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Danilo Cavapozzi
Chiara Dal Bianco

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Keywords
Retirement intentions, work disability, population ageing

JEL Codes
J21, J14, I15

Address for correspondence:
Danilo Cavapozzi
Department of Economics
Ca' Foscari University of Venice
Cannaregio 873, Fondamenta S.Giobbe
30121 Venezia - Italy
e-mail: danilo.cavapozzi@unive.it
chiara.dalbianco@unipd.it

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Department of Economics
Ca' Foscari University of Venice
Cannaregio 873, Fondamenta San Giobbe
30121 Venice Italy
Fax: ++39 041 2349210

The effect of work disability on the intention to retire of older workers[1]

Danilo Cavapozzi

Ca' Foscari University of Venice, NETSPAR

Chiara Dal Bianco

University of Padua

Abstract

In this paper, we analyze the effect of work disability on the desire to retire as soon as possible of older workers. We exploit objective health indicators and anchoring vignettes to develop work disability measures enhancing the comparability across individuals of work disability self-assessments. Our results show that, even once controlling for individual fixed-effects, individuals experiencing work limiting health problems are found to have a stronger propensity to retire. The role of work disability in determining retirement intentions varies with earnings and job characteristics.

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1. Introduction

The changes in the demographic structure of the population have triggered a long season of reforms in many developed countries to guarantee the sustainability of pension systems. The main results of these reforms have been the lengthening of working life due to the progressive increase in the statutory retirement age and the penalization or removal of early retirement pathways (Gruber and Wise, 1999).

The full economic inclusion of older workers does not only depend on the extension of their working careers but also on their labor market attachment. Older individuals who are formally at work but experience a high disutility of work and would like to retire as soon as possible might be less productive and less likely to successfully employ the human capital built up along their working career.

A clear threat to the labor market attachment of older workers is the onset of work limiting health problems. It has been widely recognized in the literature that negative health shocks reduce the propensity to keep on working, and this is particularly true at older ages as the likelihood of a health drop increases with age (Currie and Madrian, 1999, and O'Donnell et al., 2015). The onset of work disability problems can increase the willingness to retire by multiple channels, such as an increase in the value of current and future leisure and a reduction in the time horizon, which increases the annualized consumption available from current wealth (Disney et al., 2006). Moreover, everything else constant, individuals experiencing poor health might be less prone to undertake human capital investments to improve their skills and make them aligned with the technological and organizational change undergoing in their workplace (Lumsdaine and Mitchell, 1999). As a result, human capital of older workers in poorer health is more at risk of becoming obsolete and this is expected to lower workers' future earnings. Finally, even if hourly wage remains constant, poorer health might limit the number of hours spent at work producing a reduction in annual labor earnings. Overall, older workers experiencing work limiting health problems, albeit formally at work, might experience a reduction in the monetary and non-monetary rewards provided by their job and an increase in the disutility associated with their time spent in the labor market. Work disability proposes as a severe threat to the actual economic inclusion of older workers that impedes to exploit their working potential in the last part of their career. Quantifying the effect of health impairments on the labor market attachment of older workers remains an empirical issue.

In this paper, we analyze the effect of work disability on the retirement intentions of older workers in Europe by estimating fixed-effects linear probability models. We use data for working individuals age 50-65 from the first two waves of the Survey of Health, Ageing and Retirement in Europe (SHARE). SHARE is a longitudinal and multidisciplinary survey collecting information on health and economic conditions of the population aged 50 and over in Europe.

SHARE is a valuable dataset for our empirical exercise for at least two key reasons. The first is that the SHARE questionnaire asks respondents at work whether they would like to retire as early as they can from their job. Respondents' retirement intentions have been shown to be a good predictor of actual retirement. Moreover, they are negatively correlated with self-reported satisfaction with current job and positively correlated with poor psychosocial quality of work (Siegrist et al., 2006). Our paper uses individuals' intention to retire as a measure of their labor market attachment. Everything else constant, respondents who declare the desire to retire as soon as possible are expected to experience a higher disutility of work and fail to meet the opportunities that allow them to fully exploit their skills at the workplace.

Moreover, the SHARE questionnaire explicitly asks respondents to self-assess the presence of health problems or impairments limiting the amount or kind of work they can do. The results in the extensive literature investigating the effect of health on retirement behaviors have been proved sensitive to the measure of health used (French and Jones, 2017). Nevertheless, work disability self-assessments are widely used in economic analyses since they have the key advantage of summarizing in a single measure all the aspects individuals consider relevant to determine their health. However, there are several concerns challenging the interpretation of health self-assessments differentials as genuine differences in health status. First, work disability is an inherently multidimensional concept and different individuals might have different beliefs about the health dimensions to consider when assessing their own work disability and how to aggregate them to provide an overall evaluation. Second, health self-assessments are affected by individual heterogeneity in reporting styles (see for instance, Angelini et al., 2011 and 2012, Lindeboom and van Doorslaer, 2004, Kapteyn et al., 2007). Individuals might provide diverse evaluations of the same underlying health level because they base their reporting behavior on different benchmarks due to, for instance, heterogeneity in their age, socioeconomic condition or in the prevailing norms in their reference group.

We exploit SHARE data to adjust work disability self-evaluations and enhance their cross-individual comparability. Following Bound et al. (1999), we base the work disability measures of all the individuals in our sample on an extensive set of more objective health indicators less sensitive to ex-post rationalization concerns. Further, we implement an anchoring vignette methodology (see King et al., 2004 and Kapteyn et al., 2007) to control for the presence of heterogeneity in reporting styles across individuals and formally allow individuals with different fixed and time-varying characteristics to have different response behaviors in self-evaluations. The implementation of the vignette methodology is an extension of the original approach introduced by Bound et al. (1999), who assume reporting behavior to be uncorrelated with the health determinants. We use vignette information to relax this assumption. To the best of our knowledge, this is the first paper that uses objective health indicators and vignette information to produce work disability measures enhancing cross-individual comparability in a retirement intention analysis.

Despite the effect of health on retirement decisions has received a huge attention in the economic literature, the research on the effect of health on retirement intentions is more limited. A notable exception is McGarry (2004), who uses the first two waves of the US Health and Retirement Study to assess the effect of self-assessed health on individuals' subjective probability of working after age 62. Our contribution departs from McGarry (2004) for at least two reasons. The first is that retirement intentions in McGarry (2004) are elicited from a question formally asking respondents to abstract from their current job and provide a subjective assessment of their probability of keeping on working after they will pass the age eligibility requirement for early retirement benefits. Instead, our paper elicits retirement intentions by a question asking respondents to focus on their current job and declare whether they would like to retire as soon as possible. Answers to this question are more likely to reflect current beliefs about employment. The significant association between our measure of retirement intentions and the perceived job quality documented in Dal Bianco et al. (2015) supports this interpretation. Moreover, McGarry (2004) shows that the effect of self-assessed health on retirement intention remains statistically significant even when the specifications control for an additional set of more objective health indicators. Although this result witnesses the important role played by health self-evaluations in determining retirement intentions, it is not immediate to draw any conclusion about the overall size of the health effect on retirement intentions. Our work follows and extends the approach by Bound et al. (1999), which is designed to summarize the information provided by a battery of objective health indicators in a single measure of work disability and overcome the limitations of self-assessments discussed above.

We find that an increase in the work disability level from the first to the third quartile of its empirical distribution is associated with a 4 percentage point increase in the probability of desiring to retire as soon as possible. This effect is sizeable as it accounts for 10% of the retirement intention probability in the sample. The effect is heterogeneous with respect to earnings level and type of job: the increase in the propensity to retire associated with the onset of work disability conditions is lower for individuals with a higher economic reward of their skills (i.e. higher earnings), on the contrary, it is higher for blue-collar workers.

The paper proceeds as follows. In section 2, we present the econometric specifications used to derive our measures of work disability and assess how it affects the probability of desiring to retire as soon as possible. Section 3 presents the data used in our main analysis. Sections 4 summarizes the main findings of our analysis. Section 5 concludes.

2. Econometric specifications

2.1 A model of work disability measurement

The utilization of individual self-assessments of work disability as measure of their actual work disability can be criticized by the fact that different individuals might consider different sets of health dimensions when asked to self-rate their own work disability. Moreover, individuals might have different beliefs about how to weight the dimensions considered when providing the overall self-assessment. Individual heterogeneity in the dimensions considered and in the criteria followed to aggregate them in an overall evaluation questions the comparability of health self-assessments across individuals. We follow Bound et al. (1999) to develop an alternative measure of work disability measure overcoming these limitations.

We assume that the unobserved true level of work disability of a generic individual i=1,…,N at a given time period t=1,…,T is

$$wd_{it}^{*} = Z_{it}'\gamma_1 + X_{it}'\gamma_2 + \varepsilon_{it} \qquad (1)$$

where Z_{it}' is a vector including objective health indicators, X_{it}' is a vector including individual socioeconomic characteristics and ε_{it} is a random component.

