THE RATHER LIMITED ROLE OF MENTAL ILL HEALTH IN DRIVING WORK BEYOND 50

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Abstract

This paper's aim is to contribute to the literature on elderly employment barriers by exploring the role of mental health relative to that of physical health, and the complementarity between the two. The paper uses European SHARE data. It considers the distinction between the extensive and the intensive margin of work (employment rate and hours) as well as wages/productivity. Results point at the limited role of mental health in determining employment (extensive margin) and hours (the extensive margin) in comparison to physical health. Also, men's employment or hours respond more to health problems, singularly mental ones. Another result is that ill health (be it physical or mental) has no impact on wages. Finally, results suggest moderate complementarity between mental health and physical ill health in degrading people's capacity to stay in paid employment.

Keywords: Ageing, Mental Health, Physical Health, Work, Work Capacity
JEL Codes: J22, I10, J26

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Introduction

The main aim of this paper is to estimate the relative importance of mental health is driving the key dimensions of work beyond the age of 50, namely the participation to employment, the number of hours people work and their wages. By "relative" we mean in comparison with physical health. The impact of the latter on work activities of people in later middle age has been well studied starting with Costa (1996), Dwyer et al. (1999), while that of mental health got less attention, certainly by economists.

The focus is on people aged 50-59. The choice of this age range is justified by the wish to capture the relationship between (mental) health and employment that exists in the absence of systematic access to (early)retirement benefits i.e. before workers attain eligibility for public pensions and other replacement benefits. As a robustness check, we replicate the analysis by using only individuals aged 50-54, who even less than those aged 55-59 can access (early)pension benefits.

The rest of this paper is organised as follows. Section 1 reviews the existing literature on work and mental health and exposes our contribution to that literature. In Section 2, we present our method of analysis. The SHARE data on (ill-) physical and mental health used in this empirical paper are presented in Section 3. Section 4 presents the main results of the paper, while Section 5 concludes.

1 The existing literature on work and mental health, and how we contribute to it

This paper is about elderly work and more precisely the barriers to elderly employment. The relative focus is on the supply side of the labour market. We say "relative" because we all know that when it comes to labour, what we observe is always the result of the interaction of labour supply and labour demand. More precisely, the focus is on the role of ill health and in particular the relative contribution of mental health problems in limiting people's capacity to work. There are, of course, many other barriers to elderly employment. They will not be examined here. Some of these barriers originate more on the demand side of the labour market (i.e. correspond to some firms' reluctance to employ or recruit elderly workers) and have been studied by Hutchens (1986), Hutchens (2010), Dorn et al. (2010),

Dostie (2011), Skirbekk (2004), van Ours et al. (2011), Vandenberghe et al. (2013a), or Delmez et al. (2018). Other barriers point at the supply side of the labour market, but should be distinguished from health barriers studied here. Economists have documented the important role of (early)pension schemes and other welfare regimes in enticing people to withdraw early from the labour force (Blöndal et al., 1999; Jousten et al., 2010). There is a large economic literature on joint retirement among dual-worker couples,..

What is our contribution to the literature on work and ill health?

A focus on mental health. They are many works of the relationship between physical health and elderly work/retirement (see French et al., 2017 for a recent review), age and work capacity (Jousten et al., 2010, Coile et al., 2016, Banks et al., 2016, Wise, 2017 and Vandenberghe, 2020. The impact of mental health on work-related activities of people in later middle age has been less extensively studied (Catalano et al., 1999, Lu et al., 2009, Frijters et al., 2010,Clarfield, 2009,OECD, 2012). This paper tries to fill that relative void. More generally, it is a response to invitations (Layard, 2013) to pay more attention to mental health in labour economics.[1]

Not just employment. This paper examines both the extensive (employment) and the intensive margin of work (duration of work): most existing papers on health — that predominantly consider physical health — only consider the decision to work, and do not look at the relationship between ill (physical or mental) health and the number of hours worked.[2]. Our paper also explores the in-work potential consequences of poor physical & mental health by looking at wages. The idea is that of the potentially negative consequences on productivity of presenteeism (i.e; the fact some people may put aside both mental and physical health problems to attend work (Hirsch et al., 2017).[3]

Mental and physical health complementarities. The paper explores the consequences on work of what health experts call co-morbidity. It is indeed well established that poor

[1]Our reading of the works of Layard, 2013 is that it contains a lot of evidence about the negative impact of poor mental health on well-being, but much less about its impact on work/labour outcomes per se.

[2]A relatively recent survey by OECD et al. (2016) only mentions Pelkowski et al. (2004) and Moran et al. (2011) who both conclude to a negative impact of physical health on hours.

[3]There, however, we depend on the assumption that lower productivity should translate into lower wages. And in the European context, there is evidence that, particularly for elderly workers, alignment of wages and productivity cannot be taken for granted due to the existence of implicit contracts or other sources of wage rigidity (Lazear, 1979; Vandenberghe et al., 2013b)

mental health can be strongly related to physical ill health, particularly among elderly individuals. Sartorious (2013) explains that "Co-morbidity does not mean the simple addition of two diseases that independently follow their usual trajectories. The simultaneous presence of two or more diseases will worsen the prognosis". In economic terms, this hints at the possibility of (production) complementarity[4] between physical and mental health in determining people's work capacity.

A strong international dimension. Finally, it is worth stressing that we assess the relationship between mental health and work simultaneously for 20 countries (AUT, BEL, CHE, CZE, DEU, DNK, ESP, EST, FRA, GRC, HUN, IRL, ISR, ITA, LUX, PRT, SVN, SWE). And compared to many existing works this one has the advantage that it uses only one fully-harmonised data set, i.e. the Survey of Health, Ageing and Retirement in Europe (SHARE).[5]

Country unobserved heterogeneity & simultaneity. In this paper, most results consists of country-specific OLS-estimated coefficients. These are re-analysed using random-effect (RE) meta-analysis regression, in order to account for cross-country observed (GDP, typical retirement age) and unobserved heterogeneity (i.e. cultural and institutional factors that may simultaneously influence how people describe their health[6] and labour market outcomes). In an extension we also address the health-work simultaneity concern by resorting to instrumental variable (IV) regression. Blundell et al. (2017) remind us of the potential simultaneity of the relationship between labour market outcomes and health issues, including psychiatric disorders. Our identification strategy consists of using SHARE's rich set of items about childhood (i.e. age 10) physical and mental health, and also stressful events occurring before the age of 18. Ettner et al. (1997) argue that many illnesses have their origins in childhood. The inclusion of stressful events that took place before the age of 18 (hunger, financial hardship or other stressful lifetime events) is justified by our willingness to focus on pre-work, exogenous determinants of health.

[4]For an illustration of the use of the notion of production complementarity in health economics see Abramovsky et al. (2019)

[5]Börsch-Supan et al. (2013).

[6]Most health items in SHARE are self-reported.

2 Method

We deploy a two-stage estimation using the SHARE data (at stage one) plus some country-level controls (at stage two).

Stage one aims at identifying, for each country j, using characteristics of respondent i aged 50-59, the relationship between key aspects of work and physical ($PHEALTH$) or mental health ($MHEALTH$)

$$Z_i^j = \beta_0^{Z,j} + \beta_p^{Z,j} PHEALTH_{i,j} + \beta_m^{Z,j} MHEALTH_{i,j} + \gamma^{Z,j} X_{i,j} + upsilon_{i,j}^Z \tag{1}$$

with $Z = EMPL, HOURS, WAGE$

A variant of the above model consists of allowing for cross effects between physical and mental health and detect the existence of complementarities between physical and mental health in determining work

$$\begin{aligned} Z_{i,j} = \beta_0^{Z,j} + \beta_p^{Z,j} PHEALTH_{i,j} + \beta_m^{Z,j} MHEALTH_{i,j} + \\ \beta_c^{Z,j} PHEALTH_{i,j} \times MHEALTH_{i,j} + \gamma^{Z,j} X_i + upsilon_{i,j}^Z \end{aligned} \tag{2}$$

with $Z = EMPL, HOURS, WAGE$

Stage two applies meta-analysis regression methods to stage-one country-level estimates $\hat{\beta}_k^{Z,j}$ to assess the existence of a cross-country statistically significant relationship using

$$\hat{\beta}_k^{Z,j} = \eta_k^Z + \delta_k^Z W_j + \mu_{k,j}^Z + \epsilon_{k,j}^Z \tag{3}$$

with $Z = EMPL$, $HOURS$, $WAGE$ and $k = p, m, c$ for (respectively) physical(p), mental (m) and physical$X$mental combined (c) stage-one correlations. Ignoring indices Z, k hereafter, the coefficient of interest is η. It captures the cross-country effect of health on work. Note the presence of country-level controls W_j. Meta-regression is a regression used to study the relationship between study effect sizes and covariates. It is analogous to standard regression used when individual data are available, but in meta-regression the observations are the studies (i.e. countries), the outcome of interest is the effect size, and the covariates W_j (known as moderators) are recorded at the study level. Two main components of our meta-analysis are country-specific effect sizes ($\hat{\beta}^j$) and their precision (standard errors $\hat{\sigma}^j$). Note the presence of term $\mu_j \sim \mathcal{N}(0, \tau^2)$ aimed at capturing the residual between country

heterogeneity-study variance, meaning that what we estimate is a random effect (RE) meta-regression.[7]

3 Data

This paper uses waves 1,2 and 4 to 7 of the SHARE survey[8]; a total of 303,985 individuals X waves (Table 1). All individuals in SHARE are 50 or older when interviewed for the first time. Data limitations of different sorts (missing values, absence of repeated observations as the country participated only in one wave) explain that we retain 20 out of the 29 participating countries (AUT, BEL, CHE, CZE, DEU, DNK, ESP, EST, FRA, GRC, HUN, IRL, ISR, ITA, LUX, PRT, SVN, SWE) in the analysis.

SHARE contains a rich set of items describing people's work (employment status, hours of work and wages if employed) but also their physical health status and mental health. The physical health can be split in two broad categories, "subjective" (Table 2) and "objective" (Table 3). Most items in SHARE are self-reported/subjective (Table 2) but many also explicitly refer to conditions diagnosed by health professionals (heart attack, hypertension, cholesterol, stroke, diabetes, lung disease, cancer) or measured by the SHARE interviewers like the maximum grip strength of respondents (see two columns before last of Table 3).

Mental ill health here essentially means depression. The latter is characterised by melancholy, diminished interest, sleep disorders or suicidal thoughts. The detailed list of items used to assess mental health in SHARE are reported in Table 4. They logically cover the above-listed dimensions of respondents' mood or feelings. They represent depressive symptoms that, once taken together, give a fair idea of people's mental health. The 12 items are those used to build the EURO-D scale which has been validated in earlier cross-European studies of depression prevalence (Prince et al., 1999).

Table 5 contains the control variables $X_{i,j}$ used when estimating equ. 1 or equ. 2, namely the respondent highest educational attainment and its cognitive performance as captured by memory or numeracy/math test scores.

