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Retirement and Healthy Eating*

MARTINA CELIDONI,† CHIARA DAL BIANCO,‡
VINCENZO REBBA§ and GUGLIELMO WEBER◊

†*University of Padua*
(martina.celidoni@unipd.it)
‡*University of Padua*
(chiara.dalbianco@unipd.it)
§*University of Padua*
(vincenzo.rebba@unipd.it)
◊*University of Padua; Institute for Fiscal Studies*
(guglielmo.weber@unipd.it)

Abstract

This paper investigates the effect of retirement on healthy eating using data drawn from the Survey of Health, Ageing and Retirement in Europe (SHARE). We estimate the causal effect of retiring from work on daily fruit or vegetable consumption by exploiting policy changes in eligibility rules for early and

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This paper also uses data from the generated Job Episodes Panel (DOI: 10.6103/SHARE.jep.700); see Brugiavini et al. (2013) and Antonova et al. (2014) for methodological details.

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statutory retirement. Our results show that changes in eating behaviour upon retirement are gender-specific: retirement induces men to reduce healthy eating; it has no effect on women. We further show that, for men, retirement increases the probability of becoming obese.

I. Introduction

In recent years, there has been increased policy interest in healthy eating, i.e. a diet that contributes to the health and well-being of individuals. This is partly in response to population ageing and partly in response to the obesity epidemic that is spreading among all age groups in many developed countries.[1]

The importance of nutrition for individual health has generated numerous policy interventions aimed at reducing salt, sugar and saturated fat intakes. As Griffith and O'Connell (2010) and Cawley (2015) argue, public intervention is justified by the fact that individuals do not make optimal decisions due to lack of information on the costs and benefits of consumption, and/or negative externalities, i.e. they do not take into account the social costs associated with unhealthy eating. Policy interventions, aimed at tackling market failures due to imperfect information or external costs, include advertising regulations, nutritional information on food product labels, specific prevention campaigns, and taxes on selected food products. Examples of policies that successfully improved nutritional intake are the Healthy Start Scheme in the UK[2] and the Special Supplemental Nutrition Program for Women, Infants and Children in the US.[3] Such programmes were specifically designed to increase the consumption of fruit and vegetables, a key component of a healthy diet.

In this paper, we focus on older individuals, as malnutrition at older ages is associated with a number of unfavourable health outcomes, including the risk of premature mortality, coronary heart disease, hypertension, colon cancer, type II diabetes, sarcopenia, osteoporosis and weight gain.

Ageing studies around the world provide the ideal data to analyse the effects of diet on the ageing process at the individual level. Such studies have been conducted in the US (the Health and Retirement Study, HRS), in England and Wales (the English Longitudinal Study of Ageing, ELSA) and in continental Europe (the Survey of Health, Ageing and Retirement in Europe, SHARE) and have been used to compare health outcomes across countries.[4] In this paper, we use SHARE data to document the eating habits of older Europeans and to investigate the effects of retirement on them.

Retirement is a major individual decision that is strongly affected by public policy. In recent years, in many countries, several policy interventions have

[1] OECD, 2014.
[2] Griffith, von Hinke and Smith, 2018.
[3] Whaley et al., 2012.
[4] See, for instance, the widely cited UK–US comparison by Banks et al. (2006).

been implemented to reduce the financial incentives of early retirement and increase public pension eligibility ages, as documented in the highly influential International Social Security project of the National Bureau of Economic Research (NBER), led until recently by David Wise.[5] Blundell, French and Tetlow (2016) investigate the response of individuals to such reforms and conclude that the most important driver of the retirement decision appears to be pension eligibility.

The reforms we consider in this paper have almost always increased eligibility ages for different individuals at different times. They have been successful in raising the average effective retirement age, and are therefore beneficial for the sustainability of public pension systems. But the effects of postponing retirement for individuals are less clearly advantageous and must be appraised using micro data. For instance, economists have stressed that retirement is typically associated with income drops[6] but also with increased leisure time, and this should lead to more intensive shopping and a shift to home production, particularly of food.[7]

The effects of later retirement on individual health are the subject of a large body of research by both epidemiologists and social scientists, but, as Banks, Chandola and Matthews (2015) point out, empirical results are inconclusive. For instance, the use of subjective and objective health outcomes can lead to diverging results: in some countries, retirement appears beneficial using the former and of no consequence using the latter.[8] Mental and physical health indicators do not always point in the same direction.[9] Short- and long-term effects can also differ: after an initial 'honeymoon' beneficial effect, a detrimental cumulative effect sets in that exacerbates the ageing process (this applies to cognition[10] and to muscle strength loss[11]).

The mixed findings in the literature can be related to the existence of several competing channels through which retirement affects health. To fully understand the effect of retirement on health outcomes, it is useful to complement the analysis looking at health behaviours, such as eating habits. To the best of our knowledge, only Eibich (2015) tackles this issue: he finds an insignificant effect of retirement on a subjective indicator of health-conscious diet among German individuals. In this paper, we use a more objective indicator of healthy eating based on the self-reported frequency of fruit or vegetable consumption in SHARE data for many European countries, in line with the World Health Organisation (WHO) recommendations for a healthy diet.

