Career Arduousness and (Healthy) Life Expectancy in Europe

An assessment based on O*NET and SHARE data

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Abstract

The main policy response to population ageing in advanced economies has been to raise the mandatory retirement age. However, these policies have reignited calls for differentiated retirement ages that consider variations in work arduousness. This paper uses microdata to explore the relevance and feasibility of this idea in Europe. It first quantifies career arduousness using SHARE wave 7 retrospective ISCO4-digit data on careers in combination with US O*NET working conditions data. Then, using SHARE follow-up data collecting (bad)health and death information about wave 7 respondents, it estimates (healthy) life expectancy by career arduousness decile combining econometrics and life table methods. Findings reveal a life expectancy gap between the least and most arduous careers of 3.2 to 4.2 years. Healthy life expectancy differences are slightly larger, ranging from 5.3 to 9 years. On both metrics, women are slightly more impacted by arduousness. However, this paper also reveals significant variations in exposure to arduousness across genders and also countries. This suggests that compensatory retirement policies would benefit men more than women and be less common in countries with higher GDP per capita.

Keywords: Ageing, Career arduousness, (Healthy) life expectancy, Retirement Policy

JEL Codes: J14, I1, J26

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1 Introduction

In advanced economies, the most prevalent policy response to population ageing has been to raise the effective retirement age. Indeed, stricter retirement policies introduced since the mid-1990s have effectively increased employment rates (Atalay and Barrett, 2015), albeit from historically low levels (Costa, 1998). The point of this paper is that these policies have reignited concerns about the (un)fairness of uniform retirement ages.

If longevity[1] is driven by the arduousness of work [2], then a pension system with a single retirement age (or uniform contribution or replacement rates) is financially unfair. Unaccounted deterministic longevity differences – in particular those related to people's careers in a `work-related` Biskmarckian contributory pension system[3] – amount to unduly taxing short-lived people and subsidising their long-lived peers (Ayuso et al., 2016), potentially also distorting labour supply. The gradient in life expectancy reduces the progressivity of public pensions in those countries (e.g. the US) where the replacement rate is a negative function of earned income (Bosworth et al., 2016; Bommier et al., 2011). Some would even argue that non-random longevity difference makes public pensions regressive (Piketty and Goldhammer, 2015). Similarly, and beyond a purely financial conception of fairness, individuals should be entitled to the same expected time in retirement in good health. If health deteriorates faster for individuals with a more arduous career, this may also contribute to unfairness.

One of the usual policy recommendations to address these problems is to differentiate the retirement age to account for predictable (healthy) longevity differences. (Ayuso et al., 2016; Leroux et al., 2015; Vandenberghe, 2021). In this paper, adopting a Bismarckian point of view of fairness in pensions and retirement, we explore the importance of (healthy) longevity differences that can be statistically related to work/career arduousness.

The questions we ask more specifically in this paper are essentially twofold.

- First, in Europe, how much do individuals aged 50 and more differ in terms of the

[1] To be understood as the realized length of life of individuals.

[2] The same argument applies to any other characteristic systematically correlated with longevity: gender, education. . .

[3] It is common to distinguish Bismarckian and Beveridgean pension regimes. Bismarckian ones are contributory and, in that sense, work-related. Benefits are paid *prorata* the duration and level of contributions. This is a basic feature of the first fully-fledged public pension scheme introduced by German Chancellor Bismarck in 1889. By contrast, Beveridgean pensions (in reference to the British economist W. Beveridge, who presided over the design of the British system) are non-contributory and distribute (basic) universal benefits

degree of career arduousness they have been exposed to? And how can these differences be quantified? Many stakeholders, including economists, call for arduousness-based retirement age differentiation (Ayuso et al., 2016). However, implementing this simple idea is more complicated than it seems. There is indeed no consensual measure of arduousness. Arduous jobs are often defined more or less arbitrarily or using outdated classifications.[4]

- Second, how much does career arduousness predict the length of life and the length of life in good health? In other words, how do estimates of career arduousness translate into estimates of (healthy) life expectancy differences? Evidence abounds to suggest that the health status and work capacity of same-age older individuals differ a lot (Wise, 2017). And so do their expected remaining (healthy) life years.[5]. However, much less evidence exists about the link between career arduousness and long-term health and longevity. Bringing better evidence on this is important, as people also disagree about the importance of work arduousness – relative to other factors – in driving the risk of poor health or premature death.

The answer to those two questions determines the feasibility of a policy aimed at compensating work-related (healthy) life expectancy differences as it guides how much to adjust the retirement age to ensure that individuals who have experienced varying levels of work arduousness can *expect* to live the same number of years (or the same number of years in good health). Also, by examining evidence based on gender[6] and country[7], the paper evaluates the heterogeneity in arduousness-driven (healthy) life expectancy and thereby further contributes to the debate on the optimal design of retirement systems.

The rest of this paper is organised as follows. Section 2 exposes our contribution to the existing literature on arduousness and (healthy) life expectancy. Section 3 presents the SHARE and O*NET microdata we used to quantify career arduousness, and the SHARE data on the risk of death and (ill-)health. Section 4 exposes our econometric analysis of the relationship between arduousness deciles and the risk of death and bad health beyond 50. It also exposes how these econometric results contribute to estimating fully-fledged career-

[4]An exception is perhaps Poland, where daily calories needed to perform the job have been used to evaluate the arduousness of a profession (Zaidi and Whitehouse, 2009). Still, some sedentary occupations might not require as many calories as manual work but could also be detrimental to health.

[5]In Belgium, people who entered the labour market at 20 have a 10% risk of not reaching the uniform retirement age of 65. At 65, the remaining life expectancy gradient is between 8 and 10 years considering gender×education socioeconomic status categories.

[6]Hereafter, we systematically consider distinctly males and females.

[7]Our assessment of country-level heterogeneity rests solely on cross-country arduousness differences.

arduousness-adjusted life tables. Section 5 presents the paper's main results, while Section 6 concludes.

2 Contribution to the literature

This paper aims to contribute to the economic literature on the long-term consequences[8] of career arduousness, more specifically, the risk of death and bad health, and the implications for retirement policy. One of the paper's key contributions to the literature stems from our ability to link what happens during the entire career and the old-age health and death status. To assess and quantify the impact of career arduousness on (healthy) life expectancy, this paper exploits unique, and so far untapped retrospective European SHARE[9] data on careers that simultaneously document the succession of occupations, and data on health and death measured on a sample of individuals when they are aged 50+; thus, after what we call their career throughout this paper.[10]

Conceptually, hereafter, arduousness relates to how that concept is defined in the job demands and job quality literature (Bakker and Demerouti, 2007; Chen et al., 2017). A more arduous/demanding occupation or job requires more physical and/or psychological effort or skills and consumes more physiological and/or psychological resources. We will explain later how this is quantified in our data. The point is that the job demands literature has abundantly shown that occupations are not equally stressful or physically demanding, and that they may affect individuals' health and longevity. What differentiates our approach from most of the job demands literature is that we are not just interested in analysing the consequences of the current or most recent job, but the succession of jobs forming a complete career. That objective is derived from the recent availability of data that can quantify the arduousness of someone's career. With these data, we can account for the duration of these occupations and, as people change occupations, how these changes contribute to the cumulative arduousness people have been exposed to as they age. Many papers have documented the impact of events from an individual's past on the risk of death for individuals aged 50 and older (including some using SHARE data like Nicińska and Kalbarczyk-Steclik

[8]Beyond the age of 50.

[9]Survey of Health, Ageing and Retirement in Europe (SHARE) (Börsch-Supan et al., 2013); more specifically the latest wave 7 SHARELIFE retrospective survey implemented in 2017-18.

[10]Health is measured at the moment of the interview, among individuals whose age range from 50 to 102. Health is thus measured when respondents are retired and, in any case, after the period used to compute career arduousness. Information on death comes from the SHARE's capacity to conduct so-called End-of-Life interviews.

(2015)). But as far as we know, quantifying the arduousness over the entire career and analysing its (long-term) impact on (healthy) life expectancy is a novelty.

In terms of data sources and types, three things demarcate this paper. First, its use of 7th wave – the latest iteration of the retrospective SHARELIFE survey (Börsch-Supan et al., 2013). The 7th wave contains several retrospective modules that provide detailed data about the respondent's history, including their childhood health and parental longevity. What is more, extensive information is provided about job history.[11] We can identify each respondent's last and first occupations and those in between. SHARE informs us of the number of job spells.[12]

Second, although SHARE provides a lot of information about people's careers, it falls short of describing the arduousness of successive jobs. But other data sources can be mobilised for that. One is O*NET from the US[13]. More will be said about O*NET in the data Section 3, but, in short, O*NET collects information about the work content and the working conditions for a wide range of occupations (referenced using international classifications like ISCO). And that information can be used to compute arduousness indices. Then, as we do in this paper, these indices can be imported into SHARE and applied to each job spell forming SHARE respondents' careers, using the ISCO code as a merge variable. More on this in Section 3.2.

Third, we can account for what epidemiologists call people's health endowment and also other pre-labour[14] determinants of late-life health and longevity, like educational attainment. The life course literature stresses the long-lasting effects of family and social background (including educational attainment) on general health status in adulthood. Recent empirical contributions comprise Mazzonna (2014) or Antonova et al. (2017) using SHARE wave 3 data[15]; and also the recent paper by Zhu and Liao (2021), using data from the Chinese equivalent of SHARE, the China Health and Retirement Longitudinal Study (CHARLS). As far as we know, the job arduousness literature has overlooked the possibility of a link

[11] SHARE wave 3 also contained retrospective employment modules, but not with the degree of detail available in wave 7. For example, job history in wave 3 is only available at ISCO 1 digit, while ISCO 4 digits in wave 7.

[12] It also informs on the number of gaps between these, whether people worked part-time or full-time or the number of times they were made redundant. That information can be used to build career instability proxies. For an analysis of the health impact of career arduousness vs. instability, see Vandenberghe (2023).

[13] Another one is the European Working Conditions Survey (EWCS).

[14] Decided or determined before people enter the labour market.

[15] That wave of SHARE collected retrospective information on respondents' family backgrounds during their childhood, similar to the one collected via Wave 7 that we use here. But wave 3 did not contain retrospective information about people's careers.

between early life/pre-labour factors and (healthy) life expectancy. This paper aims to remedy that situation by delivering estimates of the long-term impact (or instability) of career arduousness from which the contribution of health endowment has been netted out.