Hereafter, we will make extensive use of indexes. These are computed as the first principal

[7]Each $\hat{\beta}^j$ is weighted by $\omega^j = 1/[\hat{\sigma}^j + \tau^2]$. A RE meta-regression assumes that the moderators explain only part of the heterogeneity, and a random-effect term with variance τ^2 is used to account for the remainder.

[8]Wave 3 contains life histories only, and is of no use here.

components of items listed in (respectively) Table 2, Table 3, Table 4 and Table 5. The index is always reported in the last column.

At stage two (ie. meta-analysis) the paper uses additional country-level controls (W_j in equ. 3) that are likely to influence health and work outcomes, namely the GDP per head and the average retirement ages (Table 6). The former comes from the Penn World Table (Zeileis, 2019) while the latter are from the OECD retirement database (OECD, 2018).

Table 1: SHARE data. Observations[a] by country (lines) and wave[b] (col.)

	(Waves)						
	1	2	4	5	6	7	Total
AUT	460	280	1,519	1,031	562	421	4,273
BEL	1,470	1,104	1,892	1,791	1,718	1,107	9,082
CHE	345	493	1,236	818	537	302	3,731
CZE	.	953	1,501	1,249	793	396	4,892
DEU	990	825	291	1,884	1,199	825	6,014
DNK	646	934	825	1,396	1,159	808	5,768
ESP	705	663	952	1,612	991	631	5,554
EST	.	.	1,883	1,275	1,378	957	5,493
FRA	1,205	1,010	1,813	1,106	934	569	6,637
GRC	1,059	1,174	.	.	1,233	442	3,908
HRV	.	.	.	.	788	593	1,381
HUN	.	.	981	.	.	156	1,137
IRL	.	364	.	.	.	.	364
ISR	1,009	769	.	590	262	239	2,869
ITA	827	824	857	1,196	1,283	846	5,833
LUX	.	.	.	600	503	308	1,411
POL	.	950	447	.	453	1,316	3,166
PRT	.	.	647	.	360	73	1,080
SVN	.	.	941	806	931	585	3,263
SWE	1,064	706	234	777	429	231	3,441
Total	9,780	11,049	16,019	16,131	15,513	10,805	79,297
N	79,297						

Source: SHARE 2004-2017

[a]: year$X$respondents

[b]: wave 1 [2004], wave 2 [2007], wave 4 [2011], wave 5 [2013], wave 6 [2015], wave 7 [2017]. Wave 3 [2009] contains life histories only and is not used here.

Table 2: Physical health (subjective): individuals aged 50-59. Country averages

	General ill health[a]	Self-perceived ill health (US scale)[b]	Long-term illness[c]	Limited in activities[d]	# Limitations (daily living)[e]	Limitations (instrumental)[f]	Subjective ill health index[g]
AUT	2.76	2.76	3.34	2.50	0.08	0.15	-0.38
BEL	2.83	2.83	3.31	2.50	0.14	0.20	-0.32
CHE	2.48	2.48	3.78	2.68	0.05	0.07	-0.63
CZE	3.10	3.10	3.22	2.42	0.10	0.17	-0.18
DEU	3.02	3.02	2.85	2.43	0.10	0.13	-0.18
DNK	2.37	2.37	3.17	2.61	0.09	0.13	-0.58
ESP	2.95	2.95	3.54	2.73	0.08	0.12	-0.38
EST	3.51	3.51	2.65	2.38	0.15	0.21	0.10
FRA	2.92	2.92	3.57	2.59	0.10	0.14	-0.35
GRC	2.44	2.44	4.07	2.84	0.04	0.08	-0.72
HRV	3.01	3.01	3.00	2.50	0.11	0.15	-0.22
HUN	3.41	3.41	2.66	2.40	0.15	0.28	0.06
IRL	2.16	2.16	3.81	2.77	0.11	0.12	-0.79
ISR	2.76	2.76	3.38	2.65	0.10	0.31	-0.40
ITA	2.83	2.83	3.85	2.71	0.08	0.11	-0.46
LUX	2.84	2.84	3.21	2.50	0.10	0.15	-0.32
POL	3.37	3.37	2.87	2.43	0.16	0.18	-0.01
PRT	3.44	3.44	3.22	2.48	0.18	0.19	-0.02
SVN	3.01	3.01	3.42	2.52	0.13	0.13	-0.27
SWE	2.45	2.45	3.15	2.55	0.08	0.12	-0.52

Source: SHARE 2004-2017
[a]: 1(good)-5(bad) European scale
[b]: 1(good)-5(bad) US scale
[c]: Yes (1) No (0).
[d]: Limited in activities because of health [3(no)-1 scale(severely) scale].
[e]: Number of limitations with activities of daily living(0-6 scale).
[f]: Number of imitations with instrumental activities of daily living(0-9 scale).
[g]: First principal component of a-f items (the higher, the worse is people' s perceived health). Principal component analysis is carried with all countries pooled. Displayed values correspond to the predicted score values divided by standard deviation.

Table 3: Physical health (Objective, doctor-diagnosed conditions or surveyor measurement): individuals aged 50-59. Country averages

	Hart attack	Hypertens.	Cholest.	Stroke	Diabete	lung disease	Cancer cancer	Ulcer	Parkinson	Cataract	Hip frac.	Other frac.	Alzheimer senility	Arthritis	Mobility limit.[a]	Max. strength grip[b]	Objective ill health index[c]
AUT	0.05	0.28	0.15	0.02	0.08	0.04	0.03	0.04	0.00	0.02	0.01	0.37	0.19	0.07	0.89	38.26	-0.47
BEL	0.05	0.25	0.24	0.02	0.07	0.05	0.03	0.06	0.00	0.01	0.01	0.31	0.16	0.06	1.03	38.42	-0.38
CHE	0.03	0.18	0.10	0.01	0.04	0.03	0.03	0.01	0.00	0.01	0.00	0.50	0.14	0.04	0.46	38.39	-0.76
CZE	0.06	0.35	0.17	0.02	0.08	0.05	0.03	0.05	0.00	0.02	0.01	0.33	0.19	0.06	0.95	37.79	-0.35
DEU	0.05	0.31	0.14	0.02	0.08	0.06	0.04	0.02	0.00	0.02	0.00	0.32	0.19	0.07	0.95	38.98	-0.42
DNK	0.04	0.21	0.16	0.02	0.05	0.05	0.03	0.03	0.00	0.02	0.01	0.38	0.19	0.05	0.64	40.74	-0.59
ESP	0.03	0.22	0.21	0.01	0.08	0.03	0.02	0.03	0.00	0.01	0.01	0.39	0.19	0.04	0.73	33.57	-0.46
EST	0.09	0.32	0.15	0.02	0.07	0.05	0.03	0.08	0.00	0.02	0.01	0.32	0.16	0.08	1.21	38.35	-0.34
FRA	0.04	0.21	0.16	0.01	0.07	0.03	0.03	0.03	0.00	0.02	0.01	0.38	0.14	0.04	0.92	36.81	-0.51
GRC	0.03	0.19	0.18	0.01	0.06	0.02	0.01	0.04	0.00	0.01	0.01	0.48	0.12	0.01	0.72	35.41	-0.61
HRV	0.09	0.33	0.18	0.02	0.07	0.03	0.04	0.06	0.00	0.01	0.00	0.35	0.16	0.05	1.28	38.20	-0.35
HUN	0.12	0.44	0.19	0.05	0.12	0.07	0.04	0.09	0.00	0.01	0.02	0.25	0.17	0.07	1.59	36.26	-0.05
IRL	0.03	0.17	0.23	0.01	0.05	0.01	0.04	0.06	0.00	0.00	0.02	0.44	0.09	0.02	0.68	36.52	-0.59
ISR	0.05	0.27	0.29	0.02	0.15	0.02	0.03	0.03	0.00	0.02	0.01	0.40	0.15	0.04	0.80	31.63	-0.33
ITA	0.03	0.25	0.15	0.01	0.05	0.02	0.02	0.03	0.00	0.01	0.00	0.45	0.14	0.03	0.64	35.77	-0.59
LUX	0.04	0.26	0.26	0.01	0.06	0.05	0.05	0.05	0.00	0.02	0.01	0.28	0.15	0.12	1.01	36.86	-0.33
POL	0.08	0.33	0.17	0.02	0.07	0.03	0.02	0.06	0.00	0.02	0.01	0.30	0.22	0.07	1.26	36.68	-0.28
PRT	0.05	0.35	0.35	0.03	0.13	0.06	0.04	0.06	0.00	0.02	0.01	0.23	0.18	0.06	1.51	32.47	-0.04
SVN	0.05	0.30	0.19	0.02	0.08	0.03	0.03	0.05	0.00	0.02	0.01	0.38	0.14	0.06	1.07	38.37	-0.42
SWE	0.03	0.23	0.10	0.01	0.05	0.02	0.03	0.02	0.00	0.02	0.01	0.42	0.22	0.05	0.63	39.31	-0.63

Source: SHARE 2004-2017

[a]: Number of limitations (measured by interviewer)

[b]: 0-100 (measured by interviewer)

[c]: First principal component of all items (the higher, the worse is people' s health). Principal component analysis is carried with all countries pooled. Displayed values correspond to the predicted score values divided by standard deviation.

Table 4: Mental health: individuals aged 50-59. Country averages

	Depression[a]	Pessimism[a]	Suicidality[a]	Guilt[a]	Sleep[a] (lack of)	Interest[a] (lack of)	Irritability[a]	Appetite[a] (lack of)	Fatigue[a]	Concentration[a] (lack of)	Enjoyment[a] (lack of)	Tearfulness[a]	Mental ill health index[b]
AUT	0.34	0.08	0.04	0.06	0.29	0.05	0.23	0.07	0.22	0.10	0.15	0.23	-0.26
BEL	0.41	0.11	0.09	0.11	0.37	0.07	0.31	0.09	0.34	0.20	0.09	0.35	0.04
CHE	0.43	0.07	0.05	0.06	0.30	0.04	0.31	0.05	0.27	0.10	0.05	0.25	-0.21
CZE	0.42	0.16	0.08	0.08	0.33	0.06	0.28	0.06	0.30	0.12	0.05	0.21	-0.13
DEU	0.46	0.06	0.05	0.06	0.36	0.06	0.31	0.05	0.29	0.13	0.10	0.25	-0.12
DNK	0.34	0.03	0.03	0.11	0.34	0.06	0.27	0.05	0.32	0.11	0.05	0.20	-0.23
ESP	0.33	0.17	0.06	0.07	0.29	0.11	0.25	0.07	0.33	0.16	0.09	0.26	-0.11
EST	0.50	0.20	0.05	0.16	0.41	0.08	0.42	0.06	0.46	0.10	0.11	0.22	0.11
FRA	0.49	0.17	0.11	0.12	0.40	0.08	0.40	0.08	0.35	0.19	0.09	0.29	0.13
GRC	0.29	0.14	0.03	0.08	0.18	0.12	0.27	0.07	0.24	0.14	0.12	0.26	-0.22
HRV	0.41	0.13	0.05	0.06	0.32	0.07	0.37	0.07	0.36	0.13	0.08	0.25	-0.08
HUN	0.44	0.22	0.12	0.16	0.37	0.10	0.39	0.11	0.46	0.19	0.16	0.30	0.24
IRL	0.29	0.11	0.03	0.12	0.26	0.04	0.24	0.09	0.25	0.11	0.06	0.20	-0.28
ISR	0.32	0.13	0.05	0.11	0.29	0.11	0.26	0.07	0.25	0.17	0.12	0.27	-0.13
ITA	0.36	0.12	0.04	0.10	0.27	0.11	0.43	0.07	0.30	0.20	0.19	0.24	-0.02
LUX	0.49	0.09	0.06	0.14	0.36	0.06	0.37	0.07	0.31	0.17	0.10	0.29	0.02
POL	0.54	0.34	0.10	0.13	0.40	0.10	0.45	0.09	0.37	0.17	0.24	0.23	0.27
PRT	0.51	0.42	0.08	0.09	0.39	0.12	0.36	0.12	0.27	0.27	0.21	0.35	0.29
SVN	0.36	0.26	0.04	0.09	0.32	0.05	0.29	0.05	0.25	0.09	0.08	0.18	-0.19
SWE	0.35	0.05	0.03	0.09	0.33	0.05	0.22	0.05	0.34	0.13	0.09	0.27	-0.21

Source: SHARE 2004-2017

[a]: No(0), yes(1)

[b]: First principal component of all items (the higher, the worse is people' s health). Principal component analysis is carried with all countries pooled. Displayed values correspond to the predicted score values divided by standard deviation.