Let swd_{it}^{*} be a continuous latent variable indicating how the generic individual *i* self-perceives her own work disability at time *t* and assume that $swd_{it}^{*} = wd_{it}^{*} + u_{it}$ or equivalently that

$$swd_{it}^{*} = Z_{it}'\gamma_1 + X_{it}'\gamma_2 + \varepsilon_{it} + u_{it} \qquad (2)$$

where u_{it} is an idiosyncratic error component.

The observed work disability self-assessments of an individual *i* at time *t*, denoted by swd_{it}, is the discrete counterpart of swd_{it}^{*}. The variable swd_{it} is defined as a discrete ordered outcome taking on value *j*=1,...,*J*. More precisely, swd_{it}^{*} maps the observed self-reported health status swd_{it} as follows

$$swd_{it} = j \text{ if } \alpha_{j-1} < swd_{it}^{*} \leq \alpha_j \qquad (3)$$

where $-\infty = \alpha_0 < \alpha_1 < \cdots < \alpha_J = \infty$.

If $\varepsilon_{it} + u_{it}$ follows a standard normal distribution, we can obtain valid estimates for γ_1 and γ_2 by running a standard ordered probit regression of swd_{it} on Z_{it} and X_{it}. The linear prediction produced by this regression is a measure of work disability based on individuals' achievements with respect to a battery of dimensions (Z_{it} and X_{it}) aggregated according to the $\gamma_1$and γ_2 vector of coefficients.

This approach develops a measure of work disability characterized by an improved cross-individual comparability as compared with raw self-assessments. The so-generated measure is based on a set of dimensions invariant across individuals, which are the covariates in the ordered probit regressions, and aggregates them according to the same weighting scheme, which is described by the coefficients $\gamma_1$and γ_2. The linear prediction of the ordered probit regressions is the first work disability measure we consider in our analysis.

To account for the fact that the coefficients $\gamma_1$and γ_2 are not observed a priori but estimated based on a sample, we produce a set of *M* imputations for the linear prediction of the ordered probit regression models. Following Little and Rubin (1987), we estimate the ordered probit regression model by maximum likelihood to obtain the estimated vector of coefficients $\hat{\gamma}_1$and

$\hat{\gamma}_2$ and their estimated variance and covariance matrix $\hat{\Sigma}$. Then, we repeat M times the following procedure. First, we draw a set of coefficients γ_1^m and $\gamma_2^m, m = 1 \ldots, M$, from a multivariate normal distribution having $\hat{\gamma}_1$and $\hat{\gamma}_2$ as mean vector and the matrix $\hat{\Sigma}$ as variance and covariance matrix. Second, we impute our work disability measure by taking $Z_{it}'\gamma_1^m + X_{it}'\gamma_2^m$. The traditional approach by Bound et al. (1999) previously described assumes that the cut-off points (thresholds) α_j, j=0…,J, according to which respondents rate their work disability levels, are invariant in the population. This statistical assumption is particularly important as it neglects the presence of heterogeneity in the reporting styles in individuals' self-assessments. Let us consider two individuals who share identical work disability levels but have different beliefs about the severity of the health problems that can actually limit the amount of work they can do. These two individuals might provide different answers to the work disability self-evaluation question due to individual heterogeneity in the cut-off points applied to map their perceived work disability swd^* in the discrete ordered outcome swd. Reporting behavior in work-disability self-assessments has been shown to vary with country of residence, health and socioeconomic characteristics (see for instance Angelini et al., 2011 and 2012 and Kapteyn et al., 2007). Self-assessments are then exposed to the risk of reflecting both genuine variability in health levels as well as variability in the reporting styles individuals use to rate the extent of their work limiting health problems.

As long as heterogeneity in reporting styles is systematically related with the individual health indicators and socioeconomic characteristics Z_{it} and X_{it}, the work disability measures based on the standard ordered probit regressions previously specified might be misleading as these econometric specifications impose the assumption of invariant thresholds α_j, j=1…,J, across individuals, which is actually violated by the data. The coefficients on the Z_{it} and X_{it} variables in the ordered probit equation capture a combination of true work disability differentials and the correlation of these variables with individual reporting behavior. A suitable measure of work disability based on a given set of covariates Z_{it} and X_{it} should reflect only the correlation of these variables with the true level of work disability and get rid of their correlation with the criteria used by individuals in providing self-assessments.

This limitation can be overcome within the approach proposed by Bound et al. (1999) by replacing the standard ordered probit model with the Hopit model, which is a generalized ordered probit specification that formally relaxes the assumption of cut-off points invariant in the population.

The equation (2) is replaced with

$$swd_{it}^{*} = Z_{it}'\tilde{\gamma}_1 + X_{it}'\tilde{\gamma}_2 + \varepsilon_{it} + \tilde{u}_{it} \qquad (4)$$

where $\tilde{u}_{it}$ is an idiosyncratic error component, such that $\varepsilon_{it} + \tilde{u}_{it}$ follows a standard normal distribution. The latent variable swd_{it}^{*} is mapped into the discrete observed outcome swd_{it} by individual-specific cut-off points,

$$swd_{it} = j \text{ if } \tilde{\alpha}_{ij-1} < swd_{it}^{*} \leq \tilde{\alpha}_{ij} \qquad (5)$$

where $\tilde{\alpha}_{i0} = -\infty, \tilde{\alpha}_{iJ} = \infty, \tilde{\alpha}_{i1} = Z_{it}'\delta_1^1 + X_{it}'\delta_2^1,$ $\tilde{\alpha}_{ij} = \tilde{\alpha}_{ij-1} + \exp(Z_{it}'\delta_1^j + X_{it}'\delta_2^j),$ j=2,…,J-1. In the Hopit model the thresholds are allowed to correlate with the health and socioeconomic characteristics Z_{it} and X_{it}.

The estimation of the Hopit model requires the availability of anchoring vignettes, which are a survey instrument consisting of asking respondents to rate the work disability of hypothetical persons briefly described in vignettes kept constant across respondents. Heterogeneity in respondents' evaluations of vignettes reflects heterogeneity in their reporting behavior in assessing work disability problems since the vignette contents are by construction invariant. Work disability self-assessments and vignette evaluations provide the information required to separately identify the correlation of the vectors of covariates Z_{it} and X_{it} with the perceived work disability swd^*_{it} as well as the reporting styles described by the cut-off points $\tilde{\alpha}_{ij}$, j=0,…,J. The Hopit model is estimated by maximum likelihood.

The linear prediction for swd^*_{it} produced by the Hopit specification is the second work disability measure used in our analysis. Following the same procedure described before, we produce a set of M imputations of this second work disability measure. Further details about the Hopit specification are reported in the Appendix.

2.2 Modelling how the intention to retire varies with work disability

We define the retirement intention of a generic individual i=1,…,N at time t=1,…T as a binary outcome itr_{it} taking on value 1 if she would like to retire as soon as possible and 0 otherwise. We specify the following linear probability model

$$itr_{it} = \beta_0 + \beta_1 \widehat{wd}_{it} + \beta_2 W_{it} + c_i + e_{it} \qquad (6)$$

where $\widehat{wd}_{it}$ is the multiply-imputed measure of work disability obtained by alternatively standard ordered probit or Hopit regressions and W_{it} is a vector of control variables including time-invariant and time-varying individual characteristics. The error term in the equation is decomposed in a time invariant component c_i and a time varying component e_{it}.

We are interested in β_1, the coefficient measuring how retirement intentions vary with work disability. Ordinary Least Squares (OLS) estimates of β_1 yield unbiased results only if the orthogonality condition between the explanatory variables and the error term is satisfied. This assumption might be quite restrictive as it rules out that retirement intentions and work disability might be jointly determined by unobserved common factors. Estimating equation (6) using fixed-effects methods for panel data allows to relax this orthogonality condition. The fixed-effects estimation allows the time-invariant unobserved heterogeneity c_i to be arbitrarily correlated with the explanatory variables in the model. The economic theory offers several examples of individual-specific and time invariant characteristics included in the c_i component. For instance, permanent income might influence work disability through health investments, but it might also affect retirement intentions via wealth accumulation, since higher levels of financial and real wealth can be used to anticipate the labor market exit and finance consumption during retirement years. In addition, higher discount time rates of future periods might make retirement options more attractive because agents assign a higher value to leisure but also affect how individuals evaluate the opportunity cost of health investments.

Moreover, a potential source of endogeneity in equation (6) is the measurement error in the work disability measure. An error-ridden work disability measure may create endogeneity concerns affecting the explanatory variables in equation (6) by at least two channels. First, the literature devotes great attention to the justification bias, according to which respondents strategically use work disability reporting as a way to rationalize their retirement intentions (Kerkhofs and Lindeboom, 1995). O'Donnell et al. (2015) argue that work disability reporting might be influenced by financial incentives to work, length of the working career and job environment, suggesting that it might reflect a motivation for not working. Everything else constant, if justification bias matters, individuals with a stronger desire to retire as soon as possible might be more likely to report work disability problems in order to offer an explanation for their retirement intentions and lead to overestimate the effect of work disability on retirement intentions. Second, even if not produced by any strategic behavior, systematic differences in how individuals report their work disability levels bring about a measurement error, limiting the comparability of self-assessments across individuals and of any work disability measure constructed neglecting this issue (see section 2.1).

