge 29 dicembre 1990, n. 407, e' elevato fino al compimento del 65 anno...'.* Law n. 407, 1990, article 6: *'I lavoratori dipendenti possono continuare a prestare la loro opera fino al compimento dei 62 anni.'*

[9]Decree n. 530, 1992, article 2, paragraph 1: *'Nel regime dell'assicurazione generale obbligatoria per i lavoratori dipendenti ed i lavoratori autonomi il diritto alla pensione di vecchiaia e' riconosciuto quando siano trascorsi almeno venti anni dall'inizio dell'assicurazione e risultino versati o accreditati in favore dell'assicurato almeno venti anni di contribuzione, fermi restando i requisiti previsti dalla previgente normativa per le pensioni ai superstiti.'*

Decree n. 530, 1992, article 2, paragraph 2: *'In fase di prima applicazione i requisiti di cui al comma 1 sono stabiliti in base alla tabella B allegata'*

[10]Decree n. 530, 1992, article 2, paragraph 3: *'In deroga ai commi 1 e 2:*

A.3.7 Law n. 335, 1995

Law n. 335 (1995), known as the Dini reform, marks a turning point in the Italian Social Security System guiding a transition from the definite benefit regime to a *notionally contribution benefit* one. This law assigns different pension systems to different groups of workers. People who, at 31.12.1995, have been working for more than 18 years have a pension entirely computed using the pension benefit system. People who, at 31.12.1995, have some contributions but less than 18 years have a pension computed using a mixed system, partly according to the defined benefit method, partly according to the defined contribution method. Lastly, people who, at 31.12.1995, had never worked have a fully defined contribution pension. Associated to this partition is also a set of alternative pension requirements to be fulfilled. In what follows I may call the first two groups *experienced/elderly workers* and the last group *recruits/young workers*. Experienced employees and recruits have to satisfy different prescriptions.

Article 1 paragraph 19 states that workers under the pure contribution regime have access to a single type of pension, called retirement pension. This transfer substitutes the usual old-age pension and the alternative early pension [11]. Article 1 paragraph 20 establishes the requirements that have to be fulfilled to get the pension transfer. A person is eligible if he/she is 57 years old and over and has at least 5 years of contributions (if the pension is greater than the social allowance) or with 40 years of contributions or at 65 years old [12].

Article 1 paragraph 25 sets the rules for the access to the early pension for experienced workers. These workers are entitled to the EP either at 57 years old and 35 years of contributions or at 40 years of contributions regardless of age. Article 1 paragraph 26 establishes the transitory discipline [13]. Table A.4 shows the new provisions.

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a) continuano a trovare applicazione i requisiti di assicurazione e contribuzione previsti dalla previgente normativa nei confronti dei soggetti che li abbiano maturati alla data del 31 dicembre 1992, ovvero che anteriormente a tale data siano stati ammessi alla prosecuzione volontaria di cui al decreto del Presidente della Repubblica 31 dicembre 1971, n. 1432, e successive modificazioni ed integrazioni; ...
'

[11] Law n. 335, 1995, article 1, paragraph 19: *Per i lavoratori i cui trattamenti pensionistici sono liquidati esclusivamente secondo il sistema contributivo, le pensioni di vecchiaia, di vecchiaia anticipata, di anzianita' sono sostituite da un'unica prestazione denominata "pensione di vecchiaia".*

[12] Law n. 335, 1995, article 1, paragraph 20: *'Il diritto alla pensione di cui al comma 19, previa risoluzione del rapporto di lavoro, si consegue al compimento del cinquantasettesimo anno di eta', a condizione che risultino versati e accreditati in favore dell'assicurato almeno cinque anni di contribuzione effettiva e che l'importo della pensione risulti essere non inferiore a 1,2 volte l'importo dell'assegno sociale di cui all'articolo 3, commi 6 e 7. Si prescinde dal predetto requisito anagrafico al raggiungimento della anzianita' contributiva non inferiore a 40 anni, determinata ai sensi del comma 7, secondo periodo, nonche' dal predetto importo dal sessantacinquesimo anno di eta'.' ...*

[13] Law n. 335, 1995, article 1, paragraph 25: *'Il diritto alla pensione di anzianita' dei lavoratori dipendenti a carico dell'assicurazione generale obbligatoria per l'invalidita', la vecchiaia ed i superstiti e delle forme di essa sostitutive ed esclusive si consegue: a) al raggiungimento di un'anzianita' contributiva pari o superiore a 35*

Table A.4: Law n. 335 (1995)

EP	Employees		Self-employed	
Year	Age and Contr.	Contr.	Age and Contr.	Contr.
1996	52 and 35	36	56 and 35	40
1997	52 and 35	36	56 and 35	40
1998	53 and 35	36	57 and 35	40
1999	53 and 35	37	57 and 35	40
2000	54 and 35	37	57 and 35	40
2001	54 and 35	37	57 and 35	40
2002	55 and 35	37	57 and 35	40
2003	55 and 35	37	57 and 35	40
2004	56 and 35	38	57 and 35	40
2005	56 and 35	38	57 and 35	40
2006	57 and 35	39	57 and 35	40
2007	57 and 35	39	57 and 35	40
2008	57 and 35	40	57 and 35	40

Notes: Early Pension requirements.

Article 1 paragraph 27 sets less stringent requirements for particularly experienced workers [14], but I ignore these less important possibilities.

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anni, in concorrenza con almeno 57 anni di eta' anagrafica; b) al raggiungimento di un'anzianita' contributiva non inferiore a 40 anni; . . . '

Law n. 335, 1995, article 1, paragraph 26: *'Per i lavoratori dipendenti iscritti alle forme previdenziali di cui al comma 25, fermo restando il requisito dell'anzianita' contributiva pari o superiore a trentacinque anni, nella fase di prima applicazione, il diritto alla pensione di anzianita' si consegue in riferimento agli anni indicati nell'allegata tabella B, con il requisito anagrafico di cui alla medesima tabella B, colonna 1, ovvero, a prescindere dall'eta' anagrafica, al conseguimento della maggiore anzianita' contributiva di cui alla medesima tabella B, colonna 2.*

[14]Law n. 335, 1995, article 1, paragraph 27: *'Il diritto alla pensione anticipata di anzianita' per le forme esclusive dell'assicurazione generale obbligatoria per l'invalidita', la vecchiaia ed i superstiti e' conseguibile, nella fase transitoria, oltre che nei casi previsti dal comma 26, anche:*
a) ferma restando l'eta' anagrafica prevista dalla citata tabella B, in base alla previgente disciplina degli ordinamenti previdenziali di appartenenza ivi compresa l'applicazione delle riduzioni percentuali sulle prestazioni di cui all'articolo 11, comma 16, della legge 24 dicembre 1993, n. 537;
b) a prescindere dall'eta' anagrafica di cui alla lettera a), in presenza dei requisiti di anzianita' contributiva indicati nell'allegata tabella C, con applicazione delle riduzioni percentuali sulle prestazioni di cui all'allegata tabella D che operano altresi' per i casi di anzianita' contributiva ricompresa tra i 29 e i 37 anni alla data del 31 dicembre 1995. I lavoratori, ai quali si applica la predetta tabella D, possono accedere al pensionamento al 1 gennaio dell'anno successivo a quello di maturazione del requisito contributivo prescritto'. The table of interest establishes that: if the seniority at 31.12.1995 is greater than 26 then the amount of contributions sufficient to retire is equal to 30, if the seniority is between 22 and 25 the necessary years of contributions to quit the labour market is equal to 31 and if the seniority is between 19 and 21 the contributions necessary

Article 1 paragraph 28 imposes other requirements for the self-employed. These workers are entitled to the EP either at the age of 57 with 35 years of contributions or at 40 years of contributions regardless of age. Also for this category of workers a transitory discipline is established, reported in the right part of table A.4 [15].

Remark: There is a derogation. The old discipline applies to out-of-work workers (i.e. *in mobilità*), blind workers, mine workers and people working in the asbestos sector.

A.3.8 Law n. 449, 1997

Law n. 449 (1997) refines the previous intervention. Article 6 imposes new requirements for the early pension. A differentiation is set between employees working in the private sector and those working in the public sector. In particular, compared to public workers, those in the private sector reach the EP requirements of law n. 335, 1995 more rapidly [16]. The following table A.5 shows the requirements for the EP.