Table 5: Stage one controls (Education and cognitive performance): individuals aged 50-59. Country averages

		Cognitive Performance					
	Education[a]	Orientation[b]	Memory1[c]	Memory2[d]	Verbal[e] fluency test	Numeracy[f] test	Poor cognition index[g]
AUT	3.31	3.86	5.93	4.66	24.17	3.83	-0.64
BEL	3.20	3.86	5.79	4.47	22.36	3.58	-0.46
CHE	3.25	3.92	6.14	5.09	22.57	3.97	-0.73
CZE	2.74	3.87	5.76	4.14	23.67	3.66	-0.48
DEU	3.58	3.91	6.08	4.72	23.55	3.82	-0.66
DNK	3.78	3.89	6.13	4.97	25.14	3.83	-0.77
ESP	2.18	3.80	4.81	3.49	17.63	2.95	0.19
EST	3.60	3.81	5.97	4.62	24.58	3.44	-0.55
FRA	2.95	3.81	5.50	4.20	21.13	3.32	-0.25
GRC	2.90	3.95	5.66	4.14	15.56	3.77	-0.22
HRV	2.76	3.91	5.88	4.24	21.21	3.49	-0.40
HUN	3.14	3.83	5.79	4.32	19.08	3.61	-0.32
IRL	3.63	3.81	5.88	4.88	16.79	3.57	-0.33
ISR	3.11	3.82	5.28	3.84	20.32	3.60	-0.20
ITA	2.38	3.90	5.32	3.85	17.03	3.27	-0.04
LUX	2.79	3.87	5.88	5.02	19.29	3.53	-0.44
POL	2.89	3.88	5.04	3.55	18.46	3.31	0.00
PRT	1.96	3.87	4.93	3.73	15.80	2.93	0.18
SVN	3.11	3.87	5.63	4.09	24.07	3.39	-0.40
SWE	3.41	3.92	5.91	4.82	25.35	3.82	-0.72

Source: SHARE 2004-2017
[a]: ISCED1997 classification of educational attainment [0:no degree 6: tertiary long]
[b]: Score of orientation in time test [0:bad 4:good]
[c]: Score of words list learning test - trial 1 [1-10 words]
[d]: Score of words list learning test - trial 2 [1-10 words]
[e]: Score of verbal fluency test [0-100]
[f]: Score of first numeracy test [0:bad 5:good]
[g]: first principal component all previous cognition items (the higher, the worse is people's cognitive performance). Principal component analysis is carried with all countries pooled. Displayed values correspond to the predicted score values divided by standard deviation.

Table 6: Stage two controls: country-level mean effective retirement age (M, F) and GDP per head

	Mean effective retirement age (M)	Mean effective retirement age (F)	GDP per head (2011-US dollars)
AUT	60.45	59.20	41,366
BEL	59.64	58.65	38,059
CHE	65.42	64.20	59,862
CZE	62.59	59.59	27,578
DEU	62.26	61.70	42,471
DNK	63.56	61.79	45,730
ESP	61.81	62.88	31,906
EST	64.77	63.72	24,076
FRA	59.23	59.59	36,729
GRC	62.16	60.68	24,916
HRV	62.96	61.24	21,091
HUN	61.81	59.49	23,240
IRL	65.51	64.85	53,332
ISR	67.51	64.53	28,941
ITA	61.68	59.71	35,949
LUX	59.83	59.87	55,109
POL	61.90	59.04	22,376
PRT	67.82	65.63	24,787
SVN	62.04	59.57	26,800
SWE	65.32	63.46	42,203

Source: Penn World Table (version 9.x) & OECD retirement database 2018

4 Results

4.1 The relationship between physical and mental ill health (co-morbidity)

Before turning to the main results of this paper it is worth examining the relationship between physical and mental health (Figure 1). The results of the econometric analysis are reported in the Appendix (Table 11). They confirm the strong positive association between mental health and physical health (something that doctors call co-morbidity). Results also suggest that the relationship is non-linear and convex. We consider this strong link as an invitation to explore the existence of complementarities between physical and mental ill health in driving work beyond the age of 50.

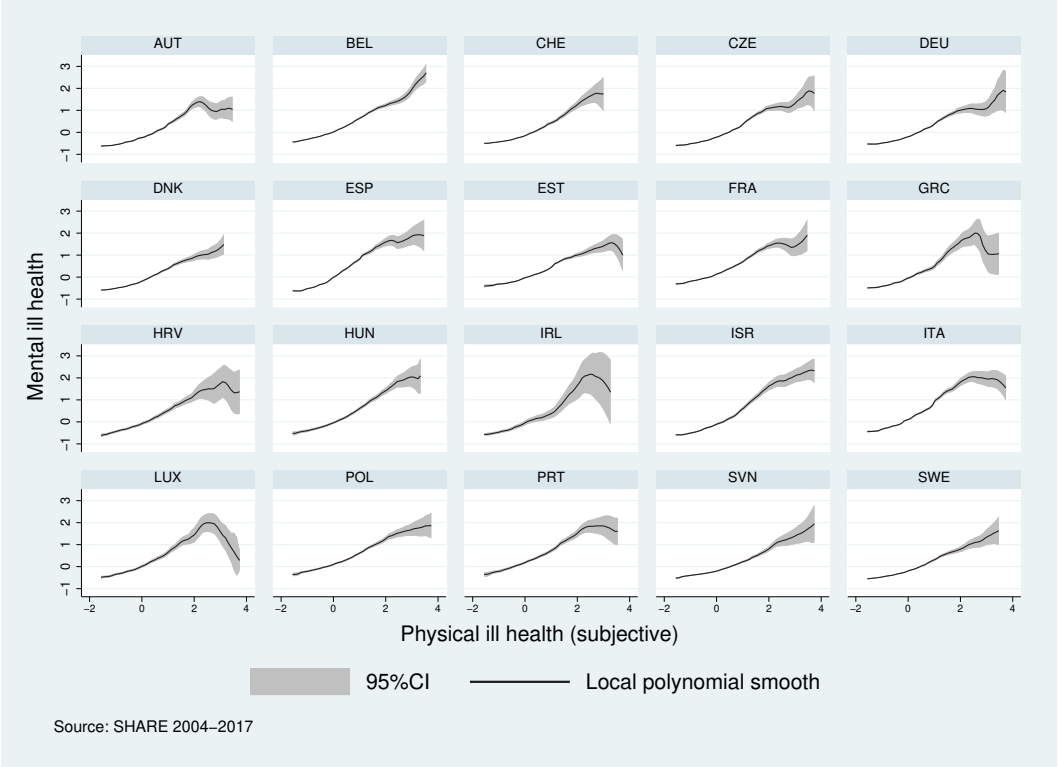

Figure 1: The positive association of mental and physical ill health - Male and Female aged 50-59 pooled

4.2 Stage-one results

The figures below display the coefficients $\hat{\beta}_k^{Z,j}$ with $k = p, m, c$ for (resp.) physical, mental and physical$X$mental marginal effect on $Z = EMPL, HOURS, WAGE$ of respondents aged 50-59. These correspond to the estimation, country by country, of stage-one equ. 1 or 2. The coefficients on display represent the change (generally a reduction) of $Z = EMPL, HOURS, WAGE$ due to a 1 standard deviation rise of ill physical or mental health. Figure 2 displays the results delivered by the estimation of equ. 1 for male respondents, when $PHEALTH$ is equal to the subjective physical health index (Table 2). Figure 3 displays the equivalent results for female respondents. Figures 4 & 5 report results when using objective physical health instead of its subjective equivalent. Finally, 6 contains the estimates of the coefficient of the $PHEALTH$, $MHEALTH$ interaction variable in equ. 2

Several things are immediately visible.

First, for both men and women, the impact of (subjective) physical health dominates that

of mental health. This holds for the intensive and the extensive margins of work ($EMPL$, $HOURS$). On average across countries, a 1 standard deviation rise of physical ill health leads to a 15(12) percentage point reduction of the male(female) employment rate. But Figures 2 & 3 show that the impact of a 1 standard deviation rise of mental ill health on hours only leads to a 5(1) percentage point reduction of the male(female) employment rates. Similar results hold when considering the impact of physical vs mental ill health on the number of hours worked ($HOURS$). For male(female) workers, a 1 standard deviation rise of physical ill health translates into a reduction of 6.58(4.80) hours, whereas a deterioration of mental health of the same magnitude reduces hours work by only 1.98(0.17) units. Figures 4 & 5 report similar results when using objective physical health[9].

Second, as revealed by the numbers above, the link between physical and mental health seems to by systematically stronger for male than female respondents, particularly for mental health.

Third, among those who keep working, there seems to be no impact of ill health, be it physical or mental, on wages (lower part of Figures 2, 3, 4, 5).

Fourth. There is evidence of complementarity between physical and mental health. In Figure 6, a negative value (upper left corner of Figure 6) suggests that negative impact on the male(female) employment rate of a 1 standard deviation rise of (say) physical ill health is 3(2) percentage point larger for someone who simultaneously experiences a 1 standard deviation rise of his(her) mental ill health. The equivalent cross-effect on hours of work is estimated to be [on average across the 20 countries] of -1.22 for male and -.51 hours for female workers. Both results hint at (a small) complementarity between physical and mental health in deteriorating the extensive and intensive margins of work. Finally, there is not evidence of cross effects when it comes to wages (lower part of Figure 6).