Finally, using a fully harmonised data set, we quantify the impact of career arduousness on health and death for 26 European countries + Israel. Compared to works using only national data, the advantage is that we analyse wider distributions, which is a prior good for identification. We also show that this is a way to capture the important role of GDP per head in driving exposure to work arduousness and its long-term consequences for people.

3 Data

3.1 SHARE wave 7- job history

The analysis of the career arduousness/longevity relationship at the core of this paper rests on a (quite important and time-consuming) preliminary work that quantifies the arduousness of the `entire career` of SHARE respondents. That task uses the 7^{th} wave of SHARE. This wave was assembled in 2017(18) across 26 European countries plus Israel (Table 1). It contains several "retrospective" modules that provide detailed data about the respondent's history. Extensive information is provided about job history at the ISCO4 level.

In the 7^{th} wave of SHARE, respondents are asked to retrace their complete job history by providing the starting/ending year of each of their successive jobs/occupations and whether these were done on a full- or part-time basis. A participant's history is reported retrospectively, and thus, a long time after work happens (i.e., a retiree in 2018 must recall her work history from 1970 if she started working at age 20). This can lead to memory biases. To reduce this problem, the SHARE surveyors used a "Life History Calendar" approach to help the respondent report accurately. The Life History Calendar (LHC) method uses a calendar-like matrix to map out life events, providing visual cues to the interviewer and interviewee regarding the onset, duration, sequencing, and co-occurrence of events. The calendar includes rows, which are categories of life events, including schools attended, jobs, living arrangements, dating relationships, and so on. Numerous innovations of the LHC provide benefits relative to data collection through traditional questionnaires. The LHC's columns encourage recall at the temporal level, while the rows encourage recall at the thematic level. The LHC has been tested extensively with respondents of varying ages and cultural backgrounds, including those with unstable lives and cognitive difficulties (DeHart, 2021). The LHC reports the occupation title for each of the successive jobs/occupations at ISCO-4 digits. We merge that information with arduousness indices estimated separately for each ISCO-4 occupation (see below in Section 3.2). The combination of SHARE job history data and arduousness data puts us in a position to compute, *inter alia*, an average career arduousness index and examine how it correlates with a series of usual predictors (gender, age, GDP per head). Also, the LHC permits calculating the duration of their entire career, both in absolute years and in equivalent-full-time years (that we use as a control hereafter).

Table 1: SHARE: Wave 7 (2017-18) respondents aged 50+ analysed in this paper. Count by country and gender

	(1)		
	Male	Female	Total
Austria	834	1,124	1,958
Germany	1,059	1,185	2,244
Sweden	738	797	1,535
Spain	715	714	1,429
Italy	985	831	1,816
France	565	743	1,308
Denmark	579	700	1,279
Greece	296	237	533
Switzerland	571	604	1,175
Belgium	1,053	1,195	2,248
Israel	542	628	1,170
Czech Republic	898	1,367	2,265
Poland	998	1,175	2,173
Luxembourg	375	410	785
Hungary	236	350	586
Portugal	346	348	694
Slovenia	1,096	1,452	2,548
Estonia	1,415	2,406	3,821
Croatia	824	852	1,676
Lithuania	356	680	1,036
Bulgaria	385	547	932
Cyprus	232	224	456
Finland	554	622	1,176
Latvia	181	306	487
Malta	278	236	514
Romania	448	390	838
Slovakia	415	469	884
Total	16,974	20,592	37,566

Source: SHARE 2004-2022 (Wave 7).

3.2 O*NET : how to quantify the arduousness of jobs and occupations

SHARE wave 7 provides a lot of information about people's careers. But it falls short of providing information about the `arduousness` of successive jobs/occupations. To overcome that limitation, we turn to O*NET from the US.[16]

O*NET is a rolling survey about working conditions by occupation that contains over 180 variables. Those variables are included in different modules. Here, we concentrate on the `Work Context` module. Items composing the module's version used here were collected in 2021. They explicitly describe working conditions (e.g. exposition to contaminants, spending time bending or twisting the body, working in very hot or cold temperatures. . .), structural job characteristics (e.g. consequence of error, time pressure, freedom to decide), and interpersonal/managerial relationship at work (e.g. contact with others, responsibility for other's health and safety, face-to-face discussions). We use a principal component (PC) analysis to get a summary indicator of occupation arduousness. More information (1st and 2nd principal components, eigenvalues and loading factors) is reported in the Appendix A.1.1. Only the 1st PC is used in the paper to quantify each occupation's arduousness. We show in that table that it correlates with working conditions items associated with arduousness (e.g. "Exposed to Contaminants", "Pace (of work) determined by the speed of Equipment", "Sounds noise levels are distracting or uncomfortable". . .). We also show that the 2nd Principal component correlates more with managerial vs. non-managerial work content: a dimension that is a priori less relevant in an exercise centred on the health impact of arduousness. In the Appendix A.1.1, Figure A.2 presents our O*NET 1st principal component (PC) at ISCO 2 level. We see that typical manual/outdoor occupations (e.g., building and related trades works) translate into high arduous PC values, while more intellectual/indoor occupations (e.g., business and administration) display much lower values.

It is important to stress what we do with these occupation-specific arduousness data. Once injected into SHARE, they are used to compute, for each respondent, career arduousness indices. For instance, we compute the weighted average of all O*NET-estimated PC for his/her consecutive ISCO 4-digit occupations self-reported in SHARE wave 7. The weights for that average reflect the duration (in years) of the successive occupation spells. Note that the years have been multiplied by .5 if the occupation was declared always part-time, 1 if always full-time and .75 when variable. Hereafter, we mostly use the entire (average) career arduousness index.

Table 2 exposes some OLS estimated partial correlations showing that career arduousness, as we have computed, rises with the age of the SHARE wave 7 respondent. This is compatible with the fact that the older individuals may have worked in harsher conditions than their (relatively) younger peers. Arduousness is also systematically lower among female

[16] `https://www.onetcenter.org/database.html`

respondents. Coefficients ranging from -1.83 to 1.84 are interpreted as evidence of a career arduousness gap of a bit less than 2 deciles of the pooled/international distribution. The last set of results on display Table 2 captures the relationship between the decile of career arduousness and the GDP of the respondent's country. Countries are themselves regrouped by quartile of the international GDP per head distribution (measured in 2017 PPP US dollars). Using the first quartile as a reference, we see, for instance, that belonging to the 4th quartile translates with a 1.18 reduction of the career arduousness decile. The second column (M2) reports the results based on the 1992 GDP per head (corresponding to a time lag of 25 years). The idea is to check the link between career arduousness and a version of GDP that is more likely to correspond to the situation when SHARE respondents were active. The point is that the results obtained with the lagged measure of GDP per head quartile are very similar to those delivered by the more recent measure of GDP.

Table 2: The determinants of career arduousness decile ^{a}: age, gender and GDP per head quartile (ref: 1st quartile)

Ard. decile	M1	M2
Age	0.0071***	0.0049***
	(0.0015)	(0.0015)
Female	-1.8435***	-1.8599***
	(0.0275)	(0.0274)
GDPq2^c	-0.3821***	
	(0.0383)	
GDPq3	-0.8658***	
	(0.0385)	
GDPq4	-1.2202***	
	(0.0388)	
GDPq2(lagged)^d		-0.2760***
		(0.0371)
GDPq3(lagged)		-1.0137***
		(0.0398)
GDPq4(lagged)		-1.2086***
		(0.0389)
N	37,566	37,566

Source: SHARE, O*NET. Our calculations Standard errors are in parentheses; *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$. [a]:Coefficients capture the marginal impact on the decile of the international arduousness distribution.
[b]: GDP per head quartile 2017 : output-side real GDP at chained PPPs (in mil. 2017US$) q1: Bulgaria, Croatia, Greece, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia q2: Cyprus, Czech Republic, Estonia, Malta, Portugal, Slovenia q3: Belgium, Finland, France, Israel, Italy, Spain q4: Austria, Denmark, Germany, Luxembourg, Sweden, Switzerland
[d]: GDP per head quartile 1992: output-side real GDP at chained PPPs (in mil. 2017US$) q1: Croatia, Estonia, Latvia, Lithuania, Poland, Romania q2: Bulgaria, Czech Republic, Greece, Hungary, Malta, Portugal, Slovakia, Slovenia, Spain q3: Belgium, Cyprus, Finland, France, Israel, Italy q4: Austria, Denmark, Germany, Luxembourg, Sweden, Switzerland

3.3 Other SHARE data used

Another important source of data for this paper is the one that allows us to quantify the risk of death at different ages. By construction, all wave 7 respondents are alive when they answer questions about their careers that we use to quantify the degree of career arduousness they have been exposed to. Thus, it is key to record deaths as they `transit` from one year to another beyond wave 7. It is done here using SHARE data collected in Waves 8, 9, 10 and End-of-Life Interviews. Table 3 informs about the number of transitions we exploit in the paper.

Also, our estimates of `healthy` life expectancy rest on SHARE health data. The item used here is self-rated health. It is measured at the moment of a SHARE interview (wave 7 or after in our case), which means at an age ranging from 50 to 102 and more, depending on the respondent's age. Our poor/bad health outcome variable is built using the answer to the question "How would you rate your health?" on a 5-item scale: "Excellent, Very Good, Good, Fair and Poor". This variable is widely known to be a reliable indicator of health (Bound, 1991; Idler and Benyamini, 1997), (Han and Jylha, 2006). It is frequently reassessed with the same conclusion about its validity (see e.g. Schnittker and Bacak, 2014).[17] Following Etilé and Milcent (2006), we dichotomized self-reported health into "Good, Fair and Poor" v.s "Excellent and Very good".

Table 4 details the frequency by age of death and bad health, underpinning our entire analysis.

Finally, this paper controls for the potential bias caused by the pre-labour determinants[18] in driving the risk of poor health in late years (Trannoy et al., 2010) of (healthy) longevity. SHARE contains data on educational attainment and health endowment. The latter comprises the health status during childhood[19] and information about parents' death status.[20] Our goal, when mobilising these items, is to assess the propensity of our results to over(under)estimate the contribution of career arduousness due to negative (positive) selection into arduousness.

[17]It is also a good predictor of more elaborate health indices that can be computed using SHARE many subjective and objective health items .

[18]Inherited or emerging during childhood, before people start working

[19]Before the respondent turns 15.

[20]We consider whether parents are currently alive (1), and if they have died, we consider whether they "prematurely" died (i.e. they died younger than the median age at death in the considered country) (2) or not (3). The resulting categorical variable can be considered as a proxy of the "genetic" background of the respondent under the assumption of intergenerational transmission of health (Trannoy et al., 2010).

