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Career arduousness and [healthy] life expectancy in Europe

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Abstract

The primary policy response to population aging in advanced economies has been to raise the mandatory retirement age. However, these policies have reignited calls for differentiated retirement ages that take into account variations in work intensity. This paper utilises microdata to examine the relevance and feasibility of this concept 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 4to 4.2 years. Healthy life expectancy differences are slightly larger, ranging from 6.9 to 9.1 years. Also, women's healthy life expectancy seems to be somewhat more impacted by arduousness.

Keywords: aging; career arduousness; (healthy) life expectancy; retirement policy

JEL Codes: J14; I1; J26

1. Introduction

In advanced economies, the most prevalent policy response to population aging 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 longevity¹ is driven by the arduousness of work, 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 Bismarckian contributory pension system²—amount to unduly taxing short-lived people and subsidising their long-lived peers (Ayuso *et al.*, 2016; Alvarez *et al.*, 2021), potentially also distorting

¹To be understood as the realised length of life of individuals.

²Pension specialists 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.

labour supply. The gradient in life expectancy (Chetty *et al.*, 2016) reduces the progressivity of public pensions, even in those countries (e.g., the United States, Germany) where the replacement rate is a negative function of earned income (Bommier *et al.*, 2011; Bosworth *et al.*, 2016; Haan *et al.*, 2020; Sanchez-Romero *et al.*, 2020). 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. (Leroux *et al.*, 2015; Ayuso *et al.*, 2016; 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 older differ in terms of the degree of career arduousness they have been exposed to? And how can these differences be quantified? Many stakeholders, including economists, advocate for differentiation of retirement ages based on arduousness (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.³ Also, the career dimension of work is often overlooked or treated as uniform, as if individuals have held the same job throughout their entire careers.
- 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.⁴ However, much less evidence exists about the link between career arduousness and long-term health and longevity. Bringing better evidence on this is essential, 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). Additionally, by examining evidence by examining evidence based on gender,⁵ the paper evaluates the heterogeneity in arduousness-driven (healthy) life expectancy. It thereby contributes further to the debate on the optimal design of retirement systems.

The rest of this paper is organised as follows. Section 2 presents our contribution to the existing literature on arduousness and (healthy) life expectancy. Section 3 presents the SHARE and O*NET microdata used to quantify career arduousness, as well as other SHARE data on the risk of death and ill health. Section 4 exposes our econometric analysis of the relationship between career arduousness

³An 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 arduous occupations might not require as many calories, but could also be detrimental to health.

⁴In 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 ranges from 8 to 10 years, considering gender and socioeconomic status categories.

⁵Hereafter, we systematically distinguish men and women.

deciles and the risk of death and bad health beyond 50. It also exposes how these econometric results contribute to estimating fully-fledged career-arduousness-adjusted life tables. [Section 5](#) presents the paper's main results and several robustness analyses, while [Section 6](#) concludes.

2. Contribution to the literature

This paper aims to contribute to the economic literature on the long-term consequences⁶ of career arduousness, more specifically, the risk of death and bad health. One of the paper's key contributions to the literature stems from our ability to link what happens during the entire career to 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 SHARE⁷ 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.⁸

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 or 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 demanding and that they may affect individuals' health and longevity. What differentiates our approach from most 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 that form 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-Stęclik (2015)). However, to the best of our knowledge, quantifying the arduousness throughout an entire career and analysing its long-term impact on (healthy) life expectancy is a novelty.

In terms of data sources and types, three key aspects distinguish this paper. First, it utilises the 7th wave of SHARE—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. Furthermore, extensive information is provided about job history.⁹ We can identify each respondent's first and last occupations and those in between. SHARE informs us of the number of job spells and their duration.¹⁰

Second, although SHARE provides a wealth 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

⁶Beyond the age of 50.

⁷Survey 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.

⁸Health 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.

⁹SHARE 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 the ISCO 1-digit level, while ISCO 4-digit information is available in wave 7.

¹⁰It also tells whether people worked part-time or full-time. Finally, it informs about breaks and their nature (e.g., 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 (2023a).

O*NET from the United States.¹¹ 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, as well as other pre-labour factors¹² determining late-life health and longevity, such as educational attainment. The life course literature emphasises 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.¹³ Also, the recent paper by Zhu and Liao (2021) uses data from the Chinese equivalent of SHARE, the China Health and Retirement Longitudinal Study (CHARLS). To the best of our knowledge, the job arduousness literature has overlooked the possibility of a link 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 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 pooled. Compared to works using only national data, the advantage is that we analyse wider distributions, which is a prior good for identification.

