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RETIREMENT AND COGNITIVE FUNCTIONING: INTERNATIONAL EVIDENCE

CAHIER DE RECHERCHE
WORKING PAPER

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Décembre / December 2016

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Dépôt légal : Bibliothèque et Archives nationales du Québec et Bibliothèque et Archives Canada, 2016.
ISSN 2368-7207

Retirement and Cognitive Functioning: International Evidence *

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Abstract

We survey the recent literature on the effects of retirement on cognitive functioning at older ages around the world. We describe results from studies using similar data, definitions of cognition, and instruments to capture causal effects. The studies yield widely varying results. Most papers find that being retired leads to a decline of cognition, controlling for different specifications of age functions and other covariates. However, the size and significance of the estimated effects varied dramatically depending on specifications used, such as whether or not models included fixed effects, dynamic specifications, or alternative specifications of instrumental variables. We replicated several of these results using the same data sets. We discuss the factors that are likely causing the differences across specifications, including endogeneity of right hand side variables, and heterogeneity across gender, occupation or skill levels. We found that results were especially sensitive to the inclusion of country fixed effects, to control for unobserved country differences, suggesting the key role of unobserved differences across countries, which both affect retirement ages and cognitive decline.

Keywords: cognition, retirement, aging, country fixed effects

JEL Codes: C26, I14, J14, J26

*We thank Olivia Mitchell and an anonymous referee for helpful comments. This research is also part of the program of the Industrial Alliance Research Chair on the Economics of Demographic Change. Arie Kapteyn acknowledges support from NIA under grant 2P01AG022481.

Introduction

The literature on the effect of retirement on cognitive function has attracted economists' attention during the last decade. There are many reasons why the topic is of interest. Two key reasons are the desire for a better understanding of the effect of prolonging working life at older ages on well-being and the policy implications that these effects could have on countries dealing with underfunded retirement plans and aging populations. Encouraging individuals to delay retirement could have significant financial and non-financial (e.g. health and well-being) implications for individuals and societies. Given the importance of this topic, we survey the recent literature on the effects of retirement on cognitive functioning at older ages and assess the robustness of estimates of the effect of retirement on cognitive capability.

There is no clear consensus in the literature on the effect of retirement on cognitive functioning. Although some studies find that being retired leads to a decline in cognition, richer specifications (i.e., including fixed effects, dynamic specifications, or alternative specifications of instrumental variables) often lead to large changes in the size and significance of the estimated effects. Some papers find a negative effect of retirement on cognition (e.g. Rohwedder and Willis 2010; Bonsang et al. 2012, Mazzonna and Peracchi 2012, 2014) while other studies find small or even a positive effect, especially when these are disaggregated by different types of occupations (e.g. Coe et al. 2012 and Bianchini and Borella 2014). Other papers find only significant effects for women (see Coe and Zamarro 2011).

Using similar data sets across several countries (i.e. the U.S. Health and Retirement Study, HRS, the English Longitudinal Study of Aging, ELSA, and the Survey of Health, Ageing and Retirement in Europe, SHARE), we replicated several of these results aiming to get a better understanding of the sources of the different effects found in the literature. Our study shows that

results are very sensitive to differences in econometric specifications. In particular, the use of country fixed effects to control for unobserved country differences tends to reduce the estimated effect of retirement on cognition dramatically, suggesting the role of unobserved differences across countries, which both affect retirement ages and cognitive decline. This is also true if we focus our analysis on different subgroups defined by different types of occupations (i.e. blue collar/ white collar jobs; physically demanding jobs; or high skilled jobs).

The structure of the remainder of this chapter is the following. We first survey the empirical literature on aging and cognitive functioning. Secondly, we summarize the results found in the empirical literature that focuses on the effect of retirement on episodic memory. We describe results from studies using similar data sets (HRS, SHARE and ELSA), definitions of cognition, and instrumental variables to capture causal effects. Third, we replicate several of these results using the same data sets. We discuss the factors that are likely causing the differences found across papers that use different specifications, including endogeneity of right hand side variables, and heterogeneity across gender, occupation or skill levels. Finally, we conclude.

Measuring Cognitive Function and its Determinants

Our goal is to understand whether being retired affects cognitive functioning. First, we briefly describe the different measures of cognitive functioning used in the literature we survey. Then, we summarize the main findings in the literature on aging and cognition, as well as the main factors affecting cognitive abilities and its decline.

Cognitive functioning. Following the classification in psychological theory on cognition, we briefly describe two types of cognitive functioning: fluid intelligence and crystallized intelligence,

as described by the Cattel-Horn-Carrol theory. [1] Fluid intelligence includes processes related to recall, in particular, episodic memory, i.e working memory, including long-term memory and how fast we process information (perceptual speed). [2] Crystallized intelligence relates to our knowledge and verbal learning. Education primarily affects the latter type of cognitive functioning. Crystallized intelligence seems to be rather stable over time and can even improve with age (i.e., Hertzog 2008; Hertzog et al. 2008; Dixon et al. 2004; Park et al. 2002; Schaie 1994), while fluid intelligence is more likely to decline with age (e.g., Anderson and Craik, 2000; Prull et al. 2000). The environment can affect memory at older ages as well as the intellectual stimulus an individual faces routinely (i.e., Salthouse 2006, 2009; Small 2002; van Praag et al. 2000). Most of the studies on cognitive function in economics focus on fluid abilities that are likely to affect dementing illnesses (i.e., Morris et al. 2001; Adam, Van der Linden, et al. 2007), such as memory or attention. The decline in fluid cognition may affect individual decision-making and adversely affect well-being. The papers discussed in this chapter all use similar measures of cognitive functioning; in particular they focus on immediate and delayed recall.

Prior evidence on cognitive functioning, aging and factors other than retirement. In order to get a better understanding on how the process of aging can affect cognitive functioning we describe findings across several disciplines, including psychology, epidemiology, gerontology, neuroscience and economics. Schaie (1989), in a review of findings from the Seattle Longitudinal Study on adult cognitive development, finds an important decline in cognitive functioning at late ages. This decline in cognitive abilities with age is also documented in Hertzog et al. (2008); Bäckman et al. (2005); Dixon et al. (2004); Peterson et al. (2002); Anderson and Craik (2000); Prull et al. (2000) and Schaie (1994), among others. Demographic variable such as gender may correlate with cognitive functioning as well, although results are mixed in the literature. Lei et al.

(2012) find lower cognitive functioning for women than for men; Johnson and Bouchard (2007) find better memory among women than among men, while Halpern (2012) finds small or no evidence of differences across gender and cognitive functioning.

Cognitive reserve refers to the phenomenon that people whose brains show extensive Alzheimer's pathology may have manifested very little clinical cognitive impairment when alive. Evidence suggests that education, activities, and occupation can affect an individual's cognitive reserve (e.g., Stern 2002, 2003). The role of education in cognition has been studied by Banks and Mazzonna (2012), Maurer (2010), McFadden (2008), and Evans et al. (1993), among others. Other factors, such as leisure activities, lifestyle, behaviour, and social networks, may also affect cognitive functioning and have also been studied in the literature. [3]

Does Retirement affect Cognitive Functioning?

One of the main interests in answering the question whether retirement affects cognitive functioning is the prospect of understanding how retirement might affect well-being at older ages and the possibility of extending employees' working lives. During recent decades, many countries have increased retirement eligibility ages for public pensions and/or are switching from defined benefit to defined contribution pension systems. These reforms can have different effects upon countries and individuals, including individuals' employment decisions. If employment status were to have an effect upon the cognitive functioning of individuals, the implications for policy-making would differ depending on the direction of the effect. For instance, if staying longer in the labor market is thought to be protective of memory capacity, encouraging workers to stay longer in the labor market would support the financial sustainability of pension systems (Dave et al. 2008 ; Bonsang et al. 2012), and potentially reduce health care and long-term care expenditures, assuming

that implied memory loss is related to increased risk of dementia and increases in disability (Albert et al. 2002; Lyketsos et al. 2002; Tabert et al. 2002). It would also aid autonomy and the capacity for sound financial decisions, including saving decisions (Christelis et al. 2010; Banks et al. 2010; Brown et al. 2012), and more generally enhance well-being and quality of life at later ages (OECD 2013).

Prior studies. Prior studies reach conflicting conclusions on the effects of retirement on memory, both with respect to the sign of the effect and as to whether there is any effect at all. The studies reviewed here use comparable measures of cognitive abilities, although they differ in their definitions of retirement. The most commonly used datasets are: (1) the Health and Retirement Study (HRS) for the U.S.; (2) the English Longitudinal Study of Ageing (ELSA) for England; and (3) the Survey of Health, Ageing and Retirement (SHARE) for Europe (see Table 1). [4]

One of the first papers studying the effect of retirement on cognitive function was by Adam et al. (2007). Using HRS, SHARE and ELSA data for the year 2004, they found a negative effect of retirement on a word recall test. The measure they used was the sum of the number of correct answers on an immediate ten item word recall test and the number of correct answers to the same list of items, about 10 minutes later. They considered both if an individual was retired and how long (s)he had been retired. Their analysis did not provide a causal interpretation of retirement on cognitive abilities.

Table 1 summarizes nine recent studies. As one can see, studies differ by the number of countries used in the analysis; whether the analysis is solely based on a cross section of countries, or whether longitudinal data are used; the age range considered and whether men and women are analyzed separately or not. Some studies differentiate between blue and white collar jobs before retirement (i.e., Mazzona and Peracchi 2014 and Bianchini and Borella 2014).