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are equal to 32.

[15] Law n. 335, 1995, article 1, paragraph 28: *'Per i lavoratori autonomi iscritti all'assicurazione generale obbligatoria, oltre che nell'ipotesi di cui al comma 25, lettera b), il diritto alla pensione di anzianita' si consegue al raggiungimento di un'anzianita' contributiva non inferiore a 35 anni ed al compimento del cinquantasettesimo anno di eta'. Per il biennio 1996- 1997 il predetto requisito di eta' anagrafica e' fissato al compimento del cinquantaseiesimo anno di eta'. ' ...*

[16] Law n. 449, 1997, article 59 paragraph 6: *'Con effetto sui trattamenti pensionistici di anzianità decorrenti dal 1 gennaio 1998, ... , il diritto per l'accesso al trattamento si consegue, salvo quanto previsto al comma 7, al raggiungimento dei requisiti di età anagrafica e di anzianità ovvero di sola anzianità contributiva indicati nella tabella C allegata alla presente legge per i lavoratori dipendenti iscritti all'assicurazione generale obbligatoria ed alle forme di essa sostitutive e nella tabella D allegata alla presente legge per i lavoratori dipendenti pubblici iscritti alle forme esclusive dell'assicurazione generale obbligatoria; per i lavoratori autonomi l'accesso al trattamento si consegue al raggiungimento di un'anzianità contributiva non inferiore a 35 anni e al compimento del cinquantottesimo anno di età. Per il periodo dal 1 gennaio 1998 al 31 dicembre 2000 resta fermo il requisito anagrafico di 57 anni ed i termini di accesso di cui al comma 8 sono differiti di quattro mesi. È in ogni caso consentito l'accesso al pensionamento al raggiungimento del solo requisito di anzianità contributiva di 40 anni.'...*

Table A.5: Law n. 449 (1997)

EP	Private Sector		Public Sector		Self-employed	
Year	Age and Contr.	Contr.	Age and Contr.	Contr.	Age and Contr.	Contr.
1998	54 and 35	36	53 and 35	36	57 and 35	40
1999	55 and 35	37	53 and 35	37	57 and 35	40
2000	55 and 35	37	54 and 35	37	57 and 35	40
2001	56 and 35	37	55 and 35	37	58 and 35	40
2002	57 and 35	37	55 and 35	37	58 and 35	40
2003	57 and 35	37	56 and 35	37	58 and 35	40
2004	57 and 35	38	57 and 35	38	58 and 35	40
2005	57 and 35	38	57 and 35	38	58 and 35	40
2006	57 and 35	39	57 and 35	39	58 and 35	40
2007	57 and 35	39	57 and 35	39	58 and 35	40
2008	57 and 35	40	57 and 35	40	58 and 35	40

Notes: Early Pension requirements.

Remark: Also in this case there are exceptions to the main prescriptions. Article 59 paragraph 7 states that the criteria established by Law 335, 1995 still apply to: i. blue collar workers (either in the private or public sector), ii. *early workers* (defined as those who have at least one year of contributions paid before 19 years of age) and iii. those who are out of work. [17].

A.3.9 Law n. 23, 2004

Law n. 23 (2004), called the Maroni Reform, introduces several innovations with respect to the eligibility criteria for the old age pension and for the early pension.

Article 1 paragraph 6 letter a establishes the new criteria for access to the EP for experienced workers. They are admitted to the EP under tighter rules, described in the following table A.6 [18].

[17]Law n. 449, 1997, article 59 paragraph 7: *Le disposizioni in materia di requisiti per l'accesso al trattamento pensionistico di cui alla tabella B allegata alla legge 8 agosto 1995, n. 335, trovano applicazione nei confronti:*
a) dei lavoratori dipendenti pubblici e privati qualificati dai contratti collettivi come operai e per i lavoratori ad essi equivalenti, come individuati ai sensi del comma 10;
b) dei lavoratori dipendenti che risultino essere stati iscritti a forme pensionistiche obbligatorie per non meno di un anno in eta' compresa tra i 14 ed i 19 anni a seguito di effettivo svolgimento di attivita' lavorativa;
c) dei lavoratori che siano stati collocati in mobilita' ovvero in cassa integrazione guadagni straordinaria per effetto di accordi collettivi stipulati . . . '

[18]Law n. 23, 2004, article 1, paragraph 6, letter a and b: *'Al fine di assicurare la sostenibilita' finanziaria del sistema pensionistico, stabilizzando l'incidenza della relativa spesa sul prodotto interno lordo, mediante l'elevazione dell'eta' media di accesso al pensionamento, con effetto dal 1 gennaio 2008 e con esclusione delle forme pensionistiche gestite dagli enti di diritto privato di cui ai decreti legislativi 30 giugno 1994, n. 509, e*

Table A.6: Law n. 23 (2004)

EP	Private Sector		Public Sector		Self-employed	
Year	Age and Contr.	Contr.	Age and Contr.	Contr.	Age and Contr.	Contr.
2008	60 and 35	40	60 and 35	40	61 and 35	40
2009	60 and 35	40	60 and 35	40	61 and 35	40
2010	61 and 35	40	61 and 35	40	62 and 35	40
2011	61 and 35	40	61 and 35	40	62 and 35	40
2012	61 and 35	40	61 and 35	40	62 and 35	40
2013	61 and 35	40	61 and 35	40	62 and 35	40
2014	62 and 35	40	62 and 35	40	63 and 35	40

Notes: Early Pension requirements.

Article 1 paragraph 6 letter b establishes the new (more stringent) criteria for access to the pension for recruits. Men are eligible, no longer at 57 years of age as mentioned before but at 65 years of age (provided that the pension transfer is not less than 1.2 times the social allowance), or if they have at least 35 years of contributions and fulfill the requirements in table A.6 or if they have at least 40 years of contribution regardless of age.

The former system of law holds for people who are eligible for a pension at 31.12.2007, for people who are out of work and for those who are recipients of a solidarity fund [19].

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10 febbraio 1996, n. 103:
a) il diritto per l'accesso al trattamento pensionistico di anzianita' per i lavoratori dipendenti ed autonomi iscritti all'assicurazione generale obbligatoria ed alle forme di essa sostitutive ed esclusive si consegue, fermo restando il requisito di anzianita' contributiva non inferiore a trentacinque anni, al raggiungimento dei requisiti di eta' anagrafica indicati, per il periodo dal 1 gennaio 2008 al 31 dicembre 2013, nella Tabella A allegata alla presente legge e, per il periodo successivo, nel comma 7. Il diritto al pensionamento si consegue, indipendentemente dall'eta', in presenza di un requisito di anzianita' contributiva non inferiore a quaranta anni;
b) per i lavoratori la cui pensione e' liquidata esclusivamente con il sistema contributivo, il requisito anagrafico di cui all'articolo 1, comma 20, primo periodo, della legge 8 agosto 1995, n. 335, e' elevato a 60 anni per le donne e a 65 per gli uomini. Gli stessi possono inoltre accedere al pensionamento: 1) a prescindere dal requisito anagrafico, in presenza di un requisito di anzianita' contributiva pari ad almeno quaranta anni; 2) con una anzianita' contributiva pari ad almeno trentacinque anni, in presenza dei requisiti di eta' anagrafica indicati, per il periodo dal 1 gennaio 2008 al 31 dicembre 2013, nella Tabella A allegata alla presente legge e, per il periodo successivo, nel comma 7; ...'

[19]Law n. 23, 2004, article 1, paragraph 3, letter a and b: *'Il lavoratore che abbia maturato entro il 31 dicembre 2007 i requisiti di eta' e di anzianita' contributiva previsti dalla normativa vigente- prima della data di entrata in vigore della presente legge, ai fini del diritto all'accesso al trattamento pensionistico di vecchiaia o di anzianita', nonche' alla pensione nel sistema contributivo, consegue il diritto alla prestazione pensionistica secondo la predetta normativa e puo' chiedere all'ente di appartenenza la certificazione di tale diritto. '*

A.3.10 Law n. 247, 2007

Law n. 247 (2007) again changes the requirements for the pensions transfers.

Article 1 paragraph 2 letter a replaces the previous dispositions for the experienced workers. The former sharp increase in the age requirement is replaced by a gradual one. The so-called *quota system* is introduced and it imposes that the sum of the age and the seniority has to be at least equal to 95 (96) until 2011 and 96 (97) after for employees (self-employed) workers. Table A.7 shows the minimum criteria to be fulfilled to reach the critical value [20].