Table 3: Number of transitions beyond wave 7

Transitions	Male	Female	Total
1	434	286	720
2	2,696	2,824	5,520
3	10,800	12,420	23,220
4	41,564	53,196	94,760
5	5,995	7,270	13,265
6	12	6	18
Total	61,501	76,002	137,503

Source: SHARE 2004-2020 (Waves 7-10 and End-of-Life surve).
*: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$

Table 4: Risk of death/bad health by age band

	Male		Female	
Age band	Death	Bad health	Death	Bad health
50-54(ref)	0.004	0.254***	0.003*	0.269***
55-59	-0.000	0.046***	-0.002	0.028**
60-64	0.002	0.072***	-0.001	0.064***
65-69	0.004	0.101***	0.000	0.109***
70-74	0.004	0.156***	0.002	0.172***
75-70	0.012***	0.216***	0.004**	0.278***
80-84	0.021***	0.276***	0.014***	0.344***
85-89	0.037***	0.315***	0.025***	0.407***
90-94	0.046***	0.358***	0.037***	0.419***
95+	0.090***	0.275***	0.070***	0.386***
N	61,501	61,501	76,002	76,002

Source: SHARE 2004-2020 (Wave 7).
*: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$.

4 Econometric analysis and arduousness-adjusted life tables

To assess how career arduousness predicts the expected length of (healthy) life, we adopt a two-step strategy that combines econometrics and the computation of arduousness-adjusted life tables.

4.1 Framework

We first analyse econometrically, using our follow-up data on death by age (Table 3). This delivers, by gender, the probability of dying at age x : $\widehat{q_x}$ or that of being in bad health at that age ($\widehat{bh_x}$). We estimate a logit model that consists of regression death and bad health dummies on age, age squared, arduousness and arduousness interacted with age. As a control, we systematically include the duration of the career and COVID dummy.[21]. In a variant of the model, we control for the role of pre-labour endowment variables (parental death status and childhood health, plus educational attainment). The econometric estimates are reported in Table 5. Note that they are derived from the estimation of logit models and have been exponentiated to correspond to odd ratios. They confirm that age (centred on 65) is a key (generally non-linear) determinant of the risk of death and bad health. More to the point here, point estimates support arduousness, increasing the risk of death and poor health, although at a decreasing rate with age (odd ratios of age interacted with arduousness are inferior to 1 and statistically significant).

The rest consists of calculating (healthy) life tables[22] using the above point estimates. We compute one life table for each career arduousness decile $k = 1, \ldots, 10$ (Madans and Molla, 2008). Using predicted death probability by age $\widehat{q}_{x,k}$ and that of being in bad health $\widehat{bh}_{x,k}$, we compute the survivorship by age and arduousness decile: $l_{x,k} = l_{x-1,k} \ \times \ (1 - \widehat{q}_{x-1,k})$. To be precise, the survivorship estimates are normalized using the Eurostat -EU 28, 2017 estimates of survival by age 50-102.[23] We impose survivorship for arduousness deciles 4 and 5 $l_{x,k}; k = 4, 5$ to correspond to the EU reference $\tilde{l}_{x,k} = l_{x,EU}; k = 4, 5$. For the other deciles, we add to the EU reference the deviation from our survivorship estimates and the average of our estimates for arduousness deciles 4 and 5. In other words, $\tilde{l}_{x,k} = l_{x,EU} \ + \ [\ l_{x,k} - \bar{l}_x\ ]; k \neq 4, 5$ where $\bar{l}_x$ is the average for deciles 4 and 5.

The healthy survivorship by age is computed as survival times the (EU normalized) likelihood to be in good health, i.e. $\tilde{hl}_{x,k} = (1 - \widehat{bh}_{x,k}) \times \tilde{l}_{x,k}$ where $\widehat{bh}_{x,k}$ is the econometrically estimated likelihood of bad health at age x for decile arduousness k. Finally, life expectancies $e_{x,k}$ and healthy life expectancies $he_{x,k}$ are computed as the integrals (over age ranging from 50 to 102) of the corresponding (EU-normalized) survivorship functions $\tilde{l}_{x,k}; \tilde{hl}_{x,k}$.

[21] Covering the period 2020/3 - 2022/12

[22] The notations $q_x, bh_x, \ldots$ hereafter are those used in the life table literature.

[23] https://ec.europa.eu/eurostat/databrowser/view/demo_mlifetable__custom_11167684/default/table

Table 5: Econometric analysis of the risk of death/bad health[a]

	Death				Bad health			
	M		F		M		F	
	M1	M2	M3	M4	M1	M2	M3	M4
Age	1.125***	1.128***	1.123***	1.126***	1.070***	1.067***	1.055***	1.049***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.003)	(0.003)	(0.002)	(0.002)
Age^2	1.001	1.000	1.001***	1.001***	1.000***	1.000***	1.000***	1.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ard. dec.	1.150***	1.120***	1.186***	1.172***	1.125***	1.093***	1.132***	1.106***
	(0.027)	(0.028)	(0.036)	(0.038)	(0.004)	(0.004)	(0.004)	(0.004)
Age X Ard. dec.	0.995***	0.995***	0.993***	0.992***	0.998***	0.998***	1.000	1.000
	(0.002)	(0.002)	(0.002)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)
Career dur.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Covid	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Educ	No	Yes	No	Yes	No	Yes	No	Yes
Child health	No	Yes	No	Yes	No	Yes	No	Yes
Mother death status	No	Yes	No	Yes	No	Yes	No	Yes
Father death status	No	Yes	No	Yes	No	Yes	No	Yes

Source: SHARE, O*NET work context items, our calculations.

Standard errors are in parentheses; *: $p < 0.1$, **: $p < 0.05$, ***: $p < 0.01$.

[a] Exponentiated coefficients.

[b] Centred on the age of 65.

4.2 Identification issues

The resulting life tables (Tables 6,7) are valid only if we properly identify the relationship between ill health/death and career arduousness. We see two key issues: one related to the measurement of arduousness and one rooted in selection.

Regarding measurement, the main issue is the "time gap", i.e. the time that has elapsed between the moment SHARE respondents worked and the one it is evaluated by O*NET. Our O*NET indices (i.e., estimates of the arduousness of occupations as they were in the early 2000s) may underestimate the actual arduousness of past occupations (i.e. when SHARE respondents worked), particularly among old respondents who appear within the highest arduousness deciles. Assuming that the passage of time has led to the disappearance of the most difficult jobs, our 2020-based O*NET arduousness index might be lower than the index that they actually experienced. All this might lead to what is known in the literature as an expansion bias (Rigobon and Stoker, 2007).[24].

Turning to selection, a correlation between career arduousness may also stem from (non-random) selection into treatment, with (pre-existing) health influencing occupational arduousness.[25] The direction of the induced bias is hard to predict: while some selection mechanisms (e.g., worse health preventing people from accessing better/less arduous jobs) point to an overestimation of the true adverse effect of work arduousness; other mechanisms (referred to as the healthy worker survivor effect in the literature[26]) leads to an attenuation of the true causal link (Belloni et al., 2022). The empirical literature struggles to cope with either of these problems. In this paper, we cannot fully address the selection problem, but, at the very least, we believe we can limit the bias due to pre-labour market selection. Remember that SHARE informs about respondents' health until age 15 (childhood health status). Moreover, SHARE informs about the parents' longevity/death status, which we use to control for the more inherited part of people's initial health endowment. Finally, we know about people's educational attainment. These are endowment items whose level is determined before people pick their first occupation and enter the labour market.

In short, measuring career arduousness correctly is not trivial. Our measure is not per-

[24]The opposite of the well-known attenuation bias driven by the inaccuracy of X. When X is systematically upward bounded (the - in real-life – high values are de facto recorded – in the data – at a lower level), it is straightforward to show that the (absolute value of the) slope of the Y, X relationship will be exaggerated.

[25]Also known as reverse causality (Ravesteijn et al., 2018.)

[26]with healthy workers being able to increase or maintain their workplace exposure to physically more demanding jobs.

fect due to what we call the “arduousness time gap”. Selection into arduousness matters also. While the latter problem might lead to an unknown bias, the former could cause underestimation. Controlling for pre-labour selection, we might have attenuated/eliminated the magnitude of the selection bias. However, the exaggeration bias due to the time gap remains. So, all in all, the odds are that the results presented hereafter should be seen as upper bounds of the true causal impact of the arduousness of (healthy) life expectancy.

5 Results

5.1 Key results

Figures 1,2 display the distribution of the age of death for arduousness deciles 1 and 10. The vertical bars show the corresponding life expectancy at age 50. These figures unambiguously support the idea that arduousness is conducive to lower life expectancy

A more detailed version of the results is displayed in Tables 6,7. The Tables are excerpts of the fully-fledged arduousness-adjusted life tables to be found in the Appendix (Section A.1.2, Tables A.2, A.3, A.5, A.5.

In Table 6, men forming the first decile of the arduousness display a life expectancy of 31.91 years at the age of 50. By contrast, those in the 10th decile are expected to live only 27.61 years. That corresponds to a life expectancy differential of [27.61- 31.91=] -4.3 years. The gap in terms of healthy life expectancy is even larger at [16.09-23.24=] -7.16 years. Turning to the estimates obtained when controlling for pre-labour entry/health endowment, we get slightly lower gaps between the lowest and the highest arduousness deciles. This is supportive of negative selection in arduousness. The life expectancy gaps (netted out from the influence of pre-labour market entry drivers of death) between arduousness decile 10 and 1 is now -3.2 years (-4.3 years without controls). Similarly, the healthy life expectancy gap is now -5.3 years (-7.16 years without controls).

Turning to women, in Table 7, we see that their life expectancy is higher overall than that of men; not so much their healthy life expectancy, in line with the well-established fact that women live longer but have more years with disability (Nusselder et al., 2019, Crimmins et al., 2019). More to the point, we see an arduousness gap (between the 10th and the 1st arduousness decile) of -4.92 years, which is very similar to the one estimated for men (-4.3

years). However, women's healthy life expectancy gap at -10.75 years is larger than that of men (-7.16 years), suggesting, again, that women differ from men in terms of morbidity more than mortality. Finally, results point to slightly lower gaps when accounting for selection in arduousness driven by pre-labour-entry endowment. The life expectancy gap is now -4.20 (compared to -4.92 years). A similar reduction is observed for healthy life expectancy.