All studies included in the table define cognitive functioning with a similar measure, also used by Adam et al. (2007) described above, (sometimes side-by-side with other measures), i.e. the sum of immediate and delayed recalled words from a list of ten words. We will denote this variable simply as "word recall" from now on. It ranges from 0 to 20.[5 6]

Three main definitions of retirement can be identified. The first definition focuses on self-reported labor force status. At times this definition takes into account whether individuals are receiving old age pension benefits. "Retired" is generally defined as a (0, 1) dummy variable. A different definition often used follows Lazear (1986) by defining being retired as not working for pay, including those out of the labor force who are unlikely to return to the labor market. The third definition is a continuous variable related to retirement duration.[7] Most of the studies measure retirement duration as the elapsed time between retirement date and interview date (i.e., Coe et al. 2012) and/or the elapsed time since the last job ended (i.e., Bonsang et al. 2012).

All studies control for age in some form. Rohwedder and Willis (2010) and Bonsang et al. (2012) controlled for age, but did not explore the effect of other covariates. As Table 1 shows, other studies include a large number of other covariates, including years of schooling, demographic, socio-economic status (SES hereafter), different health variables, country dummies, wave dummies, cohort and regional dummies.

Some papers allow for what is called a "honeymoon phase" (Atchley 1976, 1982). This refers to the fact that, when first retired, individuals often spend more time engaging in activities that they did not have time to do while working, and these activities could have a positive effect on their cognitive abilities or delay their decline. While it seems that this "phase" does not last long (i.e., Ekerdt et al. 1983; Gall et al. 1997; Mein et al. 2003; Mojon-Azzi et al. 2007; Westerlund et al. 2010), research suggests that when analyzing the relationship between retirement and cognition, researchers must take this phase into account, by controlling for the length of time one has been

retired (Bonsang et al.2012; (Mazzonna and Peracchi 2012, 2013; Bianchini and Borella 2014). Occupational characteristics such as being a blue-collar worker or having a physically demanding job could affect cognitive functioning differently from being a white-collar worker or having an intellectually engaging job (Dorm et al 1998; Potter et al. 2008). Coe et al. (2012); Mazzonna and Peracchi (2014), and Bianchini and Borella (2014) study the influence of type of occupation when analyzing the effect of retirement on cognitive functioning.

Retirement and cognitive function: causal or not? Turning to the findings, most papers start with a descriptive analysis showing the correlation of retirement and cognition. Rohwedder and Willis (2010) and Adam et al. (2007) documented a positive relationship between working and cognitive functioning. Both papers compared the employment rates of men aged 60-64 and men aged 50-54 and noted a fall in the number of words recalled by men aged 60-64 relative to men aged 50-54 across a number of SHARE countries, England, and the US. When Adam et al. (2007) controlled for occupational activities, they found that not working was negatively and significantly correlated with recall. Rohwedder and Willis (2010), using working for pay versus not working as their retirement variable, found that on average retired individuals' memory scores decreased by about 4.9 words (on a 0-20 scale) with retirement.

Coe and Zamarro (2011) also used a broad retirement definition, including retired, homemakers, disabled and sick individuals not temporarily out of the labor force as retirees. This variable was conditioned on having been working for pay at age 50. Their study confirms a significant but small negative association between retirement and cognition when demographics, SES, and health controls were included (the estimated coefficient implies a 0.28 reduction in the number of words recalled out of 20, significant at 5%). Effects of retirement on verbal fluency were

found to be insignificant. The cross-country analyses undertaken in the three papers were based exclusively on data from 2004.

Coe et al. (2012) and Bonsang et al. (2012), differ from the previous studies in their use of HRS panel data for only one country, the US. They used a continuous retirement duration variable as an explanatory variable instead of using the retirement dummy. Using the word recall measure, Coe et al. (2012) found no significant correlation for blue-collar workers. However, they did find a highly significant negative correlation, though small, for white-collar workers (-0.04 reduction of words recalled on a 0-20 scale). They also explored other cognitive function indicators such as numeracy and self-rated memory, and found similar results.

Mazzona and Peracchi (2012) examined immediate and delayed recall separately. They also examined an "orientation in time" variable, as well as verbal fluency and numeracy. They found a significant but small negative correlation of retirement duration on both immediate recall and delayed recall [-0.010* to -0.018*** words in a 0-10 scale].

The results discussed so far cannot be interpreted as causal because cognitive endowments could affect both cognitive functioning outcomes and retirement decisions. For instance, less educated individuals or people with more physically demanding jobs may retire at earlier ages than highly educated individuals or individuals with more intellectually challenging jobs (e.g. Glymour et al. 2008; Evans et al. 1993; Dorm et al. 1998; Potter et al. 2008). Finally, common factors like preferences, behaviour or health could affect both retirement and cognitive abilities (e.g. Frederik 2005; Benjamin et al. 2006; Dohmen et al. 2007).

To address these issues, in an effort to obtain a causal effect of retirement, the reviewed studies also analyzed the effect of retirement on cognition using instrumental variable (IV) approaches. Eligibility ages for both early and full pension benefits are typically used as instruments. All of the papers use the institutional information collected in *Pensions at a Glance* (OECD 2011) and/or

provided by the Social Security Administration in the US. [8] The instruments used capture the timing of eligibility for public pensions, and most of the papers use these policy variables in relation to the interview date and the age of the respondent. An exception is Coe et al. (2012) who use the early retirement windows offered by firm, as reported in the HRS, as instrument.

In order to be suitable instruments, these variables must be correlated with retirement but affect cognition only through their effect on retirement. Earlier studies on the effect of retirement on health have shown that these proposed instruments are very strong predictors of retirement behavior (i.e., Charles 2004; Coe and Lindeboom 2008; Neuman 2008; Bound and Waidmann 2007).

The nine reviewed papers follow a similar strategy to deal with the endogenous effect of retirement on cognition. We summarize the various approaches in Table 2.

When using instrumental variable methods, Rohwedder and Willis (2010) found a significant reduction of 4.67 words on a scale of 0 to 20 of cognition with retirement significant at the one percent level. However, this effect effectively became zero in Coe and Zamarro (2011) when they controlled for country dummies. Coe et al. (2012) showed a slightly positive effect for the U.S; more precisely, they found a significant and positive effect for blue-collar workers with a coefficient of about 0.38 additional words. Bingley and Martinello (2013) analysed the role of years of schooling in the validity of the proposed instruments and the estimated effects of retirement on cognition across countries and gender. The magnitude of the effect of retirement on cognition got reduced when controlling for years of schooling (-3.0 versus -5.6 reduction in words recalled). When estimating the model for men and women separately, they found a lower effect of retirement on word recall for women than for men. Mazzonna and Peracchi (2012) accounted for attrition, cohort effects and learning effects. They found a small significant negative effect of retirement

duration on cognitive abilities (-.025 words per year in retirement in immediate memory recall for men and -.055 words per year in retirement for women in immediate recall).

As previously noted, some studies also deal with unobserved heterogeneity across individuals using a fixed effect (FE) approach in combination with instrumental variable approaches. Bonsang et al. (2012) reported a significant and negative retirement coefficient of -1.01 words in their baseline model when using fixed effect methods. They also controlled for different age specifications and different retirement durations and found less robust results. Using principal components analysis, Mazzona and Peracchi (2014) constructed a cognitive capability index based on various cognition measures. They included a dummy for retirement similar to the one used in Rohwedder and Willis (2010). They also analyzed the effect of retirement duration as in Mazzonna and Peracchi (2012). Their analyses were broken down by subgroups, such as men and women, as well as less or more physically demanding jobs. They found a small negative effect of retirement duration on their cognitive index, so that more time in retirement implies a larger decrease in cognitive functioning. They also found a positive effect of immediate retirement on cognition for white-collar jobs and no significant effect for blue-collar jobs, as well as a negative effect of retirement duration for both groups. Celedoni et al. (2013) concentrated on early retirement and cognitive decline. When only using fixed effects and controlling for age and time dummies, they found a positive but small effect on the dummy of retirement: -.4; and a small negative and significant coefficient for retirement duration: -0.10, -0.13 fewer words per year in retirement recalled on a 0-20 scale depending on the specification of the age functions (as dummies or as a continuous variable, respectively). The authors also found a small negative effect of -.2 words per year in retirement on cognition with a combined IV-FE approach and excluding the retirement dummy from the regressions. Bianchini and Borella (2014) estimated a specification interacting the number of years in retirement with the retirement dummy for individuals who

actually retired during the sample period, so that they were observed both when they were working and when they retired. Using a similar approach as Celidoni et al. (2013), they found opposite results. Bianchini and Borella (2014) reported a significant small positive effect of retirement duration on cognition (with an estimated increase in words recalled on a 0-20 scale equal to 0.39 per year in retirement).

In summary, except for Rohwedder and Willis (2010), Bonsang et al. (2012) and Bingley and Martinello (2013) who found significant negative effects of retirement on words recalled (about -3 and -5 words on a scale of 0 to 20 words for Rohwedder and Willis (2010) and Bingley and Martinello (2013), respectively and about -1 word per year in retirement for Bonsang et al. (2012)), the rest of studies found much smaller and sometimes insignificant effects and opposite signs.

Disaggregating Cognitive Abilities and Reconciling Results

To better understand the sources of differential effects of retirement on cognition documented in the prior literature, we use the same three surveys mentioned previously; HRS, ELSA, and SHARE. We use data from 2004 to 2012 and countries with at least three waves (13 countries). [9] We report descriptive statistics for the baseline samples in Appendix A.3.

We seek to reconcile the different results found in the literature by considering different econometric specifications and different operationalisations of retirement. In particular we estimate possible effects of retirement on cognitive ability using Ordinary Least Squares (OLS), Instrumental Variable Methods (IV), Fixed Effects (FE) and Instrumental Variable Fixed Effect (IV-FE) methods. We do so, for all surveys combined. [10]

We also present specifications with a variety of controls. Our first specification includes no control variables at all, while our second specification adds controls for age, cohort, and gender. Our third specification adds country fixed effects to the set of controls. Note that by controlling for age, we account for the natural decline of memory with age. Therefore, our estimates of the effect of retirement capture changes in the age trajectory due to retirement. Finally, our last two specifications include demographic information (marital status and level of education), and health outcomes (self-reported health, number of limitations with activities and medical conditions) as controls. Of course, the last two specifications could raise endogeneity issues. In the former specification, marital status can affect cognitive abilities via social activities as part of the family network. In the latter specification, one may be concerned that health is affected by cognition, while health may also be affected by retirement. We have conducted various robustness checks, including the incorporation of income, wealth and other social network control variables. Because the main results do not differ, they appear in Appendix A.