Both the work disability measures considered in this paper try to account for measurement error in work disability self-assessments. The work disability measure based on the standard ordered probit model allows to clean work disability self-assessments from measurement error and justification bias under the assumption that the cut-off points (thresholds) α_j, j=0…,J, according to which respondents rate their work disability levels, are invariant in the population. Bound et al. (1999) argue that in this framework correcting work-disability self-assessments by more objective health indicators that are less sensitive to individual reporting allows to solve the comparability limitations in raw self-evaluations. However, invariance in the cut-off points in the population implies that reporting behavior is uncorrelated with individual characteristics, such as the determinants of work disability showing up in equation (1) and the explanatory variables in equation (6) modelling retirement intentions. If this assumption is violated, the use of the work disability measure based on the ordered probit model does not allow to account properly for reporting behavior heterogeneity and justification bias. This work disability measure turns out to be error-ridden and might lead to biased estimates of the role of retirement intention determinants in equation (6).

The Hopit specification explicitly allows reporting behavior to depend on individual characteristics. Therefore, the work disability measure based on the Hopit model filters out by construction the correlation between reporting behavior and the individual characteristics allowed to affect the thresholds. This measure is a priori preferable since it allows more meaningful comparisons across individuals and attempts to circumvent the estimation problems produced by the presence of error-ridden variables on the right-hand-side of the retirement intention equation.

Finally, it is worth noting that the fixed-effects estimation supports the identification of work disability differentials in retirement intentions net of reporting behavior heterogeneity. Indeed, typically unobserved factors, such as taste for work, might affect both individuals' desire to retire and their willingness to adopt strategic reporting behavior in work disability self-evaluations to rationalize their intentions. As long as these unobserved factors fall into the c_i

component, the fixed-effects estimation allows to take into account properly this latter source of endogeneity.

Given the presence of multiple imputations for our work disability measure $\widehat{wd}_{it}$, the estimation of equation (6) will be carried out by using the multiple imputation techniques developed by Little and Rubin (1987), which exploit the variability within and between each set of imputations.

3. Data

Our sample has been drawn from the first two waves of SHARE collected in 2004/5 and 2006/7 respectively. It includes 11,807 observations referring to 8,575 individuals aged 50-65 at work and living in Germany, Sweden, The Netherlands, Spain, Italy, France, Greece and Belgium.[2] In each wave, in addition to the standard CAPI (Computer Assisted Personal Interview) questionnaire, a subsample of these individuals have filled-in a paper and pencil questionnaire that asks to self-assess their own work disability by answering to the following question "*Do you have any impairment or health problem that limits the kind or amount of work you can do?*" according to the following discrete ordered scale "*1. None, 2. Mild, 3. Moderate, 4. Severe, 5. Extreme*".

Next, these respondents are also asked to rate the work disability of hypothetical individuals described in anchoring vignettes. Anchoring vignettes are survey instruments designed to address the concern that respondents might have different reporting styles and attach different health conditions to a given point in the discrete ordered scale used to self-assess their work disability. If this is the case, differences in work disability self-assessments might reflect

[2] Results are quantitatively the same if we select individuals aged 50-60. Results are available upon request.

differences in reporting styles rather than actual differences in the extent of work limiting health problems. To address this issue, respondents are presented with short descriptions of hypothetical individuals including some key aspects of their health and socioeconomic conditions relevant to rate their work disability. For instance, one of the anchoring vignette administered in SHARE is the following "*Kevin suffers from back pain that causes stiffness in his back especially at work but is relieved with low doses of medication. He does not have any pains other than this generalized discomfort. How much is Kevin limited in the kind or amount of work he could do?"* (*1. None, 2. Mild, 3. Moderate, 4. Severe, 5. Extreme"*). Notice that the scale used to rate individuals in anchoring vignettes is the same as the one used by respondents to self-assess their own work disability. Since anchoring vignettes are kept constant across respondents, differences in vignette evaluations reflect individual heterogeneity in reporting styles. The vignette sample consists of 2,529 observations referring to 2,012 individuals.

3.1 Generating work disability measures

This section explains the estimation of the work disability measures based on ordered probit and Hopit models. These specifications can be estimated by construction only on the vignette sample as only in this sample we have work disability evaluations available. Following the approach proposed by Bound et al. (1999), the key information needed to enhance the comparability of work disability self-assessments consists of an extensive battery of objective health indicators expected to be less sensitive (or not sensitive at all) to individuals' reporting behavior. Using the notation previously introduced, these health indicators fall in the vector Z_{it}, which includes: the number of limitations with Activities of Daily Living (ADLs) and with Instrumental Activities of Daily Living (IADLs); Body Mass Index (BMI); the presence of reduced muscle strength (*sarcopenia*, see Bertoni et al., 2018) based on a hand-grip strength test administered within the SHARE interview; whether the respondent does not perform the grip strength test (*grip_miss*), which is expected to capture problems with the use of hands; the number of chronic diseases, mobility limitations and symptoms; the Global Activity Limitation Indicator (GALI); an indicator of mental health (based on the EURO-D depression scale) and a set of cognitive functioning indicators, namely orientation in time and numeracy. We also define the vector X_{it}, collecting a set of covariates describing socioeconomic characteristics: gender, age, having a cohabiting partner, education (ISCED levels), earnings and wealth quartiles, number of children, number of grandchildren and country of residence. Finally, we include a dummy to discriminate between interviews conducted in the wave 1 and the wave 2 of SHARE. The sample averages of the explanatory variables used to derive our work disability measures are displayed in Table 1.

Table 1: Descriptive statistics of the covariates used in the ordered probit and Hopit models to derive the work disability measures.

Variable	Description	Mean	Standard deviation	Min	Max
adl	Number of limitations with ADLs	0.027	0.22	0	5
iadl	Number of limitations with IADLs	0.035	0.19	0	2
bmi	BMI	26.3	4.21	15.1	58.8
sarcopenia	Reduced muscle strength	0.034	0.18	0	1
grip_miss	Grip strength measure not performed	0.036	0.19	0	1
chronic	Number of diagnosed chronic conditions	0.89	1.00	0	7
mobility	Number of mobility limitations	0.51	1.09	0	9
symptoms	Number of symptoms	1.01	1.16	0	7
gali	GALI	0.23	0.42	0	1
depressed	EURO-D scale above 3	0.16	0.37	0	1
orientation	Good in orientation test	0.94	0.24	0	1
numeracy	Good in numeracy test	0.29	0.45	0	1
female	Gender	0.45	0.50	0	1
age	Age	55.6	3.70	50	65
couple	Having a cohabiting partner	0.82	0.38	0	1
isced_34	Education: ISCED level 3 or 4	0.35	0.48	0	1
isced_56	Education: ISCED level 5 or 6	0.34	0.47	0	1

nchild	Number of children	2.01	1.23	0	12
ngrchild	Number of grandchildren	0.87	1.64	0	16
earnings_q2	Earnings in the second quartile	0.22	0.41	0	1
earnings_q3	Earnings in the third quartile	0.25	0.44	0	1
earnings_q4	Earnings in the fourth quartile	0.26	0.44	0	1
totwealth_q2	Net wealth in the second quartile	0.27	0.44	0	1
totwealth_q3	Net wealth in the third quartile	0.26	0.44	0	1
totwealth_q4	Net wealth in the fourth quartile	0.28	0.45	0	1
SE	Country of residence: Sweden	0.13	0.33	0	1
NL	Country of residence: The Netherlands	0.14	0.35	0	1
ES	Country of residence: Spain	0.088	0.28	0	1
IT	Country of residence: Italy	0.077	0.27	0	1
FR	Country of residence: France	0.13	0.34	0	1
EL	Country of residence: Greece	0.15	0.36	0	1
BE	Country of residence: Belgium	0.12	0.32	0	1
wave2	Interviews conducted in wave 2	0.52	0.50	0	1
N		2,529			

The first column of Table 2 reports the results of the estimation of equation (2) by standard ordered probit techniques. The linear prediction of the outcome of this equation is our first work disability measure. Work-limiting health problems are found to be more prevalent when our battery of objective health indicators Z_{it} detects poor health episodes. Everything else constant, work disability is found to be positively correlated with limitations with ADLs, reduced muscle strength, chronic diseases, mobility problems, symptoms suffered by the respondents, limitations with activities (GALI) and depression. Along with the coefficient estimates, we report the estimates of the cut-off points α, which the ordered probit specification assumes to be invariant in the population. As previously explained, this assumption entails that whatever effect of the covariates Z_{it} and X_{it} on work disability self-assessment can only results from genuine work disability differentials and rules out any correlation with reporting behavior.

The following columns of Table 2 summarize the results of the Hopit regression, which formally relaxes the assumption of invariant cut-off points in the population and allows them to be dependent on the covariates Z_{it} and X_{it}. The second column collects the coefficient estimates of equation (3). Our second measure of work disability is based on the linear prediction of the outcome of this equation. The following columns of Table 2 (columns 3 to 6) report the estimates of the δ parameters governing the dependence of the cut-off points on the covariates in the model. The estimates of the coefficients showing up in equation (3) reflect how the true level of work disability depends on the covariates Z_{it} and X_{it}, net of their correlation with the reporting behavior described by the δ coefficients. Although the covariates are formally shown to be significantly correlated with the cut-off points[3], the main findings obtained by the standard ordered probit regression are overall confirmed. Everything else constant, poor health episodes detected by our battery of objective health indicators are largely correlated with work disability.[4]

Table 2: Estimation results of the ordered probit and Hopit models used to derive the work disability measures.