Table A.7: Law n. 247 (2007)

EP	Private Sector		Public Sector		Self-employed	
Year	Age and Contr.	Contr.	Age and Contr.	Contr.	Age and Contr.	Contr.
2008	58 and 35	40	58 and 35	40	59 and 35	40
2009	(Q.95) 59 and 35	40	(Q.95) 59 and 35	40	(Q.96) 60 and 35	40
2010	(Q.95) 59 and 35	40	(Q.95) 59 and 35	40	(Q.96) 60 and 35	40
2011	(Q.96) 60 and 35	40	(Q.96) 60 and 35	40	(Q.97) 61 and 35	40
2012	(Q.96) 60 and 35	40	(Q.96) 60 and 35	40	(Q.97) 61 and 35	40
2013	(Q.97) 61 and 35	40	(Q.97) 61 and 35	40	(Q.98) 62 and 35	40

Notes: Early Pension requirements.

Article 1 paragraph 2 letter b replaces the previous dispositions for the recruits. The pension is gained either if they are 65 years old with at least 5 years of contributions and meeting criteria on the amount of the monthly allowance, or if they have at least 40 years of contribution regardless of age, or if the criteria in table A.7 hold.

A.3.11 Law n. 102, 2009

Law n. 102 (2009) converts into law decree n. 78, 2009 that establishes that, from 1 January 2010, the retirement age for female civil servants gradually increases until reaching 65 years and that, from 1 January 2015, the adaptation of the personal requirements for retirement must be linked to the increase in life expectancy ascertained by ISTAT and validated by EUROSTAT.

[20] Law n. 247, 2007, article 1, paragraph 2: *'il diritto per l'accesso al trattamento pensionistico di anzianità per i lavoratori dipendenti e autonomi iscritti all'assicurazione generale obbligatoria e alle forme di essa sostitutive ed esclusive si consegue, fermo restando il requisito di anzianità contributiva non inferiore a trentacinque anni, al raggiungimento dei requisiti di età anagrafica indicati, per il periodo dal 1 gennaio 2008 al 30 giugno 2009, nella Tabella A allegata alla presente legge e, per il periodo successivo, fermo restando il requisito di anzianità contributiva non inferiore a trentacinque anni, dei requisiti indicati nella Tabella B allegata alla presente legge. Il diritto al pensionamento si consegue, indipendentemente dall'età, in presenza di un requisito di anzianità contributiva non inferiore a quaranta anni'; ...*

A.3.12 Law n. 214, 2011

Law 214 (2011) establishes several changes about the requirements for the OP and EP for both experienced and young workers. The new criteria have been implemented since 1.1.2012.

Article 24 paragraph 6 sets the requirements for the old-age pension. The age criteria for male employed and self-employed workers are set at 66 years of age [21]. Paragraph 7 imposes the corresponding contribution criterion to be fulfilled. The minimum amount of contributions accrued is set at 20 years. These rules are valid for all types of workers, regardless of their (definite benefit, mixed or contribution benefit) pension regime but post 95 workers are entitled if and only if their pension transfer exceeds a certain threshold [22].

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[21] Law n. 214, 2011, article 24, paragraph 6: *'Relativamente ai soggetti di cui al comma 5, al fine di conseguire una convergenza verso un requisito uniforme per il conseguimento del diritto al trattamento pensionistico di vecchiaia tra uomini e donne e tra lavoratori dipendenti e lavoratori autonomi, a decorrere dal 1 gennaio 2012 i requisiti anagrafici per l'accesso alla pensione di vecchiaia sono ridefiniti nei termini di seguito indicati:*
a. 62 anni per le lavoratrici dipendenti la cui pensione e' liquidata a carico dell'AGO e delle forme sostitutive della medesima. Tale requisito anagrafico e' fissato a 63 anni e sei mesi a decorrere dal 1 gennaio 2014, a 65 anni a decorrere dal 1 gennaio 2016 e 66 anni a decorrere dal 1 gennaio 2018. Resta in ogni caso ferma la disciplina di adeguamento dei requisiti di accesso al sistema pensionistico agli incrementi della speranza di vita ai sensi dell'articolo 12 del decreto-legge 31 maggio 2010, n. 78, convertito, con modificazioni, dalla legge 30 luglio 2010, n. 122;
b. 63 anni e 6 mesi per le lavoratrici autonome la cui pensione e' liquidata a carico dell'assicurazione generale obbligatoria, nonche' della gestione separata di cui all'articolo 2, comma 26, della legge 8 agosto 1995, n. 335. Tale requisito anagrafico e' fissato a 64 anni e 6 mesi a decorrere dal 1 gennaio 2014, a 65 anni e 6 mesi a decorrere dal 1 gennaio 2016 e a 66 anni a decorrere dal 1 gennaio 2018. Resta in ogni caso ferma la disciplina di adeguamento dei requisiti di accesso al sistema pensionistico agli incrementi della speranza di vita ai sensi dell'articolo 12 del decreto-legge 31 maggio 2010, n. 78, convertito, con modificazioni, dalla legge 30 luglio 2010, n. 122;
c. per i lavoratori dipendenti e per le lavoratrici dipendenti di cui all'articolo 22-ter, comma 1, del decreto-legge 1 luglio 2009, n. 78, convertito con modificazioni, dalla legge 3 agosto 2009, n. 102, e successive modificazioni e integrazioni, la cui pensione e' liquidata a carico dell'assicurazione generale obbligatoria e delle forme sostitutive ed esclusive della medesima il requisito anagrafico di sessantacinque anni per l'accesso alla pensione di vecchiaia nel sistema misto e il requisito anagrafico di sessantacinque anni di cui all'articolo 1, comma 6, lettera b), della legge 23 agosto 2004, n. 243, e successive modificazioni, e' determinato in 66 anni;
d. per i lavoratori autonomi la cui pensione e' liquidata a carico dell'assicurazione generale obbligatoria, nonche' della gestione separata di cui all'articolo 2, comma 26, della legge 8 agosto 1995, n. 335, il requisito anagrafico di sessantacinque anni per l'accesso alla pensione di vecchiaia nel sistema misto e il requisito anagrafico di sessantacinque anni di cui all'articolo 1, comma 6, lettera b), della legge 23 agosto 2004, n. 243, e successive modificazioni, e' determinato in 66 anni.' ...

[22] Law n. 214, 2011, article 24, paragraph 7: *'Il diritto alla pensione di vecchiaia di cui al comma 6 e' conseguito in presenza di un'anzianita' contributiva minima pari a 20 anni, a condizione che l'importo della pensione risulti essere non inferiore, per i lavoratori con riferimento ai quali il primo accredito contributivo decorre successivamente al 1° gennaio 1996, a 1,5 volte l'importo dell'assegno sociale di cui all'articolo 3, comma 6, della legge 8 agosto 1995, n. 335. Il predetto importo soglia pari, per l'anno 2012, a 1,5 volte l'importo dell'assegno sociale' ...*

Article 24 paragraph 10 establishes that only those with at least 42 years of contributions are entitled to the early pension [23]. Paragraph 11 admits post '95 workers to an early pension at 63 years of age and 20 years of contributions if the amount of the first pension transfer is higher than the social allowance [24].

Remark: As usual, people who are entitled to pension at 31.12.2011 keep the previous set of rules. Another exemption is described in article 24 paragraph 15-bis which states that private sector employees may have access to the early pension at 64 years of age if they have at least 35 years' contributions at 31.12.2012 and satisfy the requirements of the previous law at 31.12.2012. Subsequent revisions extended this right also to public and self-employed workers who had previously gained sufficient seniority as an employee in the private sector.

A.4 Time to/since eligibility

This section explains how to combine the regulatory aspects presented previously with the characteristics recorded in the surveys in order to calculate the years of eligibility of individuals. It is highlighted that the use of different ingredients leads to the creation of different estimates of the time to/from eligibility for retirement. Subsequently, these different estimates are compared in order to identify that to be preferred.