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 7th 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 ([Appendix A.1](#), [Figure A1](#)).

In the 7th 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 the work occurred (i.e., a retiree in 2018 must recall their work history from 1970 if they started working at age 20). This can lead to memory biases. To address this issue, the SHARE surveyors employed a 'Life History Calendar' (LHC) approach to help respondents provide accurate reports. The LHC method utilises a calendar-like matrix to map out life events, giving visual cues to both the interviewer and the interviewee regarding the onset, duration, sequencing, and co-occurrence of these events. The calendar includes rows, which categorise life events, including schools attended, jobs, living arrangements, dating relationships, and other relevant details. Numerous innovations of the LHC offer benefits over traditional data collection methods, including 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 successive job or occupation at ISCO-4 digits. We merge that information with arduousness indices estimated separately for each ISCO-4 occupation (see [Section 3.2](#) below).

¹¹ Another one is the European Working Conditions Survey (EWCS).

¹² Factors that are decided or determined before people enter the labour market.

¹³ 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.

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).

The combination of SHARE job history data and arduousness data enables us to compute, *inter alia*, a career average arduousness index¹⁴ and examine how it correlates with a series of usual predictors, including gender, age, and GDP per capita. Additionally, the LHC allows for calculating the duration of their entire career, both in absolute years and in equivalent full-time years (which we use as a control hereafter).

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

SHARE wave 7 provides a wealth of information about people's careers. But it falls short of providing information about the arduousness of jobs/occupations. To overcome that limitation, we turn to O*NET from the United States.¹⁵ Appendix A.1 (Figures A1; A2; A3) contains a visual presentation of how we transit from the career ISCO4 code spells to the career arduousness index version of these spells.

The O*NET dataset used in this analysis differs from a typical individual-level survey, where each row corresponds to a male or female respondent reporting their personal experience of work arduousness. Instead, O*NET provides data at the occupation level, documenting the frequency of specific job characteristics—some of which reflect physical arduousness—based on responses from incumbent workers in particular occupations. These workers are surveyed at business establishments selected through a random sampling process. For example, characteristics such as exposure to vibration or high temperatures, as reported by workers, may be more prevalent in certain occupations than others.

¹⁴As part of a robustness analysis we also use first-job arduousness and career cumulative arduousness.

¹⁵https://www.O*NETcenter.org/database.html

O*NET includes over 1,000 distinct items that describe the content of more than 900 occupations,¹⁶ providing a rich source of information about the nature of work.

As discussed by Kroll 2011, utilising O*NET occupational-level frequencies assumes that these figures represent the fundamental characteristics of occupations rather than those of the individuals who hold these positions and were interviewed.¹⁷ This assumption may become problematic if factors such as gender ratios, part-time employment rates, or average job tenure differ systematically across occupations and (non-randomly) affect the frequency of reported job characteristics. Unlike Kroll 2011, we do not have access to individual-level data underpinning the occupational frequencies in O*NET. Consequently, we cannot employ his hierarchical regression-based method for quantifying work arduousness. Kroll's approach involves purging the arduousness responses for variation statistically driven by individual-level characteristics and then computing conditional occupation-level arduousness measures.¹⁸ However, we believe that the compositional bias Kroll highlights is less relevant for O*NET. In contrast to the survey employed by Kroll to evaluate ISCO-specific arduousness, the items collected by O*NET are less explicitly or implicitly aimed at capturing work demands and stress (i.e., arduousness) and their implications for well-being or health. In short, due to their more descriptive and factual nature, rather than being oriented towards consequences, the O*NET responses are less likely to be affected by the respondents' background characteristics.

The O*NET items are organised into different modules, including job tasks, work context, skills, abilities, and more. The data is continuously updated through a rolling survey process, providing detailed and comprehensive insights into the characteristics of different occupations. For this study, we focus on the *Work Context* module, as its variables appear to align well with the definition of physical arduousness found in the job demands and job quality literature (Bakker and Demerouti, 2007; Chen *et al.*, 2017). 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 principal component (PC) analysis to obtain a summary indicator of occupational arduousness for each ISCO-4 occupation. More information (1st and 2nd principal components, eigenvalues and loading factors) is reported in the [Appendix A.2](#). Only the 1st PC is used in the paper to quantify the physical arduousness of each occupation (Figure A4). We show in [Table A1](#) in the Appendix that it correlates relatively well with working conditions items associated with physical 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 versus non-managerial work content, a dimension that is a priori less relevant here. In the Appendix A.2, Figure A5 presents our O*NET 1st principal component (PC) for a list of ISCO 2 level occupations. As expected, typical manual/outdoor occupations (e.g., building and related trades) translate into high arduous PC values. In contrast, more intellectual and indoor occupations (e.g., business and administration) display significantly lower values.