Our first retirement definition is based on self-reports of current job status (SR_Ret). Our second definition includes homemakers along with those who say they are sick or disabled into the set of retirees, but conditions on working at the age of 50 (NW1_Ret) as in Coe and Zamarro (2011). Our third definition of retirement is the most inclusive and defines as retired all those are not working now (NW2_Ret) as in Rohwedder and Willis (2010).

To address the potential endogeneity of retirement (i.e. that cognitive decline may affect when someone retires), we construct instruments based on two variables that indicate whether the respondent was eligible for full or early retirement public pensions using the country- and gender-specific pension-eligibility ages described in Appendix B. [11]

Pooled results. Table 3 presents the estimates for all surveys pooled together. Overall, Ordinary Least Square (OLS) estimates show consistently significant negative correlation between retirement and cognition scores (on a 0-20 scale) ranging from -1.28 words for specifications without controls to -0.28 words for specifications with more detailed controls. The more controls we add, the lower the estimated coefficient. The size of the effect varies depends on the definition of retirement used. The definition based on the respondent declaring not to be working (NW2_Ret) generates the highest estimated negative effects, followed by NW1_Ret and self-reported retirement status (SR_Ret).

The IV estimates mostly imply bigger effects than the OLS results. [12] Results change dramatically when country fixed effects are included. When country effects are not included in the analysis estimates are based on variation not only within countries but also across countries and so, the cognition of all those above retirement age is compared with the cognition of those below. Including country fixed effects changes the sources of identification and interpretation of the estimated retirement effects. When country effects are included in the analysis, retirement effects are estimated by comparing individuals in the same country above retirement eligibility age to those who are just below (Coe and Zamarro 2011). Combining country fixed effects with IV restores the estimated negative effect of retirement on cognition in most cases, but the effects are now mostly small and often insignificant.

Heterogeneity across individuals. If the causal effect of retirement on cognition is heterogeneous across respondents, then the estimated effect recovered by IV is a weighted average of the effects for those individuals who are induced to change their decisions because of the instrument. In our case, the instruments are based on retirement eligibility and hence the issue is which labor force participants are induced to retire once they reach the eligibility age. This is what is known as the local average treatment effect (LATE; Imbens & Angrist 1994; Angrist & Pischke 2015). Thus, IV

studies that estimate the same model with different IVs or use samples from different populations may obtain very different estimates of the causal effect.

Average cognitive scores differ between men and women. Men recall 9.58 words on average while women recall 10.39 words. These numbers are quite stable over the period studied. Figure 1 shows that the averages vary across countries, but women always score better than men.

Table 4 shows results of OLS estimates by gender, which are seen to be similar. In the IV specifications the results for women mostly retain significant and negative coefficients even controlling for all co-variates, while for men the coefficients of interest lose significance once we control for country fixed effects. The IV-FE estimates for men are statistically insignificant, while for women, the estimated effects of retirement on cognition remain negative and mostly statistically significant, even when country fixed effects and covariates are included.

As Bingley and Martinello 2013 argue, the differences in eligibility ages across gender can be correlated with education level. Table 5 shows a breakdown of results for two different education levels. The OLS and IV estimates are similar across the two groups, although the coefficients are smaller for higher educated individuals than for lower educated individuals. The IV-FE specifications show generally insignificant results for both groups.

We also define two types of variables that capture physically demanding occupations. One variable asks for the physical effort in the current job directly, while a second variable is constructed by matching the reported occupations to administrative classifications (ISCO coding for Continental Europe; SOC2010 for England, Census coding for the U.S.) to distinguish between blue collar jobs and white collar jobs. More details about the variables can be found in Appendix A. Individuals working in physically demanding jobs recall about 10 words, while the ones with less physically demanding jobs recall about 11. We find similar differences when comparing blue-

collar jobs and white-collar jobs. Table 6 shows results for the subsamples broken down according to the physical demanding job definition. [13]

To sum up the results, when we distinguish by physical effort, the OLS estimates are different across occupations. While for the physically demanding jobs the effect of retirement on cognition is negative and significant only before controlling for country fixed effects or other covariates, for individuals with less physically demanding jobs, the effect remains significantly negative even after controlling for more explanatory variables and for all retirement definitions. Yet, once we control for country fixed effects and apply instrumental variable estimation the effects for both groups become generally insignificant.

Overall, our analysis shows that the estimated effects of retirement on cognition are very sensitive to model specification. In particular, results are especially sensitive to the inclusion of country fixed effects to control for unobserved country differences. When unobserved country differences were controlled for in the model, the estimated effect of retirement on cognition tended to be small and mostly insignificant.

Conclusion

This chapter reviewed the empirical literature on aging and cognitive function and in particular prior literature on the effects of retirement on episodic memory. Results using internationally comparable datasets show an enormous variation in outcomes. Our analysis shows that outcomes are very sensitive to econometric specifications. In particular, the use of country fixed effects tends to dramatically reduce the estimated effect of retirement on cognition. This is also true if we consider subgroups distinguished by blue collar/ white collar; physical demands; or skill level.

The upshot of our work is therefore that results found in prior studies are very sensitive to the methods used and hence must considered quite fragile. It should be pointed out that our IV strategy aims to identify a sharp immediate effect of retirement on cognition, rather than considering the effect of retirement duration on cognitive decline. Our review of the literature suggests that the effects of these estimates are equally fragile.

APPENDIX

Appendix A: Data Description

The data used in the studies reviewed in our paper come from longitudinal surveys of the over-50 population: the Health and Retirement Study (HRS) for the U.S., the English Longitudinal Study of Ageing (ELSA) for England and the Study of Health, Ageing and Retirement in Europe (SHARE). Since SHARE was introduced in 2004, we focus our analysis on the year 2004 and subsequent waves of all surveys through 2012. We analyze 5 waves for HRS and ELSA and 4 waves for SHARE (wave 3 of SHARE collects life histories and does not contain cognitive abilities variables). HRS, ELSA and SHARE cover an equally broad range of topics, including demographics (age, gender and education), labor supply, income, pension benefits, wealth, health and cognitive function. They contain identical question wordings whenever possible.

Cognitive functioning variables. The three surveys ask several questions about cognitive functioning. Their measures of cognitive abilities are comparable, and follow similar interview procedures. Below we describe the construction of the word recall variable.

HRS: The interviewer read a list of 10 nouns (e.g., lake, car, army, etc.) to the respondent. Immediate Word Recall: After reading the list, individuals were asked to recall as many words as possible. The list could be given in any order. Between waves, the list of nouns may have changed.

Delayed Word Recall: After approximately 5 minutes of being asked other survey questions (e.g., about other cognition items) individuals were asked to recall the list again in any order. The sum of the outcomes of both Immediate Word Recall (10 words) and Delayed Word Recall (10 words) is used to build a recall summary score. The values range from 0 to 20.

ELSA: A list of 10 nouns could be read from a computer screen or by the interviewer if there were technical issues. Respondents were given the following instructions:

"The computer will now read a set of 10 words. I would like you to recall as many as you can. We have purposely made the list long so it will be difficult for anyone to recall all the words.

Please listen carefully to the set of words as they cannot be repeated.

When it has finished, I will ask you to recall aloud as many of the words as you can, in any order. Is this clear?"

After several other questions were asked, the respondent was asked to recall the words again. The summary test recall score is again the sum of both immediate and delayed word recall for a maximum of 20. The values range from 0 to 20.

SHARE: Like in the case of ELSA, the list of 10 nouns could be read from a computer screen. At the beginning of immediate word recall the interviewer read this message: "Please listen carefully, as the set of words cannot be repeated. When I have finished, I will ask you to recall aloud as many of the words as you can, in any order. Is this clear?"

As in HRS, for the delayed word recall the respondent was asked to recall the words again after several questions were asked about other cognitive abilities. The summary test recall score is again the sum of both the immediate and delayed word recall for a maximum of 20. A disadvantage of SHARE is that all respondents in the household and through waves 1 and 2 could receive the exact same test over time. The survey corrected this issue in waves 4 and 5.

Retirement. All surveys have similar questions about current work status and retirement status.

HRS measures self-reported work status by asking: 1) Working now, 2) Unemployed and looking for work, 3) Temporarily laid off, on sick or other leave, 4) Disabled, 5) Retired, 6) Homemaker, 7) Other (specify). For the salaried workers, there is a follow-up question whether individuals are currently working for pay.

ELSA measures self-reported work status by asking: 1) Retired, 2) Employed, 3) Self-employed, 4) Unemployed, 5) Permanently sick or disabled, 6) Looking after home or family, 95) Other, and 96) Spontaneous: semi-retired.

SHARE measures self-reported work status by asking: 1) Retired, 2) Employed or self-employed (including working for family business), 3) Unemployed and looking for work, 4) Permanently sick or disabled, 5) Homemaker, 97) Other (Renter, Living off own property, Student, Doing voluntary work)

We define three binary measures of retirement: SR_Ret is based on self-reported current work status; NW1_Ret also includes as retired homemakers, sick or disabled, non-temporarily away from labor force if respondents declared they worked at age 50; NW2_Ret includes all those who are not working now as retired.

Other covariates. Demographic variables include age, age-squared, female, being married or in a couple and their interaction with being female. Other controls such as cohort, years and country dummies are also included. We include three education levels: tertiary, secondary, and primary.