A.4.1 Coding the Italian social security system

Once the evolution of the pension access criteria has been reconstructed, it is possible to proceed with the calculation of the time to/since eligibility. To do this, however, it is necessary to find a rule that is capable of comparing the characteristics of individuals with the legal criteria to be met. This calculation rule should return a variable identifying the years that separate the individual to/since the time of access to the pension. This variable should be

[23] Law n. 214, 2011, article 24, paragraph 10: *'A decorrere dal 1° gennaio 2019 e con riferimento ai soggetti la cui pensione e' liquidata a carico dell'AGO e delle forme sostitutive ed esclusive della medesima, nonche' della gestione separata di cui all'articolo 2, comma 26, della legge 8 agosto 1995, n. 335, l'accesso alla pensione anticipata e' consentito se risulta maturata un'anzianita' contributiva di 42 anni e 10 mesi per gli uomini e 41 anni e 10 mesi per le donne. Il trattamento pensionistico decorre trascorsi tre mesi dalla data di maturazione dei predetti requisiti.'*

[24] Law n. 214, 2011, article 24, paragraph 11: *'Fermo restando quanto previsto dal comma 10, per i lavoratori con riferimento ai quali il primo accredito contributivo decorre successivamente al 1° gennaio 1996 il diritto alla pensione anticipata, previa risoluzione del rapporto di lavoro, puo' essere conseguito, altresi', al compimento del requisito anagrafico di sessantatre anni, a condizione che risultino versati e accreditati in favore dell'assicurato almeno venti anni di contribuzione effettiva e che l'ammontare mensile della prima rata di pensione risulti essere non inferiore ad un importo soglia mensile, annualmente rivalutato sulla base della variazione media quinquennale del prodotto interno lordo (PIL) nominale, appositamente calcolata dall'Istituto nazionale di statistica (ISTAT), con riferimento al quinquennio precedente l'anno da rivalutare, pari per l'anno 2012 a 2,8 volte l'importo mensile dell'assegno sociale ...'*

such that it assumes negative values when the criteria are not yet satisfied and positive values once they are. Furthermore, since access can take place through two distinct channels - that of the old-age pension and that of the early pension - the rule must be able to select the first channel available.

Let α be the eligibility criterion set in terms of age and let ζ be the eligibility criterion set in terms of years of contribution. To distinguish the two access channels, subscripts, OP for old-age pension and EP for early pension, are introduced. For the sake of simplicity, first the calculation rule for the old-age pension is introduced and then the one for the early pension.

Let S_{OP} be the time to/since eligibility for the old age pension. It is computed as:

$$S_{OP} = min[(Age_i - \alpha_{OP}), (Contr_i - \zeta_{OP})] \tag{A.3}$$

where $Age_i, Contr_i$ are the actual age and seniority of the individual i. It is worth examining how the function is composed. Two differences are considered: a difference between actual age and age of access to the pension and a difference between contributions paid and minimum pension access contributions. Each of these differences assumes a positive value if the legal condition is satisfied and a negative value otherwise. The min function ensures that a person is eligible only if both conditions are met.

Similarly, let S_{EP} be the time to/since eligibility for the early pension [25]. It is computed as:

$$S_{EP} = max\{min[(Age_i - \alpha_{EP}), (Contr_i - \zeta_{EP})], (Contr_i - \zeta^*_{EP})\} \tag{A.4}$$

where ζ_{EP} and ζ^*_{EP} are two different contribution criteria set by the law. Indeed, access to early retirement can take place upon satisfaction of a combination of age and contributions or upon exceeding a higher threshold of contributions, for $\zeta^*_{EP} > \zeta_{EP}$. The max function ensures that the first available exit is considered.

Finally, let S be the time to/since eligibility for the labour pension. It is computed as:

$$S = max\{S_{OP}; S_{EP}\} \tag{A.5}$$

A.4.2 Computation of the time to/since eligibility

To carry out the calculation of the years of eligibility, the data from the Italian Survey on Household Income and Wealth (henceforth SHIW) are used. This survey is carried out by the Bank of Italy every two years on a stratified random sample that is representative of the entire Italian resident population. Data are collected through personal interviews. The unit of observation is the family, which is defined as including all persons residing in the

[25] To be precise, formula A.4 is valid for the years from 1965 to 2009. To perfectly represent the requirements imposed by the reforms of 2007 and 2011, adjustments must be made to the equation. However, since the structure of the calculation is very similar, it is considered unnecessary to address these details.

same dwelling who are related by blood, marriage, or adoption. Data have a rotating panel component which sums up to fifty percent of the sample each year. The questions regarding individual income are addressed at individual level while queries regarding the household as a whole are answered by the household head or the person most knowledgeable about the family's finances. The rich structure of the questionnaire enables a collection of detailed information on demographic variables, working history, income, consumption, and wealth.

I consider the information from the 2000 to the 2016 wave and I treat the data as repeated cross-sections. For each household I set the head to be the man in the couple. The dataset thus composed consists of more than 53 thousand observations. However some of these individuals will not be used in the exercise. In particular, since the interest is on workers and retirees from work, the unemployed and recipients of social security allowances other than work pensions are excluded from the sample. Then the people for whom it is not possible to make a complete reconstruction of the work activity are removed. The resulting sample consists of 45,647 observations.

To make the calculation it is necessary to know the age and years of contributions paid. There are many ways to define accrued seniority; here two alternative approaches are presented.

Age. Age is measured for each individual in the sample and it is expressed in terms of completed years.

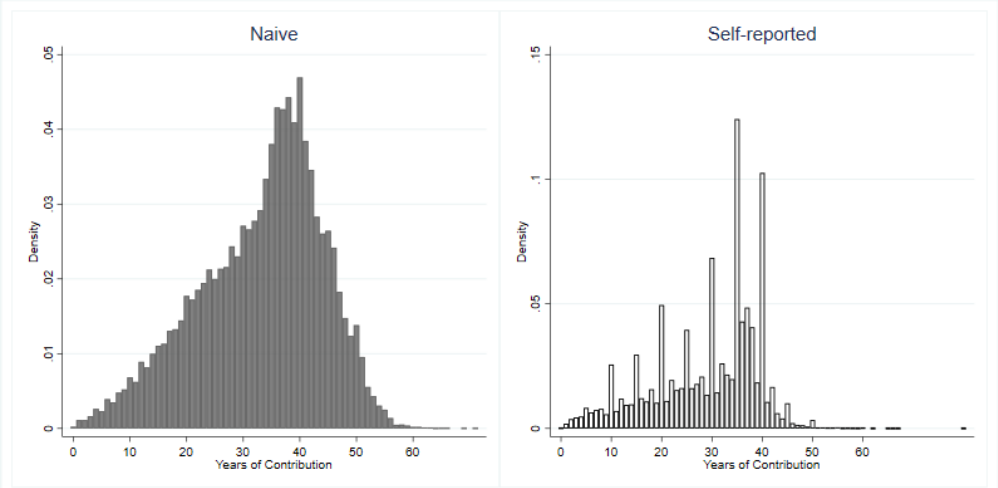
Naive contributions. A first approach to measure the contributions consists in deducing the accrued seniority from basic individual features such as the year in which the person entered the labour market, and the year of the interview or the year of retirement. The social security contributions are measured as the simple difference between the year of interview and the first year of employment for someone still in the labour force, and as the difference between the year of exit and the year of entry in the labour force for someone who is retired. This type of approach is used very frequently as the information needed for the calculation is commonly reported in surveys; additionally all these variables tend to be correctly reported because people can easily remember these crucial points in time.

Self-reported contributions. An alternative is to use the answers to a specific query in the questionnaire that asks people to report the contributions effectively paid over time. The main advantage of this approach is that there is no need to build a routine to compute the contributions. Even if this piece of information could be hard to remember exactly, there are reasons to believe that people close to retirement are more likely to report a precise value. Indeed, if individuals choose the time of exit from the labour market, they will look at retirement incentives comparing the wage earnings to the present value of the future retirement. In order to do that a person has to be aware of the exact amount of paid contributions.