[5]Gruber and Wise, 1999; Wise, 2012.
[6]Bernheim, Skinner and Weinberg, 2001.
[7]Aguiar and Hurst, 2007.
[8]Neuman, 2008.
[9]Johnston and Lee, 2009.
[10]Celidoni, Dal Bianco and Weber, 2017.
[11]Bertoni, Maggi and Weber, 2018.

The causal impact of retirement on healthy eating cannot be estimated by simply comparing how individuals eat before and after retirement, because unobserved characteristics are likely to affect both retirement decisions and eating habits. For instance, a person affected by a negative health shock (such as a heart attack) is more likely to retire from work at younger ages but also to follow a healthier diet as a result. To identify the causal effect of retirement, we focus on those individuals whose retirement is induced by reaching their gender-, country- and time-specific pension eligibility age. In other terms, we instrument the retirement decision with eligibility criteria for early and statutory retirement pensions, which in continental Europe vary not only across gender and countries but also over time.

On prior grounds, the effect of retirement on healthy eating and other forms of preventive care is ambiguous. In fact, when they retire, consumers enjoy more leisure, and this affects their consumption level[12] and their spending patterns.[13] On the one hand, health no longer affects income – this reduces the need to spend money and effort to enhance health. On the other hand, the opportunity cost of time falls – less effort is needed not only to exercise, but also to search for cheap healthy foods.[14]

Our estimation results show a significant negative effect of retirement on daily fruit or vegetable consumption for men and no significant effect for women. We also show that retirement causes an increase in a specific health risk factor, obesity, among men – particularly those men who retire from physically demanding occupations.[15] Our rich data allow us to investigate whether retirement causes other behavioural changes that may affect weight gain, such as physical activity, protein intake, alcohol consumption or smoking. In all these dimensions, we find small and insignificant effects. We then conclude that the change in vegetable or fruit eating is a promising candidate in the explanation of the negative effect of retirement on obesity for men.

The paper is organised as follows: Section II presents the data, Section III describes the empirical strategy, Section IV discusses the results on healthy eating, Section V presents estimation results for other outcomes of interest (obesity, physical activity, smoking, protein intake and alcohol consumption) and Section VI concludes.

II. Data

We use data drawn from SHARE, a multidisciplinary survey that collects information on individuals aged 50 or over, plus their partners regardless of

[12]Heckman, 1974; Banks, Blundell and Tanner, 1998; Battistin et al., 2009.
[13]Miniaci, Monfardini and Weber, 2010.
[14]Aguiar and Hurst, 2005.
[15]As in Godard (2016).

age.[16] In addition to economic conditions, health and demographic data, eating habits information is gathered in the fourth (2011–12) and fifth (2013) waves for all respondents, longitudinal and refreshment sample.[17] Individuals are asked to answer questions regarding how often, within a regular week, they eat a certain category of food. The categories considered are dairy products, legumes/beans/eggs, meat/fish/chicken and fruit/vegetables. The answering options are *every day*, *3 to 6 times a week*, *twice a week*, *once a week* and *less than once a week*.

In this paper, we focus on fruit or vegetable consumption, for which there are specific WHO recommendations. This allows us to derive a measure of healthy diet that is more accurate than other indicators used in the literature based on overall subjective evaluations.[18] According to the World Health Organisation (2018), a healthy diet contains ‘fruit, vegetables, legumes (e.g. lentils and beans), nuts and whole grains (e.g. unprocessed maize, millet, oats, wheat and brown rice)’. In quantitative terms, consuming at least 400 grams of fruit and vegetables a day is considered part of a healthy diet. We therefore proxy a healthy diet with a dummy variable that takes the value 1 if the respondent reports eating fruit or vegetables every day.

Our working sample is composed of individuals who self-report being retired from work or employed/self-employed, who participate in both waves 4 and 5, and whose age is between 50 and 75,[19] with no missing information on the relevant variables.[20] Approximately 74 per cent of men and 83 per cent of women declare to consume fruit or vegetables daily. A substantial fraction of individuals consume fruit or vegetables three to six times a week (18 per cent for men and 12 per cent for women). Among men, 8 per cent eat fruit or vegetables twice a week or less, whereas the percentage for women is lower, at about 4.5 per cent. Overall, women tend to consume fruit or vegetables more often than men. This is true in each country considered in the analysis (see Table 1). In particular, the difference between men and women is remarkable in Sweden, Austria, the Czech Republic, Denmark and Germany. The consumption frequency varies substantially by country, between 64 and 89 per cent. The lowest percentages of daily fruit or vegetable consumption are reported in the Czech Republic, Austria, Estonia, Sweden and Germany. The highest values are in the Netherlands, Belgium, France, Slovenia and Italy.

[16] See Börsch-Supan et al. (2013) for details.
[17] In the sixth wave, only the refreshment sample are asked about eating habits.
[18] For example, Eibich (2015).
[19] When we run our analysis on individuals aged 50–70, we obtain very similar results.
[20] We drop from the sample 2,490 individuals (1,159 men and 1,331 women) who participated in wave 4 but not in wave 5. Our results are robust to this form of sample selection (attrition), as reported in Section V.