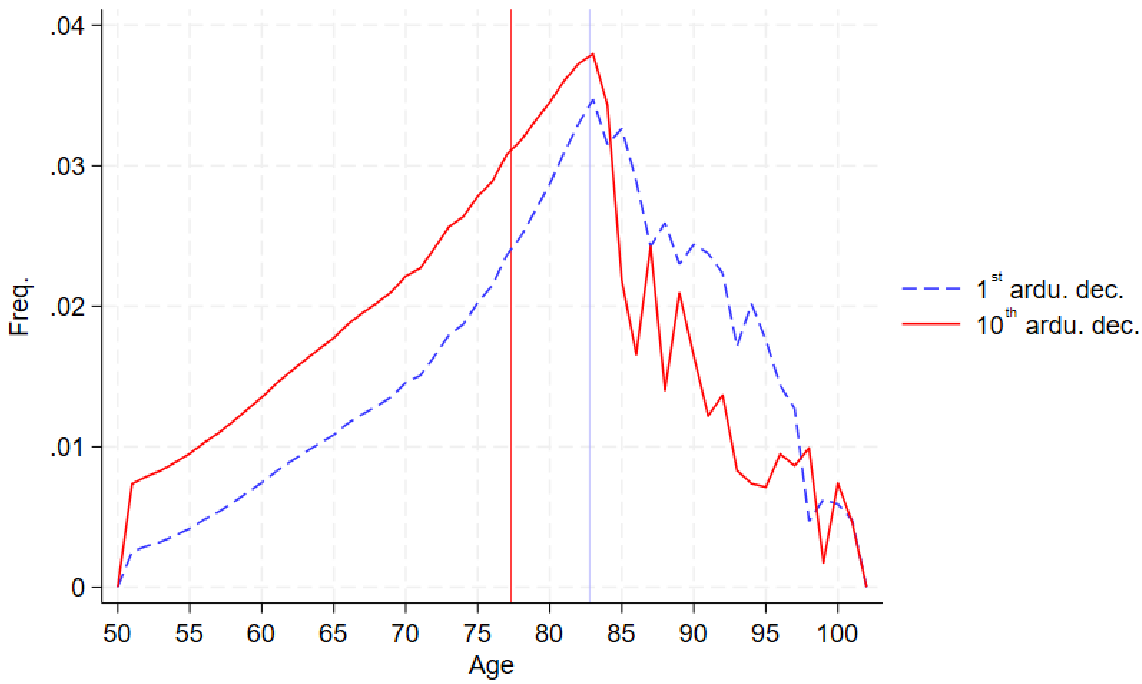

Figure 1: Age of death distribution: 1st vs 10th arduousness decile (M)
Source: SHARE w8,9,10, O*NET 2020, Work Context Items.

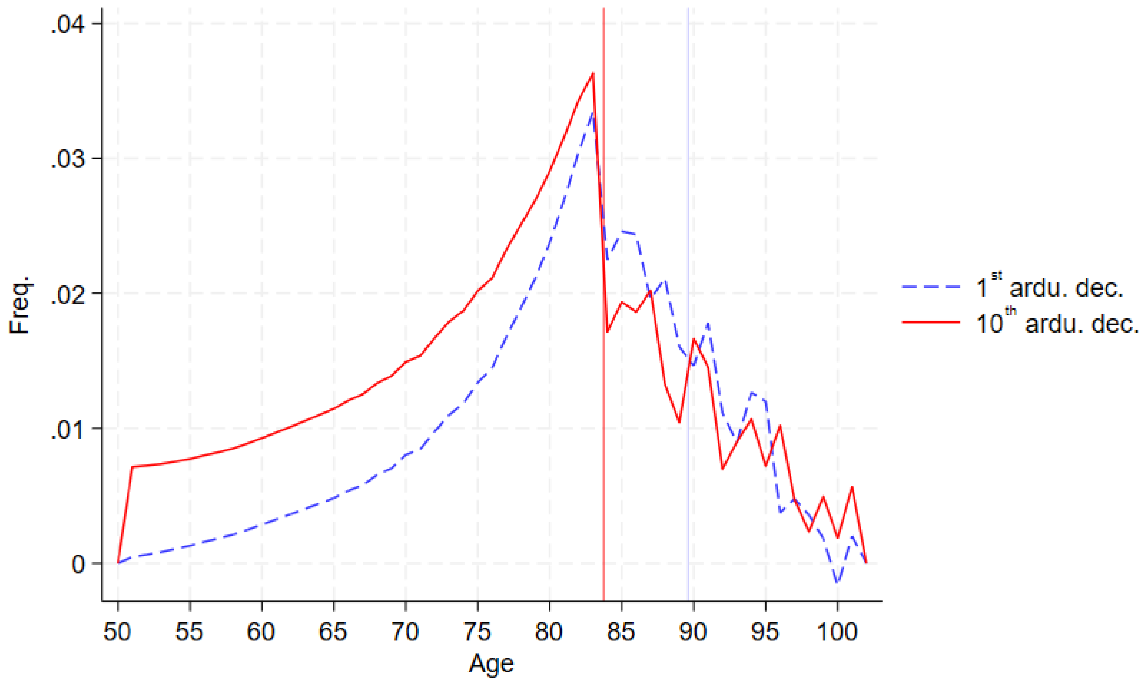

Figure 2: Age of death distribution: 1st vs 10th arduousness decile (F)
Source: SHARE w8,9,10, O*NET 2020, Work Context Items.

Table 6: Estimates of (healthy) life expectancy at the age of 50 (M), by decile of career arduousness

	Without controls					With controls				
	Levels		Gaps[a]			Levels		Gaps[a]		
Ard. dec.	L. exp.[b]	H.l. exp.[c]	L. exp.[d]	H.l. exp[e]	B.h.l.exp[f]	L. exp.[b]	H.l. exp.[c]	L. exp.[d]	H.l. exp.[e]	B.h.l.exp[f]
1	31.91	23.24	0.00	0.00	0.00	31.58	22.39	0.00	0.00	0.00
2	31.68	22.76	-0.23	-0.48	0.25	31.40	22.01	-0.18	-0.38	0.20
3	31.45	22.27	-0.46	-0.97	0.51	31.19	21.62	-0.38	-0.77	0.39
4	31.07	21.52	-0.84	-1.72	0.89	30.90	21.09	-0.68	-1.29	0.62
5	30.44	20.71	-1.47	-2.54	1.06	30.44	20.50	-1.14	-1.88	0.74
6	30.44	20.11	-1.47	-3.13	1.66	30.44	20.06	-1.14	-2.33	1.19
7	29.73	19.17	-2.18	-4.07	1.89	29.93	19.39	-1.64	-2.99	1.35
8	29.03	18.10	-2.88	-5.14	2.26	29.41	18.56	-2.17	-3.83	1.66
9	28.57	17.39	-3.34	-5.85	2.51	29.07	18.06	-2.51	-4.32	1.81
10	27.61	16.09	-4.30	-7.16	2.85	28.38	17.08	-3.20	-5.30	2.11

Source: SHARE, O*NET work context items, our calculations.

[a] Ref: 1st decile of career arduousness.

[b] Life expectancy.

[c] Healthy life expectancy.

[d] Life expectancy handicap.

[e] Healthy life expectancy handicap.

[f] Bad health life expectancy handicap.

Table 7: Estimates of (healthy) life expectancy at the age of 50 (F), by decile of career arduousness

	Without controls					With controls				
	Levels		Gaps[a]			Levels		Gaps[a]		
Ard. dec.	L. exp.	H.l. exp.	L. exp.	H.l. expx	B.h.l.exp	L. exp.	H.l. exp.	L. exp.	H.l. expx	B.h.l.exp
1	39.15	24.85	0.00	0.00	0.00	38.91	24.53	0.00	0.00	0.00
2	38.86	23.79	-0.29	-1.07	0.78	38.66	23.64	-0.25	-0.89	0.64
3	38.53	22.64	-0.63	-2.21	1.59	38.38	22.69	-0.53	-1.84	1.31
4	38.17	21.47	-0.99	-3.38	2.39	38.06	21.70	-0.85	-2.83	1.98
5	37.45	20.18	-1.70	-4.68	2.98	37.45	20.63	-1.45	-3.90	2.44
6	37.45	19.18	-1.70	-5.68	3.98	37.45	19.83	-1.45	-4.70	3.24
7	36.65	17.83	-2.51	-7.03	4.52	36.76	18.65	-2.14	-5.88	3.74
8	35.93	16.58	-3.22	-8.27	5.05	36.16	17.61	-2.75	-6.92	4.18
9	35.15	15.32	-4.00	-9.53	5.53	35.49	16.56	-3.41	-7.97	4.56
10	34.23	14.10	-4.92	-10.75	5.83	34.71	15.45	-4.20	-9.08	4.88

Source: SHARE, O*NET work context items, our calculations.

[a] Ref: 1st decile of career arduousness.

[b] Life expectancy.

[c] Healthy life expectancy.

[d] Life expectancy handicap.

[e] Healthy life expectancy handicap.

[f] Bad health life expectancy handicap.

5.2 Exposure to arduousness: gender and country heterogeneity

An interesting extension is considering the country and gender heterogeneity regarding exposure to arduousness and its implications regarding the average (healthy) life expectancy gap.

Remember that our measure of arduousness is "universal"; it is obtained by applying a unique vector of O*NET "weights" to ISCO4-digit occupations. Also, the arduousness deciles are obtained from the pooled data set, where we consider all countries and confound male and female respondents. The point here is that the likelihood of being exposed to arduousness, say decile 1 or decile 10, varies greatly across genders and countries, as could be inferred from Table 2. It is even more clear in Appendix (Section A.1.3, Figures A1, A2) where the reader can find the percentage frequency distribution by arduousness decile for each country and gender. Women are overrepresented in low-arduousness deciles compared to men. And, "ceteris paribus", citizens of wealthier countries (higher GPD per head) are less likely to have been exposed to the most arduous careers overall.

The consequence of this exposure to arduousness heterogeneity between genders and across countries can be summarized by the computation of the country × gender weighted average (healthy) life expectancy gap. This is done here by summing over the different gaps visible in Tables 6,7, to which one has applied weights equal to the country × gender-specific likelihood of being exposed to that degree of career arduousness. These likelihoods are simply the percentage frequency distribution of SHARE respondents across arduousness deciles.