Figure A.3 compares the two methodologies for measuring contributions. The left graph depicts naive contributions. The distribution is very smooth, with no particular peaks and is concentrated around 40 years of contributions. The graph on the right represents the

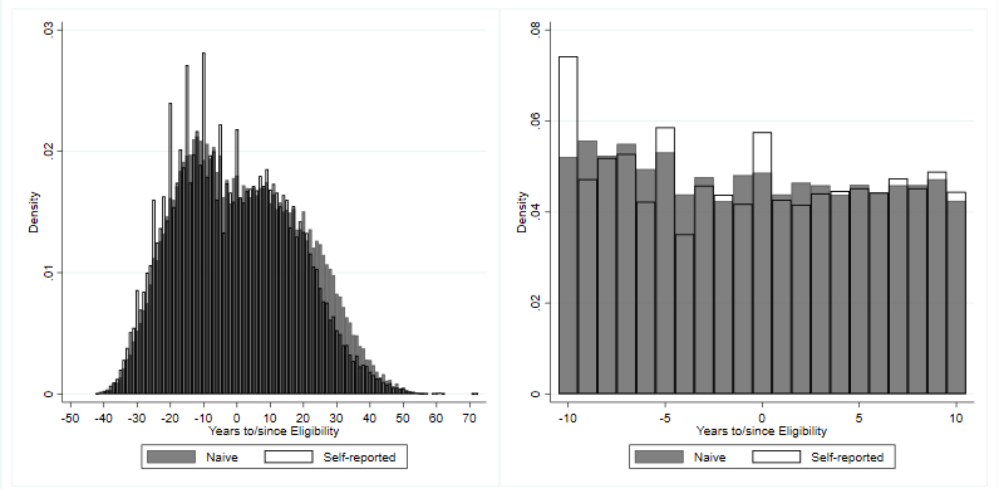
distribution of the self-reported contributions. In this case the distribution is concentrated around 35 years of contributions; moreover, numerous peaks are found, every five units, possibly due to rounding errors by the interviewees.

Figure A.3: Comparison between naive and self-reported contribution.



Notes: The figure proposes a comparison between the naive contributions and the self-reported contributions. The left graph shows the distribution of the naive contribution. The right graph shows the distribution of the self-reported contribution.

Figure A.4: Comparison between naive and self-reported eligibility.



Notes: The figure proposes a comparison between the eligibility computed using the naive contributions and the one computed using the self-reported contributions. The left graph shows the complete distributions overlapped. The right graph focuses on the time of entitlement.

Using equation A.5, two measures of eligibility are then calculated: one using naive contributions and another using self-reported contributions. Figure A.4 shows the two running variables overlapped. In the graph on the left it is possible to appreciate the entire distribution of values, while in the graph on the right it is concentrated near the moment of eligibility (i.e. when S passes from negative to positive values).

The eligibility calculated with the naive contribution shows a more pronounced right tail while the eligibility obtained considering the self-reported contributions presents some peaks. However, the two distributions appear very similar.

A.4.3 Validation of the time to/since eligibility

It has been highlighted how the two types of eligibility, calculated through the use of different types of contributions, exhibit a rather similar profile. However, it must be recognized that this type of inspection has a purely qualitative value. More rigorous comparisons are made by looking at the two fundamental properties that are required of this variable: *i)* the ability to create a randomization around the cut-off, and *ii)* the ability to capture the phenomenon of retirement.

Randomization around the cut-off. Appropriate randomization occurs when marginally eligible and marginally ineligible people are on average comparable with respect to observable as well as un-observable characteristics. The homogeneity of the latter, being by definition out of the researcher's control, cannot be tested. I then proceed with the verification of the former. For a number of demographic characteristics (i.e. y_{it}) the following regression model is specified:

$$y_{it} = \tau + I(S_{it} \geq 0)\beta + f(S_{it})\gamma + \varepsilon_{it} \tag{A.6}$$

where the subscript i denotes the individual and t signals the survey year, τ are year specific intercepts, $I(S_{it} \geq 0)$ is a binary indicator for the eligibility status, $f(S_{it})$ is a second order polynomial in the time to/since eligibility and ε_{it} is an idiosyncratic component.

Tables A.8 and A.9 show the test results. The different outcomes tested are shown in rows. In each column a different estimation range is considered: from $[-12, 12]$ to $[-8, 8]$. to simplify the reading of the tables, instead of reporting the estimated coefficients, symbols are inserted which show the presence (i.e. $\times$) or absence (i.e. $\surd$) of a significant effect of the withdrawal. Ideally, one would like eligibility never to have any effect on outcomes. Reality does not seem to deviate too much from this goal. Only sporadically does eligibility status seem to have significant repercussions on the characteristics considered. Both eligibility measures meet this requirement.

Table A.8: Sample Balance - Naive eligibility.

Variables	$[-12, 12]$	$[-11, 11]$	$[-10, 10]$	$[-9, 9]$	$[-8, 8]$
Age	√	√	√	√	√
Yr Education	√	√	√	√	√
Diploma	√	√	√	√	√
Degree	×	√	√	√	√
Married	√	√	√	√	√
Divorced	√	√	√	√	√
Widower	√	√	√	√	√
Family Size	√	√	√	√	√
N. Children	×	√	√	√	√
N. Children≥25	√	√	√	√	√
Northern Area	√	√	√	√	√
Central Area	√	√	√	√	√
Southern Area	√	√	√	√	√

Notes: The table reports the estimated causal effect of retirement on socio-demographic features. The dependent variables are shown in the left column. The model considered is the one in equation A.6. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). × is reported if retirement has an effect significant at 5%. Standard errors are clustered at eligibility and survey year.

Table A.9: Sample Balance - Self-reported eligibility.

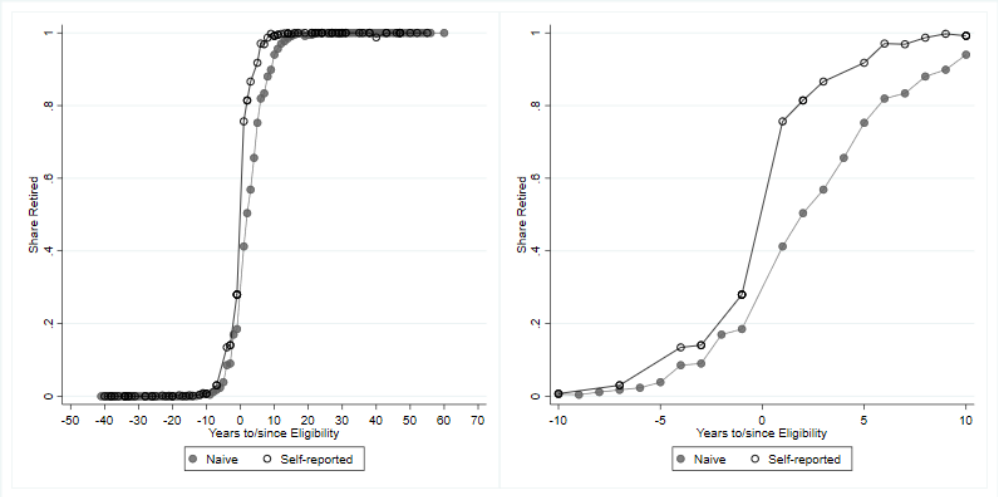
Variables	$[-12, 12]$	$[-11, 11]$	$[-10, 10]$	$[-9, 9]$	$[-8, 8]$
Age	√	√	√	√	√
Yr Education	√	√	√	√	√
Diploma	√	√	√	√	√
Degree	√	√	√	√	√
Married	√	√	√	√	√
Divorced	√	√	√	√	√
Widower	√	√	√	√	√
Family Size	√	√	√	√	√
N. Children	×	√	√	√	√
N. Children≥25	√	√	√	√	√
Northern Area	√	×	√	√	√
Central Area	√	√	√	√	√
Southern Area	×	×	×	×	√

Notes: The table reports the estimated causal effect of retirement on socio-demographic features. The dependent variables are shown in the left column. The model considered is the one in equation A.6. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). × is reported if retirement has an effect significant at 5%. Standard errors are clustered at eligibility and survey year.

Correlation between retirement status and eligibility status. The other important characteristic that good eligibility must possess is the ability to represent the phenomenon of retirement. In other words, pension eligibility and retirement must be aligned, thus pension eligibility manages to predicts the exit from the labor market.

To investigate this feature, a graphical analysis is firstly proposed. Figure A.5 shows the share of pensioners by year of eligibility. The left graph refers to the whole range of eligibility values, while the right one focuses on the values around the threshold. Self-reported eligibility would seem to better capture the exit of individuals from the labor market as there is a very large jump in the share of retirees close to zero, going from 25 percent - one year before eligibility - to nearly eighty percent - one year after eligibility. Naive eligibility has a more gradual trend and the discontinuity around the cut-off is much less pronounced, moving from 20 percent - one year before eligibility - to 40 percent - one year after eligibility.