TABLE 1

Number of respondents and fraction consuming fruit or vegetables every day, by gender and country

	Men		Women		All
	Fraction	*N*	*Fraction*	*N*	*Fraction*
Sweden	0.63	912	0.82	1,080	0.73
Denmark	0.69	1,282	0.86	1,386	0.78
Germany	0.66	692	0.82	676	0.74
Netherlands	0.87	1,324	0.93	1,054	0.89
Belgium	0.84	2,218	0.93	2,004	0.88
France	0.84	2,218	0.92	2,456	0.88
Switzerland	0.76	1,934	0.90	1,774	0.83
Austria	0.61	2,218	0.79	2,576	0.71
Spain	0.82	1,312	0.87	640	0.84
Italy	0.85	1,444	0.90	1,036	0.87
Estonia	0.67	2,288	0.76	3,818	0.73
Czech Republic	0.55	2,168	0.71	3,222	0.64
Slovenia	0.82	994	0.93	1,204	0.88
Total	0.74	21,004	0.83	22,926	0.79

Note: Sample is composed of individuals who self-report being retired from work or employed/self-employed, who participate in both waves 4 and 5, and whose age is between 50 and 75, with no missing information on the relevant variables.

A key variable in our analysis is retirement. We define as retired those individuals who declare to be retired from work.[21] Retirement is considered an *absorbing state*; no transitions from retirement back to work are therefore observed.

Table 2 presents the summary statistics of the variables used in the analysis. We consider only individuals who participate in both waves 4 and 5 living in one of the countries listed in Table 1. For each individual, we also establish, using contextual information, whether he/she was eligible for a public pension scheme, either of the early retirement (ER) or of the statutory retirement (SR) type. The percentage of respondents who are retired is 62 per cent for both men and women. More than two-thirds of men (70 per cent) and women (74 per cent) were eligible for an ER scheme in either wave; little over a half were eligible for an SR pension (this is also known as 'old-age pension' in many countries).

Table 2 reports sample statistics by gender and by retirement status. From the last row of the table, we see that the sample of men consists of 21,004 observations (corresponding to 10,502 individuals); of these, 13,007 are retired

[21]We also adopt a wider definition of retirement, following Bonsang, Adam and Perelman (2012), which classifies all individuals not working for pay as retired (excluding individuals who never worked); our main estimation results are qualitatively unaffected.

TABLE 2

Summary statistics

	Men			Women		
	All	*Retired*	*Workers*	*All*	*Retired*	*Workers*
Fruit or vegetables every day	0.74	0.75	0.72	0.83	0.83	0.85
Protein every day	0.79	0.78	0.80	0.81	0.80	0.84
Obesity	0.22	0.23	0.19	0.22	0.25	0.18
Vigorous physical activity (weekly)	0.61	0.54	0.72	0.53	0.47	0.64
Alcohol consumption	0.32	0.32	0.30	0.11	0.10	0.12
Smoking	0.22	0.21	0.25	0.18	0.16	0.22
Eligible ER	0.70	0.95	0.30	0.74	0.97	0.37
Eligible SR	0.52	0.79	0.08	0.59	0.88	0.11
Age	63.4	67.2	57.3	62.9	66.7	56.8
Couple	0.84	0.84	0.85	0.68	0.64	0.73
Lower or upper secondary education	0.43	0.41	0.46	0.43	0.42	0.45
College or above	0.26	0.22	0.32	0.26	0.20	0.35
No. of observations	21,004	13,007	7,997	22,926	14,206	8,720

Note: Sample is composed of individuals living in one of the countries in Table 1 who self-report being retired from work or employed/self-employed, who participate in both waves 4 and 5, and whose age is between 50 and 75, with no missing information on the relevant variables.

and 7,997 are working. The men are 63.4 years old on average and 84 per cent live with a partner. Not surprisingly, the retired are older (roughly 10 years older: 67.2 versus 57.3) – differences between retirees and workers are partly attributable to age, not to retirement, and that is why we always control for age in the analyses. We also see from the table that very few men who are SR eligible still work (only 8 per cent), while a very large proportion of those who are retired are ER eligible (95 per cent). The number of observations for women is 22,926; of these, 14,206 are retired while 8,720 still work. The women are slightly younger than the men on average (62.9 years of age) and less likely to live with a partner (68 per cent). Among both men and women, 26 per cent have tertiary education (college or above) and 43 per cent have lower or upper secondary education.

In addition to daily consumption of fruit or vegetables, we use as alternative outcomes the following 0–1 indicators: daily protein intake, obesity, vigorous physical activity, alcohol consumption and smoking. Daily protein intake indicates whether an individual reports eating dairy products, legumes/beans/eggs or meat/fish/chicken every day. Obesity indicates whether the Body Mass Index (BMI) is equal to at least 30.[22] Vigorous physical activity indicates whether the individual reports performing vigorous activities at least

[22] In SHARE, weight and height are self-reported. Weight is asked in each wave, whereas height is asked only in the first interview.

once a week. Alcohol consumption indicates whether the individual consumes two or more alcoholic drinks at least three days a week.[23] Smoking is a binary indicator for current smokers.