It is essential to emphasise how we utilise these occupation-specific O*NET arduousness indices. Once injected into SHARE, they are used to compute, for each respondent, a *career arduousness score*. For most of the results presented here, it is calculated as the weighted average of all O*NET-estimated PC for his/her consecutive ISCO-4-digit occupations self-reported in SHARE wave 7 (see [Appendix A.1](#), [Figure A3](#)). The weights reflect the proportion of total full-time

¹⁶Roughly corresponding to the 4-digit level in the ISCO classification.

¹⁷The incumbents in the O*NET documentation.

¹⁸In more technical terms, the occupation-level arduousness he uses corresponds to the regression-predicted values derived solely from the estimated random effects for each occupation.

equivalent years forming the career during which each occupation was performed. To achieve full-time equivalence, the years have been multiplied by .5 if the occupation was always declared part-time, 1 if always full-time and .75 when variable.¹⁹

Hereafter, we use a respondent's `decile` in the international distribution of career average arduousness scores to predict his/her risk of ill health and mortality and to generate life tables specific to each decile of career arduousness.

Before turning to the fully-fledged econometric analysis of the relationship between these deciles and bad health or death, and the computation of life tables, Table 2 presents some interesting stylised facts regarding these arduousness deciles. First, we observe that they increase with the age of the SHARE wave 7 respondents (i.e., the age at the time of the interview). This is consistent with the notion that older cohorts (e.g., those aged 70 and above) may have experienced harsher working conditions than their relatively younger peers, reflecting a general decline in work-related arduousness over time.²⁰

We also find that career arduousness is systematically lower, on average, among female respondents. In Table 2, coefficients ranging from -1.83 to -1.84 suggest a gender gap in career arduousness of approximately two deciles within the pooled (international) distribution. This finding underscores the importance of distinguishing between men and women when estimating the impact of career arduousness econometrically and when computing life tables.

Finally, Table 2 hints at the strong link between career arduousness deciles and the GDP per capita of the respondent's country. Countries are grouped by quartile of the international GDP per capita distribution, measured in 2017 PPP U.S. dollars. Using the first quartile as the reference category, we observe, for example, that living in a country in the fourth quartile is associated with a 1.18-point reduction in the career arduousness decile. The second model (M2) reports results using GDP per capita data from 1992, corresponding to a 25-year lag. This alternative measure is designed to more accurately capture the economic context during respondents' active working lives. Importantly, the results obtained using lagged GDP per capita are very similar to those based on the more recent measure, reinforcing the robustness of the observed association.

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. Table 4 contains a first indication of how these SHARE follow-up data can be used to deliver death indicators by gender and age.

Additionally, our estimates of healthy life expectancy are based 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 in the closest previous wave if missing in wave 7), 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 recognised as 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).²¹ Following Etilé and

¹⁹Ideally, working-hour differences should be measured more precisely.

²⁰Possibly due to technological innovation and the adoption of more capital-intensive production methods, and an overall shift in the distribution of work across occupations.

²¹It is also a good predictor of more elaborate health indices that can be computed using SHARE many subjective and objective health items.

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

Ard. decile	M1	M2
Age ^b	0.0071*** (0.0015)	0.0049*** (0.0015)
Female	-1.8435*** (0.0275)	-1.8599*** (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; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
^aCoefficients capture the marginal impact on the decile of the international arduousness distribution.
^bThe respondent's age at the interview.
^cGDP 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
^dGDP 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

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 survey).-
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Milcent (2006), we dichotomised self-reported health into Good, Fair and Poor versus Excellent and Very Good. Table 4 details the frequency by age of death and bad health, underpinning our analysis.

Finally, this paper controls for the potential bias caused by the pre-labour determinants²² in driving the risk of poor health in late years (Trannoy *et al.*, 2010) or death. SHARE contains data on educational attainment and health endowment. The latter comprises the health status during childhood²³ and information about parents' death status.²⁴ 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.

²²Inherited or emerging during childhood, before people start working
²³Before the respondent turns 15.
²⁴We 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 4. SHARE wave 7 respondents follow-up: risk of death/bad health by age band (OLS estimates)

Age band	Male		Female	
	Death	Bad health ^a	Death	Bad health ^a
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***
75-79	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 follow-up). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

a1: Good, Fair and Poor, 0: Excellent and Very good.