Figure A.5: Fraction of retired by naive and self-reported eligibility.



Notes: The figure reports the fraction of retired people by year of eligibility, comparing the results from the naive and the self-reported eligibility. The left graph shows the complete distributions overlapped. The right graph focuses on the time of entitlement.

Subsequently, the correlation between retirement and eligibility is measured by means of a regression analysis specified as follows:

$$R_{it} = \tau + I(S_{it} \geq 0)\beta + f(S_{it})\gamma + \varepsilon_{it} \tag{A.7}$$

where the outcome of interest is the retirement status R_{it}, τ are year specific intercepts, $I(S_{it} \geq 0)$ is a binary indicator for the eligibility status, $f(S_{it})$ is a second order polynomial in the time to/since eligibility and ε_{it} is an idiosyncratic component. Table A.10 reports the results.

Table A.10: Effect of eligibility on retirement.

R_{it}	1	2
$I(S_{it} \geq 0)$	0.234***	0.550***
	0.023	0.021
f(S)	Yes	Yes
Covariates	No	No
Year Dummies	Yes	Yes
N.Observations	15726	15957
R^2_Adj	0.713	0.859
N.Clusters	180	180

Columns: 1. results obtained using the naive running variable, 2. results obtained using the self-reported running variable.
Notes: The table reports OLS estimates. Standard errors are robust to heteroskedasticity and clustered at year of eligibility, survey year, and type of work. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Column 1 shows the results for naive eligibility, column 2 for self-reported eligibility. Both models have a very high r-square and the eligibility status coefficient is significant. However, the coefficient in column 2 is almost double that in column 1: with self-reported eligibility, the acquisition of pension eligibility status increases the probability of becoming retired by 55 percent.

RD analysis. As a further validation test RD analyses are carried out, aiming to understand whether the two types of eligibility are capable of leading the researcher to similar conclusions. The exercise considered is the one examined in Battistin, Brugiavini, Rettore, and Weber (2009) and Celidoni and Weber (2020) and wants to evaluate the effect of retirement on spending on non-durable consumption. SHIW collects information on non-durable consumption through the following question:

You said that your household spends approximately XXXXX in cash per month. How much did the household spend on average per month in 2012 in cash, by credit card, cheque or Bancomat card, on all items? Include all spending, for both food and non-food, and exclude only the following items: i. purchases of valuables, cars, etc., maintenance, alimony, allowances, gifts; ii. extraordinary maintenance of dwelling; iii. rental of dwelling; iv. mortgage instalments; v. life insurance premiums; vi. contributions to supplementary pension schemes.

In the spirit of Battistin, Brugiavini, Rettore, and Weber (2009) and Celidoni and

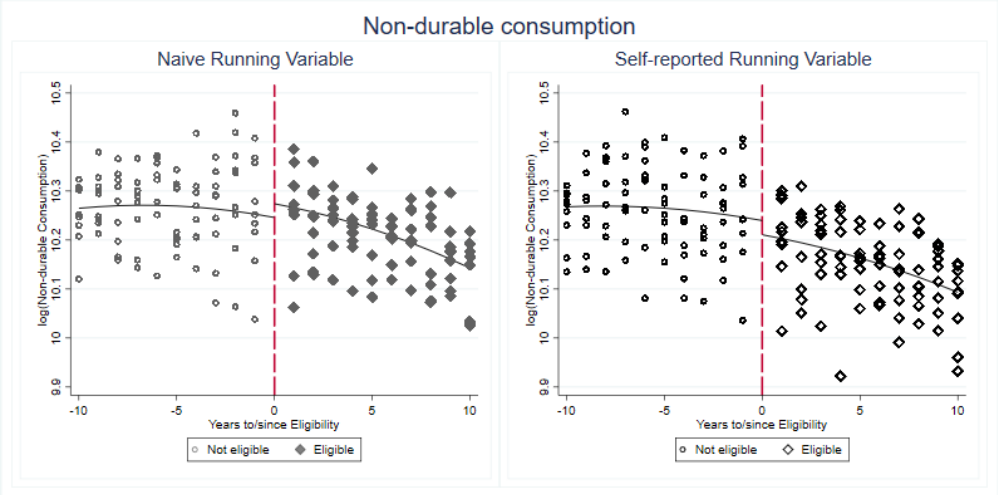
Weber (2020) the model specification is the following

$$log(Cons_{it}) = \tau + R_{it}\beta + f(S_{it})\gamma + X'_{it}\delta + \varepsilon_{it} \tag{A.8}$$

where $log(Cons_{it})$ is the outcome of interest, τ are year specific intercepts, R_{it} is a binary indicator for the retirement status, $f(S_{it})$ is a second order polynomial in the time to/since eligibility, $X_{i,t}$ is a matrix that collects additional controls - such as a first order polynomial of the age of the head, dummies on the educational attainments of the head of the household, and dummies on the marital status -, and ε_{it} is an idiosyncratic component.

Firstly, a graphical analysis is proposed. Figure A.6 shows the relationship between

Figure A.6: RD plot: average consumption by year of eligibility.



Notes: The figure reports the fraction of retired people by year of eligibility, comparing the results from the naive and the self-reported eligibility. The left graph shows the complete distributions overlapped. The right graph focuses on the time of entitlement.

the non-durable consumption and the running variable (S). The left graph considers the eligibility computed using the naive contributions and the right graph consider the eligibility computed using the self-reported contributions. Each point represents the average non-durable consumption for a particular year of eligibility. For descriptive purposes we interpolate the masses of dots at the two sides of the cut-off using fitted values that come from linear regressions. Both graphs show the presence of a discontinuity at the cut-off.

Secondly, we proceed with the estimation of model A.8. Table A.11 reports the results. Column 1 reports the coefficient estimated using a model that uses the naive running variable, column 2 the one that considers the self-reported running variable. The results are profoundly different. The effect estimated with the naive running variable is equal to zero and the estimate is very imprecise. On the contrary, the effect measured with the self-reported running variable is equal to -5.7 percent and is statistically different from zero. It would therefore seem that the use of one method rather than another leads to divergent results.

The first stage F statistic confirms what we saw in the previous section, i.e. a greater ability of the self-reported running variable to predict the retirement of individuals. Although both statistics are greater than 100, the one reported at the bottom of column 2 is six times greater than the one reported in column 1.

Table A.11: RD estimates.

$\log(Cons_{it})$	1	2
R_{it}	0.007	-0.057**
	0.061	0.028
f(S)	Yes	Yes
Covariates	Yes	Yes
Year Dummies	Yes	Yes
N.Observations	15726	15957
N.Clusters	180	180
F.First.Stage	112	660

Columns: 1. results obtained using the naive running variable, 2. results obtained using the self-reported running variable.
Notes: The table reports the estimated causal effect of retirement on the consumption response to a small income change. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial of the age of the head, dummies on the educational attainments of the head of the household, dummies on the marital status of the head of the household, and year dummies. The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

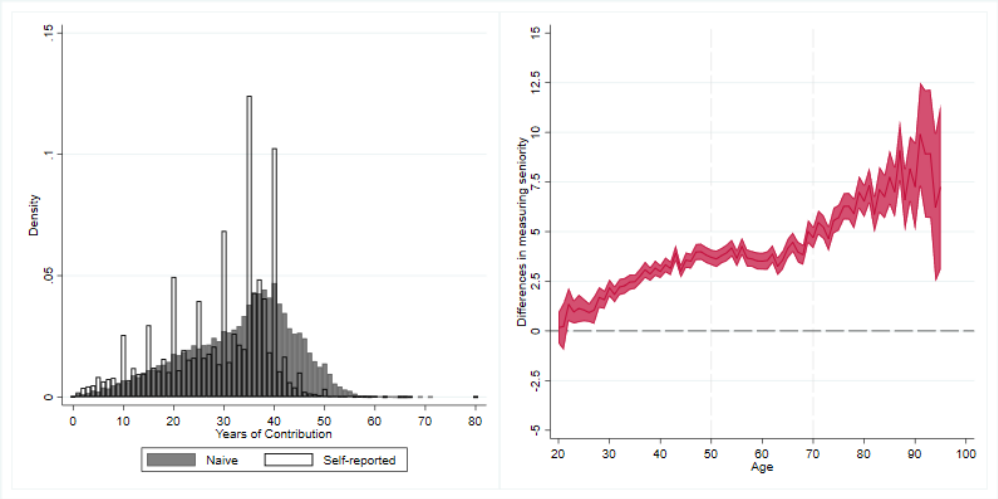
A.4.4 Discussion

In this section it has been highlighted that naive and self-reported eligibility have very similar profiles, that both are able to create a randomization around the cut-off, and that both are able to capture the retirement phenomenon well. However, the RD estimates obtained using the two running variables are profoundly different: in one case the researcher is led to believe that the phenomenon has no effect, while in the other he would conclude that retirement has a significant effect both economically and statistically. Such conflicting results are not desirable.