[9]With the nuance the contrast between the impact of physical vs mental ill health on work is more pronounced for women than men

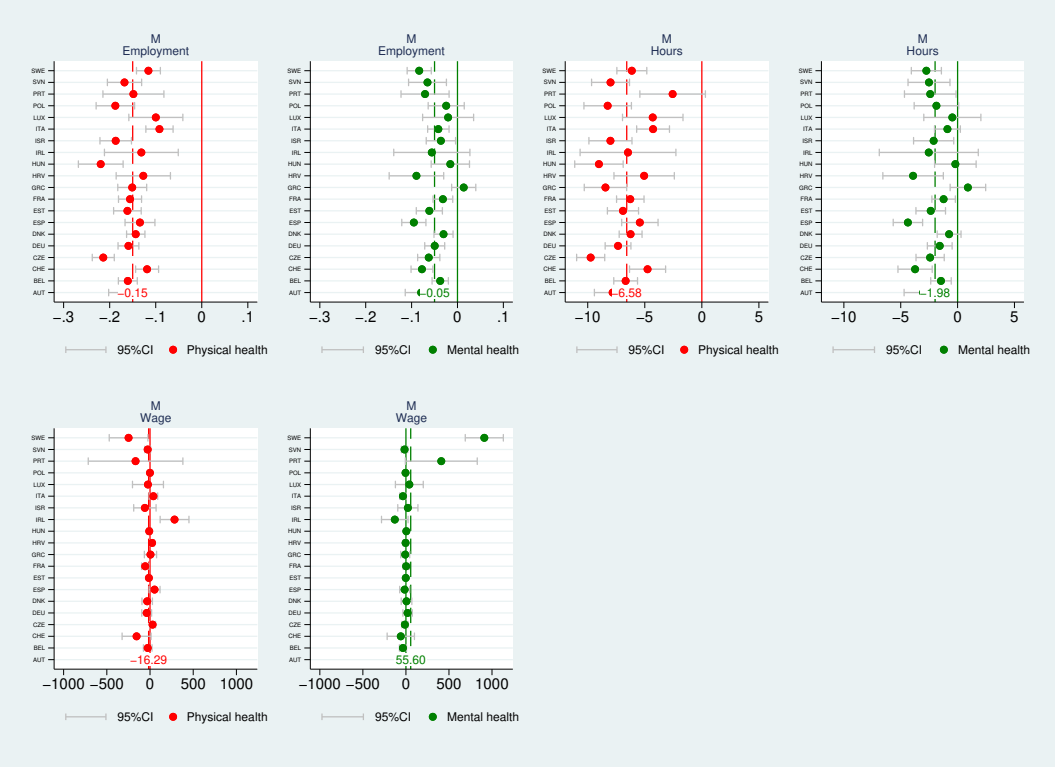

Figure 2: Impact of one standard-dev. rise of physical (subjective) ill health ($\hat{\beta}_p^{Z,j}$) vs mental health ($\hat{\beta}_m^{Z,j}$) on work ($Z = EMPL, HOURS, WAGE$) - Males aged 50-59

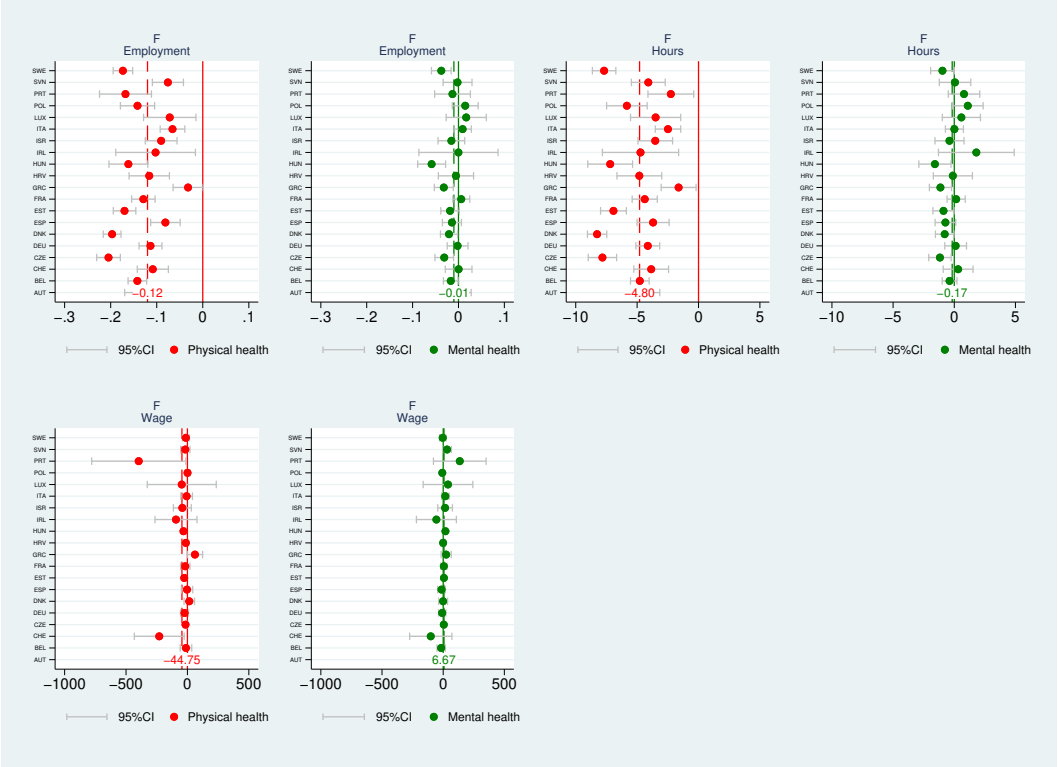

Figure 3: Impact of one standard-dev. rise of physical (subjective) ill health ($\hat{\beta}_p^{Z,j}$) vs mental health ($\hat{\beta}_m^{Z,j}$) on work ($Z = EMPL, HOURS, WAGE$) - Females aged 50-59

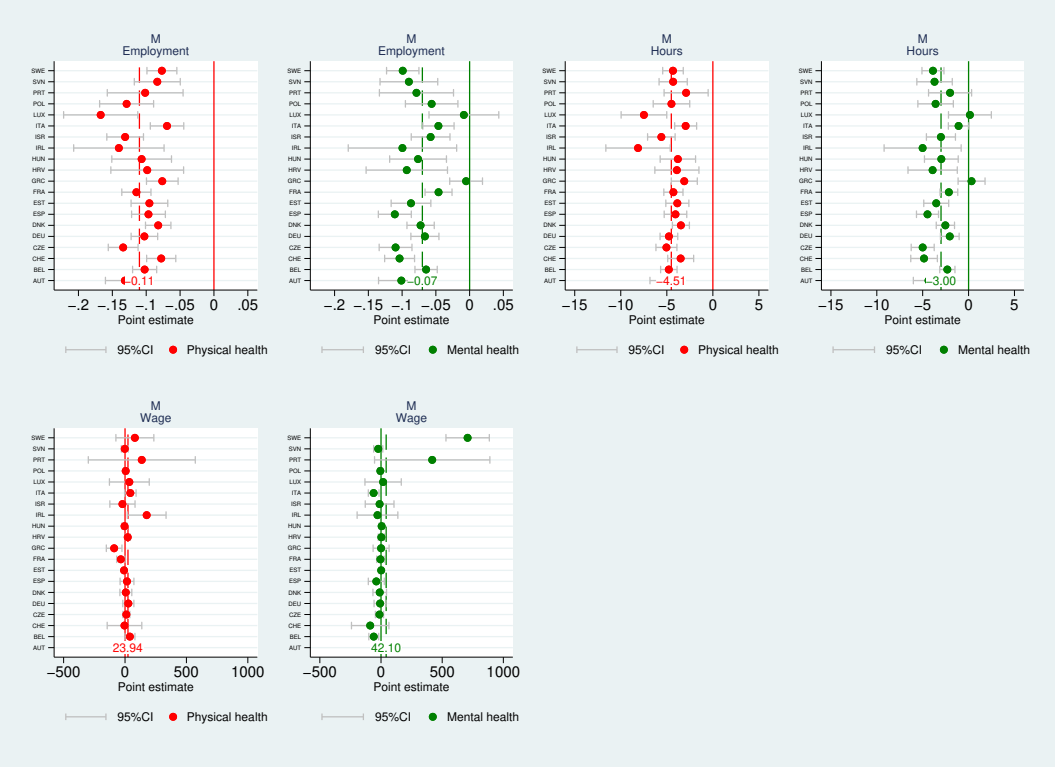

Figure 4: Impact of one standard-dev. rise of physical (objective) ill health ($\hat{\beta}_p^{Z,j}$) vs mental health ($\hat{\beta}_m^{Z,j}$) on work ($EMPL, HOURS, WAGE$) - Males aged 50-59

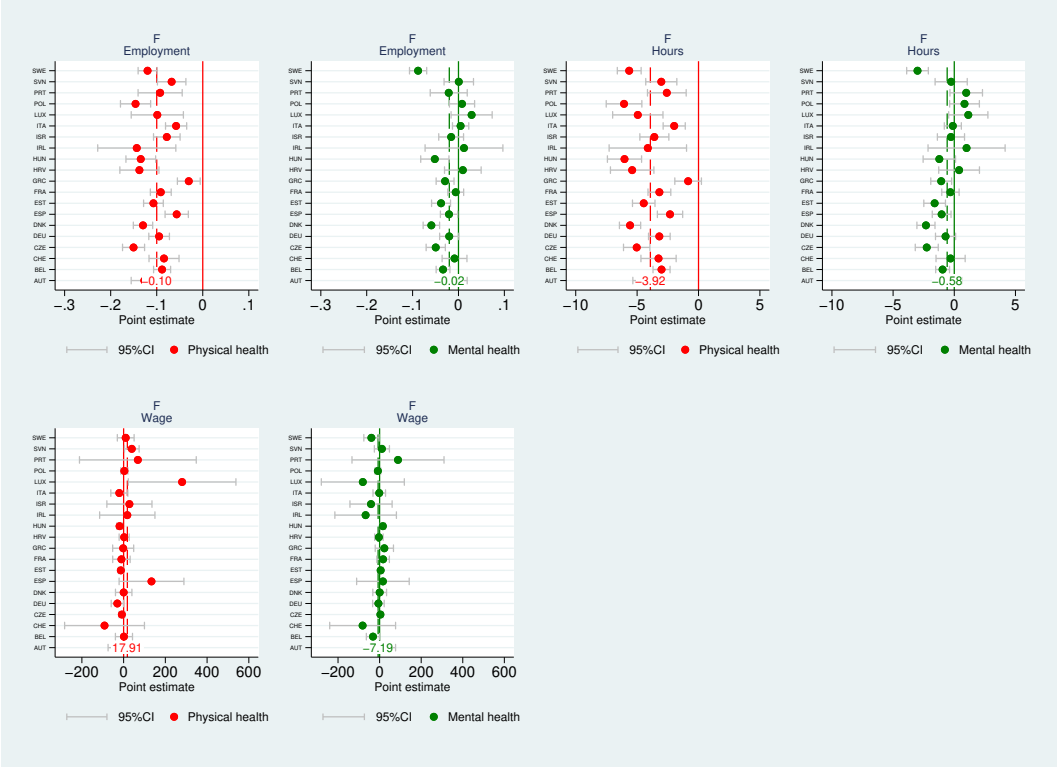

Figure 5: Impact of one standard-dev. rise of physical (objective) ill health ($\hat{\beta}_p^{Z,j}$) vs mental health ($\hat{\beta}_m^{Z,j}$) on work ($Z = EMPL, HOURS, WAGE$) - Females aged 50-59