We note that self-reported measures of all these indicators are likely to suffer from various response biases. For instance, Kapteyn et al. (2018) show that self-reported measures of physical activity differ from objective (accelerometer-based) measures because individuals fail to report being inactive or very active. This should be kept in mind when interpreting our estimation results.

In the sample, 79 per cent of men and 81 per cent of women consume protein on a daily basis, 22 per cent are obese, and 61 per cent of men and 53 per cent of women perform vigorous physical activity at least weekly. Frequent alcohol consumption is more common among men (32 per cent) than women (11 per cent). Current smokers are 22 per cent among men and 18 per cent among women. We tested for and rejected the equality of sample means between the retired and workers (with one exception: we failed to reject equality of 'couple' for men). The proportion of working men eating fruit or vegetables every day is 72 per cent (85 per cent for women), compared with 75 per cent (83 per cent) among the retired. Daily protein intake, smoking and vigorous physical activity are higher among workers (both men and women), whereas obesity is lower.

Despite the relatively short time distance across waves (roughly two years), we observe non-negligible numbers of transitions from work to retirement (7 per cent for men and 6 per cent for women) and from non-eligibility to eligibility for ER pension (7 per cent for both men and women) and SR pension (9 per cent and 7 per cent, respectively). We also note that the 'couple' indicator is not fixed over time (1.7 per cent of men transit from single to couple and 1 per cent from couple to single; for women, 3 per cent transit from single to couple and 0.6 per cent from couple to single).

We also stress that, for roughly 80 per cent of respondents, age in wave 5 is two years more than age in wave 4. For the remaining 20 per cent, though, the age difference is one or three, depending on the exact date of the interview. For this reason, in the estimation, we shall not assume that the first difference in age is constant.

In the next section, we present the empirical strategy used to identify the causal effect of retirement on healthy eating.

III. Empirical strategy

In our empirical analysis, we focus on the following linear specification:

$$(1) \qquad y_{it} = \alpha_1 Retired_{it} + \boldsymbol{X}'_{it}\boldsymbol{\beta} + e_i + u_{it},$$

[23]The question asks about the consumption of any alcoholic beverages, such as beer, cider, wine, spirits or cocktails.

where y_{it} is the outcome of interest for individual i at time t (for example, eating fruit or vegetables daily) and $\boldsymbol{X}_{it}$ is a vector of individual time-varying characteristics (age, marital status, etc.). The error term is decomposed into a time-invariant component e_i (known as the 'fixed effect') and a time-varying component u_{it}.

We are interested in α_1, the coefficient associated with *Retired*, which should capture the causal effect of retirement on the dependent variable. Ordinary least squares (OLS) estimates of α_1 yield unbiased results of the causal effect only if retirement is not correlated with both components of the error term. We account for time-invariant heterogeneity (which is represented in the equation by e_i) in two alternative ways: either we assume e_i to be a linear function of observable characteristics, such as educational attainment and country of residence, and control for them; or we remove it by taking first differences of the equation. The first procedure has the advantage of retaining all information in the data, but requires that any residual time-invariant heterogeneity is purely noise (not correlated with retirement status or any of the other explanatory variables). The second procedure eliminates all time-invariant heterogeneity (observed and unobserved) but throws away information about differences between individuals: our ability to identify the parameter of interest rests on observing enough individuals transiting from work to retirement over the relatively short time period under consideration.

Even if we successfully model or remove the fixed effect (e_i), a potential threat to the identification of the causal effect of retirement on the dependent variable is the existence of time-varying individual unobserved factors that affect the dependent variable and correlate with retirement. The linear specification we adopt allows us to account for the potential endogeneity of the retirement decision by relying on the exogenous variability induced by differences in eligibility rules[24] for early retirement and statutory old-age pension over time and across several European countries.[25] SHARE data offer substantial within-country variability in eligibility criteria arising from pension reforms over the last three decades.

We now show an example of institutional changes in terms of eligibility criteria for men in Austria. The Austrian government enacted in 2001 and 2003 two major pension reforms to improve the sustainability of the social security system. The increase in early retirement age was phased in at a different pace depending on the year of birth. Figure 1 shows with dashed lines the SR eligibility age up to 2000 (left panel) and from 2001 onwards (right panel), and with solid lines the ER eligibility ages up to 2000 (60 for all – left panel) and from 2001 onwards (60, 61 or 62 depending on the year of birth – right

[24]For retirees, eligibility rules refer to the reported retirement year; for employed individuals, eligibility is defined according to the interview year.

[25]Angelini, Brugiavini and Weber, 2009.