Several health variables are distinguished. A binary indicator is included for having at least one major chronic condition from among cancer, lung disease, heart attack and stroke. A second indicator is defined as having at least one minor chronic condition from among hypertension, diabetes and arthritis. Self-reported health is coded (0,1) as well (=1 if the individual reports bad

or poor health and 0 otherwise). ADLA and iADLA indicators for limitations with daily activities are also considered. Similar questions are asked in all surveys about difficulties in five basic activities: bathing, dressing, eating, getting in and out of bed, and walking across a room. Individuals were classified as having any ADL limitation if they reported limitations with one or more of the five activities. Preparing meals, shopping, making phone calls, taking medications and managing money. Those who reported having some difficulty with any of the five activities were classified as having an iADL limitation.

Physically demanding jobs are coded as follows. ELSA distinguishes four categories: sedentary occupation, standing occupation, physical work, and heavy manual work. We code the variable "physically demanding job" equal to 1 for the last two categories, and 0 otherwise. HRS asks directly if the current job requires physical effort "whether all/almost all the time", "most of the time", "some of the time" and "none/almost none of the time". We define a "physically demanding job" variable equal to 1 for "all/almost all the time" and 0 otherwise. In SHARE, individuals are asked: My job is physically demanding. Would you say you "strongly agree", "agree", "disagree" and "strongly disagree"? In our analyses the "physically demanding job" variable is coded as 1 for "strongly agree" and 0 otherwise. The blue-collar and white-collar definitions are based on SHARE's ISCO coding and the HRS 1980 and 2000 census coding. For ELSA we use the categories in the SOC2010 volume 3: the National Statistics Socio-economic classification (NS-SEC rebased on SOC2010). Blue collar jobs are defined as those that involve routine or manual work; white collar jobs are defined as managerial and professional occupations or intermediate occupations.

Appendix A Table a1 Descriptive statistics

Variable	ALL COUNTRIES Obs	Mean	Std. Dev.	Min	Max	SHARE Obs	Mean	Std. Dev.	Min	Max
words recalled(0-20 scale)	169487	10.36	3.38	0	20	91485	9.86	3.41	0	20
SR_Ret	142545	0.47	0.50	0	1	75733	0.51	0.50	0	1
NW1_Ret	157945	0.52	0.50	0	1	84831	0.56	0.50	0	1
NW2_Ret	173559	0.49	0.50	0	1	92422	0.52	0.50	0	1
Age	174395	60.51	5.70	50	70	93061	60.29	5.73	50	70
Female	174395	0.55	0.50	0	1	93061	0.54	0.50	0	1
Married	171965	0.79	0.41	0	1	90653	0.82	0.39	0	1
Education	167031	1.84	0.72	1	3	89422	1.91	0.63	1	3
Skill: 1 Unskilled	167031	0.64	0.48	0	1	89422	0.75	0.43	0	1
Bad Health	168452	0.24	0.43	0	1	93061	0.26	0.44	0	1
ADLAs	173896	0.08	0.28	0	1	92679	0.06	0.23	0	1
IADLAs	173888	0.03	0.17	0	1	92679	0.02	0.13	0	1
Minor conditions	173884	0.56	0.50	0	1	92623	0.46	0.50	0	1
Mayor conditions	173836	0.22	0.41	0	1	92623	0.17	0.37	0	1
Physcial demanding job	54202	0.22	0.41	0	1	19141	0.20	0.40	0	1
Occupation: 1 Blue-collar	62516	0.39	0.49	0	1	18115	0.47	0.50	0	1

Variable	ELSA Obs	Mean	Std. Dev.	Min	Max	HRS Obs	Mean	Std. Dev.	Min	Max
words recalled(0-20 scale)	30567	11.33	3.30	0	20	47435	10.70	3.18	0	20
SR_Ret	26900	0.44	0.50	0	1	39912	0.42	0.49	0	1
NW1_Ret	29965	0.49	0.50	0	1	43149	0.47	0.50	0	1

NW2_Ret	31609	0.48	0.50	0	1	49528	0.44	0.50	0	1
Age	31630	60.57	5.42	50	70	49704	60.89	5.77	50	70
Female	31630	0.54	0.50	0	1	49704	0.57	0.50	0	1
Married	31622	0.78	0.41	0	1	49690	0.74	0.44	0	1
Education	27917	1.96	0.89	1	3	49692	1.64	0.73	1	3
Skill: 1 Unskilled	27917	0.58	0.49	0	1	49692	0.49	0.50	0	1
Bad Health	25687	0.21	0.41	0	1	49704	0.23	0.42	0	1
ADLAs	31612	0.12	0.33	0	1	49605	0.11	0.31	0	1
IADLAs	31612	0.03	0.16	0	1	49597	0.05	0.22	0	1
Minor conditions	31621	0.55	0.50	0	1	49640	0.74	0.44	0	1
Mayor conditions	31621	0.23	0.42	0	1	49592	0.31	0.46	0	1
Physcial demanding job	11612	0.28	0.45	0	1	23449	0.20	0.40	0	1
Occupation: 1 Blue-collar	19851	0.39	0.49	0	1	24550	0.33	0.47	0	1

Notes: The following are the variables listed in the above table: Survey of Health, Ageing and Retirement in Europe (SHARE) English Longitudinal Study of Aging (ELSA), and U.S. Health and Retirement Study (HRS).

Source: Authors' Computations

Appendix B Table b1 Early and full retirement ages across the OECD nations

Early and full retirement ages (full retirement ages in parentheses)

	2004		2006		2008		2010		2012	
Country	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
Austria	65 (65)	60 (60)	65 (65)	65 (65)	65 (65)	65 (65)	62(65)	60(65)	62(65)	62(65)
Belgium	60(65)	60 (65)	60(65)	60(65)	60(65)	60(65)	60(65)	60(65)	62(65)	62(65)
Czech Republic	60(65)	58 (63)	60(65)	58 (63)	60(65)	60(64)	60(65)	60(64)	64(69)	64(69)
Denmark	65 (65)	65 (65)	65 (65)	65 (65)	65 (65)	65 (65)	67(67)	67(67)	67(67)	67(67)
France	60 (60)	60(60)	60 (60)	60 (60)	61(61)	61(61)	56-60(65)	56-60(65)	60(67)	60(67)
Germany	63(65)	63(65)	63(65)	63(65)	63(67)	63(67)	63(67)	63(67)	63(67)	63(67)
Italy	60(65)	60(65)	60(65)	60(60)	60(65)	60(60)	61(65)	60(60)	62(67)	62(67)
Netherlands	60(65)	60(65)	60(65)	60(65)	60(65)	60(65)	65(65)	65(65)	67(67)	67(67)
Spain	60(65)	60(65)	60(65)	60(65)	60(65)	60(65)	61(65)	61(65)	65(67)	65(67)
Sweden	61(65)	61(65)	61(65)	61(65)	61(65)	61(65)	61(65)	61(65)	61(65)	61(65)
Switzerland	63(65)	62(64)	63(65)	62(64)	63(65)	62(64)	63(65)	62(64)	63(65)	62(64)
England	65(65)	65(65)	68(68)	68(68)	68(68)	68(68)	68(68)	68(68)	68(68)	68(68)
United States*	62(65+)	62(65+)	62(65+)	62(65+)	62(65+)	62(65+)	62(65+)	62(65+)	62(65+)	62(65+)

*Full retirement age depends on birth year

Sources: OECD *Pensions at a Glance* several years.

Appendix C Table c1 First stage results, pooled data

	Dependent Variables	*SR_Ret*	*NW1_Ret* First Stage	*NW2_Ret*
1. No Controls	*Above full retirement age*	0 .25***	0 .22***	0 .20***
		(0 .003)	(0 .003)	(0 .003)
	Above early retirement age	0.42***	0.38***	0.29***
		(0 .003)	(0 .003)	(0 .003)
2. Years, Cohorts, Gender	*Above full retirement age*	0.48***	0.04***	0.04***
		(0.004)	(0.004)	(0.004)
	Above early retirement age	0.14***	0.12***	0.08***
		(0.003)	(0.003)	(0.003)
3. 2 + Country Fixed Effects	*Above full retirement age*	0.031***	0.025***	0.022***
		(0.004)	(0.004)	(0.004)
	Above early retirement age	0.10***	0.10***	0.05***
		(0 .003)	(0 .003)	(0 .003)
4. 3 +Demographics	*Above full retirement age*	0.035***	0.025***	0.024***
		(0 .004)	(0 .004)	(0 .004)
	Above early retirement age	0.10***	0.10***	0.05***
		(0 .003)	(0 .003)	(0 .003)
5. 4+ Health Controls	*Above full retirement age*	0.05***	0.04***	0.08***
		(0 .004)	(0 .004)	(0 .19)
	Above early retirement age	0.12***	0.11***	0.03
		(0 .003)	(0 .003)	(0 .02)

Notes: The following are the variables listed in the above table: self-reports of current job status (SR_Ret), homemakers with those who say they are sick or disabled (NW1_Ret), and all those who are not working now (NW2_Ret).

Source: Authors' computations

Appendix C Table c2 First stage results by skill group, pooled data

	Dependent Variables	*SR_Ret*	*NW1_Ret*	*NW2_Ret*	*SR_Ret*	*NW1_Ret*	*NW2_Ret*
		First Stage: Unskilled workers			First Stage: Middle and Skilled workers		
1. No Controls	*Above full retirement age*	0 .22***	0 .19***	0 .18***	0 .30***	0 .27***	0 .23***
		(0 .00)	(0 .00)	(0 .00)	(0 .00)	(0 .00)	(0 .00)
	Above early retirement age	0.45***	0.39***	0.29***	0.34***	0.35***	0.25***
		(0 .00)	(0 .00)	(0 .00)	(0 .00)	(0 .00)	(0 .00)
2. Years, Cohorts, Gender	*Above full retirement age*	0.04***	0.04***	0.04***	0.03***	0.03***	0.02*
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Above early retirement age	0.16***	0.13***	0.08***	0.06***	0.07***	0.03***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
3. 2 + Country Fixed Effects	*Above full retirement age*	0.03***	0.03***	0.02***	0.03***	0.02**	0.02**
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Above early retirement age	0.12***	0.11***	0.06***	0.05***	0.07***	0.03***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
4. 3 +Demographics	*Above full retirement age*	0.03***	0.02***	0.02***	0.03***	0.01**	0.02*
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Above early retirement age	012***	011***	0.06***	0.06***	0.07***	0.03***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
5. 4+ Health Controls	*Above full retirement age*	0.04***	0.03***	0.03***	0.04***	0.03***	0.03***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
	Above early retirement age	0.13***	0.11***	0.06***	0.06***	0.08***	0.05***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Notes: The following are the variables listed in the above table: self-reports of current job status (SR_Ret), homemakers with those who say they are sick or disabled (NW1_Ret), and all those who are not working now (NW2_Ret).