Results are reported in Figures 3, 4. They show that women are generally less exposed to arduousness than men, which, by construction, leads to lower average weighted (healthy) life expectancy gaps.[27] Results also confirm the importance of country heterogeneity in exposure to arduousness.For countries, exposure to arduousness is the only possible source of difference in terms of the reported average weighted expectancy gaps. What is more, it is the country with the highest GPD (i.e. quartiles 3 and 4) that the average weighted (healthy) life expectancy gaps appear to be the smallest.

These results have important policy implications for retirement policy. Considering the above results, early retirement aimed at compensating for the negative consequences of career arduousness would de facto benefit more men than women and would be less present

[27]Strictly speaking, these male vs. female average gaps could also be driven by the gender-specific impact of arduousness on (healthy) life expectancy. We have seen in Tables 6,7 that such an impact is larger for women. Hence, our claim is that what we see here is primarily driven by a lower exposure to arduousness.

in countries with higher GDP per head.

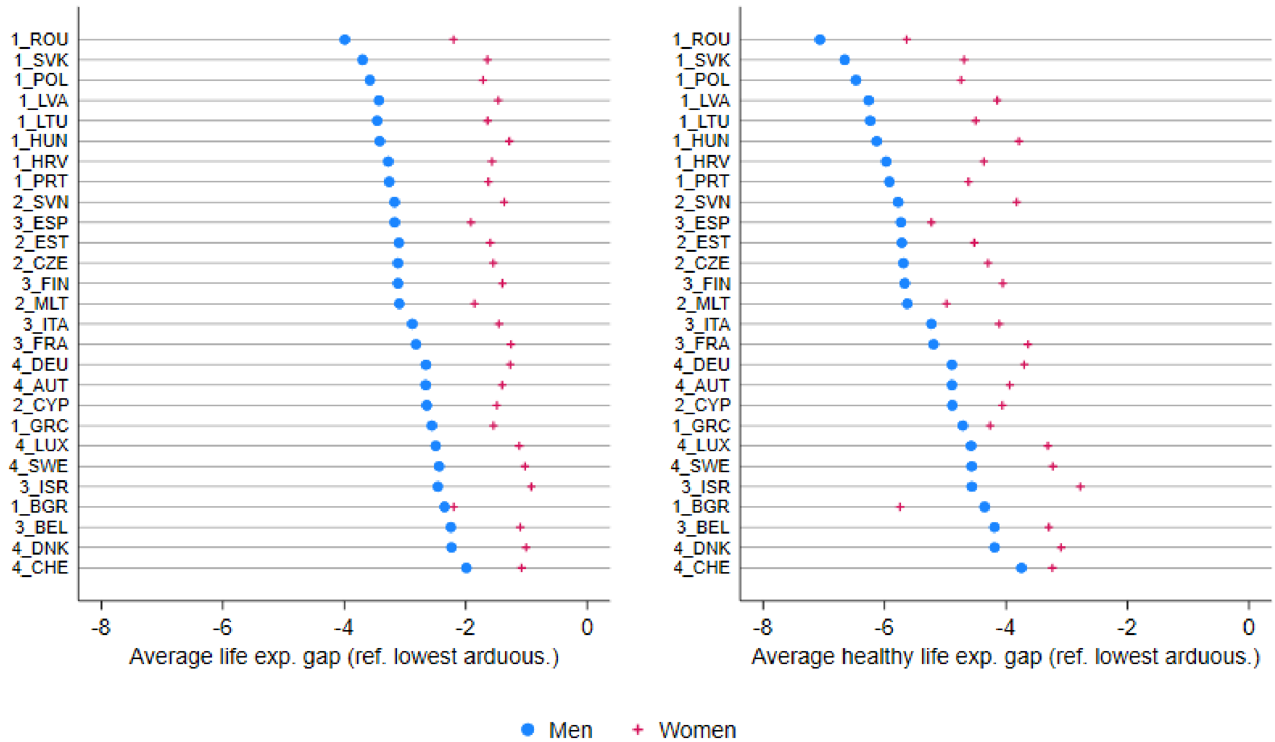

Figure 3: Country and Gender heterogeneity: average (healthy) life exp. gap (M)/ref. ard. dec. 1 (computed using estimates without controls).Figure before country ISO-3 code is GDP per head quartile 2017 : output-side real GDP at chained PPPs (in mil. 2017US$). Source: SHARE w8,9,10, O*NET 2020, Work Context Items.

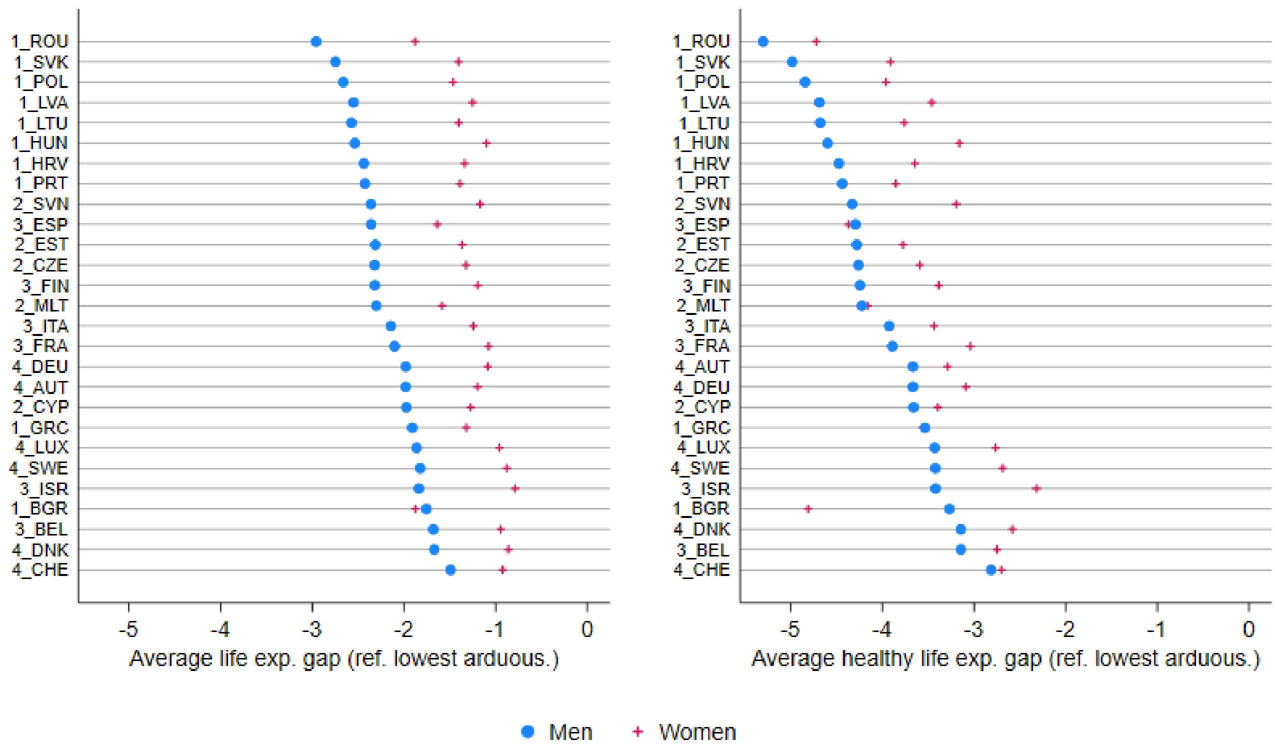

Figure 4: Country and Gender heterogeneity: average (healthy) life exp. gap (M)/ref. ard. dec. 1 (computed using estimates with controls). Figure before country ISO-3 code is GDP per head quartile 2017 : output-side real GDP at chained PPPs (in mil. 2017US$). Source: SHARE w8,9,10, O*NET 2020, Work Context Items.

6 Concluding Remarks

The primary response to the challenge of population ageing in advanced economies has indeed centred on raising the mandatory retirement age. However, these measures have triggered fresh discussions regarding the necessity and feasibility of tailored retirement age policies that recognize the diverse levels of work-related strain individuals have encountered.

This paper thoroughly investigates this issue through detailed microdata analysis focusing on Europe. It evaluates (entire) career arduousness by scrutinizing retrospective ISCO4-digit career data from SHARE wave 7 respondents aged 50 plus, supplemented by US O*NET working conditions detailed data on each ISCO occupation. Subsequently, leveraging follow-up data from SHARE, which includes information on health status and mortality among wave 7 participants, the paper estimates (healthy) life expectancy across various levels of career arduousness, employing both econometric and life table methodologies.

The outcomes of this analysis reveal a notable discrepancy in life expectancy between individuals who were engaged in the least and most demanding careers, with the gap ranging from 3.2 to 4.2 years for men and women, respectively. Disparities in healthy life expectancy are even more pronounced, spanning from 5.3 to 9 years for men and women, respectively.

However, while women demonstrate a higher susceptibility to the challenges posed by arduous work according to these metrics, our study uncovers significant variations in exposure to arduousness across genders, with women being less likely to be exposed to high levels of arduousness in almost every country surveyed. Systematic lower exposure differences are also observed (for both men and women) in high-GDP countries. We show in this paper that any policy interventions to mitigate the burdens of demanding careers should, therefore, disproportionately benefit men over women and be less prevalent in nations with higher GDP per capita.

Finally, regarding feasibility, it's crucial not to underestimate the statistical and practical demands that policymakers would face if they were to replicate the methodology outlined in this paper. Analysing the relationship between career arduousness and (healthy) life expectancy relies heavily on data- and time-intensive processes. The initial step involves quantifying the arduousness of the entire career trajectory of SHARE respondents. This task presents several challenges. First, it requires the capability to collect and continuously update data throughout workers' careers. The data from SHARE reveal that individuals often transition between occupations multiple times over the course of their working lives, underscoring the complexity of tracking and analysing these career trajectories. Moreover, it necessitates the ability to quantify the level of arduousness associated with each distinct career spell, which further adds to the complexity and resource requirements of the undertaking. Additionally, the feasibility hinges on the capacity to establish a robust (ideally strictly causal) link between career arduousness and the risk of experiencing adverse health outcomes and mortality. Overall, while the methodology employed in this paper offers valuable insights on how to proceed, but the replication on a broader scale would pose logistical, methodological and credibility challenges for policymakers.

Acknowledgement

This paper uses data from SHARE Waves 1, 2, 4, 5, 6, 7, 8, 9 and 10 (the so-called Covid waves). See Börsch-Supan et al. (2013) for methodological details.