To find the origin of the discrepancy in the RD results it is good to go back to comparing the two types of contributions. Figure A.7 reports useful comparisons between the two

measures. The two distributions of values are superimposed in the graph on the left. A clear difference in the right tail emerges: while only 5 percent of the sample has a self-reported contribution over 40 years, almost 15 percent of people have a naive contribution above the same threshold. The differences in the right tail are even more marked for some subgroups of the sample such as: people with low educational qualifications, people living in the South, employees in the private sector - especially blue-collar workers - or self-employed, people who have changed jobs often, and people who started working before 18 years of age [26]. The

Figure A.7: Differences between naive and self-reported contribution.



Notes: The figure proposes a comparison between the naive contributions and the self-reported contributions. The left graph shows the distributions overlapped. The right graph shows the difference between the naive and the self-reported contributions by years of age.

graph on the right studies the difference between naive and self-reported contributions. This variable can be interpreted as a measurement error of the naive contribution with respect to self-reported. The error is then represented with respect to the age of the individual. The difference between the two variables is always positive, with an increasing trend, and, close to retirement, stands around 3 years. The error is usually greater for working people than for retirees. The differences in terms of educational qualifications are very marked: on the one hand, workers who have at most an elementary school leaving certificate report a very high overestimation error, which varies between 10 and 15 years; on the other hand, graduates - workers or retirees - have a substantially zero error. Similar overestimation errors are also shown by private sector workers - blue collar workers in particular - by the self-employed, by those who have had more than five jobs, and by those who started working before the age of

[26]The analyses relating to the differences between the two types of contributions are available upon request.

18 [27].

It would therefore seem evident that the discrepancy in the two measurement methodologies is accentuated for those who have low human capital and/or who live in economically depressed areas. These results are in contrast with the assumptions underlying the calculation of the naive contribution: *i)* continuity of working activity, and *ii)* perfect correspondence between years of work and payment of contributions. The application of the naive contribution determines a systematic overestimation error for the categories of people mentioned above, generating inaccurate and biased RD estimates.

A.5 Beyond the naive

Often the use of the naive contribution is not dictated by a voluntary choice of the researcher but by the scarcity of available data. Consequently, one cannot escape from its use. The question I try to address in this section is whether it is possible to find a rule for correcting the naive contribution in order to bring it closer to the self-reported one.

A.5.1 Correction rule

Let us assume that the naive and self-reported contributions are linked by the following relationship:

$$Contr_i^N = \alpha + Contr_i^S \beta + \tau + \varepsilon_i \tag{A.9}$$

where the outcome $Contr_i^N$ is the naive contributions of individual i, and $Contr_i^S$ is the self-reported one and τ are year dummies.

To eliminate the erratic component from the naive contribution, the regression model is estimated on sub-samples stratified by retirement status (i.e. not retired, retired) and type of work (i.e. private employee, public employee and self-employed). The results are shown in table A.12.

[27]The analyses relating to the measurement error are available upon request.

Table A.12: Estimates for the correction rule.

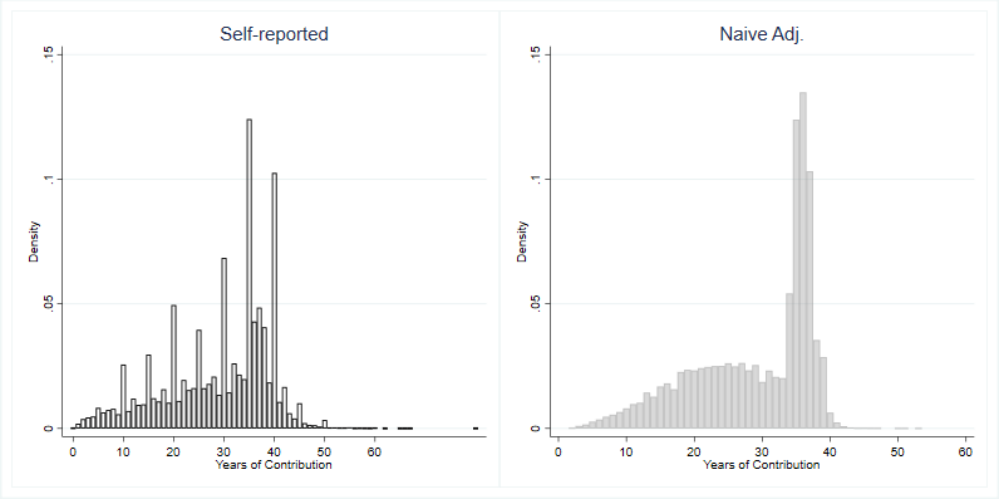
$Contr^N$	1	2	3	4	5	6
$Contr^S$	0.764***	0.823***	0.727***	0.082***	0.322***	0.057***
	0.006	0.009	0.009	0.011	0.017	0.020
Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes
N.Obs.	12914	5107	5971	12316	4433	3927
R^2_{Adj}	0.619	0.692	0.580	0.029	0.175	0.042

Columns: 1. results obtained using the subgroup of private sector employees, 2. results obtained using the subgroup of public sector employees, 3. results obtained using the subgroup of self-employed, 4. results obtained using the subgroup of ex-private sector employees, 5. results obtained using the subgroup of ex-public sector employees, and 6. results obtained using the subgroup of ex-self-employed.
Notes: The table reports the OLS estimates of the correlation between naive and self-reported contributions. Standard errors are robust to heteroskedasticity. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Figure A.8 proposes a comparison between the new naive contribution and the self-reported one. Looking at the graph on the left we see that the adjusted naive distribution is more concentrated in the center and has fewer bulky tails. The graph on the right shows the prediction error of the corrected naive contribution defined as the difference between the new naive contribution and the self-reported one. There is a clear improvement compared to what we saw previously. More detailed information is available upon request.

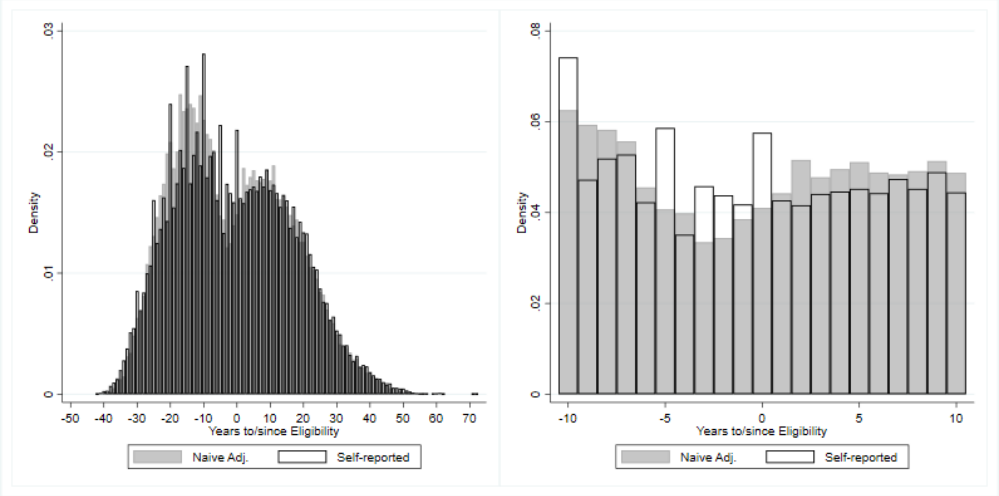
Once in possession of this new type of contribution - denominated as adjusted naive - the corresponding eligibility is calculated using equation A.5. The new eligibility is then compared to the self-reported one. Figure A.9 shows the two running variables overlapped. The new eligibility is smoother then the other one and has less pronounced spikes. However, they are very similar.