	(1)	(2)	(3)	(4)	(5)	(6)
	Ordered		Hopit: threshold equations			
VARIABLES	probit	Hopit	$\tilde{\alpha}_1$	$\tilde{\alpha}_2$	$\tilde{\alpha}_3$	$\tilde{\alpha}_4$
adl	0.217**	0.280**	0.076	0.066	-0.120	0.038
	(0.108)	(0.119)	(0.076)	(0.078)	(0.088)	(0.137)
iadl	0.140	0.229*	0.069	0.024	0.062	-0.488***
	(0.124)	(0.137)	(0.085)	(0.077)	(0.078)	(0.157)
Bmi	0.026	0.038	0.025	-0.019	-0.023	-0.073***
	(0.026)	(0.028)	(0.016)	(0.016)	(0.015)	(0.025)
sarcopenia	0.464***	0.406***	-0.035	-0.017	-0.099	0.189

[3] The Wald joint significance tests for the parameters of each threshold equation ($\tilde{\alpha}_j$) reject the null that the parameters are equal to zero at the 1 percent significance level. The tests are asymptotically distributed as a χ^2 with 33 degrees of freedom (test statistic for $\tilde{\alpha}_1$ is 157.63, for $\tilde{\alpha}_2$ is 164.24, for $\tilde{\alpha}_3$ is 137.23 and for $\tilde{\alpha}_4$ is 76.56).

[4] The achievement of the convergence in the maximum likelihood estimation of the Hopit model is facilitated by defining explanatory variables ranging over comparable supports. To this end, we standardize the *bmi* by subtracting its sample average and dividing it by its standard deviation, we subtract 50 to *age* and we divide *nchild* and *ngrchild* by 10. For sake of comparability, these transformations are applied both in the ordered probit and the Hopit estimation.

	(0.129)	(0.144)	(0.090)	(0.090)	(0.088)	(0.121)
grip_miss	0.309**	-0.040	-0.451***	0.272***	-0.048	0.206
	(0.133)	(0.155)	(0.112)	(0.086)	(0.080)	(0.133)
chronic	0.108***	0.105***	-0.006	0.001	-0.019	0.044
	(0.028)	(0.032)	(0.019)	(0.018)	(0.017)	(0.030)
mobility	0.123***	0.120***	-0.011	-0.003	0.041**	0.013
	(0.026)	(0.029)	(0.018)	(0.017)	(0.016)	(0.030)
symptoms	0.146***	0.137***	-0.020	0.020	0.025	-0.005
	(0.027)	(0.030)	(0.018)	(0.017)	(0.017)	(0.031)
gali	0.736***	0.826***	0.109**	-0.048	-0.081*	-0.000
	(0.064)	(0.073)	(0.044)	(0.041)	(0.041)	(0.070)
depressed	0.326***	0.277***	-0.043	-0.030	0.046	0.032
	(0.071)	(0.079)	(0.048)	(0.046)	(0.043)	(0.079)
orientation	-0.110	-0.022	0.107	-0.063	-0.013	0.103
	(0.100)	(0.114)	(0.072)	(0.063)	(0.059)	(0.106)
numeracy	-0.041	-0.041	-0.007	0.056	-0.009	-0.083
	(0.061)	(0.069)	(0.039)	(0.036)	(0.036)	(0.060)
female	-0.118**	0.013	0.143***	0.012	-0.095***	-0.113*
	(0.058)	(0.065)	(0.037)	(0.035)	(0.034)	(0.059)
age	-0.006	-0.009	-0.009*	0.017***	-0.005	-0.013*
	(0.008)	(0.009)	(0.005)	(0.005)	(0.005)	(0.008)
couple	0.092	0.089	-0.000	-0.000	-0.003	0.039
	(0.075)	(0.084)	(0.046)	(0.044)	(0.043)	(0.068)
nchild	0.332	0.064	-0.314*	0.252	-0.001	0.028
	(0.247)	(0.281)	(0.167)	(0.154)	(0.149)	(0.255)
ngrchild	-0.403**	-0.486**	-0.067	-0.183	0.321***	0.203
	(0.194)	(0.218)	(0.129)	(0.125)	(0.111)	(0.170)
isced_34	-0.055	-0.080	-0.048	0.090**	-0.058	0.049
	(0.067)	(0.076)	(0.044)	(0.041)	(0.040)	(0.067)
isced_56	-0.048	-0.027	0.030	0.004	0.000	-0.048
	(0.073)	(0.082)	(0.046)	(0.044)	(0.042)	(0.070)
earnings_q2	-0.080	-0.097	-0.031	0.015	0.128***	-0.035
	(0.074)	(0.083)	(0.049)	(0.046)	(0.044)	(0.076)
earnings_q3	-0.125*	-0.083	0.041	-0.030	0.068	0.014
	(0.071)	(0.080)	(0.045)	(0.043)	(0.043)	(0.073)
earnings_q4	-0.219***	-0.244***	-0.023	0.014	0.052	0.001
	(0.076)	(0.086)	(0.048)	(0.046)	(0.044)	(0.076)
totwealth_q2	0.007	0.038	0.029	0.001	-0.003	-0.051
	(0.078)	(0.087)	(0.049)	(0.048)	(0.045)	(0.073)
totwealth_q3	-0.072	-0.098	-0.035	0.023	0.039	-0.009
	(0.081)	(0.091)	(0.052)	(0.049)	(0.047)	(0.075)
totwealth_q4	0.041	0.085	0.033	-0.010	0.112**	-0.012
	(0.081)	(0.091)	(0.051)	(0.050)	(0.047)	(0.080)
wave2	0.006	0.282***	0.293***	-0.096***	0.103***	0.225***
	(0.054)	(0.062)	(0.037)	(0.034)	(0.032)	(0.058)
SE	-0.281***	-0.394***	0.027	-0.317***	-0.511***	0.054
	(0.099)	(0.113)	(0.068)	(0.076)	(0.063)	(0.095)
NL	-0.272***	-0.245**	-0.053	0.306***	-0.158***	-0.131
	(0.094)	(0.108)	(0.068)	(0.058)	(0.056)	(0.122)
ES	-0.085	-0.121	-0.022	-0.048	-0.084	0.109

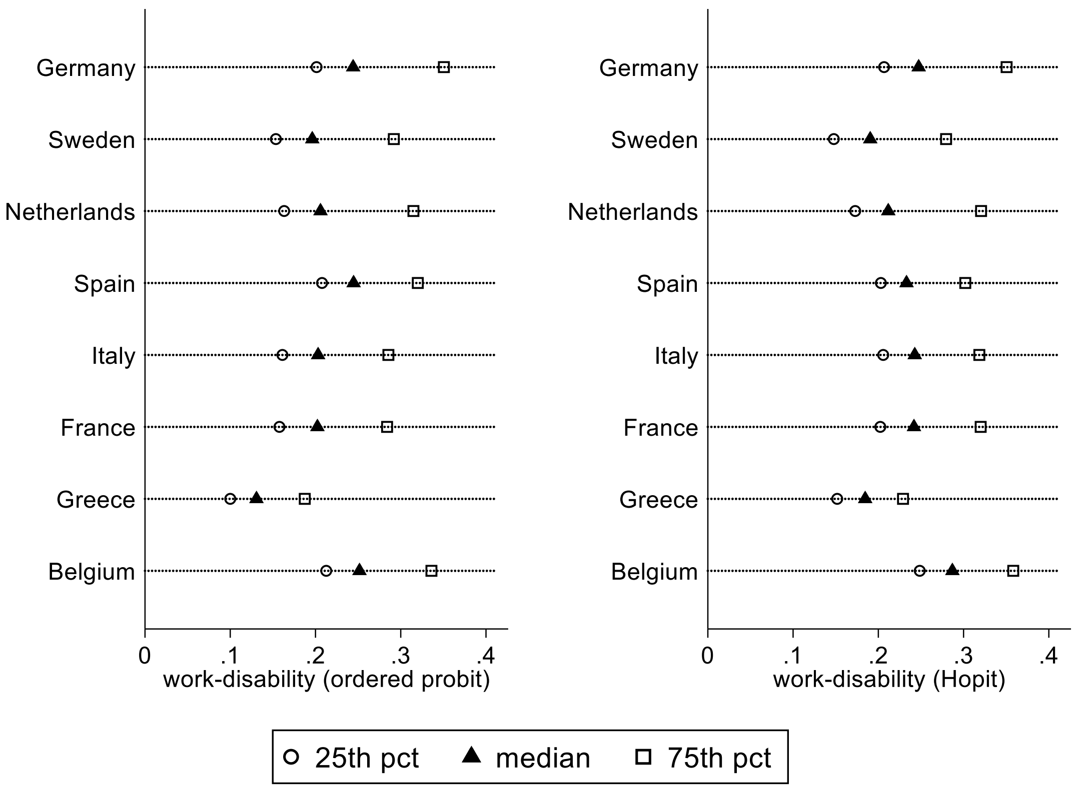
	(0.111)	(0.126)	(0.078)	(0.077)	(0.061)	(0.117)
IT	-0.383***	-0.173	0.226***	0.025	-0.075	-0.287**
	(0.116)	(0.130)	(0.074)	(0.070)	(0.066)	(0.143)
FR	-0.356***	-0.104	0.301***	-0.111*	-0.170***	-0.013
	(0.100)	(0.111)	(0.064)	(0.063)	(0.056)	(0.112)
EL	-0.664***	-0.425***	0.283***	-0.176***	-0.155***	-0.293***
	(0.105)	(0.117)	(0.063)	(0.064)	(0.055)	(0.106)
BE	-0.004	0.209*	0.159**	0.193***	-0.192***	0.034
	(0.095)	(0.107)	(0.063)	(0.057)	(0.059)	(0.133)
α_1	0.564***					
	(0.169)					
α_2	1.586***					
	(0.172)					
α_3	2.486***					
	(0.179)					
α_4	3.354***					
	(0.208)					
Constant			0.591***	-0.083	-0.030	-0.070
			(0.173)	(0.111)	(0.105)	(0.178)
Observations	2,529	2,529				