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Appendix

A.1.1 O*NET Principal Components, Load Factors

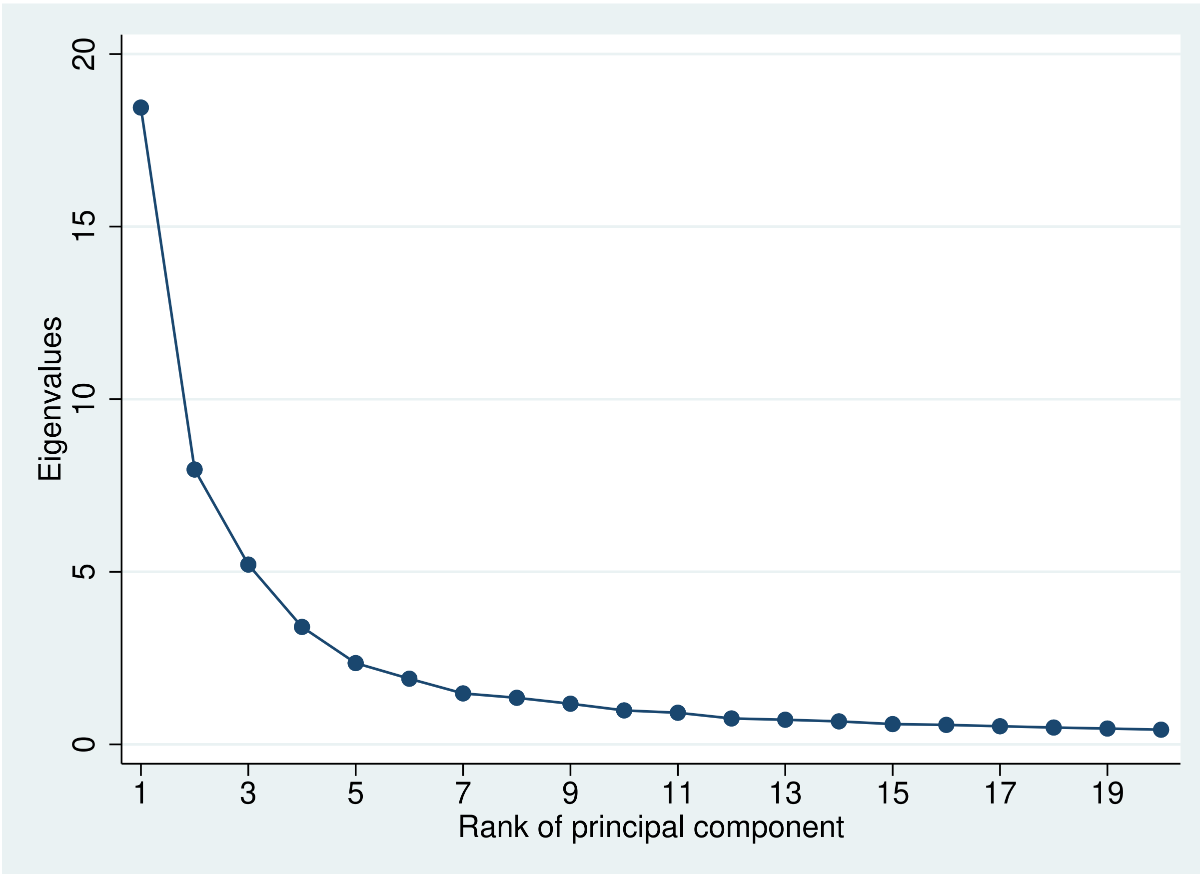

Figure A.1: O*NET arduousness items (ISCO4): proportion of variance explained by first (and following) principal components (i.e. eigenvalues)

Source: O*NET 2020, Work Context Items.

Table A.1: O*NET arduousness items (ISCO4): Loading factors for 1^{st} and 2^{nd} Principal Component[a]

	Load factors	
	Principal Comp.#1	Principal Comp.#2
Consequence_of_Error	0.10	0.18
Contact_With_Others	-0.06	0.23
Coordinate_or_Lead_Others	-0.03	0.25
Cramped_Work_Space_Awkward_Positions	0.20	0.07
Deal_With_External_Customers	-0.08	0.21
Deal_With_Physically_Aggressivity	0.01	0.16
Deal_With_Unpleasant_or_Angry_	-0.01	0.18
Degree_of_Automation	-0.00	0.00
Duration_of_Typical_Work_Week	0.00	0.12
Electronic_Mail	-0.16	0.15
Exposed_to_Contaminants	0.20	0.02
Exposed_to_Disease_or_Infections	-0.01	0.15
Exposed_to_Hazardous_Condition	0.18	0.05
Exposed_to_Hazardous_Equipment	0.20	0.02
Exposed_to_High_Places	0.17	0.07
Exposed_to_Minor_Burns_Cuts_Bi	0.21	-0.00
Exposed_to_Radiation	0.04	0.11
Exposed_to_Whole_Body_Vibrations	0.17	0.04
Extremely_Bright_or_Inadequate	0.19	0.07
Face-to-Face_Discussions	-0.03	0.22
Freedom_to_Make_Decisions	-0.07	0.16
Frequency_of_Conflict_Situations	-0.03	0.25
Frequency_of_Decision_Making	0.02	0.25
Impact_of_Decisions_on_Coworkers	0.00	0.27
Importance_of_Being_Exact_or_Accurate	-0.01	0.08
Importance_of_Repeating_Same_Task	0.01	0.07
In_an_Enclosed_Vehicle_or_Equipment	0.10	0.14
In_an_Open_Vehicle_or_Equipment	0.18	0.03
Indoors_Environmentally_Controlled	-0.17	0.06
Indoors_Not_Environmentally_Controlled	0.18	0.04
Letters_and_Memos	-0.12	0.21
Level_of_Competition	-0.04	0.10
Outdoors_Exposed_to_Weather	0.15	0.10
Outdoors_Under_Cover	0.14	0.11
Pace_Determined_by_Speed_of_Equipment	0.16	-0.07
Physical_Proximity	0.05	0.12
Public_Speaking	-0.10	0.11
Responsibility_for_Outcomes_an	0.06	0.21
Responsible_for_Others_Health_	0.15	0.16
Sounds_Noise_Levels_Are_Distraction	0.18	0.04
Spend_Time_Bending_or_Twisting	0.20	-0.03
Spend_Time_Climbing_Ladders_Scaffolds	0.17	0.04
Spend_Time_Keeping_or_Regaining_Balance	0.19	0.03
Spend_Time_Kneeling_Crouching_	0.18	0.00
Spend_Time_Making_Repetitive_M	0.10	-0.11
Spend_Time_Sitting	-0.17	0.04
Spend_Time_Standing	0.17	-0.05
Spend_Time_Using_Your_Hands_to_Handle_objects	0.16	-0.08
Spend_Time_Walking_and_Running	0.17	-0.01
Structured_versus_Unstructured	-0.10	0.15
Telephone	-0.11	0.23
Time_Pressure	0.02	0.10
Very_Hot_or_Cold_Temperatures	0.20	0.04
Wear_Common_Protective_or_Safety_Equipment	0.19	0.03
Wear_Specialized_Protective_or_Safety_Equipment	0.16	0.08
Work_Schedules	0.09	-0.01
Work_With_Work_Group_or_Team	-0.01	0.21

Source: O*NET 2021, Work Context Items. [a] Only the 1^st Principal component is used in this paper to compute career arduousness $CAR_{i,j}^{ard}$ in equation (1). It clearly correlates with items associated with arduousness (e.g. Exposed to Contaminants, Pace (of work) determined by speed of Equipment, Sounds noise levels are distracting or uncomfortable. . . . The second Principal component correlates more with managerial vs non-managerial work content, a dimension that is a priori less relevant in an exercise centred on the health impact of arduousness.

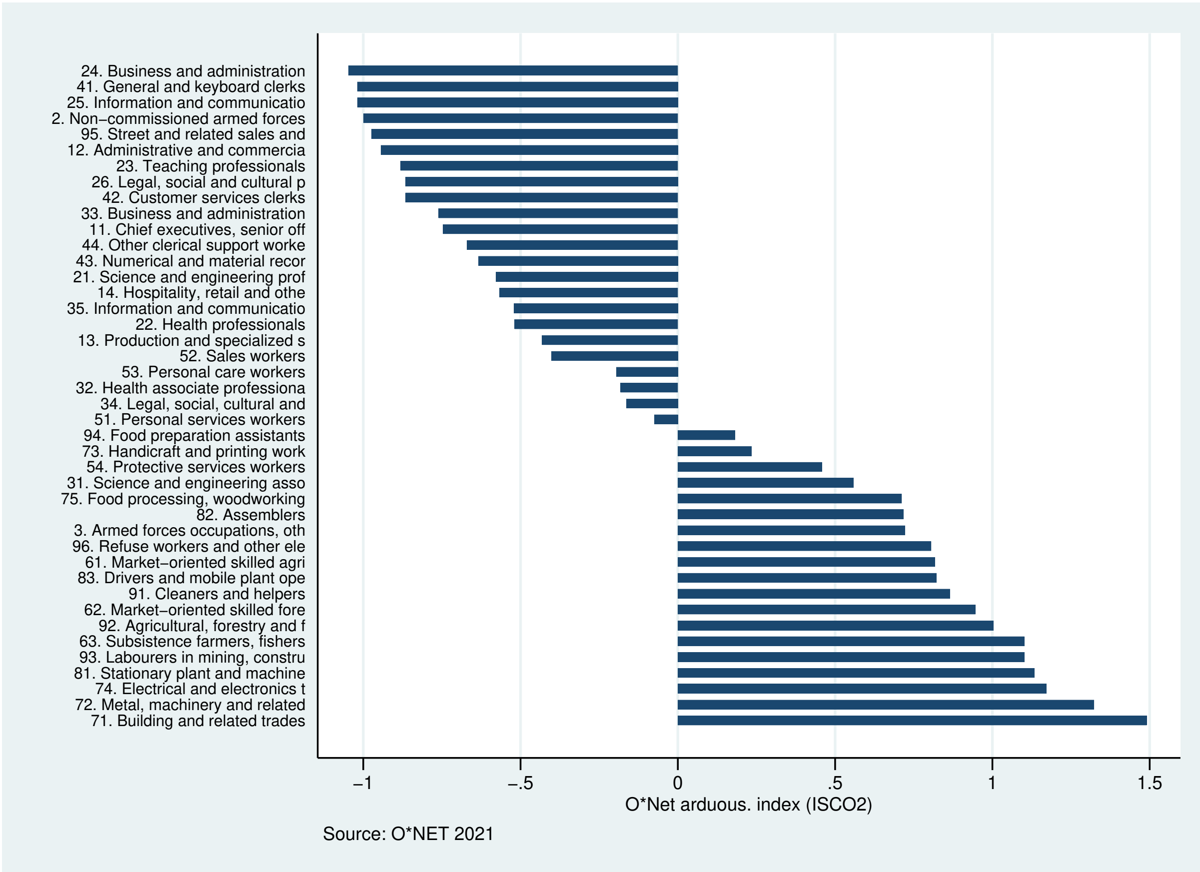

Figure A.2: O*NET career arduousness indices (ISCO 2)