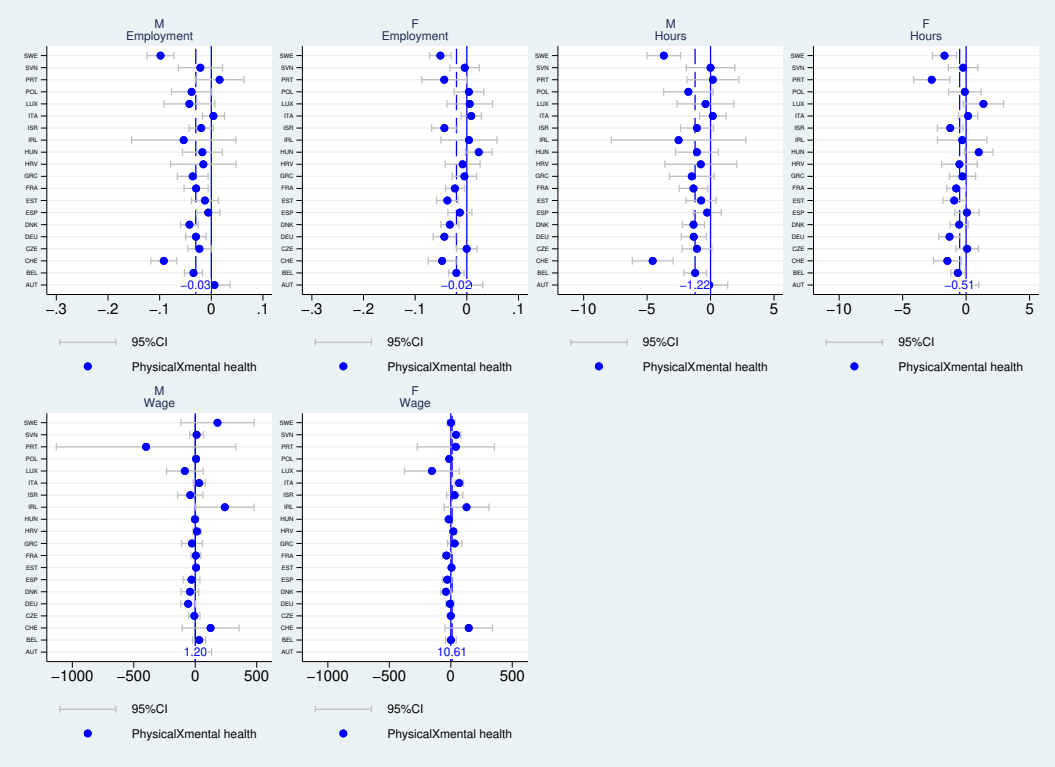

Figure 6: Interaction of physical(subj) and mental health $\hat{\beta}_c^{Z,j}$) in impacting work $(EMPL, HOURS, WAGE)$ - Males & Females aged 50-59

4.3 Stage-two results

We now turn to the results of the meta-analysis applied to the country-level coefficients displayed in the Figures above. These are for individuals aged 50-59 (results for individuals aged 50-54 are reported in Appendix Tables 12,13,14. They largely align with those presented here). The idea is to see if the outcome of the visual inspection of results is confirmed econometrically, also when accounting for country-level observed (and non observed) determinants. Results reported in Tables 7, 8, 9 expose the results of random effect (RE) meta-regression (equ. 3). Table 7 largely confirms what was visible in the Figures above.

First, for both males and females the impact of (subjective) physical health dominates that of mental health for both the intensive and the extensive margins of work $(EMPL, HOURS)$. On average, across countries, a 1 standard deviation rise of physical ill health leads to a 15.3(12.7=15.3-2.6) percentage-point reduction of the male(female) employment rate, but the difference between men and women is not statistically significant. Also neither the average age of effective retirement, nor the level of GDP per capita in the coun-

try do play a significant role. The impact of a 1 standard deviation rise of mental-ill health on hours only leads to a 4.8(1.5=4.8-3.3) percentage-point reduction of the male(female) employment rates. And this time the gender difference is statistically significant. Similar results hold when considering the impact of physical vs mental ill health on the number of hours worked ($HOURS$). For male(female) workers, a 1 standard deviation rise of physical ill health translates into a reduction of 6.73(4.8=6.73-1.83) hours, whereas deterioration of mental health of the same magnitude reduces hours work by only 1.85(.39=1.85-1.46) units.

Second, we again find that the link between physical and mental-health and work is stronger for male than female respondents, and in particular for mental health.

Third, we confirm the absence of relation between health (physical or mental) and wages. Table 8 replicates these results when using objective ill-health items instead of the subjective ones.

Finally, Table 9 reports the results for the model that allows for interaction between mental and physical ill health. We find negative value of -.027 for the coefficient of the interaction variable when studying the employment rate of men and women (there is no difference between men and women), implying that negative impact on the employment rate of a 1 standard deviation rise of physical ill health is 2.7 percentage-points larger for someone who simultaneously experiences a 1 standard deviation rise of his(her) mental ill health. The equivalent cross effect on hours of work is estimated to be of -1.07 (again no significant difference across genders). Both results are supportive of the idea of (moderate) complementarity between physical and mental health in deteriorating the extensive and intensive margins of work. Finally, we confirm that there is no evidence of a cross effect when it comes to wages.

Table 7: Stage two results: random effect (RE) meta-regression applied to stage one coefficients ($\hat{\beta}_p^{Z,j}$;$\hat{\beta}_m^{Z,j}$) [equ. 1 with **subjective** physical ill health - respondents aged 50-59]

	Physical Health ($\hat{\beta}_p^{Z,j}$)			Mental Health ($\hat{\beta}_m^{Z,j}$)		
	Empl.	Hours	Wage	Empl.	Hours	Wage
η_k^z (ref.=$Male$)	-0.153***	-6.732***	-0.616	-0.048***	-1.853***	-5.406
	(0.000)	(0.000)	(0.933)	(0.000)	(0.000)	(0.357)
$Female$	0.026	1.936**	-16.303	0.033***	1.466***	9.253
	(0.067)	(0.002)	(0.064)	(0.000)	(0.000)	(0.146)
$Retirement^a$	-0.001	0.073	-1.858	-0.003	-0.071	-0.055
	(0.780)	(0.591)	(0.414)	(0.129)	(0.299)	(0.971)
GDP^b	0.001	0.030	0.020	0.000	0.008	-0.221
	(0.147)	(0.288)	(0.968)	(0.857)	(0.608)	(0.567)
Nobs	40	40	40	40	40	40
τ^{2c}	0.001	2.667	97.602	0.000	0.278	6.924
$\tau^2 share^d$	79.91	79.85	17.33	50.23	36.36	2.14
Q_res^e	189.911	197.979	59.744	68.811	58.138	72.779
$p\_Q\_res^e$	0.0000	0.0000	0.0077	0.0008	0.0112	0.0003

Source: SHARE 2004-2017

p-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[a]: Effective retirement age (country$X$Gender)

[b]: GDP per head in 2011 $US (country)

[c]:Parameter τ^2 represents the between-study variability and is often referred to as the heterogeneity parameter. It estimates the variability among the studies, beyond the sampling variability.

[d]:The $\tau^2 share$ statistic represents the percentage of residual between-study variation relative to the total variability.

[e]: Residual homogeneity test, which mathematically translates to H0:$\tau^2 = 0$. This test is based on the residual weighted sum of squares Q_res

Table 8: Stage-two results: random effect (RE) meta-regression applied to stage-one coefficients ($\hat{\beta}_p^{Z,j}$;$\hat{\beta}_m^{Z,j}$) [equ. 1 with **objective** physical ill health - respondents aged 50-59]

	Physical Health ($\hat{\beta}_p^{Z,j}$)			Mental Health ($\hat{\beta}_m^{Z,j}$)		
	Empl.	Hours	Wage	Empl.	Hours	Wage
η_k^z (ref.=$Male$)	-0.103***	-4.370***	7.044	-0.071***	-2.866***	-10.067
	(0.000)	(0.000)	(0.246)	(0.000)	(0.000)	(0.090)
$Female$	0.005	0.555	-13.258	0.044***	2.039***	8.786
	(0.594)	(0.214)	(0.074)	(0.000)	(0.000)	(0.192)
$Retirement^a$	0.002	0.046	-0.616	-0.004	-0.110	0.570
	(0.463)	(0.636)	(0.748)	(0.076)	(0.235)	(0.729)
GDP^b	0.000	-0.015	0.267	-0.000	-0.001	-0.592
	(0.963)	(0.475)	(0.545)	(0.923)	(0.947)	(0.137)
Nobs	40	40	40	40	40	40
τ^{2c}	0.001	1.121	46.543	0.001	1.014	16.989
$\tau^2 share^d$	69.51	67.61	11.21	69.96	69.21	4.80
Q_res^e	114.929	112.150	43.385	116.110	105.242	76.375
$p\_Q\_res^e$	0.0000	0.0000	0.1855	0.0000	0.0000	0.0001

Source: SHARE 2004-2017

p-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[a]: Effective retirement age (country$X$Gender)

[b]: GDP per head in 2011 $US (country)

[c]:Parameter τ^2 represents the between-study variability and is often referred to as the heterogeneity parameter. It estimates the variability among the studies, beyond the sampling variability.

[d]:The $\tau^2 share$ statistic represents the percentage of residual between-study variation relative to the total variability.

[e]: Residual homogeneity test, which mathematically translates to H0:$\tau^2 = 0$. This test is based on the residual weighted sum of squares Q_res

Table 9: Stage-two results: random effect (RE) meta-regression applied to stage-one coefficients ($\hat{\beta}_p^{Z,j}$;$\hat{\beta}_m^{Z,j}$) [equ. 2 with interaction between physical & mental health - respondents aged 50-59]

	Physical Health ($\hat{\beta}_p^{Z,j}$)			Mental Health ($\hat{\beta}_m^{Z,j}$)			Physica$X$Mental health ($\hat{\beta}_c^{Z,j}$)		
	Empl.	Hours	Wage	Empl.	Hours	Wage	Empl.	Hours	Wage
η_k^z (ref.=$Male$)	-0.155***	-6.836***	-0.695	-0.051***	-1.925***	-2.768	-0.027***	-1.071***	2.246
	(0.000)	(0.000)	(0.929)	(0.000)	(0.000)	(0.666)	(0.000)	(0.000)	(0.780)
$Female$	0.034*	2.239***	-15.617	0.035***	1.519***	7.076	0.003	0.327	-2.574
	(0.016)	(0.001)	(0.095)	(0.000)	(0.000)	(0.313)	(0.612)	(0.201)	(0.786)
$Retirement^a$	-0.000	0.107	-2.359	-0.003	-0.076	-0.317	-0.005***	-0.191***	0.908
	(0.903)	(0.455)	(0.327)	(0.107)	(0.305)	(0.849)	(0.001)	(0.001)	(0.700)
GDP^b	0.001	0.023	-0.018	-0.000	-0.005	-0.163	-0.001***	-0.024*	-0.213
	(0.192)	(0.434)	(0.973)	(0.527)	(0.770)	(0.700)	(0.001)	(0.046)	(0.686)
Nobs	40	40	40	40	40	40	40	40	40
τ^{2c}	0.001	2.961	123.938	0.000	0.412	23.132	0.000	0.079	131.123
$\tau^2 share^d$	78.62	80.72	20.02	55.38	44.64	6.33	35.65	14.93	23.54
Q_res^e	178.952	203.611	63.087	77.321	64.489	63.502	56.317	46.162	50.011
$p\_Q\_res^e$	0.0000	0.0000	0.0035	0.0001	0.0025	0.0031	0.0167	0.1195	0.0604

Source: SHARE 2004-2017

p-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[a]: Effective retirement age (country$X$Gender)

[b]: GDP per head in 2011 $US (country)

[c]:Parameter τ^2 represents the between-study variability and is often referred to as the heterogeneity parameter. It estimates the variability among the studies, beyond the sampling variability.