Note: Standard errors in parentheses are clustered at the individual level. *** p<0.01, ** p<0.05, * p<0.1

The ordered probit and Hopit models allow us to recover estimates of our work disability measures specified by equation (2) and (3), which cannot be observed a priori. These econometric specifications, conditional on the assumptions they pose, allow estimating them consistently by maximum likelihood methods. In order to account for the randomness embedded in any estimation exercise and specified by the fact that any estimator is a random variable following a distribution, we produce M=10 multiple imputations of both our work disability measures following the procedure described in Section 2. Finally, it is worth noting that although the ordered probit and Hopit regressions can be run only on the vignette sample, as work disability evaluations are available only for this subset of respondents, the linear predictions based on the coefficient estimates they produce can be taken for the overall sample since all the explanatory variables are defined based on the information collected by the standard CAPI interview administered to all SHARE respondents. As a result, we produce multiply imputed sets of work disability measures for all the 11,807 observations (8,575 individuals) in our main sample.

To ease the comparability and interpretation of the coefficients in the retirement intention equation, we rescale the two work disability measures to vary between zero and one. Figure 1 reports the first, second and third quartiles of their country-specific distributions. Overall, the median for the ordered probit specification is 0.21 and it ranges from 0.13 in Greece to 0.25 in Belgium. Cross-country differences in work disability are generated by heterogeneity in country-specific characteristics, such as the generosity of disability benefit schemes which affects the incentives to participate in the labor market for work disabled persons, as well as differences across countries in the distribution of the explanatory variables considered in the ordered probit and Hopit models. The comparison between the left and the right graphs can provide some descriptive evidence about the role of reporting styles in determining work disability self-assessments. The distribution of the work disability measure obtained with the Hopit specification is slightly shifted to the right with an overall median of 0.23. With the exception of Sweden and Spain, the median work disability levels always increase once heterogeneity in reporting styles is taken into account. These variations are wider for Italy, France and Greece, where the median work disability calculated by the Hopit model increases by 25% for Italy and France and by 54% for Greece with respect to the ordered probit specifications.

Figure 1: Distribution by country of the work disability measures obtained with the ordered probit model specification (left panel) and the Hopit model specification (right panel).



3.2 Intention to retire and work disability

The standard CAPI interview of SHARE asks respondents at work about their retirement intentions by the question "*Thinking about your present job, would you like to retire as early as you can from this job?*" (Yes/No). In our sample, 44% of the respondents would like to retire as soon as possible from work. This aggregate percentage hides sizeable cross-country variability. Whereas it is equal to 32% for Belgium and the Netherlands, it jumps to 57% and 64% for Italy and Spain respectively. All the other countries lie in between. In our sample 46% of male and 42% of female workers have a strong desire to retire. Education is also a significant predictor of retirement intention. Among those with the lowest educational attainments (ISCED levels at most equal to 2), 51% would like to retire immediately, but this percentage shrinks to 35% when looking at those with the highest education levels (ISCED levels 5 or 6).

Figure 2: Probability of desiring to retire as soon as possible by work disability quartiles.

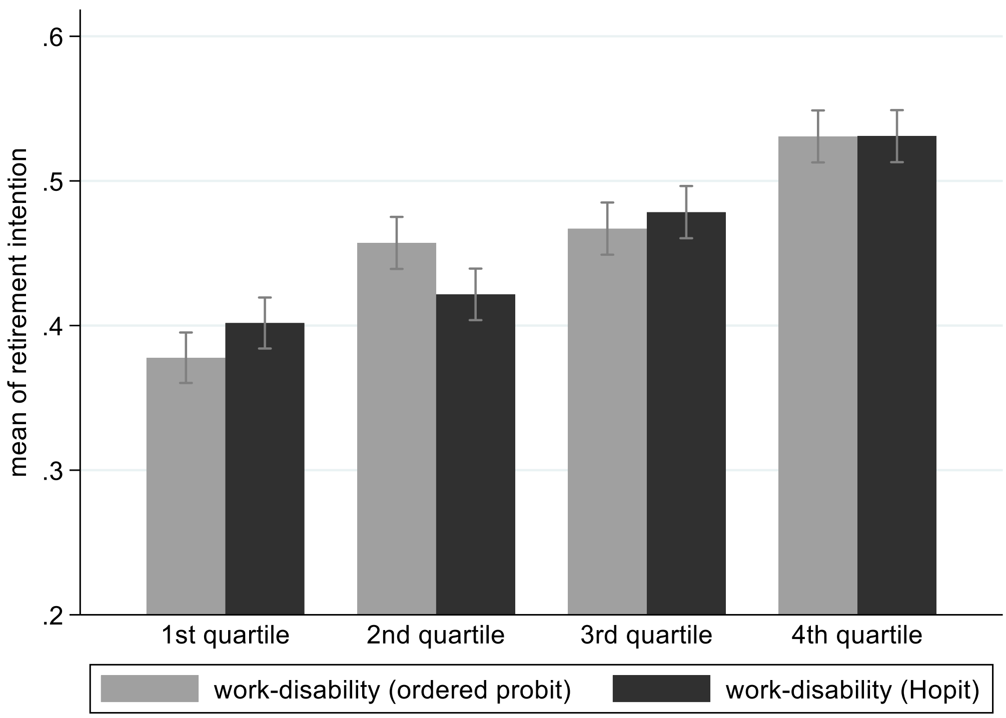


Figure 2 shows how the probability of desiring to retire as soon as possible varies across the quartiles of the empirical distribution of the work disability measures based on the ordered probit and the Hopit models. According to both measures, the proportion of individuals desiring to retire as soon as possible from work is positively correlated with work disability. In particular, among those with work disability in the first quartile of the distribution, about 40% want to retire as soon as possible. The percentage increases to 53% for those with work disability in the fourth quartile. Poor health episodes clearly propose as a powerful determinant of retirement intentions. The next section will assess whether work disability remains a predictor of retirement intentions once we control for household and individual heterogeneity.

4. Results

We analyze the determinants of retirement intentions by estimating linear probability models. Our specifications control for gender, age, presence of a cohabiting partner, education, job characteristics (whether the respondent works in the public sector and whether she is self-employed), earnings, wealth, number of children, number of grandchildren, a dummy taking on value one if the interview has been done in wave 2 and zero otherwise. Moreover, we control for two variables reflecting financial incentives to retire, namely the number of years to and since the minimum retirement age, which is an institutional setting varying by country and over time. These indicators are designed to capture penalizations for early retirees and incentives to prolong the working career set by the Social Security systems. Table 3 reports summary statistics for all the explanatory variables considered.

Table 3: Descriptive statistics of the explanatory variables included in the intention to retire model.