Indices reported on the X axis are First Principal Components of items forming the O*NET *Work Context* module. More information (1st and 2nd principal components, eigenvalues and loading factors) is available in the Appendix (Figure 5, Table 15)

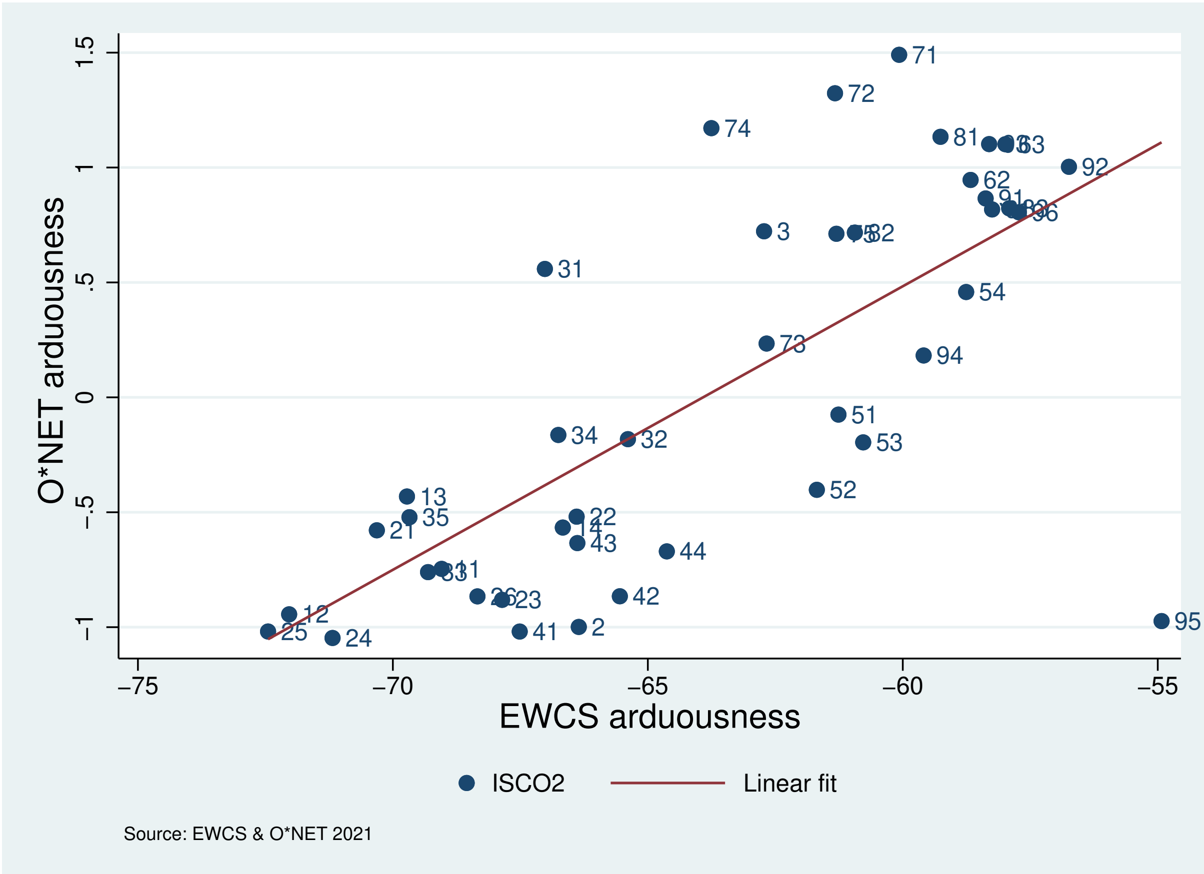

Figure A.3: O*NET vs. EWCS arduousness indices at ISCO 2 level

0 Armed forces occupations 1 Commissioned armed forces officers 2 Non-commissioned armed forces officers 3 Armed forces occupations, other ranks 10 Managers 11 Chief executives, senior officials and legislators 12 Administrative and commercial managers 13 Production and specialised services managers 14 Hospitality, retail and other services managers 20 Professionals 21 Science and engineering professionals 22 Health professionals 23 Teaching professionals 24 Business and administration professionals 25 Information and communications technology professionals 26 Legal, social and cultural professionals 30 Technicians and associate professionals 31 Science and engineering associate professionals 32 Health associate professionals 33 Business and administration associate professionals 34 Legal, social, cultural and related associate professionals 35 Information and communications technicians 40 Clerical support workers 41 General and keyboard clerks 42 Customer services clerks 43 Numerical and material recording clerks 44 Other clerical support workers 50 Services and sales workers 51 Personal services workers 52 Sales workers 53 Personal care workers 54 Protective services workers 60 Skilled agricultural, forestry and fishery workers 61 Market-oriented skilled agricultural workers 62 Market-oriented skilled forestry, fishery and hunting workers 63 Subsistence farmers, fishers, hunters and gatherers 70 Craft and related trades workers 71 Building and related trades workers (excluding electricians) 72 Metal, machinery and related trades workers 73 Handicraft and printing workers 74 Electrical and electronics trades workers 75 Food processing, woodworking, garment and other craft and related trades workers 80 Plant and machine operators and assemblers 81 Stationary plant and machine operators 82 Assemblers 83 Drivers and mobile plant operators 90 Elementary occupations 91 Cleaners and helpers 92 Agricultural, forestry and fishery labourers 93 Labourers in mining, construction, manufacturing and transport 94 Food preparation assistants 95 Street and related sales and services workers 96 Refuse workers and other elementary workers.

A.1.2 Life tables

Table A.2: Life table (M): Survival, life expectancy and healthy life expectancy, 1st and 10ˆth decile of career arduousness

	Survival		Life expect.		Health. Survival		Heath. Life expect.	
	Dec 1	Dec 10	Dec1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10
50	1.000	1.000	0.000	0.0000	0.895	0.760	0.000	0.0000
51	0.997	0.994	0.999	0.9971	0.885	0.744	0.890	0.7522
52	0.994	0.988	1.994	1.9880	0.875	0.728	1.771	1.4886
53	0.990	0.981	2.986	2.9723	0.864	0.712	2.641	2.2087
54	0.986	0.973	3.974	3.9493	0.853	0.695	3.499	2.9120
55	0.981	0.965	4.958	4.9186	0.841	0.678	4.346	3.5983
56	0.976	0.956	5.937	5.8795	0.828	0.660	5.180	4.2672
57	0.971	0.947	6.910	6.8313	0.814	0.642	6.001	4.9181
95	0.108	0.031	31.760	27.5861	0.095	0.047	22.921	15.9335
96	0.066	0.006	31.846	27.6038	0.080	0.033	23.009	15.9730
97	0.034	0.000	31.896	27.6056	0.065	0.035	23.081	16.0071
98	0.000	0.000	31.911	27.6056	0.050	0.023	23.139	16.0364
99	0.000	0.000	31.910	27.6056	0.038	0.018	23.183	16.0561
100	0.000	0.000	31.910	27.6056	0.026	0.011	23.215	16.0706
101	0.000	0.000	31.910	27.6056	0.014	0.010	23.235	16.0813
102	0.000	0.000	31.910	27.6056	0.000	0.000	23.243	16.0872

Source: SHARE, O*NET work context items, our calculations.

Table A.3: Life table (M with controls): Survival, life expectancy and healthy life expectancy, 1st and 10ˆth decile of career arduousness

	Survival		Life expect.		Health. Survival		Heath. Life expect.	
	Dec 1	Dec 10	Dec1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10
50	1.000	1.000	0.000	0.0000	0.879	0.761	0.000	
51	0.997	0.995	0.998	0.9974	0.869	0.747	0.874	
52	0.993	0.989	1.994	1.9892	0.858	0.732	1.737	
53	0.990	0.982	2.985	2.9749	0.846	0.717	2.589	
54	0.985	0.976	3.973	3.9540	0.834	0.702	3.429	
55	0.981	0.968	4.956	4.9259	0.821	0.686	4.257	
56	0.975	0.960	5.934	5.8901	0.808	0.670	5.071	
57	0.970	0.951	6.906	6.8458	0.794	0.654	5.872	
95	0.103	0.044	31.428	28.3303	0.084	0.057	22.073	
96	0.065	0.026	31.512	28.3656	0.079	0.045	22.155	
97	0.034	0.000	31.561	28.3776	0.063	0.035	22.227	
98	0.000	0.000	31.577	28.3761	0.047	0.027	22.282	
99	0.000	0.000	31.575	28.3765	0.037	0.026	22.323	
100	0.000	0.000	31.576	28.3764	0.026	0.018	22.355	
101	0.000	0.000	31.575	28.3764	0.017	0.012	22.376	
102	0.000	0.000	31.575	28.3764	0.000	0.000	22.386	

Source: SHARE, O*NET work context items, our calculations.

Table A.4: Life table (F): life expectancy and healthy life expectancy: 1st and 10ˆth decile of career arduousness

	Survival		Life expect.		Health. Survival		Heath. Life expect.	
	Dec 1	Dec 10	Dec1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10
50	1.000	1.000	0.000	0.0000	0.839	0.643	0.000	0.0000
51	0.999	0.994	0.999	0.9972	0.832	0.630	0.836	0.6364
52	0.998	0.989	1.998	1.9887	0.825	0.616	1.665	1.2596
53	0.996	0.983	2.995	2.9743	0.817	0.603	2.486	1.8693
54	0.995	0.976	3.990	3.9538	0.809	0.589	3.299	2.4653
55	0.993	0.970	4.984	4.9270	0.800	0.575	4.103	3.0474
56	0.991	0.963	5.976	5.8937	0.791	0.561	4.898	3.6155
57	0.988	0.956	6.965	6.8536	0.781	0.546	5.684	4.1691
95	0.392	0.322	36.741	32.4817	0.120	0.045	23.583	14.0924
96	0.359	0.301	37.116	32.7945	0.104	0.038	23.696	14.1340
97	0.338	0.282	37.464	33.0850	0.080	0.037	23.788	14.1723
98	0.308	0.273	37.787	33.3624	0.070	0.021	23.863	14.2017
99	0.285	0.253	38.083	33.6258	0.048	0.017	23.923	14.2203
100	0.263	0.244	38.355	33.8714	0.029	0.011	23.961	14.2341
101	0.235	0.227	38.614	34.1167	0.021	0.011	23.985	14.2449
102	0.000	0.000	38.750	34.2495	0.000	0.000	23.997	14.2513

Source: SHARE, O*NET work context items, our calculations.