Figure A.8: Comparison between naive and adjusted naive contribution.



Notes: The figure proposes a comparison between the naive contributions and the adjusted naive contributions. The left graph shows the distributions overlapped. The right graph shows the difference between the naive and the enhanced naive contributions by years of age.

Figure A.9: Comparison between adjusted naive and self-reported eligibility.



Notes: The figure proposes a comparison between the eligibility computed using the adjusted naive contributions and the one computed using the self-reported contributions. The left graph shows the complete distributions overlapped. The right graph focuses on the time of entitlement.

A.5.2 Validation of the new time to/since eligibility

Randomization around the cut-off. To verify whether the new running variable is able to produce a good randomization around the time of entitlement, a collection of regressions are run, following equation A.6. Table A.13 reports the results and shows a good balance at the cut-off.

Table A.13: Sample Balance - Naive adjusted eligibility.

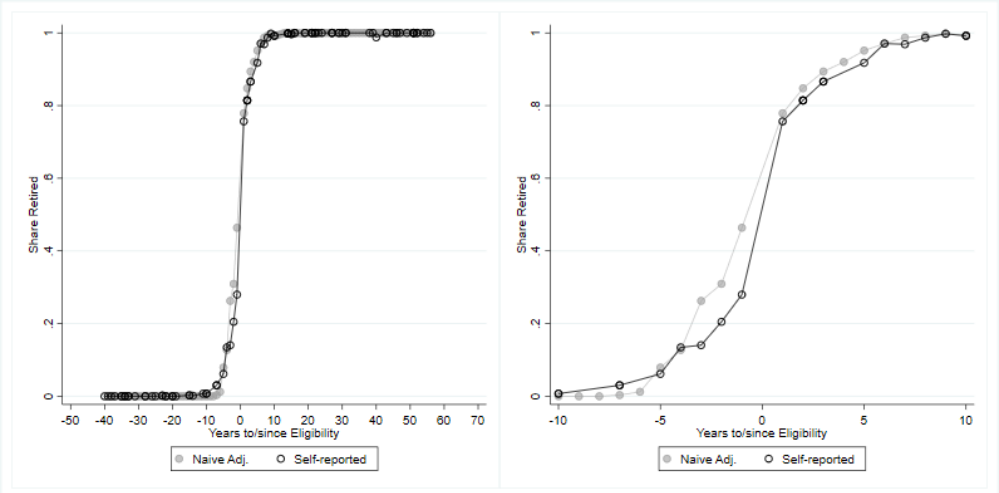
Variables	$[-12, 12]$	$[-11, 11]$	$[-10, 10]$	$[-9, 9]$	$[-8, 8]$
Age	×	×	√	√	√
Yr Education	√	√	√	√	√
Diploma	√	√	√	√	√
Degree	√	√	√	√	√
Married	√	√	√	√	√
Divorced	√	√	√	√	√
Widower	√	√	√	√	√
Family Size	√	√	√	√	√
N. Children	√	√	√	√	√
N. Children≥25	√	√	√	√	√
Northern Area	√	√	√	√	√
Central Area	√	√	√	√	√
Southern Area	√	√	√	√	√

Notes: The table reports the estimated causal effect of retirement on socio-demographic features. The dependent variables are shown in the left column. The model considered is the one in equation A.6. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). × is reported if retirement has an effect significant at 5%. Standard errors are clustered at eligibility and survey year.

Correlation between retirement status and eligibility status. To verify whether the new running variable is capable of accurately representing the phenomenon of retirement, figure A.10 shows the share of pensioners per year of eligibility for both the naive adjusted and self-reported running variables. This new variable has a trend more similar to that shown by the self-reported running variable. However, the leap to the cut-off is not of the same magnitude: the share of pensioners, from one year before eligibility to one year after, goes from 40 percent to 75 percent

Subsequently, in table A.14, the effect that eligibility has on the probability of retirement is estimated. Once again, the collected results are compared with those obtained using the self-reported score. Results are very similar.

Figure A.10: Fraction of retired by naive and self-reported eligibility.



Notes: The figure reports the fraction of retired people by year of eligibility, comparing the results from the adjusted naive and the self-reported eligibility. The left graph shows the complete distributions overlapped. The right graph focuses on the time of entitlement.

Table A.14: Effect of eligibility on retirement.

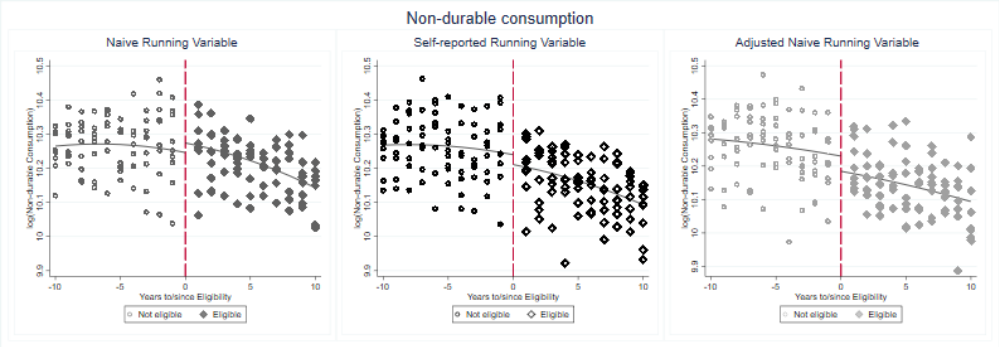
R_{it}	1	2	
Eligible	0.234***	0.550***	0.448***
	0.023	0.021	0.035
f(S)	Yes	Yes	Yes
Covariates	No	No	No
Year Dummies	Yes	Yes	Yes
N.Observations	15724	15956	15500
R^2_{Adj}	0.713	0.860	0.879
N.Clusters	180	180	180

Columns: 1. results obtained using the naive running variable, 2. results obtained using the self-reported running variable, 3. results for the adjusted naive running variable.
Notes: The table reports OLS estimates. Standard errors are robust to heteroskedasticity. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

RD analysis. The RD analysis is repeated. Figure A.11 shows the presence of a discontinuity at the cut-off in both graphs.

Secondly, the estimation of equation A.8 is carried out.

Figure A.11: RD plot: average consumption by year of eligibility.



Notes: The figure reports the fraction of retired people by year of eligibility, comparing the results from the naive and the self-reported eligibility. The left graph shows the complete distributions overlapped. The right graph focuses on the time of entitlement.

Table A.15: RD estimates.

$\log(Cons_{it})$	1	2	3
Retired	0.008	-0.057**	-0.108***
	0.061	0.028	0.035
f(S)	Yes	Yes	Yes
Covariates	Yes	Yes	Yes
Year Dummies	Yes	Yes	Yes
N.Observations	15724	15956	15500
N.Clusters	180	180	180
F.First.Stage	116	662	162

Columns: 1. results obtained using the naive running variable, 2. results obtained using the self-reported running variable, 3. results obtained using the adjusted naive running variable.
Notes: The table reports the estimated causal effect of retirement on the consumption response to a small income change. The retirement status is instrumented with the eligibility status ($I(S \geq 0)$). The covariates are a first order polynomial of the age of the head, dummies on the educational attainments of the head of the household, dummies on the marital status of the head of the household, and year dummies. The window of the estimation is for $S \in [-10, 10]$. Standard errors are clustered at type of work, eligibility and survey year. ***, **, and * respectively denote statistical significance at the 1%, 5% and 10% levels.

Table A.15 reports the results. Although there is not a great improvement in terms of first-stage F compared to the naive running variable, the coefficient estimated in column 3 is much more similar to that obtained using the self-reported running variable.

A.6 Conclusion

This paper proposes guidelines for calculating pension eligibility, a very important variable for properly estimating the effect of retirement on a given outcome. Accuracy in measuring this variable is particularly important in those analyses that employ the RD methodology.

Through the study of the Italian case, it is shown how to stylize a pension system and how to codify it through a single rule. Through the use of SHIW data, various types of eligibility are then compared, obtained through the use of ingredients of different quality: the naive contribution and the self-reported one. It is highlighted how the accuracy in measuring the contributions paid is fundamental in order to be able to properly compare workers and pensioners and detect the desired causal effect. Since quality information is often not available, a correction rule for naive contributions is proposed which makes it possible to achieve satisfactory results.

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