Source: Authors' Computations

Appendix C Table c3. First stage results by physical demanding jobs groups, pooled data

	Dependent Variables	*SR_Ret*	*NW1_Ret*	*NW2_Ret*	*SR_Ret*	*NW1_Ret*	*NW2_Ret*
		Fisrt Stage: Physical demanding job			Fisrt Stage: More Intelectual job		
1. No Controls	*Above full retirement age*	0 .25***	0 .23***	0 .13***	0 .28***	0 .27***	0 .14***
		(0 .014)	(0 .01)	(0 .01)	(0 .007)	(0 .007)	(0 .006)
	Above early retirement age	0.24***	0.26***	0.14***	0.20***	0.25***	0.13***
		(0 .011)	(0 .01)	(0 .01)	(0 .005)	(0 .005)	(0 .005)
2. Years, Cohorts, Gender	*Above full retirement age*	0.024***	-0.03**	0.01	0.08***	0.05***	-0.01
		(0.017)	(0.02)	(0.02)	(0.008)	(0.006)	(0.08)
	Above early retirement age	0.07***	0.01	0.09***	0.03***	0.06***	-0.001
		(0.011)	(0.01)	(0.01)	(0.005)	(0.006)	(0.005)
3. 2 + Country Fixed Effects	*Above full retirement age*	0.01***	0.00	-0.03	0.06***	0.04***	-0.007
		(0.016)	(0.004)	(0.02)	(0.008)	(0.009)	(0.008)
	Above early retirement age	0.05***	0.07***	0.01	0.03***	0.06***	0.01
		(0 .013)	(0 .01)	(0 .01)	(0 .006)	(0 .007)	(0 .006)
4. 3 +Demographics	*Above full retirement age*	-0.006	0.014	0.05***	0.06***	0.04***	-0.009
		(0 .01)	(0 .02)	(0 .02)	(0 .009)	(0 .009)	(0 .008)
	Above early retirement age	0.06***	0.07***	0.01	0.03***	0.06***	0.01
		(0 .01)	(0 .014)	(0 .01)	(0 .006)	(0 .007)	(0 .006)
5. 4+ Health Controls	*Above full retirement age*	0.01***	-0.00	-0.03	0.07***	0.05***	0.002
		(0 .02)	(0 .02)	(0 .02)	(0 .009)	(0 .009)	(0 .008)
	Above early retirement age	0.06***	0.07***	0.02*	0.04***	0.07***	0.02***
		(0 .01)	(0 .01)	(0 .01)	(0 .006)	(0 .007)	(0 .006)

Notes: The following are the variables listed in the above table: self-reports of current job status (SR_Ret), homemakers with those who say they are sick or disabled (NW1_Ret), and all those who are not working now (NW2_Ret).

Source: Authors' Computations

Appendix C Table c4. First stage results by blue collar jobs and white collar jobs, pooled data

	Dependent Variables	*SR_Ret*	*NW1_Ret*	*NW2_Ret*	*SR_Ret*	*NW1_Ret*	*NW2_Ret*
		First Stage: Blue-collar jobs			First Stage: White-collar jobs		
1. No Controls	*Above full retirement age*	0 .27***	0 .26***	0 .13***	0 .27***	0 .26***	0 .14***
		(0 .01)	(0 .01)	(0 .009)	(0 .008)	(0 .008)	(0 .007)
	Above early retirement age	0.25***	0.28***	0.16***	0.18***	0.23***	0.11***
		(0 .008)	(0 .008)	(0 .007)	(0 .006)	(0 .006)	(0 .005)
2. Years, Cohorts, Gender	*Above full retirement age*	0.05***	0.03**	-0.04***	-0.26***	0.05***	-0.003
		(0.012)	(0.013)	(0.012)	(0.012)	(0.01)	(0.009)
	Above early retirement age	0.08***	0.10***	0.02***	0.002***	0.04***	-0.02***
		(0.008)	(0.008)	(0.008)	(0.000)	(0.007)	(0.006)
3. 2 + Country Fixed Effects	*Above full retirement age*	0.03***	0.02	-0.04***	0.06***	0.04***	0.001
		(0.012)	(0.013)	(0.012)	(0.01)	(0.01)	(0.009)
	Above early retirement age	0.06***	0.08***	0.03***	0.02***	0.05***	-0.02
		(0 .009)	(0 .01)	(0 .009)	(0 .007)	(0 .008)	(0 .007)
4. 3 +Demographics	*Above full retirement age*	0.016	0.009	-0.05***	0.06***	0.03***	-0.003
		(0 .01)	(0 .01)	(0 .012)	(0 .01)	(0 .01)	(0 .009)
	Above early retirement age	0.06***	0.08***	0.03***	0.02*	0.05***	-0.03
		(0 .009)	(0 .01)	(0 .009)	(0 .007)	(0 .008)	(0 .007)
5. 4+ Health Controls	*Above full retirement age*	0.02**	0.02	-0.03**	0.07***	0.05***	0.008
		(0 .013)	(0 .013)	(0 .012)	(0 .01)	(0 .01)	(0 .009)
	Above early retirement age	0.06***	0.09***	0.03***	0.03***	0.06***	0.005
		(0 .009)	(0 .01)	(0 .009)	(0 .008)	(0 .008)	(0 .007)

Notes: The following are the variables listed in the above table: self-reports of current job status (SR_Ret), homemakers with those who say they are sick or disabled (NW1_Ret), and all those who are not working now (NW2_Ret).

Source: Authors' Computations

Appendix D Table d1 Effect of retirement on cognition by survey

HRS	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-1.05***	-1.56***	-0.46***	-1.81***	-0.89***	-1.39***	-0.38***	-1.76***	-1.01***	-1.95***	-0.35***	-2.34***
	(0.04)	(0.06)	(0.06)	(0.16)	(0.04)	(0.06)	(0.05)	(0.13)	(0.04)	(0.08)	(0.04)	(0.17)
2. Years, Cohorts, Gender	-0.89***	-0.30	-0.12	0.20	-0.73***	-0.12	-0.08	-0.08	-0.98***	0.25	-0.13**	0.35
	(0.05)	(0.45)	(0.06)	(0.5)	(0.05)	(0.43)	(0.05)	(0.43)	(0.04)	(0.73)	(0.05)	(0.70)
3. 2 +Demographics	-0.65***	0.23	-0.12	0.19	-0.53***	0.48	-0.08	-0.09	-0.66***	1.18	-0.13**	0.35
	(0.05)	(0.45)	(0.06)	(0.49)	(0.04)	(0.42)	(0.05)	(0.43)	(0.04)	(0.76)	(0.05)	(0.70)
4. 3+ Health Controls	-0.37***	0.14	-0.10	0.18	-0.28***	0.29	-0.06	-0.08	-0.40***	0.77	-0.11*	0.29
	(0.05)	(0.43)	(0.06)	(0.49)	(0.04)	(0.40)	(0.05)	(0.43)	(0.04)	(0.67)	(0.05)	(0.69)
ELSA	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-0.74	-2.54***	0.03	-1.14*	-0.79***	-2.75***	0.04	-1.64***	-0.90***	-2.94***	0.0002	-1.43**
	(0.05)	(0.1)	(0.06)	(0.48)	(0.05)	-0,11	-0,05	-0,5	(0.05)	(0.12)	(0.05)	-0,46
2. Years, Cohorts, Gender	-0.83***	-5.68***	0.04	0.03	-0.98***	-6.19***	0,06	0.42	-1.13***	-8.77***	0,01	0,34
	(0.02)	(0.20)	(0.07)	(0.66)	(0.02)	(0.23)	-0,06	-0,71	(0.03)	(0.34)	(0.06)	-0,86
3. 2 +Demographics	0.07	-1.62*	0.07	-0.18	-0.19**	-1,8	0,08	0,16	-0.34***	-2.29*	0,03	0,11
	(0.07)	(0.76)	(0.07)	(0.70)	-0,06	-0,94	-0,06	-0,75	(0.06)	(1.14)	(0.06)	-0,9
4. 3+ Health Controls	0.15*	-1.97	0.06	-0.33	-0.28***	-2,49	0,06	-0,15	-0.41***	-3,24	0,05	-0,3
	(0.07)	(1.20)	(0.08)	(0.83)	(0.02)	-1,5	-0,07	-0,87	(0.02)	(1.85)	(0.07)	-1,1
SHARE	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-1.29***	-1.84***	0.38***	0.91***	-1.33***	-2.02***	0.32***	0.99***	-1.43***	-2.31**	0.13**	1.93***
	(0.03)	(0.04)	(0.05)	(0.12)	(0.03)	(0.04)	(0.04)	(0.13)	(0.03)	(0.04)	(0.04)	(0.22)
2. Years, Cohorts, Gender	-0.75***	-2.13***	-0.04	-0.189	-1.04***	-2.38***	-0.02	0.12	-1.15***	-2.49***	-0.07	0.39
	(0.04)	(0.19)	(0.05)	(0.38)	(0.03)	(0.25)	(0.05)	(0.43)	(0.03)	(0.26)	(0.05)	(0.89)
3. 2 + Country Fixed Effects	-0.52***	-0.84***			-0.75***	-0,57			-0.83***	-0.65		
	(0.04)	(0.24)			(0.03)	(0.30)			(0.03)	-0,37		

4. 3 +Demographics	-0.31***	-0.65**	-0.04	-0.19	-1.03***	-2.38***	-0.01	0.12	-1.15***	-2.49***	-0.07	0.39
	(0.04)	(0.24)	(0.05)	(0.38)	(0.03)	(0.25)	(0.05)	(0.43)	(0.03)	(0.26)	(0.04)	(0.88)
5. 4+ Health Controls	-0.21***	-0.66**	-0.04	-0.28	-0.75***	-0.56	-0.01	-0.03	-0.83***	-0.65	-0.06	0.09
	(0.04)	(0.23)	(0.056)	(0.40)	(0.03)	(0.30)	(0.05)	(0.45)	(0.03)	(0.37)	(0.04)	(0.89)

Notes: The following are the variables listed in the above table: self-reports of current job status (SR_Ret), homemakers with those who say they are sick or disabled (NW1_Ret), and all those who are not working now (NW2_Ret).