[d]:The $\tau^2 share$ statistic represents the percentage of residual between-study variation relative to the total variability.

[e]: Residual homogeneity test, which mathematically translates to H0:$\tau^2 = 0$. This test is based on the residual weighted sum of squares Q_res

4.4 Simultaneity, endogeneity

In econometric terms what has been presented so far rests on the analysis of cross-sectional micro data. Results essentially consists of country-level OLS-estimated correlations to which we apply some second-stage analysis[10] that accounts for country-level observed and unobserved heterogeneity. The reader should thus abstain from interpreting these as strict causal evidence, singularly when considering each health variable's impact in isolation. In relative terms, these results are probably more robust as one may assume that biases affect both the

[10]Meta-regression analysis

estimates of physical and mental health symmetrically. But one should further however. A growing body of research recognises that, at the level of each individual, health and work are jointly determined. Blundell et al. (2017), reminds us that properly estimating the effect of health — and presumably as much mental as physical health — on work is a research programme of its own. Consumer choice models of utility maximisation (Grossman, 1972) suggest that employment, income and to some extent health are determined simultaneously. Hardship at work may also accelerate the depletion of people's health stock.[11] There is also the question raised by Bound (1991) of the magnitude of the "justification bias" relative to the traditional measurement error that one expects with self-reported health.[12]

In this subsection we address these identification problems by resorting to IV techniques. Following Ettner et al. (1997) we use childhood physical and mental health indices — based mostly on what respondents say about their health at the age of 10 — to instrument age 50-59 heath indices (see Appendix Tables 13, 14 for a presentation of the items forming our childhood indices). These indices also include events (hunger, financial hardship or stressful episodes) that took place before the age of 18. That age limit is justified by our willingness to focus on pre-work, hopefully exogenous, determinants of health.

A limitation of that IV estimation is that we are unable to replicate the above country-by-county stage one analysis, followed by the stage-two RE meta-regression. This is simply because the cell sizes were too small for many countries. For that reasons, we decided to pool all countries (while still distinguishing males and females respondents) and to resort to country fixed effects (FE) to capture a maximum of the country-level unobserved heterogeneity. And our focus is to determine whether physical health's apparent dominance over mental health in driving elderly work still holds.

Results are on display in Table 10. The bottom of the table contains the results of the tests for weak instruments or under-identification. We reject the null of no statistically significant relationship between the childhood health indices and the 50-59 health measures. This demonstrates that childhood health issues (both physical and mental) are strong predictors of health status at a much more advanced stage of life, in line with what Ettner et al., 1997 observed for the U.S. But, what is more, 10 results tend to confirm the asymmetric role of physical ($PHEALTH$) vs mental health ($MHEALTH$). First, we still find with

[11] See Bassanini et al. (2015) for a review of the (rather mixed) evidence on the impact of work on health. Some papers point at work, in particular long hours or night shifts, accelerating health decline; while others suggest exactly the opposite.

[12] To justify the fact that they don't work, non-working respondents may classify a given health problem as a more serious work limitation than working respondents, creating an upward bias of the OLS-estimated coefficients.

IV that health (be it physical or mental) plays no role in determining wages. Second, and more importantly, we see that with IV physical ill health ($PHEALTH$) remains the only dimension of health that is negatively impacting employment and hours.

Table 10: OLS vs IV, cross-country pooled regression, individuals aged 50-59

	Male						Female					
	OLS			IV			OLS			IV		
	Empl.	Hours	Wage	Empl.	Hours	Wage	Empl.	Hours	Wage	Empl.	Hours	Wage
$PHEALTH$	-0.147***	-6.585***	-6.597	-0.851***	-34.882***	-44.408	-0.128***	-5.078***	-13.129	-1.206***	-42.123***	188.633
	(0.000)	(0.000)	(0.586)	(0.000)	(0.000)	(0.724)	(0.000)	(0.000)	(0.295)	(0.000)	(0.000)	(0.203)
$MHEALTH$	-0.045***	-1.713***	-11.430	0.466***	18.362***	61.172	-0.012**	-0.329*	-18.315	0.867***	30.087***	-157.782
	(0.000)	(0.000)	(0.301)	(0.000)	(0.000)	(0.668)	(0.002)	(0.045)	(0.060)	(0.000)	(0.000)	(0.183)
Controls	Educational attainment (ISCED), cognition index, country & year fixed effects											
Nobs	10,869	10,916	8,222	10,869	10,916	8,222	14,550	14,591	8,933	14,550	14,591	8,933
Cragg-Donald Wald F-statistic[a]				8.73	8.79	3.94				7.18	7.21	4.24
Cragg-Donald Wald LM-statistic[b]				95.66	96.26	43.41				78.77	79.15	46.69
Cragg-Donald Wald LM-statistic [p-value]				0.0000	0.0000	0.0000				0.0000	0.0000	0.0000
Instrumented var.	Mental & physical ill health indices ($PHEALTH$, $MHEALTH$)											
Instruments	Childhood physical & mental ill health indices, age 10											

Source: SHARE 2004-2017

p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[a]: The Cragg-Donald Wald test are weak identification tests. They are in essence a F-test (i.e. it test the significance of all stage-on regressors to be jointly equal to zero) that accounts for the presence of heteroscedasticity.

[b]: The underidentification test is an LM test of whether the equation is identified, i.e., that the excluded instruments are "relevant", meaning correlated with the endogenous regressors. The test is essentially the test of the rank of a matrix: under the null hypothesis that the equation is underidentified, the matrix of reduced form coefficients on the $L1$ excluded instruments has rank=$K1-1$ where $K1$=number of endogenous regressors. Under the null, the statistic is distributed as chi-squared with degrees of freedom=$(L1-K1+1)$. A rejection of the null indicates that the matrix is full column rank, i.e., the model is identified.

5 Summary and concluding remarks

The aim of this paper was to contribute to the literature on barriers to employment beyond the age of 50 by exploring not just the role of physical ill health, but also mental ill health in reducing work. By work we mean the fact of staying or not in paid employment (the extensive margin of work), but also the number of hours worked (the intensive margin) and the hourly wage (which in principle could capture the loss of productivity of people with physical or mental health issues). The focus here is on people aged 50-59. The choice of this age range is justified by the wish to capture the relationship between health and work that exists in the absence of systematic access to (early or part-time)retirement benefits. Also, the paper considers simultaneously 20 countries (AUT, BEL, CHE, CZE, DEU, DNK, ESP, EST, FRA, GRC, HUN, IRL, ISR, ITA, LUX, PRT, SVN, SWE) who differ quite significantly in many respects (GDP per capita, retirement institutions...), but uses comparable fully harmonised microdata, amassed via the SHARE survey.

The results are essentially fourfold.

First, for both males and females aged 50-59, the impact of physical health dominates — in fact, it is at least double — that of mental health, for both the intensive and the extensive margins of work. In spite all that has been written recently about mental problems — their rising prevalence (Knapp et al., 2020) and cost for communities[13] and their highly detrimental impact on people's private or professional life (Layard et al., 2014) — it seems that people's participation to paid work remains primarily driven by physical (ill) health. And this is the case across 20 countries who tend to differ quite significantly in terms of their overall wealth (GDP per head of Switzerland is more than double that of Poland, and significantly larger than that of Belgium) or for key determinants of elderly employment like the average retirement age in the country. Could it be that mental health problems are intrinsically less of a barrier to elderly employment? Or is it that they remain largely hidden, underdiagnosed or simply accepted at a legitimate cause of (total or partial) absence from work?

Second, the link between health (and particularly mental health) is stronger for male compared with female respondents, In other words, when men aged 50-59 suffer from poor physical, and especially mental health, they are more prone to reduce their supply of work.

[13]In 2011, the World Economic Forum projected that, by 2030, mental ill health will account for more than half of the global economic burden attributable to noncommunicable diseases, at US$6 trillion (Bloom et al., 2012)

Third, we detect no effect of ill health (physical or mental) on the wages of elderly workers. This could be interpreted as evidence that "presenteeism" has no adverse consequences on labour productivity. This result contrasts with those stemming from many medical studies (Beck et al., 2011). But, more realistically in the European context underpinning the SHARE survey, this probably suggests that workers with health problems are relatively immune from wage cuts.

Fourth, individuals aged 50-59 tend to simultaneously suffer from physical and mental ill heath (i.e. co-morbidity is common); and this raises the question of cross-effects (complementarity) between the two dimensions of health in influencing work. Our results are supportive of (moderate) complementarity between physical and mental ill health. Said differently, mental and physical ill health reinforce each other in deteriorating elderly individuals' employment rate and hours of work.