Table A.5: Life table (F with controls): life expectancy and healthy life expectancy: 1st and 10ˆth decile of career arduousness

	Survival		Life expect.		Health. Survival		Heath. Life expect.	
	Dec 1	Dec 10	Dec1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10
50	1.000	1.000	0.000	0.0000	0.839	0.643	0.000	0.0000
51	0.999	0.994	0.999	0.9972	0.832	0.630	0.836	0.6364
52	0.998	0.989	1.998	1.9887	0.825	0.616	1.665	1.2596
53	0.996	0.983	2.995	2.9743	0.817	0.603	2.486	1.8693
54	0.995	0.976	3.990	3.9538	0.809	0.589	3.299	2.4653
55	0.993	0.970	4.984	4.9270	0.800	0.575	4.103	3.0474
56	0.991	0.963	5.976	5.8937	0.791	0.561	4.898	3.6155
57	0.988	0.956	6.965	6.8536	0.781	0.546	5.684	4.1691
95	0.392	0.322	36.741	32.4817	0.120	0.045	23.583	14.0924
96	0.359	0.301	37.116	32.7945	0.104	0.038	23.696	14.1340
97	0.338	0.282	37.464	33.0850	0.080	0.037	23.788	14.1723
98	0.308	0.273	37.787	33.3624	0.070	0.021	23.863	14.2017
99	0.285	0.253	38.083	33.6258	0.048	0.017	23.923	14.2203
100	0.263	0.244	38.355	33.8714	0.029	0.011	23.961	14.2341
101	0.235	0.227	38.614	34.1167	0.021	0.011	23.985	14.2449
102	0.000	0.000	38.750	34.2495	0.000	0.000	23.997	14.2513

Source: SHARE, O*NET work context items, our calculations.

A.1.3 Exposure to arduousness by gender (F, M) × country

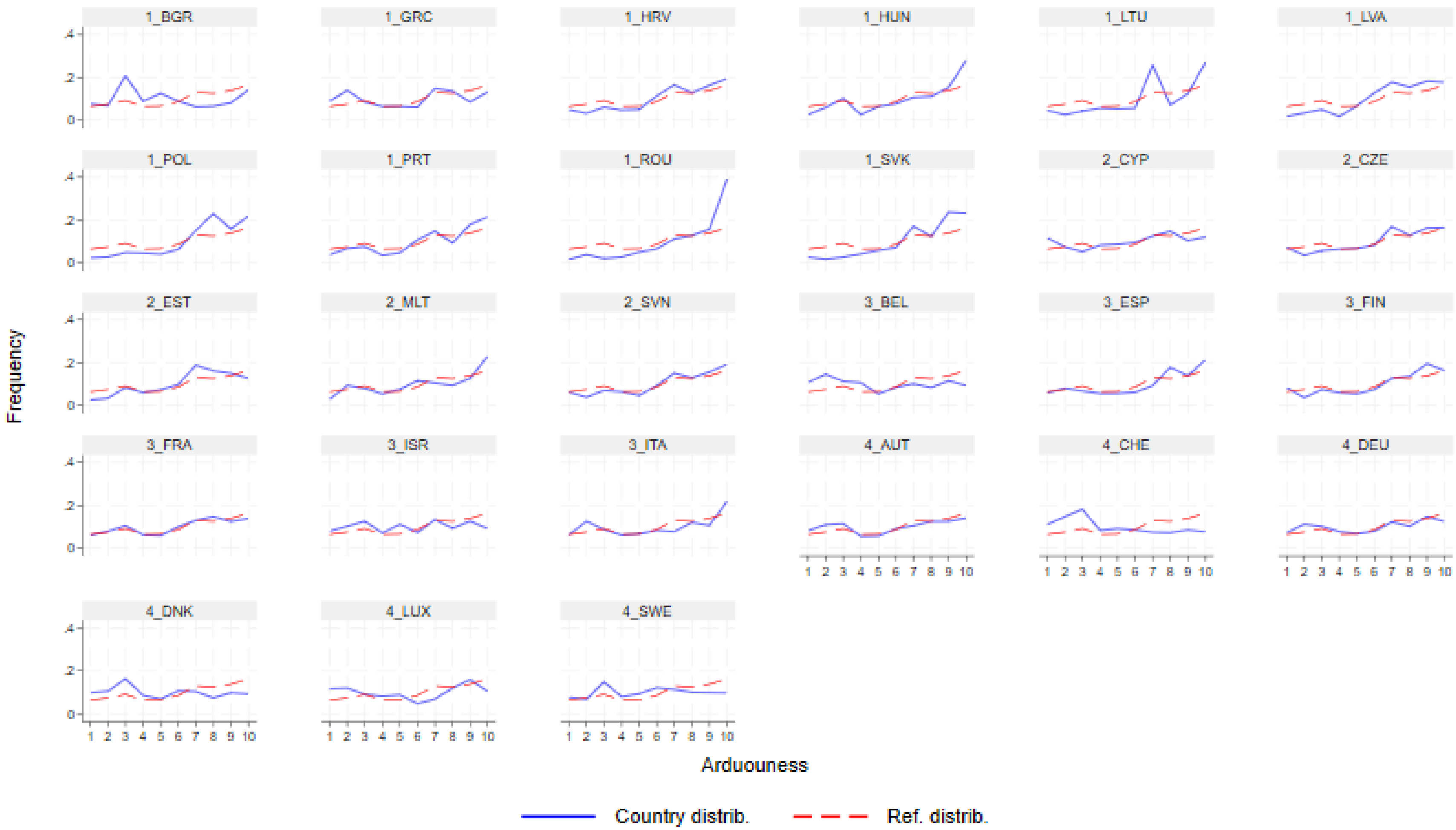

Figure A1: Exposure to arduousness: gender (M) *times* country

Source: SHARE w7, O*NET 2020. Figure before country ISO-3 code is GDP per head quartile 2017 : output-side real GDP at chained PPPs (in mil. 2017US$).

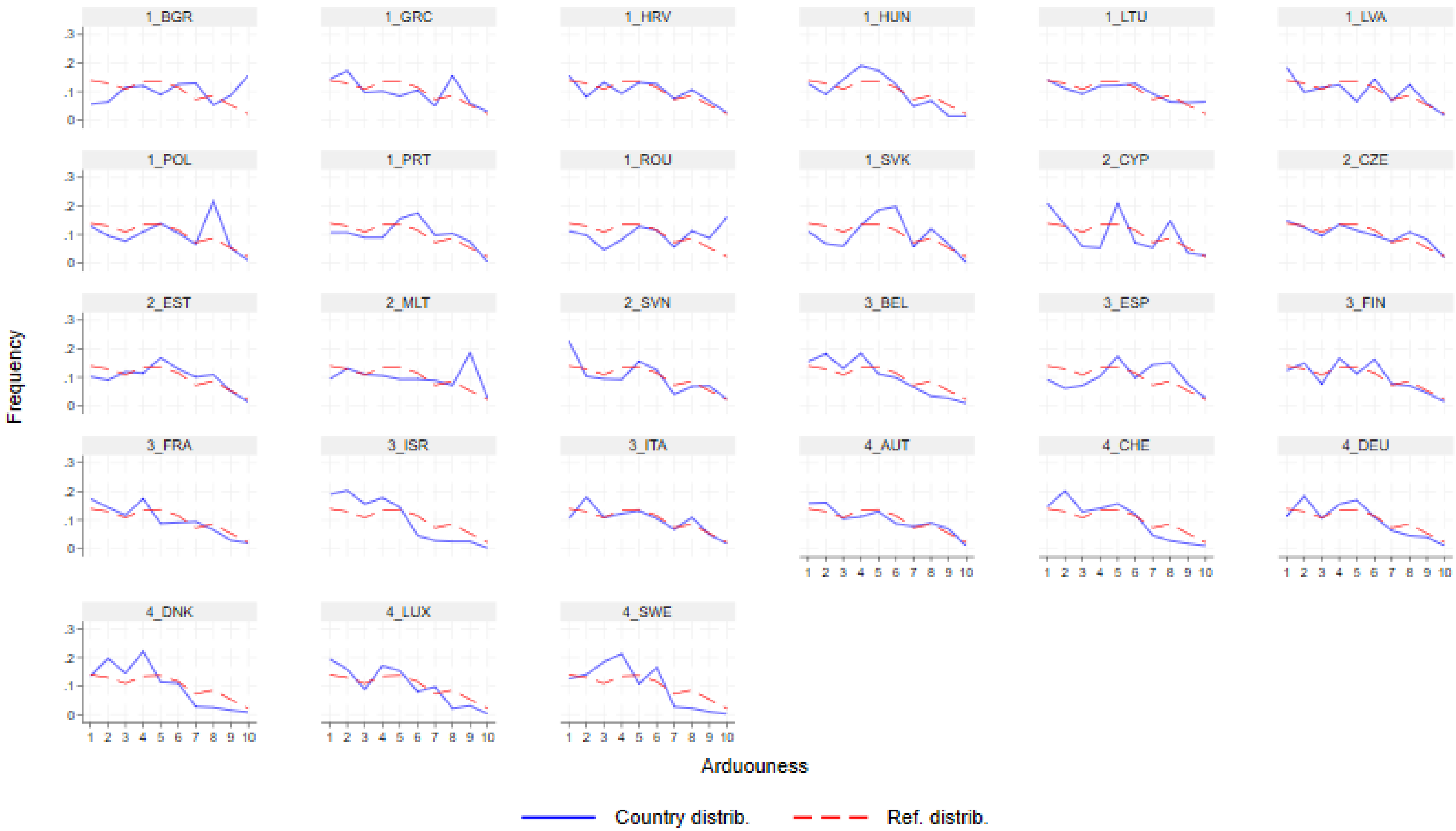

Figure A2: Exposure to arduousness gender (F) *times* country

Source: SHARE w7, O*NET 2020. Figure before country ISO-3 code is GDP per head quartile 2017 : output-side real GDP at chained PPPs (in mil. 2017US$).