Source: Authors' Computations

Appendix E Table e1 Effect of retirement on cognition, pooled data by occupation

Blue-collar workers	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-0.27***	-1.46***	0.02	-0.003	-0.23***	-1.37***	0.03	-0.13	-0.20**	-2.40***	0.02	-0.16
	(0.06)	(0.12)	(0.06)	(0.11)	(0.06)	(0.11)	(0.05)	(0.11)	(0.06)	(0.20)	(0.05)	90.13)
2. Years, Cohorts, Gender	-0.35***	-2.51***	-0.04	0.06	-0.21***	-2.23***	0.03	-0.33	-0.35***	-5.48***	0.03	0.56
	(0.07)	(0.37)	(0.07)	(0.84)	(0.06)	(0.32)	(0.06)	(0.68)	(0.07)	(1.01)	(0.06)	(1.59)
3. 2 + Country Fixed Effects	-0.18*	0.034			-0.08	0.90			-0.27***	0.65		
	(0.07)	(0.38)			(0.06)	(0.32)			(0.07)	(0.74)		
4. 3 +Demographics	-0.16*	0.10	-0.003	-0.25	-0.08	0.25	0.06	-0.62	-0.17*	1.80	0.05	-0.07
	(0.07)	(1.28)	(0.07)	(0.89)	(0.07)	(0.89)	(0.06)	(0.70)	(0.07)	(1.91)	(0.06)	(1.54)
5. 4+ Health Controls	-0.10	-0.04	0.002	0.13	-0.04	0.06	0.04	-0.32	-0.09	1.59	0.06	-0.26
	(0.07)	(1.12)	(0.08)	(0.84)	(0.07)	(0.85)	(0.07)	(0.67)	(0.07)	(1.96)	(0.07)	(1.56)
White-collar workers	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-0.35***	-2.16***	0.03	-0.26*	-0.27***	-1.76***	-0.01	-0.37***	-0.28***	-3.42***	-0.12**	-0.49***
	(0.05)	(0.11)	(0.05)	(0.10)	(0.05)	(0.09)	(0.04)	(0.10)	(0.05)	(0.19)	(0.04)	(0.12)
2. Years. Cohorts. Gender	-0.48***	-3.45***	0.13*	0.96	-0.33**	-3.35***	0.09	0.85	-0.50***	-5.44***	-0.05	-1.37
	(0.06)	(0.21)	(0.06)	(1.79)	(0.05)	(0.19)	(0.05)	(1.05)	(0.06)	(0.39)	(0.05)	(4.81)
3. 2 + Country Fixed Effects	-0.15*	0.23			-0.09	1.02			-0.30***	-4.29		
	(0.06)	(1.19)			(0.05)	(0.98)			(0.06)	(0.48)		
4. 3 +Demographics	-0.16**	-0.25	0.10	0.75	-0.08	1.03	0.06	0.97	-0.32***	-12.51	-0.04	0.44
	(0.06)	(1.28)	(0.06)	(1.96)	(0.05)	(1.01)	(0.05)	(1.09)	(0.06)	(24.73)	(0.05)	(5.16)
5. 4+ Health Controls	-0.09	-0.76	0.10	-0.20	-0.02	0.06	0.07	0.29	-0.23***	-2.47	-0.04	21.33
	(0.06)	(1.02)	(0.06)	(1.35)	(0.05)	(0.90)	(0.05)	(0.91)	(0.06)	(7.75)	(0.05)	(56.33)

Notes: The following are the variables listed in the above table: self-reports of current job status (SR_Ret), homemakers with those who say they are sick or disabled (NW1_Ret), and all those who are not working now (NW2_Ret).

Source: Authors' computations

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Endnotes

[1] See Cattell (1941); Horn (1965); Horn and Cattell(1967); Carroll (1993) for details.

[2] We need to keep in mind possible measurement errors in using these variables and the context in which cognitive tests are conducted (Morris et al. 1999). These include re-testing effects: performance tends to improve when individuals repeat cognitive tests (Ferrer et al., 2004; Rabbitt et al. 2001; Schaie 1996; McArdle and Woodcock 1997).

[3] Leisure activities, lifestyle, and social networks are thought to affect cognitive functioning. The idea behind this is that engaging in activities that stimulate an individual's brain may maintain or repair cognitive functioning. Some evidence for the importance of social contacts at older ages can be found in Hertzog et al. (2008), Salthouse (2006), Scarmeas and Stern (2003), Fratiglioni et al. (2004), and Börsch-Supan and Schuth (2013) among others. Some studies relate

personality traits like patience and risk aversion to cognition (e.g., Frederik 2005; Benjamin et al. 2006; Dohmen et al. 2007; Midanik et al. 1995)

[4] More details about the data sets and variables can be found in Appendix A.

[5] See Appendix A for details

[6] Adam et al.(2007) exclude from the analysis the respondents that cannot recall any words.

[7] Adam et al. (2007) use five dummy variables to define the retirement status in order to capture the retirement duration. The category of working variables was their reference variable and the other variables were ranges as <5 years retired, [5-9], [10-15], more than 15 years retired and having never worker.

[8] Source: https://www.ssa.gov/planners/retire/ageincrease.html

[9] The thirteen countries are: Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden, Switzerland, US and UK.

[10] We also run the models separately for the three surveys HRS, ELSA, and SHARE. Results can be found in Appendix D. The OLS estimates confirm the same results through the different surveys. The IV and IV-FE results vary somewhat across surveys but generally retirement is only found to have a significant negative effect on cognition in the models without country fixed effects.

[11] The ages for the US refer to Social Security claiming ages rather than retirement ages; 62 is the earliest age at which one can claim Social Security. For comparison purposes we treat the US early claiming age and full retirement age similarly to the treatment of early and full retirement ages in the European countries.

[12] First stage estimates are presented in Appendix C and show that the instruments are positively related to the retirement variables. These estimates show that the instruments in general continue to be good predictors of retirement despite the multiple definitions of retirement and the alternative specifications. Their coefficients decrease when controls are introduced but they remain significant at 1% in almost all cases.

[13] The results for blue and white collar jobs show a similar pattern. We present the estimates in Appendix E. We also present the first stage estimates and the second state estimates for occupational definitions in Appendix C.

Table 1. Data set, samples, dependent and independent variables in the reviewed papers

Authors	Countries	Data Set	Year	Sample	Cognitive Abilities	Retirement	Explanatory Variables
Rohwedder, S. and R.J. Willis (2010)	United States, England, and 11 European countries	HRS, SHARE and ELSA	2004	Men and women together (60-64 years)	Memory test scores (recall summary score 20)	Retired(dummy)	Different age forms
Coe N. and G. Zamarro (2011)	Europe 11 countries	SHARE	2004	Men (50-69 years old)	1. Memory test scores (recall summary score 20) 2. Verbal fluency	Retired(dummy) (cond. Working age 50)	Demographic; SES ; health and country dummies
Coe et al. (2012)	US	HRS	1996-2008	1. Blue and white collars workers 2. 50-70 years old 3. Men and women together	1. Self-rated memory, 2. Immediate, delayed and total word recall, 3. Working memory and 4. Numeracy	Retirement duration (years in retirement)- continuous variable	Demographic; education. wave dummies.
Bonsang et al. (2012)	US	HRS	1998–2008	Men and women together (51-75 years old) working at 50	Memory test scores (recall summary score 20)	Retirement duration (non parametric specification) after one year of retirement	Different age forms

Mazzonna, F. and Peracchi, F. (2012)	Europe 11 countries	SHARE	2004-2006	1. 50-70 years old 2. Menand women separately	1. Immediate memory 2. Delay memory 3. Orientation in time 4. Verbal fluency 5. Numerancy	Retirement duration (years in retirement)- continuous variable	Demographic; SES; country, cohort and regional dummies
Mazzonna, F. and Peracchi, F. (2014)	Europe 10 countries	SHARE	2004-2006	Men and Women separately. Occupations: Physical demanding job	1. Memory test scores (recall summary score 20) 2. Verbal fluency 3. Numerancy 4. Cognitivity Index (PCA)	Retired (dummy) and retirement duration (years in retirement)- continuous variable	Demographic; SES ; health
Celidoni et al. (2013)	Europe	SHARE	2004-2010	Men and women separately and all together	Memory test scores (recall summary score 20)	Lag of retired dummy + retirement duration	Demographic; SES ; health
Bingley, P. and Martinello, A. (2013)	United States, England, and 11 European countries	HRS, SHARE and ELSA	2004	Men and women and all together	Memory test scores (recall summary score 20)	Retired(dummy)	Different age forms and years of schooling.

Bianchini, L. and M. Borella (2014)	Europe	SHARE	2004-2010	Men and women together. 50-70 working at age 50. Blue/white collars workers	Memory test scores (recall summary score 20)	Retired (dummy) and retirement duration	Demographic; SES; health; behaviour; learning and contextual factor

Table 2. Instrument and different instrumental approaches. Results.