Variable	Description	Mean	Standard Deviation	Min	Max
female	Gender	0.45	0.50	0	1
age	Age	55.8	3.79	50	65
couple	Having a cohabiting partner	0.83	0.37	0	1
nchild	Number of children	2.04	1.22	0	15
ngrchild	Number of grandchildren	0.95	1.73	0	20
isced_34	Education: ISCED level 3 or 4	0.36	0.48	0	1
isced_56	Education: ISCED level 5 or 6	0.31	0.46	0	1
public	Employed in the public sector	0.31	0.46	0	1
selfemployed	Self-employed	0.20	0.40	0	1
earnings_q2	Earnings in the second quartile	0.23	0.42	0	1
earnings_q3	Earnings in the third quartile	0.25	0.43	0	1
earnings_q4	Earnings in the fourth quartile	0.25	0.43	0	1
totwealth_q2	Net wealth in the second quartile	0.25	0.43	0	1
totwealth_q3	Net wealth in the third quartile	0.26	0.44	0	1
totwealth_q4	Net wealth in the fourth quartile	0.27	0.45	0	1
yearsto_mra	Number of years to minimum	4.79	3.46	0	13

	retirement age				
yearssince_mra	Number of years since minimum retirement age	0.33	1.07	0	10
wave2	Interviews conducted in wave 2	0.49	0.50	0	1
SE	Country of residence: Sweden	0.18	0.39	0	1
NL	Country of residence: The Netherlands	0.14	0.34	0	1
ES	Country of residence: Spain	0.074	0.26	0	1
IT	Country of residence: Italy	0.080	0.27	0	1
FR	Country of residence: France	0.13	0.34	0	1
EL	Country of residence: Greece	0.13	0.34	0	1
BE	Country of residence: Belgium	0.13	0.34	0	1
N	Number of observations	11,807			

Table 4, columns 1 to 3, reports the results for our specifications based on the work disability measures produced by the ordered probit regression implemented according to the standard approach by Bound et al. (1999). The first column shows the results produced by estimating the linear probability models by OLS. If we look at equation (6) in Section 2, this means that we are currently modelling the time-invariant individual-specific component c_i as uncorrelated with the other explanatory variables in the model. Standard errors are clustered to allow for arbitrary correlation in the error term at the individual level. All the regression analyses are carried out by following the multiple imputation technique in Little and Rubin (1987) to formally account for the variability within and between the sets of imputations produced.

Table 4: Estimation results for the retirement intention model. Work disability measure from the ordered probit model (columns 1 to 3) and from the Hopit model (columns 4 to 6).

	Work disability (ordered probit)			Work disability (hopit)		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	OLS unbalanced	OLS balanced	FE	OLS unbalanced	OLS balanced	FE
work disability	0.575***	0.583***	0.281***	0.646***	0.654***	0.317***
	(0.063)	(0.082)	(0.105)	(0.089)	(0.105)	(0.118)
female	-0.073***	-0.074***	-	-0.085***	-0.087***	-

	(0.012)	(0.017)		(0.012)	(0.017)	
age	-0.023***	-0.032***	0.006	-0.022***	-0.032***	0.002
	(0.005)	(0.008)	(0.008)	(0.005)	(0.008)	(0.008)
couple	0.053***	0.050**	0.008	0.056***	0.052**	0.009
	(0.017)	(0.022)	(0.053)	(0.016)	(0.021)	(0.053)
nchild	-0.024***	-0.026***	0.011	-0.021***	-0.023***	0.012
	(0.005)	(0.007)	(0.016)	(0.005)	(0.007)	(0.016)
ngrchild	0.012***	0.009*	-0.009	0.012***	0.009*	-0.009
	(0.004)	(0.005)	(0.010)	(0.004)	(0.005)	(0.010)
isced_34	-0.046***	-0.034*	-	-0.043***	-0.030	-
	(0.014)	(0.019)		(0.014)	(0.019)	
isced_56	-0.133***	-0.115***	-	-0.135***	-0.117***	-
	(0.015)	(0.021)		(0.015)	(0.020)	
public	0.003	0.011	0.020	0.003	0.010	0.020
	(0.011)	(0.016)	(0.024)	(0.011)	(0.016)	(0.024)
selfemployed	-0.094***	-0.091***	-0.064	-0.093***	-0.090***	-0.064
	(0.013)	(0.020)	(0.051)	(0.013)	(0.020)	(0.051)
earnings_q2	0.037**	0.029	-0.005	0.032**	0.023	-0.008
	(0.015)	(0.019)	(0.020)	(0.014)	(0.018)	(0.020)
earnings_q3	0.061***	0.043**	-0.019	0.054***	0.035*	-0.023
	(0.014)	(0.018)	(0.018)	(0.015)	(0.019)	(0.018)
earnings_q4	0.022	0.005	0.011	0.020	0.002	0.009
	(0.015)	(0.020)	(0.021)	(0.016)	(0.020)	(0.021)
totwealth_q2	0.019	0.013	0.006	0.014	0.008	0.004
	(0.015)	(0.021)	(0.026)	(0.019)	(0.024)	(0.027)
totwealth_q3	0.023	0.011	-0.001	0.026	0.015	0.002
	(0.015)	(0.021)	(0.030)	(0.017)	(0.022)	(0.030)
totwealth_q4	-0.011	-0.023	-0.004	-0.019	-0.030	-0.007
	(0.017)	(0.023)	(0.033)	(0.018)	(0.024)	(0.033)
yearsto_mra	-0.021***	-0.028***	0.000	-0.021***	-0.029***	0.000
	(0.005)	(0.008)	(0.009)	(0.005)	(0.008)	(0.009)
yearssince_mra	0.011	0.014	-	0.011	0.014	-
	(0.007)	(0.010)		(0.007)	(0.010)	
wave2	-0.004	0.030**	-	-0.027***	0.007	-
	(0.011)	(0.014)		(0.010)	(0.013)	
SE	-0.099***	-0.128***	-	-0.092***	-0.120***	-
	(0.024)	(0.034)		(0.023)	(0.033)	
NL	-0.164***	-0.218***	-	-0.164***	-0.218***	-
	(0.025)	(0.039)		(0.026)	(0.040)	
ES	0.155***	0.101**	-	0.165***	0.111***	-
	(0.027)	(0.042)		(0.028)	(0.043)	
IT	0.020	-0.025	-	-0.001	-0.046	-
	(0.037)	(0.056)		(0.037)	(0.056)	
FR	0.068**	0.019	-	0.046*	-0.003	-
	(0.028)	(0.041)		(0.027)	(0.040)	
EL	0.099***	0.030	-	0.076**	0.007	-
	(0.035)	(0.051)		(0.035)	(0.051)	
BE	-0.161***	-0.233***	-	-0.182***	-0.254***	-
	(0.026)	(0.038)		(0.026)	(0.038)	
Constant	1.774***	2.377***	0.024	1.759***	2.361***	0.217

	(0.342)	(0.514)	(0.489)	(0.343)	(0.515)	(0.488)
Observations	11,807	6,464	6,464	11,807	6,464	6,464
Individuals	8,575	3,232	3,232	8,575	3,232	3,232

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimation is based on 10 sets of multiply-imputed work disability measures combined according to Little and Rubin (1987).

Work disability is an important determinant of retirement intention. The coefficient is highly significant and shows that on average passing from the first to the third quartile (i.e. the interquartile range) of our work disability measure empirical distribution is associated with a 8 percentage point increase in the probability of desiring to retire to as soon as possible, which is comparable to the effect of moving from the highest level of educational attainments (*isced_56*=1) to the intermediate level (*isced_34*=1).

Our findings point out the presence of statistically significant cross-country differentials in retirement intentions. Everything else constant, Dutch and Belgian workers are those less willing to retire as soon as possible, whereas Spanish and Greek workers have a strong desire to retire. Women are significantly more willing to carry on working than men are. Having a partner is associated with a stronger preference to retire due for instance to higher levels of utility produced by the time spent out of the labor market with the other couple member. Workers whose current age is lower than the minimum retirement age set by the Social Security System have a lower propensity to retire soon probably due to the financial penalizations they would face in the computation of their pension benefit. Our full sample is longitudinally unbalanced as we include all individuals who have been interviewed in at least one wave. If we select only individuals appearing in both waves, the sample size reduces to 6,464 observations (3,232 individuals). The second column of Table 4 shows that this sample selection leaves our results quantitatively unaffected.

Most importantly, defining a balanced sample is particularly relevant in order to run a fixed-effects (FE) analysis and fully exploit the longitudinal dimension of SHARE. Using panel estimation controlling for individual fixed-effects is more suitable than OLS to account for time invariant unobserved factors, such as initial health endowment, taste for work, motivation and skills, which are expected to correlate with retirement intentions and many explanatory variables in our specifications, including work disability. The results are reported in the third column of Table 4. Although the point estimate shrinks, work disability remains a significant predictor of retirement intentions. Everything else constant, switching the work disability level from the first to the third quartile is associated with a 4 percentage point increase in the probability of desiring to retire as soon as possible. This effect is sizeable as it accounts for 10% of this probability in the sample. The comparison between OLS and FE estimates suggests that OLS overestimates the effect of interest supporting the hypothesis that the individual heterogeneity summarized by the c_i component includes factors that make individuals both more tempted to retire and more likely to report work limiting health problems.

Columns 4 to 6 of Table 4 summarize the results produced by replicating our analysis considering the work disability measure obtained by the Hopit model in order to account for individual heterogeneity in reporting behavior. Our previous findings remain overall confirmed across all the specifications considered and proved not be driven by reporting bias in work disability self-assessments. Individuals with higher levels of work disability are found to have a stronger desire to retire as soon as possible.[5] As we argued above, the estimation of the Hopit model is particularly important in our set-up since it is specifically designed to model the presence of heterogeneity in reporting styles in the population as a function of observed

[5] We follow Wooldridge (2010) and use inverse probability weighting to assess whether attrition (i.e. the exit from the sample between wave1 and wave2) produces a bias in our results. Our findings are entirely confirmed. Results are available upon request.

covariates and provide a work disability measure filtering out this source of measurement error. Neglecting the dependence of reporting behavior in work disability self-assessments on individual characteristics would lead to error-ridden work disability measures potentially blurring the coefficients of interest. This interpretation is supported by the evidence in Table 4, which shows that the coefficient estimates on the work disability measure based on the Hopit model are always higher than their counterparts on the work disability measure produced by standard ordered probit techniques.