FIGURE 1

Retirement age of men in Austria, by reason for retirement

Note: The dashed and solid lines show the SR eligibility age and the ER eligibility age, respectively, up to 2000 (left panel) and from 2001 onwards (right panel). From 2001 onwards, early retirement is possible from 60 years of age for men born before 1942, 61 for those born in 1942 and 62 for those born in 1943 or later.

panel). It also shows the frequency of retirement ages for men in the pre- and post-reform periods, and the reason the respondent gave for retirement. As we can see, retirement age peaks at 60 in the pre-reform period, whereas we observe multiple peaks in the post-reform period in line with birth-cohort-specific early retirement eligibility ages. In all cases, the most common reason given for retirement is that the respondent became eligible for an ER or SR pension. In estimation, these changes in ER eligibility ages might have affected our respondents.

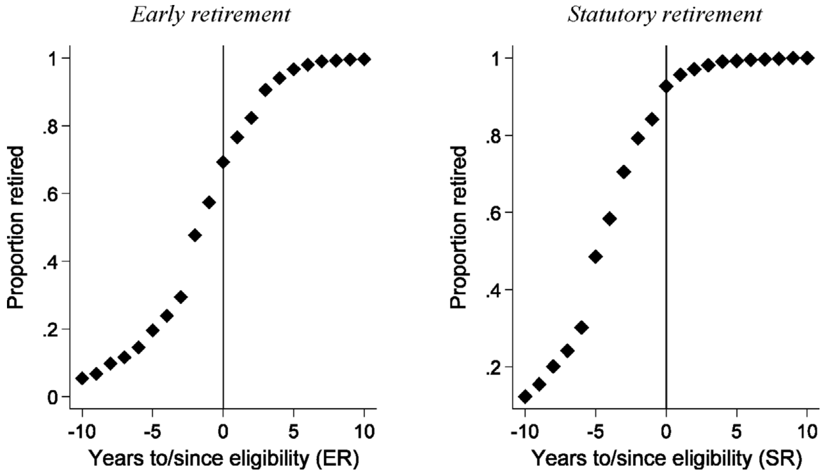
Keeping Austria as an example, in Figure 2 we show the proportions of men who report being retired as a function of the years to/since the eligibility age separately for early and statutory retirement. The two graphs show sizeable increases in the proportion of retired at both eligibility ages.[26]

Exploiting information about statutory (or old-age) and early-retirement pension eligibility criteria provided by Gruber and Wise (1999 and 2010), Wise

[26]The same increase is observed for most of the countries considered in the analysis for both men and women. Figures are available upon request.

FIGURE 2

Proportion of Austrian men who are retired, by years to/since eligibility age



Note: ER = early retirement; SR = statutory retirement.

(2012) and other sources,[27] we define two 0–1 dummies indicating whether the individual is eligible either for early (*EligibleER*) or for statutory (*EligibleSR*) retirement and use them to instrument *Retired* and provide two-stage least squares (2SLS) estimates.

IV. Results on healthy eating

In Table 3, we report estimates of the equation that explains men's daily fruit or vegetable consumption as a function of retirement status and observable characteristics. Columns 1 and 3 present OLS and 2SLS estimates where the time-invariant component e_i is a function of time-invariant observables (educational attainment and country dummies).[28] We also include as controls age, age squared, country-specific quadratic age trends, a wave dummy and a binary indicator for having a partner (*Couple*). Columns 2 and 4 report parameter estimates of the first-differenced (FD) equation: column 2 treats (the first difference of) *Retired* as exogenous, while column 4 allows for its endogeneity and instruments the first difference of *Retired* with the first differences in ER and SR eligibility. In the FD specifications, we control for the change in *Couple* and the first differences of country-specific quadratic

[27]For a list, see the online appendix.

[28]Bingley and Martinello (2013) show that differences in eligibility ages across country (and gender) are correlated with differences in years of schooling which affect health (and health behaviours) at older ages. For this reason, we incorporate educational attainment among both controls and instruments.

TABLE 3

Effect of retirement on daily fruit or vegetable consumption: men

	(1) *OLS*	(2) *FD*	(3) *2SLS*	(4) *FD-2SLS*
Retired	–0.026**	0.016	–0.085**	–0.158*
	(0.011)	(0.020)	(0.035)	(0.085)
Couple	0.096***	0.074**	0.096***	0.078**
	(0.010)	(0.030)	(0.010)	(0.032)
No. of observations	21,004		21,004	
No. of individuals		10,502		10,502
Sargan–Hansen *p*-value			0.181	0.572
EligibleER			0.222***	0.106***
			(0.022)	(0.019)
EligibleSR			0.291***	0.179***
			(0.022)	(0.022)
Weak identification			225.007	47.284

Note: Additional controls: education, wave 5 dummy, country dummies, age, age squared, and country-specific quadratic age trends (columns 1 and 3) or the first differences of country-specific quadratic age trends (columns 2 and 4). Standard errors: column 1 – clustered at the individual level; columns 3 and 4 – clustered by country and cohort. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$. Stock–Yogo weak identification test critical values: 10 per cent maximal IV size 19.93; 15 per cent maximal IV size 11.59; 20 per cent maximal IV size 8.75; 25 per cent maximal IV size 7.25.

age trends. For 2SLS estimates, we report robust standard errors clustered by country and cohort.