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Appendix

Table 11: Relationship between mental ($MHEALTH^a$) and physical ($PHEALTH$) ill health - econometric analysis by country. Individuals aged 50-59

	AUT"	BEL	CHE	CZE	DEU	DNK	ESP	EST	FRA	GRC	HRV	HUN	IRL	ISR	ITA	LUX	POL	PRT	SVN	SWE
$PHEALTH$	0.48***	0.54***	0.53***	0.49***	0.48***	0.46***	0.70***	0.39***	0.50***	0.47***	0.48***	0.52***	0.56***	0.48***	0.56***	0.55***	0.43***	0.45***	0.32***	0.45***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$PHEALTH^2$	0.09***	0.07***	0.13***	0.08***	0.11***	0.07***	0.14***	0.09***	0.07***	0.07**	0.03	0.15***	0.14***	0.14***	0.10***	0.11**	0.09**	0.08*	0.08***	0.06**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.358)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)	(0.003)	(0.045)	(0.000)	(0.001)
$Female$	0.24***	0.36***	0.27***	0.31***	0.26***	0.23***	0.38***	0.28***	0.41***	0.30***	0.30***	0.37***	0.16*	0.20***	0.27***	0.34***	0.39***	0.50***	0.24***	0.21***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.031)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$Aged51$	0.03	0.07	0.10	-0.01	0.07	-0.05	-0.02	0.12	-0.16	-0.14	-0.02	-0.14	-0.09	0.01	0.22*	-0.09	0.14	0.55*	-0.02	-0.17
	(0.753)	(0.309)	(0.346)	(0.907)	(0.437)	(0.517)	(0.864)	(0.322)	(0.073)	(0.120)	(0.927)	(0.601)	(0.809)	(0.963)	(0.037)	(0.752)	(0.468)	(0.041)	(0.913)	(0.118)
$Aged52$	0.05	0.04	0.03	-0.01	0.02	-0.07	0.01	0.05	-0.07	-0.17	0.36	0.05	0.11	-0.04	0.12	-0.04	0.01	0.38	0.13	-0.09
	(0.653)	(0.590)	(0.797)	(0.936)	(0.808)	(0.357)	(0.955)	(0.719)	(0.441)	(0.079)	(0.096)	(0.841)	(0.762)	(0.735)	(0.245)	(0.895)	(0.943)	(0.143)	(0.412)	(0.429)
$Aged53$	0.04	0.00	0.05	0.09	0.13	-0.07	-0.01	0.10	-0.13	-0.08	0.25	-0.20	0.14	0.06	0.21	-0.18	0.09	0.37	-0.02	-0.12
	(0.667)	(0.982)	(0.659)	(0.360)	(0.171)	(0.375)	(0.894)	(0.442)	(0.160)	(0.392)	(0.262)	(0.424)	(0.683)	(0.596)	(0.059)	(0.511)	(0.647)	(0.144)	(0.892)	(0.259)
$Aged54$	-0.11	0.08	-0.01	0.10	0.04	-0.11	0.06	0.12	-0.07	-0.10	0.11	-0.09	-0.09	-0.02	0.18	-0.21	-0.13	0.66*	0.11	-0.28**
	(0.296)	(0.268)	(0.960)	(0.300)	(0.618)	(0.199)	(0.576)	(0.331)	(0.448)	(0.272)	(0.612)	(0.728)	(0.805)	(0.849)	(0.103)	(0.455)	(0.527)	(0.011)	(0.475)	(0.008)
$Aged55$	-0.02	-0.02	-0.03	0.02	-0.05	-0.07	-0.04	0.17	-0.08	-0.13	0.02	-0.20	-0.05	-0.04	-0.01	-0.19	-0.03	0.51*	0.03	-0.18
	(0.830)	(0.822)	(0.769)	(0.833)	(0.574)	(0.406)	(0.714)	(0.195)	(0.363)	(0.153)	(0.914)	(0.413)	(0.894)	(0.709)	(0.907)	(0.496)	(0.898)	(0.048)	(0.857)	(0.089)
$Aged56$	-0.11	-0.09	-0.06	0.09	-0.06	-0.09	-0.03	0.12	-0.16	-0.17	0.20	-0.09	-0.24	-0.08	0.09	-0.18	-0.05	0.49	0.07	-0.21*
	(0.293)	(0.267)	(0.610)	(0.372)	(0.523)	(0.336)	(0.762)	(0.346)	(0.088)	(0.061)	(0.367)	(0.706)	(0.498)	(0.468)	(0.430)	(0.519)	(0.807)	(0.059)	(0.663)	(0.047)
$Aged57$	-0.07	-0.06	-0.02	0.03	-0.03	-0.18*	-0.03	0.09	-0.16	-0.17	0.09	-0.17	-0.27	-0.08	0.08	-0.18	-0.11	0.50	0.07	-0.23*
	(0.510)	(0.428)	(0.827)	(0.724)	(0.722)	(0.042)	(0.781)	(0.485)	(0.076)	(0.066)	(0.664)	(0.506)	(0.438)	(0.481)	(0.450)	(0.516)	(0.585)	(0.054)	(0.639)	(0.025)
$Aged58$	-0.11	0.01	-0.12	-0.10	-0.09	-0.22*	0.02	0.09	-0.27**	-0.11	0.07	0.01	-0.19	-0.18	-0.01	-0.12	-0.14	0.59*	0.14	-0.28**
	(0.271)	(0.934)	(0.258)	(0.293)	(0.343)	(0.015)	(0.852)	(0.487)	(0.004)	(0.238)	(0.752)	(0.958)	(0.586)	(0.105)	(0.953)	(0.674)	(0.493)	(0.024)	(0.357)	(0.008)
$Aged59$	-0.15	-0.04	-0.16	-0.12	0.03	-0.18*	-0.05	0.12	-0.25*	-0.24*	0.22	-0.10	-0.19	-0.07	0.07	-0.42	-0.08	0.52*	0.07	-0.30**
	(0.136)	(0.631)	(0.148)	(0.217)	(0.745)	(0.039)	(0.617)	(0.375)	(0.010)	(0.012)	(0.313)	(0.678)	(0.579)	(0.552)	(0.505)	(0.135)	(0.704)	(0.045)	(0.664)	(0.005)
$Cognition^b$	0.03	0.08***	0.02	0.15***	0.09***	0.08***	0.12***	0.20***	0.07**	0.13***	0.17***	0.25***	0.06	0.17***	0.20***	0.14***	0.21***	0.12*	0.11***	0.09***
	(0.208)	(0.000)	(0.360)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.273)	(0.000)	(0.000)	(0.000)	(0.000)	(0.026)	(0.000)	(0.000)
$ISCED3$	-0.03	-0.01	-0.13*	-0.03	-0.14**	0.02	-0.01	-0.04	-0.02	0.01	-0.07	-0.07	-0.15	-0.15**	-0.01	-0.02	0.06	-0.03	-0.02	0.09*
	(0.541)	(0.707)	(0.013)	(0.479)	(0.008)	(0.705)	(0.891)	(0.447)	(0.589)	(0.868)	(0.334)	(0.435)	(0.163)	(0.006)	(0.787)	(0.770)	(0.394)	(0.788)	(0.714)	(0.040)
$> ISCED3$	0.02	-0.02	-0.08	0.14*	-0.10	0.01	-0.01	0.01	0.01	-0.03	0.13	0.01	0.02	-0.07	0.01	0.00	0.12	-0.06	-0.06	0.16***
	(0.685)	(0.487)	(0.224)	(0.014)	(0.071)	(0.778)	(0.880)	(0.904)	(0.850)	(0.515)	(0.181)	(0.926)	(0.855)	(0.202)	(0.845)	(0.990)	(0.238)	(0.583)	(0.385)	(0.001)
$Year$	0.01	0.02***	0.00	0.04***	0.03***	0.01	-0.01	-0.03**	0.01**	0.04***	0.00	0.00	0.00	-0.06***	0.01*	0.05	-0.01	-0.04	-0.00	0.01
	(0.140)	(0.000)	(0.532)	(0.000)	(0.000)	(0.230)	(0.052)	(0.008)	(0.006)	(0.000)	(.)	(.)	(.)	(0.000)	(0.040)	(0.166)	(0.184)	(0.329)	(0.767)	(0.091)
$\_cons$	-20.77	-34.74***	-8.98	-81.44***	-64.84***	-10.47	20.07	55.26**	-27.09**	-89.25***	-0.24	0.08	0.05	113.16***	-17.91*	-104.09	19.08	83.68	6.43	-15.15
	(0.136)	(0.000)	(0.531)	(0.000)	(0.000)	(0.230)	(0.053)	(0.008)	(0.006)	(0.000)	(0.258)	(0.751)	(0.880)	(0.000)	(0.039)	(0.167)	(0.185)	(0.332)	(0.776)	(0.091)
N	1915	4523	1666	2593	3050	2594	2635	2366	3149	2663	772	965	354	1562	3001	759	1284	665	1589	1901

Source: SHARE 2004-2017

p-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

[a]:Dependent variable

[b]:Poor cognition index

Table 12: Stage two results: random effect (RE) meta-regression applied to stage one coefficients ($\hat{\beta}_p^{Z,j}$;$\hat{\beta}_m^{Z,j}$) [equ. 1 with subjective physical ill health - respondents **aged 50-54**]

	Physical Health ($\hat{\beta}_p^{Z,j}$)			Mental Health ($\hat{\beta}_m^{Z,j}$)		
	Empl.	Hours	Wage	Empl.	Hours	Wage
η_k^z (ref.=$Male$)	-0.130***	-5.705***	-7.165	-0.056***	-2.244***	-9.040
	(0.000)	(0.000)	(0.393)	(0.000)	(0.000)	(0.223)
$Female$	0.006	0.873	-1.597	0.033***	1.648***	14.762
	(0.719)	(0.207)	(0.874)	(0.001)	(0.000)	(0.086)
$Retirement^a$	0.001	0.119	-0.292	-0.003	-0.079	1.750
	(0.744)	(0.441)	(0.902)	(0.168)	(0.332)	(0.365)
GDP^b	0.001	0.030	0.507	0.000	0.009	-0.213
	(0.207)	(0.337)	(0.375)	(0.527)	(0.596)	(0.651)
Nobs	40	40	40	40	40	40
τ^{2c}	0.002	2.523	0.000	0.000	0.127	0.000
$\tau^2 share^d$	75.33	65.11	0.00	46.55	11.82	0.00
Q_res^e	141.323	108.395	51.837	64.834	41.873	70.420
$p\_Q\_res^e$	0.0000	0.0000	0.0424	0.0022	0.2311	0.0005

Source: SHARE 2004-2017
p-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a]: Effective retirement age (country$X$Gender)
[b]: GDP per head in 2011 $US (country)
[c]:Parameter τ^2 represents the between-study variability and is often referred to as the heterogeneity parameter. It estimates the variability among the studies, beyond the sampling variability.
[d]:The $\tau^2 share$ statistic represents the percentage of residual between-study variation relative to the total variability.
[e]: Residual homogeneity test, which mathematically translates to H0:$\tau^2 = 0$. This test is based on the residual weighted sum of squares Q_res

Table 13: Stage two results: random effect (RE) meta-regression applied stage one coefficients ($\hat{\beta}_p^{Z,j}$;$\hat{\beta}_m^{Z,j}$) [equ. 1 with objective physical ill health - respondents **aged 50-54**]

	Physical Health ($\hat{\beta}_p^{Z,j}$)			Mental Health ($\hat{\beta}_m^{Z,j}$)		
	Empl.	Hours	Wage	Empl.	Hours	Wage
η_k^z (ref.=$Male$)	-0.079***	-3.204***	2.925	-0.078***	-3.358***	-16.345*
	(0.000)	(0.000)	(0.680)	(0.000)	(0.000)	(0.027)
$Female$	-0.015	-0.387	-12.549	0.043***	2.264***	22.396*
	(0.207)	(0.401)	(0.165)	(0.000)	(0.000)	(0.014)
$Retirement^a$	-0.003	-0.121	0.083	-0.003	-0.079	2.410
	(0.316)	(0.247)	(0.971)	(0.341)	(0.454)	(0.287)
GDP^b	0.000	0.007	0.053	0.000	-0.006	-0.195
	(0.469)	(0.775)	(0.920)	(0.958)	(0.776)	(0.694)
Nobs	40	40	40	40	40	40
τ^{2c}	0.001	0.637	10.380	0.001	0.845	39.260
$\tau^2 share^d$	55.79	36.14	1.60	65.73	49.27	6.50
Q_res^e	79.422	56.032	38.031	99.694	69.300	78.595
$p\_Q\_res^e$	0.0000	0.0178	0.3770	0.0000	0.0007	0.0001