4.1 Heterogeneous effects

Our previous analysis assesses how retirement intentions varies with work disability in the overall sample. From a policy point of view, it is particularly important to understand the profile of the workers who are exposed to the higher risk of compromising their actual labor market attachment as a result of a poor health episode. We first investigate whether there is any cross-gender differential in the relationship of interest. On the one hand, it might be argued that men are typically the "breadwinners" and their earnings are the most important source of income of their households. Their retirement intention might be less driven – up to some extent – by poor health episodes and more sensitive to the financial incentives set by the Social Security systems. On the other hand, labor force participation is usually lower for women. Given the definition of our sample (we consider only working individuals in the age range 50-65), we expect women in our sample to be characterized by a stronger labor market attachment than in the overall population as they decided not to specialize in housework, entered the labor market in the past and are still working at later ages. Whether and how the work disability differential in retirement intentions varies across genders is an empirical issue. We augmented our fixed-effects specifications with the interaction between the gender dummy and the work disability measure. Results are reported in the first column of Table 5, referring to the work disability measure calculated using ordered probit (upper panel) and Hopit (lower panel) specifications respectively. The coefficient on the interaction term is never statistically significant. Work disability is found to increase the intention to retire of both male and female workers in the same way.

Next, we tested the hypothesis that retirement intentions are affected by the extent of work disability in a way depending on household and family composition. Presence of a cohabiting partner, children and grandchildren might influence the utility associated with the retirement option. Time spent outside the labor market might be more valuable if it can be spent along with a partner, looking after grandchildren or providing practical help to children to support them in reconciling their family and work responsibilities. We then interacted our work disability measures with the corresponding variables describing the presence of partner, number of children and grandchildren. Our findings (second, third and fourth columns of Tables 5) support the hypothesis that the importance of work disability in shaping retirement intentions does not depend on household and family composition.

We also assess whether human capital can influence the work disability related differentials in retirement intentions. Workers with higher levels of human capital might be in the position of offsetting the work-limiting problems generated by poor health episodes by a higher flexibility in adapting their skills to new job tasks assigned to them by their firms in view of their worsened health conditions. Moreover, individuals with higher human capital levels might be more valuable to their firms, which might be more willing to create a job environment suited to maintain their employees fully productive, or at least to reduce the negative consequences of their health conditions. We interacted our work disability measures with education dummies (three groups are considered: ISCED 0-2 is the omitted baseline group, ISCED 3-4 and ISCED 5-6), which are indicators of individuals' human capital levels, and with the earnings quartile dummies, which can be considered as indicators of the economic rewards of workers' skills. Although we find no effect for education (column 5), individuals with earnings in the top quartile show a lower association between work disability and retirement intentions with respect to individuals with earnings in the first quartile.[6] The onset of work disability conditions affects less the desire to retire of individuals with a higher economic reward of their skills.

Finally, we investigate whether work disability differentials in retirement intentions change with the job characteristics. Everything else constant, the consequences of a poor health episode might be more severe if individuals carry out more physically demanding jobs (Bound et al., 1995). They might be forced to change their job or at least to change some of the tasks they were required to manage. Blue-collar workers face an higher risk of being more hampered by a health shock. Indeed, if we interact our work disability measure with the blue-collar dummy, we find that the same increase in work disability is associated with a higher increase in the propensity towards retirement for blue-collars[7]. This suggests that firms are reluctant to adapt the job contents of older blue-collar workers to their health conditions due to, for instance, organizational constraints or the short time horizon over which their investments to train workers to carry out the new job can be recouped, which makes this option less economically attractive. We also assess whether there is any heterogeneity between employees and self-employed as the latter might have more flexibility in adapting their job tasks to their current health conditions. However, we do not find any heterogeneity with this respect.

[6] In the specifications of column 5 and 6, we also include the interaction terms between work disability and *isced_34*, and the second and third earnings quartiles respectively. They are not reported in the table, however they are not significant.

[7] Note that the number of observations in column 7 (6,188) is lower than in the other specifications (6,464) due to missing values in the blue-collar dummy.

Table 5: Heterogeneity analysis.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
X	*female*	*couple*	*nchild*	*ngrchild*	*isced_56*	*earnings_q4*	*Blue collar*	*Self-employed*
				Work disability (ordered probit)				
Work disability	0.415***	0.476**	0.269**	0.219*	0.333**	0.426***	0.139	0.278**
	(0.149)	(0.230)	(0.130)	(0.113)	(0.160)	(0.156)	(0.116)	(0.113)
*Work disability*X*	-0.253	-0.239	0.006	0.057	-0.143	-0.368*	0.406*	0.027
	(0.203)	(0.244)	(0.037)	(0.046)	(0.216)	(0.201)	(0.219)	(0.234)
X	-	0.071	0.009	-0.021	-	0.093*	-0.021	-0.070
		(0.083)	(0.024)	(0.014)		(0.048)	(0.083)	(0.070)
				Work disability (hopit)				
Work disability	0.418***	0.550**	0.362**	0.273**	0.385**	0.551***	0.160	0.328***
	(0.160)	(0.247)	(0.152)	(0.125)	(0.175)	(0.180)	(0.126)	(0.127)
*Work disability*X*	-0.193	-0.287	-0.021	0.040	-0.144	-0.460**	0.441*	-0.074
	(0.209)	(0.257)	(0.045)	(0.049)	(0.223)	(0.218)	(0.233)	(0.242)
X	-	0.089	0.020	-0.019	-	0.123**	-0.034	-0.046
		(0.089)	(0.025)	(0.016)		(0.060)	(0.092)	(0.077)
Observations	6,464	6,464	6,464	6,464	6,464	6,464	6,188	6,464

Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. Estimation is based on 10 sets of multiply-imputed work disability measures combined according to Little and Rubin (1987).

5. Conclusions

This paper investigates the consequences of the presence of work-limiting health problems on the retirement intentions of older workers. We draw data from the first two waves of SHARE and base our analysis on a panel sample representative of the population of individuals at work in the age interval 50-65 and living in Germany, Sweden, The Netherlands, Spain, Italy, France, Greece and Belgium.

This research question proposes to be extremely relevant from a policy point of view. The Social Security reforms of the last twenty years strengthened the financial sustainability of pension systems by increasing retirement age and penalizing early withdrawals from the labor market. These reforms were needed in order to adapt the Social Security systems architecture to the ongoing dramatic demographic changes produced by population ageing and low fertility rates. However, older individuals, albeit formally at work, are not necessarily either productive or actively involved in the productive process at their workplace. Workers who desire to retire as soon as possible from their jobs might experience work arrangements failing to provide them with the monetary and non-monetary incentives needed to perform their tasks efficiently and undertake human capital investments in order to maintain their skills aligned with the technological change and improve their productivity. Understanding the determinants of the actual labor market attachment of older workers becomes of primary importance for policy makers to improve the economic inclusion of the older part of workforce.

Work limiting health problems are expected to be among the major risk factors challenging the labor market attachment of older workers because of the sharp increase in their incidence as individuals age. This paper aims at quantifying the effect of work disability on labor market attachment, which we measure by individuals' intention to retire. Although the SHARE questionnaire collects respondents' self-assessment of work disability, which is a widely used indicator in the literature, we formally address the concerns arising when using self-assessments in applied research. Many contributions (Bound et al., 1999, Crossley and Kennedy, 2002, French and Jones, 2017, Lindeboom and van Doorslaer, 2004) point out that comparability of self-assessments across individuals might be questioned. Individuals might have different beliefs about the dimensions to consider when self-assessing their work-limiting health problems and might disagree about the relative importance to assign to all these dimensions when aggregating them to produce an overall self-assessment. Finally, individuals, based on their health and socioeconomic conditions, might have developed different reporting behavior in self-assessing their disability. Everything else constant, the same work disability condition might be evaluated more or less severe depending on the reporting styles of respondents and their beliefs regarding the concept of a work disability condition. This issue becomes even more compelling if respondents strategically use work disability reporting as a way to rationalize their retirement intentions and bring about what the economic literature classifies as “justification bias”. Individuals with a stronger desire to retire as soon as possible might overstate their work limiting health problems to offer a justification for their retirement intention.

Our paper follows and extends the approach by Bound et al. (1999) to enhance the comparability across individuals of work disability self-assessments. More specifically, we developed two alternative measures of work disability. The first measure is based on standard ordered probit regressions of work disability self-assessments on a battery of objective health indicators and individual characteristics. This measure has the advantage of providing each individual in the sample with a work disability concept based on a common set of health dimensions and individual characteristics aggregated according to the same weighting scheme. Still, it imposes the uncorrelation between work disability determinants and reporting behavior. We relax this assumption by exploiting a key feature available in the first two waves of the SHARE questionnaire. These two data-collections collect anchoring vignettes, which is an established survey instrument (see Angelini et al., 2011 and 2012, Kapteyn et al., 2007, King et al., 2004) designed to control for individual heterogeneity in reporting behavior. The vignette information allows the estimation of the Hopit model, which makes it possible to disentangle the role of the health dimension and individual characteristics in determining work disability from their correlation with reporting behavior. Our second measure of work disability is based on the same set of health indicators and individual characteristics as the first one but it filters out the dependence of these variables on response styles. This improves the comparability across individuals of this measure and eliminates a potential source of measurement error in its calculation.