The point estimate of α_1 in column 1 is negative and significantly different from zero; this implies that for men the partial correlation between retirement and our proxy of healthy eating is negative, suggesting that individuals are 2.6 percentage points less likely to eat fruit or vegetables daily upon retirement. This compares with the 3 percentage point positive difference in sample averages between retirees and workers shown in Table 2. This discrepancy is due to the effect of age and other confounding factors. Column 3 reports 2SLS estimates, where *Retired* is treated as potentially correlated with the composite error term and is instrumented using the two eligibility variables described above. The interesting finding is that the point estimate of α_1 is still negative, is larger in absolute value than in column 1 and is significantly different from zero. We can then conclude that retirement induces an 8.5 percentage point reduction in the probability of a healthy diet among men.

The possibility remains that this result is driven by some unobservable, time-invariant characteristic that affects the propensity to eat healthy food and correlates with pension eligibility. For instance, individuals with present-bias preferences may choose jobs that allow them to retire early and may indulge in unhealthy eating habits because they care less about the long-run detrimental effect of a low-quality diet. The only way to be sure that such characteristics have no impact on parameter estimates is to remove the fixed effect by first-differencing the equation (the alternative of taking deviations from individual means leads to identical conclusions in our case, because we observe the same individual only twice). Columns 2 and 4 of Table 3 report estimates of the first-differenced equation. In column 2, we treat the first difference in retirement as exogenous and find a positive but clearly insignificant effect – given that the decision to retire may correlate with unobserved changes in determinants of dietary changes, this result is of little interest. Column 4 instead treats the first difference in retirement as endogenous and instruments it with the first differences in pension eligibility. The point estimate of α_1 is negative (–0.158) and significant at the 10 per cent level. This point estimate implies that, upon retirement, the probability of daily fruit or vegetable consumption drops substantially for men, from 72 per cent to 56 per cent. We checked that the 2SLS estimates of α_1 presented in columns 3 and 4 are not significantly different from each other.[29]

When using 2SLS estimators, the issue arises of whether the model identifies the causal effect under investigation. For this to be true, we require that the instruments are relevant, i.e. that they strongly predict the variable that is treated as endogenous. In the 2SLS case, we require that, conditional upon the other explanatory variables, *Retired* is strongly correlated with at least one of the pension eligibility variables that we use as instruments. In the FD-2SLS model, the requirement is much stronger: changes in retirement must be predicted by changes in eligibility.[30]

In the lower part of columns 3 and 4, we report selected first-stage coefficients to show the relevance and the strength of the instruments used. The coefficients of *EligibleER* and *EligibleSR* are significant at the 1 per cent level, and weak identification F-statistics[31] on the excluded instruments are always well above the Stock and Yogo (2005) critical values reported below the table. This confirms that eligibility rules are important determinants of the retirement decision.

Another condition that must be met for 2SLS estimates to be consistent is that the instruments should not correlate with the error term – that is, whatever variability in the dependent variable is not explained by the model should not be explained by eligibility. This condition is to some extent not testable, but in the

[29]To run this check, we adopted a bootstrap approach, using 1,000 replications, stratified by country and five-year birth cohorts.

[30]For this reason, we checked that our estimation results in this case are robust to the exclusion of those countries (Sweden, the Netherlands and Spain) where no changes in eligibility rule could have affected our respondents.

[31]The reported F-statistic is the Kleibergen–Paap rank Wald F-statistic, which is robust in the presence of heteroskedastic errors and corresponds to the standard F-statistic on the excluded instruments when there is a single endogenous variable.

TABLE 4

Effect of retirement on daily fruit or vegetable consumption: women

	(1) OLS	(2) FD	(3) 2SLS	(4) FD-2SLS
Retired	–0.023**	–0.010	0.002	0.022
	(0.009)	(0.017)	(0.027)	(0.102)
Couple	0.038***	0.005	0.037***	0.005
	(0.006)	(0.021)	(0.007)	(0.025)
No. of observations	22,926		22,926	
No. of individuals		11,463		11,463
Sargan–Hansen *p*-value			0.489	0.877
EligibleER			0.167***	0.045*
			(0.023)	(0.023)
EligibleSR			0.398***	0.202***
			(0.025)	(0.026)
Weak identification			252.971	32.661

Note: Additional controls: education, wave 5 dummy, country dummies, age, age squared, and country-specific quadratic age trends (columns 1 and 3) or the first differences of country-specific quadratic age trends (columns 2 and 4). Standard errors: column 1 – clustered at the individual level; columns 3 and 4 – clustered by country and cohort. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Stock–Yogo weak identification test critical values: 10 per cent maximal IV size 19.93; 15 per cent maximal IV size 11.59; 20 per cent maximal IV size 8.75; 25 per cent maximal IV size 7.25.

case of more instruments than explanatory variables there is over-identification and a test statistic can be computed. Since our model is over-identified (we have two instruments that are excluded from the equation and one endogenous explanatory variable), we can compute the Sargan–Hansen over-identification test. We report its *p*-values, which are above 10 per cent, and therefore conclude that the over-identifying restrictions are not rejected.