Authors	Countries	Year	Dependent variable	Instruments	Empirical Strategy	Results		
Rohwedder, S. and R.J. Willis (2010)	United States, England, and 11 European countries	2004	Words recalled out of 20	Eligible age for early and for full pension benefits	IV	Ret. Dum.	-4.666***	
Coe N. and G. Zamarro (2011)	Europe 11 countries	2004	Words recalled out of 20	Eligible age for early and for full pension benefits	IV	Ret. Dum.	−.0390	
Coe et al. (2012)	US	1996-2008	Words recalled out of 20	The offering of an early retirement window	IV	Ret. Dur.	0.37845*** (Blue-Collars)	0.00521 (White-Collars)
Bonsang et al. (2012)	US	1998–2008	Words recalled out of 20	Eligible age for early and for full pension benefits	IV-FE	Ret. Dur.	-1.021***	
Mazzonna, F. and Peracchi, F. (2012)	Europe 11 countries	2004-2006	1. Imm. 2. Delay	Eligible age for early and for full pension benefits	IV	Ret. Dur. M.:-.025*** (im.) 0.009 (del.) W.: -.055*** (im.) -.029*** (del.)		
Mazzonna, F. and Peracchi, F. (2014)	Europe 10 countries	2004-2006	Cognitivity Index (PCA)	Eligible age for early and for full pension benefits	IV-FE	Ret. Dur. -.06*** M. -.069*** W.-.057***		
Celidoni et al. (2013)	Europe	2004-2010	Words recalled out of 20	Eligible age for early and for full pension benefits	IV-FE	Ret. Dur.	-.2***	

Bingley, P. and Martinello, A. (2013)	United States, England, and 11 European countries	2004	Words recalled out of 20	Eligible age for early and for full pension benefits. They valid it controlling for years of schooling	IV	Ret. Dum. - 3.014***	M. -5.485***	W. - 1.607**
Bianchini, L. and M. Borella (2014)	Europe	2004-2010	Words recalled out of 20	Eligible age for early and for full pension benefits	IV-FE	Ret. Dur.	0.3919***	

Notes: In the column results we find the effect of retirement dummy (Ret. Dum.) or of retirement duration (Ret. Dur.) on cognition on words recalled on a scale of 0 to 20. Some estimates are the effect of retirement on immediate (im.) or delay (del.) memory scores. The estimates can also be differentiated by gender M. is Men and W. is Women.

Table 3 Effects of retirement on cognition for all countries

	SR_Ret				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-1.19***	-2.18***	0.05	-0.23*	-1.18***	-2.28***	0.02	-0.34***	-1.27***	-2.74***	-0.08**	-0.41**
	(0.02)	(0.02)	(0.03)	(0.09)	(0.02)	(0.03)	(0.02)	(0.09)	(0.02)	(0.03)	(0.02)	(0.13)
2. Years, Cohorts, Gender	-0.83***	-5.68***	0.006	-0.78	-0.97***	-6.19***	-0.007	-0.78	-1.12***	-8.77***	-0.09***	-1.19
	(0.02)	(0.20)	(0.03)	(0.52)	(0.02)	(0.23)	(0.03)	(0.46)	(0.02)	(0.39)	(0.02)	(1.02)
3. 2 + Country Fixed Effects	-0.60***	-0.70**	0.006	-0.78	-0.69***	-0.61*	-0.007	-0.09***	-0.88***	-0.70	-0.78	-1.19
	(0.02)	(0.26)	(0.03)	(0.52)	(0.02)	(0.26)	(0.03)	(0.02)	(0.02)	(0.44)	(0.46)	(1.02)
4. 3+ Demographics	-0.44***	-0.70**	0.007	-0.80	-0.46***	-0.48	-0.005	-0.77	-0.61***	-0.61	-0.09**	-1.09
	(0.02)	(0.25)	(0.03)	(0.52)	(0.02)	(0.26)	(0.03)	(0.46)	(0.02)	(0.42)	(0.03)	(0.99)
5. 4+ Health Controls	-0.28***	-0.75**	0.007	-0.65	-0.28***	-0.57*	-0.008	-0.08**	-0.41***	-0.81*	-0.65	-0.90
	(0.02)	(0.23)	(0.03)	(0.47)	(0.02)	(0.24)	(0.03)	(0.02)	(0.02)	(0.36)	(0.43)	(0.86)

Notes: Ordinary Least Squares (OLS); Instrumental Variable Methods (IV); Fixed Effects (FE); Instrumental Variable Fixed Effect Methods (IV-FE). Retirement definitions: SR_Ret is based on self-reports of current job status; NW1_Ret includes homemakers along with those who say they are sick or disabled into the set of retirees, but conditions on working at the age of 50; NW2_Ret defines as retired all those are not working now.

Source: Authors' Computations

Table 4. Effect of retirement on cognition for all countries by gender

Men	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-1.28***	-2.18***	0.03	0.04	-1.21***	-2.09***	-0.001	-0.19	-1.34***	-2.58***	-0.10**	-0.19
	(0.03)	(0.04)	(0.04)	(0.13)	(0.03)	(0.04)	(0.04)	(0.13)	(0.03)	(0.05)	(0.04)	(0.18)
2. Years, Cohorts, Gender	-0.89***	-4.86***	-0.04	0.24	-0.89***	-4.76***	-0.04	-0.20	-1.07***	-6.87***	-0.13**	-0.17
	(0.04)	(0.25)	(0.05)	(0.65)	(0.04)	(0.26)	(0.05)	(0.59)	(0.03)	(0.42)	(0.04)	(1.12)
3. 2 + Country Fixed Effects	-0.65***	0.05			-0.69***	0.11			-0.92***	0.49		
	(0.04)	(0.33)			(0.04)	(0.32)			(0.03)	(0.48)		
4. 3 +Demographics	-0.48***	0.01	-0.01	0.28	-0.49***	0.11	-0.03	-0.15	-0.66***	0.38	-0.10*	-0.05
	0.04	(0.32)	(0.05)	(0.64)	(0.04)	(0.32)	(0.05)	(0.59)	(0.03)	(0.46)	(0.04)	(1.09)
5. 4+ Health Controls	-0.32***	0.04	-0.02	0.34	-0.28***	0.10	-0.01	-0.08	-0.43***	0.29	-0.09*	0.17
	0.04	(0.31)	(0.05)	(0.59)	(0.04)	(0.31)	(0.05)	(0.55)	(0.03)	(0.43)	(0.04)	(1.01)
Women	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-1.16***	-2.18***	0.08	-0.51***	-1.29***	-2.44***	0.05	-0.49***	-1.40***	-2.89***	-0.06	-0.61**
	(0.03)	(0.04)	(0.04)	(0.15)	(0.03)	(0.05)	(0.04)	(0.14)	(0.03)	(0.05)	(0.04)	(0.19)
2. Years, Cohorts, Gender	-0.77***	-6.60***	0.05	-2.13*	-1.04***	-7.79***	0.01	-1.46*	-1.17***	-10.02***	-0.07*	-3.05
	(0.04)	(0.35)	(0.05)	(0.83)	(0.04)	(0.41)	(0.04)	(0.71)	(0.03)	(0.65)	(0.04)	(1.88)
3. 2 + Country Fixed Effects	-0.56***	-1.62***			-0.66***	-1.52**			-0.85***	-2.51**		
	(0.04)	(0.44)			(0.03)	(0.47)			(0.03)	(0.88)		
4. 3 +Demographics	-0.4***	-1.57***	0.04	-2.24**	-0.42***	-1.27**	0.01	-1.54*	-0.57***	-2.13**	-0.08*	-2.89
	(0.04)	(0.41)	(0.05)	(0.84)	(0.03)	(0.45)	(0.04)	(0.72)	(0.03)	(0.79)	(0.04)	(1.81)
5. 4+ Health Controls	-0.25***	-1.58***	0.03	-1.83*	-0.26***	-1.39***	-0.005	-1.29	-0.38***	-2.17***	-0.08	-2.38
	(0.04)	(0.37)	(0.05)	(0.73)	(0.03)	(0.42)	(0.04)	(0.66)	(0.03)	(0.64)	(0.04)	(1.44)

Notes: Ordinary Least Squares (OLS); Instrumental Variable Methods (IV); Fixed Effects (FE); Instrumental Variable Fixed Effect Methods (IV-FE). Retirement definitions: SR_Ret is based on self-reports of current job status; NW1_Ret includes homemakers along with those who say they are sick or disabled into the set of retirees, but conditions on working at the age of 50; NW2_Ret defines as retired all those are not working now.