We estimate fixed-effects linear probability models to analyze how the desire to retire as soon as possible varies with our work disability measures. Our findings strongly indicate that the presence of work limiting health problems significantly increases the probability of older workers of desiring to retire as soon as possible. We also analyze to what extent this relationship varies with individuals' socioeconomic conditions. In particular, we investigate the presence of heterogeneity with respect to gender, household and family composition, human capital dimensions and job characteristics. We find that the positive effect of work disability on the propensity to retire as soon as possible is remarkably stable but it is higher when looking at blue-collar occupations and lower for high earners. On the one hand, individuals who carry out more physically demanding jobs are also those more at risk of experiencing more dramatic job-related consequences from a negative health shock. On the other hand, workers with higher earnings are likely to have higher levels of human capital and more valuable skills. These workers are expected to offset more easily work-limiting health problems thanks to a higher ability of adapting to new job tasks and a stronger willingness of the firms to create a work environment suitable for their health conditions.

Overall, our results indicate that public policies aimed at improving health conditions of individuals along the life cycle through prevention, access to health care services and promotion of healthier life styles are not just advisable from a social point of view but can have important economic consequences in preserving the actual economic inclusion of the older workforce.

References

Angelini, V., Cavapozzi, D. and Paccagnella, O. (2011). Dynamics of reporting work disability in Europe. Journal of the Royal Statistical Society: Series A, 174(3), 621-638.

Angelini, V., Cavapozzi, D. and Paccagnella, O. (2012). Cross-country differentials in work disability reporting among older Europeans. Social Indicators Research, 105(2), 211-226.

Bertoni, M., Maggi S., and Weber, G. (2018). Work, retirement and muscle strength loss in old age. Health Economics, 27(1), 115-128.

Bound, J., Schoenbaum M., and Waidmann, T. (1995). Race and Education Differences in Disability Status and Labor Force Attachment in the Health and Retirement Survey. The Journal of Human Resources, 30, S227-S267.

Bound, J., Schoenbaum, M., Stinebrickner, T. R. and Waidmann, T. (1999). The dynamic effects of health on the labor force transitions of older workers. Labour Economics, 6, 179-202.

Börsch-Supan, A., Brandt, M., Hunkler, C., Kneip, T., Korbmacher, J., Malter, F., Schaan, B., Stuck, S. and Zuber, S. (2013). Data resource profile: The Survey of Health, Ageing and Retirement in Europe (SHARE). International Journal of Epidemiology, 42(4), 992-1001.

Crossley, T. F. and Kennedy, S. (2002). The reliability of self-assessed health status. Journal of Health Economics, 21, 643-658.

Currie, J. and Madrian, B. C. (1999). Health, health insurance and the labor market. Handbook of Labor Economics, 3, 3309-3416.

Dal Bianco, C., Trevisan, E. and Weber, G. (2015). I want to break free. The role of working conditions on retirement expectations and decisions. European Journal of Ageing, 12, 17-28.

Disney, R., Emmerson, C. and Wakefield, M. (2006). Ill health and retirement in Britain: A panel data-based analysis. Journal of Health Economics, 25, 621-649.

French, E. and Jones, J. (2017). Health, health insurance, and retirement: A survey. Annual Review of Economics, 9, 383-409.

Gruber, J. and Wise, D. A. (Eds.) (1999). Social Security Programs and Retirement Around the World, University of Chicago Press.

Kapteyn, A., Smith, J., and van Soest, A. (2007). Vignettes and self-reports of work disability in the United States and the Netherlands. American Economic Review, 97(1), 461–473.

Kerkhofs, M. and Lindeboom, M. (1995). Subjective health measures and state dependent reporting errors. Health Economics, 4, 221-235.

King, G., Murray, C., Salomon, J., and Tandon, A. (2004). Enhancing the validity and cross-cultural comparability of measurement in survey research. American Political Science Review, 98(1), 191–207.

Lindeboom, M. and van Doorslaer, E. (2004). Cut-point shift and index shift in self-reported health. Journal of Health Economics, 23, 1083-1099.

Little, R. J. and Rubin, D. B. (1987). Statistical analysis with missing data (1st ed.). Wiley

Lumsdaine, R. L. and Mitchell, O. S. (1999). New developments in the economic analysis of retirement. Handbook of Labor Economics, 3, 3261-3307.

McGarry, K. (2004). Health and retirement: Do changes in health affect retirement expectations? The Journal of Human Resources, 39(3), 624-648.

O'Donnell, O. van Doorslaer, E. and van Ourti, T. (2015). Health and inequality. In Atkinson, A. B. and Bourguignon, F. J. (eds.), Handbook of Income Distribution, 2B, 1419-1533.

Siegrist, J., Wahrendorf, M., von dem Knesebeck, O., Jürges, H., Börsch-Supan, A. (2006). Quality of work, well-being, and intended early retirement of older employees: Baseline results from the share study. European Journal of Public Health, 17, 62–68.

Wooldridge, J. M. (2010) Econometric Analysis of Cross Section and Panel Data, 2nd edition. Cambridge: MIT Press.

Appendix: The Hopit model

This appendix summarizes the main assumptions underlying the use of the Hierarchical Ordered ProbIT (Hopit) model. As specified in Section 2, in our framework the implementation of the Hopit model requires the availability of the work disability self-assessment "*Do you have any impairment or health problem that limits the kind or amount of work you can do?*" according to the discrete ordered scale "*1. None, 2. Mild, 3. Moderate, 4. Severe, 5. Extreme*" as well as of anchoring vignette evaluations provided according to same scale. The Hopit model is a system of ordered probit equations (one for the self-evaluation and one for each of the vignettes considered) connected by a common set of thresholds (i.e. cut-off points). The equations are jointly estimated via maximum likelihood.

The first equation refers to the work disability self-evaluation and can be defined as follows

$$swd_{it}^{*} = Z_{it}'\tilde{\gamma}_1 + X_{it}'\tilde{\gamma}_2 + \varepsilon_{it} + \tilde{u}_{it}$$

where $\tilde{u}_{it}$ is an idiosyncratic error component, such that $\varepsilon_{it} + \tilde{u}_{it}$ follows a standard normal distribution. The latent variable swd_{it}^{*} describes perceived work disability and is mapped into the discrete observed outcome swd_{it} collected in the SHARE interview by individual-specific cut-off points,

$$swd_{it} = j \text{ if } \tilde{\alpha}_{ij-1} < swd_{it}^{*} \leq \tilde{\alpha}_{ij}$$

where $\tilde{\alpha}_{i0} = -\infty, \tilde{\alpha}_{iJ} = \infty, \tilde{\alpha}_{i1} = Z_{it}'\delta_1^1 + X_{it}'\delta_2^1,\quad \tilde{\alpha}_{ij} = \tilde{\alpha}_{ij-1} + \exp(Z_{it}'\delta_1^j + X_{it}'\delta_2^j)$, j=2,…,J-1.

The second set of equations includes one equation for each vignette l administered to respondents and can be defined as follows

$$V_{ilt}^{*} = \theta_{lt} + \vartheta_{ilt}$$

V_{ilt}^{*} is the level of work disability of the hypothetical persons in the vignette l as perceived by the respondent i at time t. It is set equal to the summation of a constant term θ_{lt} that does not vary across respondents (vignette equivalence assumption) and an idiosyncratic error component $\vartheta_{ilt} \sim N(0, \sigma^2)$ assumed to independent of $\varepsilon_{it} + \tilde{u}_{it}$. The vignette equivalence assumption states that the perceived level of work disability of the vignette individuals is on average perceived by respondents in the same way.

The latent variable V_{ilt}^* is mapped into the discrete observed outcome V_{ilt} (i.e. the vignette evaluation provided by respondents according to the predetermined discrete ordered response scale previously specified) by the same individual-specific cut-off points used in the self-evaluation component (response consistency assumption),

$$V_{ilt} = j \text{ if } \tilde{\alpha}_{ij-1} < V_{it}^* \leq \tilde{\alpha}_{ij}$$

where $\tilde{\alpha}_{i0} = -\infty, \tilde{\alpha}_{iJ} = \infty, \tilde{\alpha}_{i1} = Z_{it}'\delta_1^1 + X_{it}'\delta_2^1$, $\tilde{\alpha}_{ij} = \tilde{\alpha}_{ij-1} + \exp(Z_{it}'\delta_1^j + X_{it}'\delta_2^j)$, j=2,…,J-1. According to the response consistency assumption, respondents use the same reporting styles when assessing their own work disability and the work disability of the hypothetical individuals in the vignettes. Combining individuals' self-evaluations and vignette evaluations in the Hopit specification allows to separately identify all the coefficients involved in the system of equations.