Table 4 reports a similar set of estimates for women. Although a negative partial correlation between retirement and healthy eating is also estimated for women, this result is not confirmed when we consider 2SLS estimates, either in levels or in first differences. The test statistics in the lower part of columns 3 and 4 suggest that the instruments are relevant, even though the coefficient of *EligibleER* in the first stage of the FD-2SLS specification is significant only at the 10 per cent level. This is not surprising considering that our sample is composed of older women who typically have discontinuous careers and are more likely to retire when they reach old-age retirement pension eligibility. The over-identifying restrictions test fails to reject the null, so the instruments appear to be valid.

The main conclusion we can draw from the estimates presented in Tables 3 and 4 is that changes in eating behaviour upon retirement are gender-specific:

retirement induces men to reduce healthy eating; it has no such effect on women.

V. Results on obesity and some of its likely determinants

Our estimation results show a significant negative effect of retirement on daily fruit or vegetable consumption for men and no significant effect for women. Our rich data allow us to investigate whether retirement causes other health-related behavioural changes in physical activity, smoking, protein intake or alcohol consumption for men or for women. In this section, we shall see that in some of these dimensions retirement has small and insignificant effects for men, while there is some evidence of an increase in alcohol consumption among women. Given that all these effects were estimated on a sample of 50- to 75-year-olds, they should be seen as representing the short- to medium-term impact of retirement on behaviours.

A natural question to ask is whether these behavioural changes have an effect on health. The literature has stressed that retirement is normally associated with an instantaneous health improvement,[32] which goes under the name of 'honeymoon effect'. The most important negative effects of retirement on physical and mental health occur after some time.[33] Our estimation strategy, with its focus on the 'young old', is unlikely to detect the negative effects of retirement-induced dietary changes on health, as these are likely to manifest themselves after relatively long periods of time; for this reason, we instead look at a specific risk factor – obesity – that is likely to be directly (and relatively quickly) affected by diet. We will show that retirement causes an increase in obesity, mostly among men. Obesity can be due not only to malnutrition, but also to lack of exercise, frequent alcohol intake or giving up smoking, as stressed in the literature.[34] We also show in this section that retirement does not affect men's physical activity, smoking, alcohol consumption or intake of proteins, and therefore conclude that changes in eating behaviour are a promising candidate in the explanation of the positive effect of retirement on obesity for men.

Let us first of all consider obesity as the dependent variable of an equation such as equation 1. Estimation results that take into account the likely endogeneity of retirement are presented in Table 5 for both men and women. We see that retirement has a positive effect on the probability of being obese for men. The effect is large: the probability of being obese increases from 19 per cent to 30 per cent upon retirement if we consider the FD-2SLS estimates. One might expect that individuals retiring from physically

[32] Eibich, 2015.

[33] Celidoni, Dal Bianco and Weber, 2017; Mazzonna and Peracchi, 2017; Bertoni, Maggi and Weber, 2018.

[34] Lahti-Koski et al., 2002; Griffith, Lluberas and Lührmann, 2016; Bush et al., 2016.

TABLE 5

Effect of retirement on obesity: men and women

	(1) Men 2SLS	(2) Men FD-2SLS	(3) Women 2SLS	(4) Women FD-2SLS
Retired	0.076**	0.108**	0.020	0.074
	(0.033)	(0.045)	(0.030)	(0.049)
Couple	0.013	0.000	–0.010	–0.003
	(0.010)	(0.020)	(0.008)	(0.017)
No. of observations	21,004		22,926	
No. of individuals		10,502		11,463
Sargan–Hansen *p*-value	0.721	0.214	0.132	0.973

Note: Additional controls: education, wave 5 dummy, country dummies, age, age squared, and country-specific quadratic age trends (columns 1 and 3) or the first differences of country-specific quadratic age trends (columns 2 and 4). Standard errors are clustered by country and cohort. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

demanding occupations gain weight if they do not compensate for the loss of on-the-job physical exercise. We can use the self-reported information on whether the current or last job is/was physically demanding to split the sample.[35] We find that the effect of retirement on obesity is positive for all, but stronger for individuals retiring from physically demanding jobs. These results are consistent with Godard (2016)'s findings using SHARE wave 1, 2, and 4 data.

The effect for women is more mixed: it is quite close to zero and insignificant in the 2SLS estimation in levels; and it is positive but marginally insignificant (*p*-value: 13 per cent) when 2SLS estimates are computed in the first-differences equation.

We find no significant effect of retirement on the probability of vigorous physical exercise every week, despite the large falls reported in Table 2. The most likely explanation for this discrepancy is that the retired are on average older, and vigorous activity falls rapidly with age. We do estimate an increase in moderate physical exercise for women (not for men), which may be of some consequence for body weight. We find insignificant effects of retirement on smoking behaviour for both men and women.

In Table 6, we estimate the effect of retirement on alcohol consumption. Previous studies have used alcohol abstention as the outcome variable,[36] but this measure can be uninformative about the effect of alcohol consumption

[35]Information on how physically demanding the last job was for retirees is collected in the retrospective waves (3 and 7).