Source: SHARE 2004-2017
p-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a]: Effective retirement age (country$X$Gender)
[b]: GDP per head in 2011 $US (country)
[c]:Parameter τ^2 represents the between-study variability and is often referred to as the heterogeneity parameter. It estimates the variability among the studies, beyond the sampling variability.
[d]:The $\tau^2 share$ statistic represents the percentage of residual between-study variation relative to the total variability.
[e]: Residual homogeneity test, which mathematically translates to H0:$\tau^2 = 0$. This test is based on the residual weighted sum of squares Q_res

Table 14: Stage two results: random effect (RE) meta-regression applied stage one coefficients ($\hat{\beta}_p^{Z,j}$; $\hat{\beta}_m^{Z,j}$; $\hat{\beta}_c^{Z,j}$) [equ. 2 with interaction between subjective physical and mental ill health - respondents **aged 50-54**]

	Physical Health (subjective) $\hat{\beta}_p^{Z,j}$			Mental Health $\hat{\beta}_m^{Z,j}$			Mental$X$Physical Health $\hat{\beta}_c^{Z,j}$		
	Empl.	Hours	Wage	Empl.	Hours	Wage	Empl.	Hours	Wage
η_k^z (ref.=$Male$)	-0.131***	-5.718***	-10.027	-0.060***	-2.367***	-8.046	-0.038***	-1.464***	-4.872
	(0.000)	(0.000)	(0.248)	(0.000)	(0.000)	(0.308)	(0.000)	(0.000)	(0.631)
$Female$	0.015	1.103	2.655	0.034**	1.719***	15.816	0.004	0.521	6.014
	(0.407)	(0.126)	(0.796)	(0.003)	(0.000)	(0.081)	(0.642)	(0.102)	(0.629)
$Retirement^a$	0.001	0.114	-1.158	-0.004	-0.119	2.458	-0.005*	-0.163*	1.773
	(0.789)	(0.479)	(0.631)	(0.080)	(0.195)	(0.217)	(0.010)	(0.023)	(0.560)
GDP^b	0.001	0.026	0.343	-0.000	-0.006	-0.024	-0.001	-0.016	0.175
	(0.286)	(0.431)	(0.559)	(0.720)	(0.764)	(0.963)	(0.164)	(0.325)	(0.788)
Nobs	40	40	40	40	40	40	40	40	40
τ^{2c}	0.002	2.797	0.000	0.001	0.359	0.000	0.000	0.000	180.319
$\tau^2 share^d$	74.69	66.25	0.00	54.55	26.28	0.00	41.45	0.00	18.02
Q_res^e	140.858	112.848	48.062	76.645	50.478	72.115	61.811	47.279	70.723
$p\_Q\_res^e$	0.0000	0.0000	0.0862	0.0001	0.0552	0.0003	0.0047	0.0989	0.0005

Source: SHARE 2004-2017
p-values in parentheses * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
[a]: Effective retirement age (country$X$Gender)
[b]: GDP per head in 2011 $US (country)
[c]:Parameter τ^2 represents the between-study variability and is often referred to as the heterogeneity parameter. It estimates the variability among the studies, beyond the sampling variability.
[d]:The $\tau^2 share$ statistic represents the percentage of residual between-study variation relative to the total variability.
[e]: Residual homogeneity test, which mathematically translates to H0:$\tau^2 = 0$. This test is based on the residual weighted sum of squares Q_res

Table 15: Childhood physical health conditions and events

	General[a]	Missed school[b]	Infectious[c]	Polio[d]	Asthma[e]	Respiratory[f]	Allergies[g]	Diarrhoea[h]	Ear problems[i]	Difficulty seeing[j]	Broken bones[k]	Heart trouble[l]	Leukaemia[m]	Cancer[n]	Other serious[o]	Hunger[p]	Childhood index[r]
AUT	2.210	4.474	0.874	0.007	0.008	0.031	0.032	0.018	0.032	0.027	0.150	0.007	0.000	0.002	0.082	0.009	0.079
BEL	1.973	4.384	0.843	0.002	0.032	0.055	0.076	0.016	0.022	0.035	0.143	0.008	0.000	0.001	0.064	0.011	0.082
CHE	2.156	4.492	0.853	0.008	0.040	0.029	0.085	0.010	0.050	0.044	0.155	0.007	0.001	0.000	0.033	0.008	0.107
CZE	2.176	4.234	0.806	0.002	0.014	0.035	0.030	0.014	0.051	0.032	0.145	0.014	0.000	0.002	0.056	0.006	0.128
DEU	2.285	4.279	0.894	0.005	0.016	0.022	0.046	0.030	0.038	0.045	0.158	0.012	0.001	0.000	0.054	0.015	0.192
DNK	1.712	4.671	0.961	0.004	0.037	0.027	0.086	0.009	0.053	0.024	0.147	0.008	0.000	0.001	0.043	0.006	-0.109
ESP	2.336	4.664	0.697	0.004	0.015	0.019	0.041	0.007	0.012	0.020	0.066	0.001	0.000	0.000	0.047	0.015	-0.077
EST	2.604	4.386	0.858	0.003	0.006	0.130	0.037	0.039	0.047	0.042	0.101	0.032	0.001	0.001	0.054	0.016	0.414
FRA	2.187	4.350	0.843	0.005	0.048	0.031	0.053	0.014	0.026	0.022	0.106	0.006	0.000	0.001	0.066	0.017	0.121
GRC	1.461	4.890	0.657	0.003	0.006	0.013	0.039	0.008	0.009	0.003	0.047	0.001	0.000	0.000	0.021	0.012	-0.536
HRV	1.823	4.681	0.838	0.001	0.006	0.015	0.012	0.010	0.027	0.022	0.078	0.008	0.000	0.004	0.063	0.007	-0.239
HUN	2.197	4.656	0.641	0.008	0.006	0.005	0.015	0.015	0.032	0.015	0.091	0.020	0.000	0.000	0.058	0.011	-0.101
IRL	1.645	4.624	0.759	0.000	0.020	0.029	0.024	0.004	0.016	0.000	0.090	0.004	0.000	0.004	0.033	0.008	-0.319
ISR	1.839	4.634	0.632	0.009	0.017	0.023	0.034	0.008	0.018	0.032	0.044	0.007	0.000	0.000	0.048	0.010	-0.232
ITA	1.996	4.730	0.794	0.006	0.013	0.017	0.027	0.003	0.015	0.035	0.047	0.003	0.000	0.001	0.032	0.015	-0.229
LUX	2.173	4.464	0.939	0.004	0.039	0.029	0.067	0.017	0.034	0.032	0.170	0.005	0.001	0.001	0.053	0.009	0.120
POL	2.195	4.587	0.765	0.003	0.005	0.015	0.011	0.008	0.022	0.006	0.083	0.011	0.000	0.000	0.086	0.011	-0.078
PRT	2.239	4.552	0.690	0.006	0.000	0.009	0.041	0.009	0.006	0.006	0.009	0.000	0.000	0.000	0.100	0.062	-0.074
SVN	2.166	4.421	0.877	0.001	0.019	0.028	0.024	0.002	0.030	0.029	0.095	0.014	0.000	0.002	0.082	0.015	0.047
SWE	1.782	4.672	0.948	0.003	0.039	0.026	0.099	0.012	0.054	0.012	0.112	0.005	0.000	0.001	0.034	0.009	-0.104

Source: SHARE 2004-2017

[a]: Childhood health general [1:excellent 6:poor]; [b]: Missed school for 1 month or longer [0:no 1:yes]

[c]: Infectious disease [0:no 1:yes] [0:no 1:yes]; [d]: Polio [0:no 1:yes]

[e]: Asthma [0:no 1:yes]; [f]: Respiratory problems other than asthma [0:no 1:yes]

[g]: Allergies (other than asthma)[0:no 1:yes]; [h]: Severe diarrhoea [0:no 1:yes]

[i]: Chronic ear problems [0:no 1:yes]; [j]: Difficulty seeing even with eyeglasses [0:no 1:yes]

[k]: Broken bones, fractures[0:no 1:yes]; [l]: Heart trouble [0:no 1:yes]

[m]: Leukaemia or lymphoma [0:no 1:yes]; [n]: Cancer or malignant tumour [0:no 1:yes]

[o]: Other serious health cond. [0:no 1:yes]; [p]: Experienced hunger ¡18 [0:no 1:yes]

[q]: Childhood physical ill health index; first principal component of a-p items (the higher, the worse is people's health)

Table 16: Childhood mental health conditions and events

	Meningitis[a]	Speech impair.[b]	Headache[c]	Epilepsy[d]	Psychiatric prob.[e]	Stress[f]	Financial hard.[g]	Childhood index[h]
AUT	0.022	0.008	0.037	0.008	0.019	0.023	0.029	0.043
BEL	0.013	0.008	0.073	0.012	0.031	0.056	0.024	0.235
CHE	0.010	0.012	0.079	0.001	0.023	0.042	0.019	0.121
CZE	0.025	0.022	0.031	0.006	0.009	0.015	0.003	-0.037
DEU	0.010	0.015	0.070	0.006	0.022	0.037	0.028	0.135
DNK	0.007	0.014	0.092	0.014	0.024	0.014	0.030	0.146
ESP	0.006	0.003	0.044	0.005	0.008	0.010	0.019	-0.105
EST	0.009	0.009	0.062	0.006	0.010	0.017	0.011	-0.033
FRA	0.009	0.011	0.074	0.015	0.035	0.053	0.015	0.242
GRC	0.001	0.005	0.012	0.000	0.001	0.010	0.029	-0.197
HRV	0.009	0.002	0.035	0.004	0.006	0.020	0.023	-0.099
HUN	0.003	0.005	0.038	0.009	0.005	0.012	0.038	-0.076
IRL	0.004	0.008	0.045	0.004	0.012	0.033	0.033	0.008
ISR	0.000	0.010	0.032	0.002	0.002	0.020	0.022	-0.127
ITA	0.002	0.006	0.021	0.005	0.007	0.020	0.019	-0.120
LUX	0.009	0.015	0.102	0.005	0.014	0.051	0.026	0.190
POL	0.008	0.005	0.032	0.004	0.011	0.016	0.010	-0.107
PRT	0.009	0.000	0.172	0.000	0.000	0.012	0.095	0.204
SVN	0.019	0.005	0.021	0.005	0.008	0.022	0.011	-0.097
SWE	0.021	0.013	0.072	0.014	0.032	0.016	0.030	0.179

Source: SHARE 2004-2017

[a]: Meningitis/encephalitis [0:no 1:yes]
[b]: Speech impairment [0:no 1:yes]
[c]: Severe headaches or migraines [0:no 1:yes]
[d]: Epilepsy, fits or seizures [0:no 1:yes]
[e]: Emotional, nervous, or psychiatric problem [0:no 1:yes]
[f]: Stress ¡18 [0:no 1:yes]
[g]: Financial hardship ¡18 [0:no 1:yes]
[h]: Childhood mental ill health index - first principal component of a-g items (the higher, the worse is people's health).

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