Source: Authors' Computations

Table 5. Effect of retirement on cognition for all countries by skill education

Middle and Low-skilled workers	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-1.07***	-1.91***	0.07	0.05	-1.05***	-2.07***	0.06	-0.04	-1.09***	-2.45***	-0.05	-0.01
	(0.03)	(0.04)	(0.04)	(0.13)	(0.03)	(0.04)	(0.04)	(0.13)	(0.03)	(0.05)	(.0.03)	(0.18)
2. Years, Cohorts, Gender	-0.73***	-2.5***	0.03	-0.09	-0.86***	-2.64***	-0.01	-0.03	-0.95***	-3.01***	-0.03	-0.26
	(0.03)	(0.60)	(0.05)	(0.51)	(0.03)	(0.13)	(0.04)	(0.49)	(0.03)	(0.15)	(0.49)	(1.13)
3. 2 + Country Fixed Effects	-0.52***	-0.62*			-0.61***	-0.39			-0.73***	-0.45		
	(0.03)	(0.28)			(0.03)	(0.30)			(0.03)	(0.51)		
4. 3 +Demographics	-0.04	-0.21	-0.04	-0.21	-0.01	-0.16	-0.01	-0.16	-0.09**	-0.43	-0.09**	-0.43
	(0.05)	(0.53)	(0.05)	(0.53)	(0.04)	(0.50)	(0.04)	(0.50)	(0.04)	(1.13)	(0.03)	(1.13)
5. 4+ Health Controls	-0.04	-0.16	-0.04	-0.16	-0.35***	0.08	-0.35***	0.08	-0.56***	0.37	-0.56***	0.37
	(0.05)	(0.49)	(0.05)	(0.49)	(0.04)	(0.62)	(0.04)	(0.62)	(0.04)	(1.14)	(0.04)	(1.14)
Higher-skilled workers	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-0.70***	-1.54***	0.04	-0.66***	-0.60***	-1.51***	-0.02	-0.74***	-0.68***	-1.92***	-0.11*	-0.95***
	(0.04)	(0.05)	(0.05)	(0.16)	(0.03)	(0.05)	(0.04)	(0.15)	(0.04)	(0.07)	(0.04)	(0.19)
2. Years, Cohorts, Gender	-0.39***	-1.55***	0.08	-2.27	-0.36***	-1.69***	0.03	-1.6	-0.55***	-2.09***	-0.07	-2.19
	(0.05)	(0.16)	(0.05)	(1.56)	(0.04)	(0.17)	(0.05)	(1.05)	(0.04)	(0.24)	(0.05)	(2.30)
3. 2 + Country Fixed Effects	-0.39***	-0.03			-0.35***	0.08			-0.56***	0.37		
	(0.05)	(0.75)			(0.04)	(0.62)			(0.04)	(1.14)		
4. 3 +Demographics	-0.39***	-0.06	0.07	-2.27	-0.35***	0.03	0.01	-1.63	-0.55***	0.24	-0.08	-2.02
	(0.05)	(0.75)	(0.05)	(1.57)	(0.04)	(0.61)	(0.05)	(1.05)	(0.04)	(1.11)	(0.05)	(2.21)
5. 4+ Health Controls	-0.26***	-0.34	0.07	-2.04	-0.19***	-0.24	0.01	-1.7	-0.39***	-0.34	-0.06	-2.19
	(0.05)	(0.64)	(0.06)	(1.32)	(0.04)	(0.56)	(0.05)	(0.97)	(0.04)	(0.88)	(0.05)	(1.93)

Notes: Ordinary Least Squares (OLS); Instrumental Variable Methods (IV); Fixed Effects (FE); Instrumental Variable Fixed Effect Methods (IV-FE). Retirement definitions: SR_Ret is based on self-reports of current job status; NW1_Ret includes homemakers along with those who say they are sick or disabled into the set of retirees, but conditions on working at the age of 50; NW2_Ret defines as retired all those are not working now.

Source: Authors' Computations

Table 6. Effect of retirement on cognition for all countries by physically demanding job

Physically Demanding Job	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-0.33***	-1.81***	-0.19*	-0.32	-0.24**	-1.61***	-0.18*	-0.44**	-0.30***	-2.84***	-0.15*	-0.55**
	(0.09)	(0.18)	(0.08)	(0.17)	(0.08)	(0.16)	(0.07)	(0.16)	(0.08)	(0.29)	(0.07)	(0.19)
2. Years, Cohorts, Gender	-0.47***	-2.86***	-0.18	0.13	-0.31***	-2.81***	-0.13	-0.37	-0.48***	-4.77***	-0.09	1.28
	(0.10)	(0.35)	(0.10)	(1.30)	(0.57)	(0.34)	(0.09)	(1.14)	(0.10)	(0.25)	(0.09)	(2.92)
3. 2 + Country Fixed Effects	-0.17	2.28			-0.07	1.87			-0.34***	3.61		
	(0.11)	(1.93)			(0.09)	(1.50)			(0.10)	(4.32)		
4. 3 +Demographics	-0.14	2.69	0.13	-0.19	-0.05	-0.23*	-0.37	-0.13	2.11	3.21	1.28	-0.09
	(0.11)	(2.17)	(1.30)	(0.10)	(0.09)	(0.10)	(1.14)	(0.09)	(1.59)	(3.16)	(2.92)	(0.09)
5. 4+ Health Controls	-0.03	1.39	-0.17	-0.35	0.05	-0.10	-0.11	-0.75	1.04	4.95	-0.05	-0.07
	(0.11)	(1.79)	(0.11)	(1.33)	(0.09)	(0.10)	(0.10)	(1.14)	(1.43)	(4.10)	(0.09)	(2.46)
Not Physical Demanding job	*SR_Ret*				*NW1_Ret*				*NW2_Ret*			
	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE	OLS	IV	FE	IV-FE
1. No Controls	-0.37***	-1.87***	0.10*	-0.08	-0.29***	-1.61***	0.07*	-0.20*	-0.25***	-3.01***	-0.02	-0.26**
	(0.04)	(0.09)	(0.04)	(0.08)	(0.04)	(0.08)	(0.03)	(0.08)	(0.05)	(0.16)	(0.04)	(0.10)
2. Years. Cohorts. Gender	-0.56***	-3.33	0.14**	0.35	-0.42***	-3.28***	0.12**	0.29	-0.47***	-5.52***	0.02	2.23
	(0.05)	(0.18)	(0.05)	(1.05)	(0.23)	(0 .17)	(0.04)	(0.69)	(0.07)	(0.34)	(0.04)	(2.94)
3. 2 + Country Fixed Effects	-0.20***	-0.39			-0.15**	0.12			-0.36***	7.07		
	(0.05)	(0.90)			(0.05)	(0.71)			(0.05)	6.27		
4. 3 +Demographics	-0.19***	-0.51	0.13*	0.45	-0.12**	0.33	0.12**	0.32	-0.28***	(9.11)	0.03	2.36
	(0.05)	(0.93)	(0.05)	(1.12)	(0.04)	(0.71)	(0.04)	(0.70)	(0.05)	6.65	(0.04)	(2.85)
5. 4+ Health Controls	-0.14**	-0.75	0.12*	0.32	-0.07	-0.10	0.11*	0.22	-0.21***	3.05	0.02	3.70
	(0.05)	(0.78)	(0.05)	(0.90)	(0.04)	(0.66)	(0.04)	(0.62)	(0.05)	(3.18)	(0.05)	(3.49)

Notes: Ordinary Least Squares (OLS); Instrumental Variable Methods (IV); Fixed Effects (FE); Instrumental Variable Fixed Effect Methods (IV-FE). Retirement definitions: SR_Ret is based on self-reports of current job status; NW1_Ret includes homemakers along with those who say they are sick or disabled into the set of retirees, but conditions on working at the age of 50; NW2_Ret defines as retired all those are not working now.
Source: Authors' Computations.

FIGURES

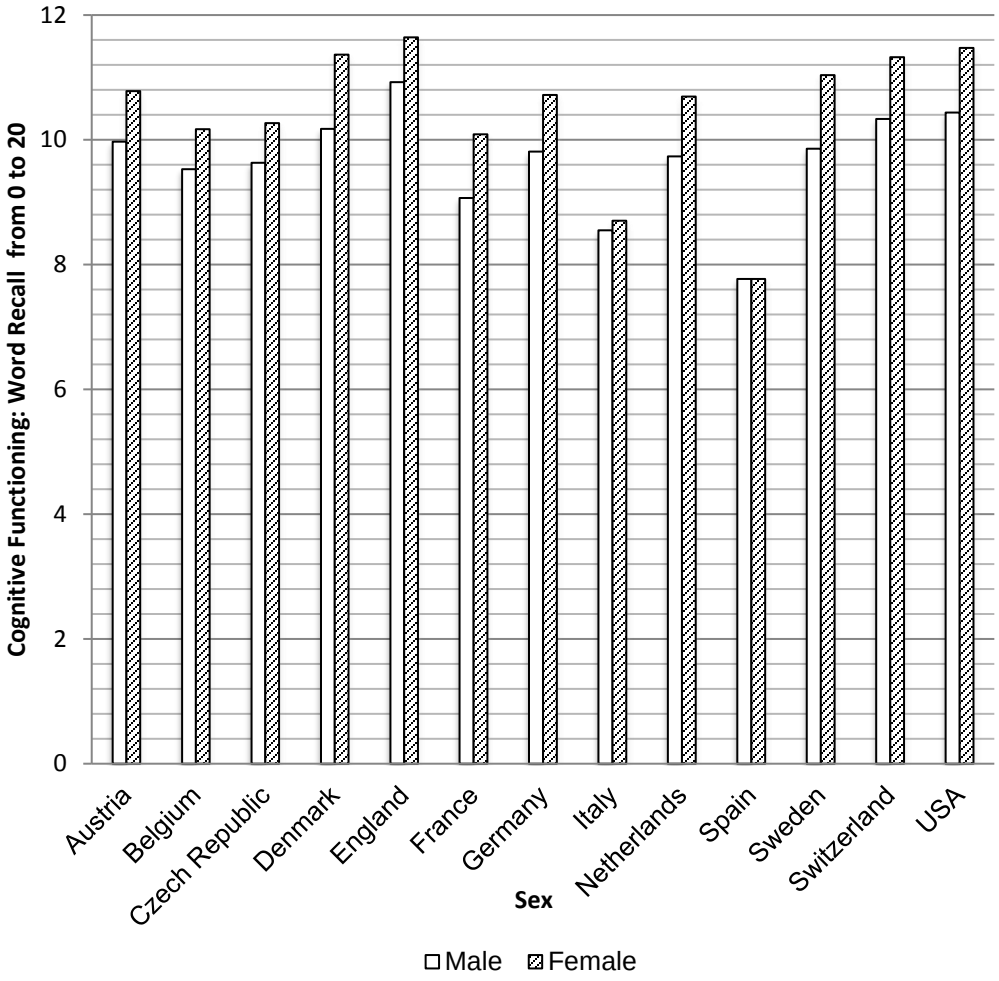

Figure 1 Cognitive functioning (word recall from 0 to 20) and Gender Differences

Source: Authors' computations. Weighted pooled data: HRS, ELSA, and SHARE