[36]Eibich, 2015; Celidoni and Rebba, 2017.

TABLE 6

Effect of retirement on frequent alcohol consumption: men and women

	(1) *Men* *2SLS*	*(2)* *Men* *FD-2SLS*	*(3)* *Women* *2SLS*	*(4)* *Women* *FD-2SLS*
Retired	0.027	0.063	0.047**	0.083
	(0.039)	(0.085)	(0.022)	(0.052)
Couple	–0.007	–0.004	0.017***	0.001
	(0.011)	(0.028)	(0.005)	(0.017)
No. of observations	21,004		22,926	
No. of individuals		10,502		11,463
Sargan–Hansen *p*-value	0.481	0.828	0.248	0.443

Note: Additional controls: education, wave 5 dummy, country dummies, age, age squared, and country-specific quadratic age trends (columns 1 and 3) or the first differences of country-specific quadratic age trends (columns 2 and 4). Standard errors are clustered by country and cohort. $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

on health, given the non-linear relationship between the two.[37] We improve upon previous research in this area by using a measure that accounts for the frequency of alcohol consumption – two or more alcoholic beverages at least three days a week. Estimates show that men do not change their behaviour upon retirement and keep drinking substantially, whereas women drink more.

We also consider the effect of retirement on the prevalence of consuming protein-rich meals at least once a day (this includes dairy products, meat, legumes and eggs). If retirement had a negative effect on this variable, it would contribute to explaining the long-term loss in muscle strength that we mentioned in the introduction, which could in turn increase the probability of weight gain because of the associated sedentary behaviour. However, our analysis does not reveal a significant effect of retirement on this particular dietary intake.

The increase in obesity among men could be the result of less fruit and vegetable eating in retirement, with no improvements in other behaviours (physical exercise and alcohol consumption). A possible explanation for the much weaker effects on obesity among women, despite the positive effect of retirement on frequent alcohol drinking, is that women compensate for a higher calorie intake upon retirement by increasing moderate physical exercise.

In the remainder of this section, we describe the analyses we have performed to assess the robustness of our results. Estimation results are available upon request.

[37]Ziebarth and Grabka, 2009.

Our first concern is attrition bias. Since we exploit the longitudinal dimension of the SHARE data, our sample could be a selected one: individuals in bad health are more likely to exit the panel. We account for non-random attrition by applying the inverse probability weighting (IPW) approach of Fitzgerald, Gottschalk and Moffitt (1998). We estimate the probability of participation in the fifth wave, conditional on participating in the fourth wave, as a function of the outcome variables, the instruments, the full set of regressors and interviewer characteristics (rounding behaviour in grip strength measurements).[38] The weights are then computed as the inverse of fitted probabilities. We find that weighted and unweighted point estimates are similar. Insignificant effects for women are confirmed.

Second, the results for women could be driven by our sample selection, since we focus on individuals reporting having worked. The selection is particularly worrisome in countries where women's labour market participation rate is very low, i.e. Italy and Spain. We rerun the analysis for women excluding those countries. Results are broadly unaffected despite a loss in terms of precision in some specifications.

Finally, gender differences may be dampened because of joint food consumption within couples. So far, we have captured the fact that couples are likely to share meals by allowing for an intercept shift. We have found that men in couples are much more likely to consume fruit or vegetables daily. To fully remove joint consumption, we re-estimate the model on single people. In this much smaller sample, we find that gender differences are in line with our main specification: the effect of retirement on daily fruit or vegetable consumption is negative for men (though less precisely estimated) and is zero for women.

VI. Conclusions

In this paper, we investigate the causal link between retirement and eating habits using individual panel data covering a number of continental European countries. Retirement is a major individual decision that is highly influenced by public policy – for instance, public pension eligibility rules, which have changed over the years across different European countries for both men and women.

To measure eating habits, we have defined a dummy indicator that takes the value 1 if the individual consumes fruit or vegetables daily. As retirement is likely to be correlated with the error term due to omitted variables (both time-varying and time-invariant unobserved factors) and/or reverse causality, we solve the endogeneity problem using an instrumental variable approach. Our instruments are eligibility for early and statutory (normal) retirement pension.

[38]We construct indicators of rounding behaviour in measurements following Korbmacher and Schröder (2013); see also Bristle et al. (2019).

We find that retirement has a negative effect on the frequency of fruit or vegetable consumption for men and it has no effect for women. We also find a positive effect of men's retirement on the probability of being obese. Given that we find no effects of men's retirement on physical exercise, protein intake, smoking and alcohol consumption, we conclude that the reduction in fruit or vegetable consumption is a promising candidate in the explanation of the retirement-induced increase in obesity among men.

For women, we find that retirement has no effect on their diet and very little effect on their obesity. This result suggests that retirement has more far-reaching consequences for men than for women, possibly due to differences in daily activities that are not easily captured by responses to survey questions but that could be investigated by collecting more objective and complete measures of motion over extended periods of time (such as those taken by an accelerometer[39]).

Supporting information

Additional supporting information may be found online in the Supporting Information section at the end of the article.

- Appendix

References

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