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

Our econometric analysis (step 1) utilises the follow-up data to estimate a logit model where death and poor health indicators are regressed on age, age squared, and deciles of career arduousness, including an interaction term between age and arduousness. To control for other factors, we systematically include the (mean-centred) career duration and a COVID dummy variable.²⁵ Including career duration helps account for the direct effects of unusually short or long careers on health and mortality risk. In a separate study (Vandenberghe, 2023a), we show that individuals with shorter careers—often due to repeated interruptions such as periods of unemployment—tend, *ceteris paribus*, to exhibit poorer health after age 50. We interpret this finding as evidence that career instability, independent of career arduousness, can have lasting negative consequences for individual health and longevity outcomes.

In a model variant, we also control for the role of pre-labour endowment variables (parental death status, childhood health, and 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 odds ratios. They confirm that the age of the respondent is a key (generally non-linear) determinant of the risk of death and poor health. Point estimates suggest that increased work arduousness raises the risk of death and poor health. For example, an odds ratio of 1.15 for male mortality implies that each additional decile of arduousness increases the risk of death by 15%. However, this effect diminishes with age, as shown by statistically significant odds ratios below 1 for the interaction between age and arduousness.

Step 2 consists of calculating (healthy) life tables using the above point estimates. The notations hereafter are those used in the life table literature, with subscript x referring to the age band. We compute one life table for each career arduousness decile $k = 1, \dots, 10$ (Madans and Molla, 2008). Using predicted death probability by age $\hat{q}_{x,k}$ and that of being in bad health $\hat{bh}_{x,k}$, we compute the survivorship by age and arduousness decile: $l_{x,k} = l_{x-1,k} \times (1 - \hat{q}_{x-1,k})$. To be precise, the survivorship estimates are normalized using the Eurostat-EU 28, 2017 estimates of survival by age 50–102; indexed on Human Mortality Database (HMD).²⁶ We thus 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

²⁵ Covering the period from March 2020 to December 2022.

²⁶ 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	
Age ^b	1.125*** (0.017)	1.128*** (0.017)	1.124*** (0.017)	1.127*** (0.018)	1.070*** (0.003)	1.067*** (0.003)	1.055*** (0.002)	1.049*** (0.002)
Age ²	1.001 (0.000)	1.000 (0.000)	1.001*** (0.000)	1.001*** (0.000)	1.000*** (0.000)	1.000*** (0.000)	1.000*** (0.000)	1.000*** (0.000)
Ard. dec.	1.150*** (0.027)	1.119*** (0.028)	1.186*** (0.036)	1.172*** (0.038)	1.125*** (0.004)	1.093*** (0.004)	1.132*** (0.004)	1.106*** (0.004)
Age X Ard. dec.	0.995*** (0.002)	0.995*** (0.002)	0.993*** (0.002)	0.992*** (0.002)	0.998*** (0.000)	0.998*** (0.000)	1.000 (0.000)	1.000 (0.000)
Career dur. ^c	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; * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. ^aExponentiated coefficients, ^bCentred on the age of 65, ^cCentred on the average (men: 37.43 fte years, women: 29.95 fte years)

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 justification for this is that we are fully aware that longitudinal surveys, such as SHARE, tend to underestimate mortality rates (Bergmann *et al.*, 2020), which could introduce bias if used directly. To address this, we rely exclusively on the gradient of mortality across arduousness deciles within SHARE to differentiate mortality patterns, while anchoring the overall level to the HMD.

The healthy survivorship by age is computed as survival (EU/HMD normalized) times the 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-HMD normalized) survivorship functions $\tilde{l}_{x,k}$; $\tilde{hl}_{x,k}$.

4.2. Identification issues

The resulting life tables (Tables 6 and 7) are valid only if, using econometrics, we correctly identify the relationship between the risk of poor 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 moment arduousness is assessed 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 older respondents who appear in the highest arduousness deciles (Table 2). Assuming that the passage of time has led to the disappearance of the most challenging jobs, our 2020-based O*NET arduousness index might be lower than the index that they experienced. All this might lead to an overestimation bias known in the literature as an expansion bias due to censored regressors (Rigobon and Stoker, 2007). This is an X -related bias. However, it should not be confounded with the well-known attenuation bias driven by the presence of a (large) additive measurement error/random term to X . With the expansion bias, 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, in such a case, the (absolute value of the) slope of the Y, X relationship will be exaggerated (Rigobon and Stoker, 2007).

Regarding selection, we posit that non-random selection into arduous occupations may occur both before labour market entry and during individuals' time in the workforce. Before entering the labour market, pre-existing health conditions can influence occupational choices, with healthier individuals more likely to select into more demanding jobs. During their careers, health deterioration, also known as health shocks, may cause individuals to leave jobs that are more challenging or stressful. This is just the flip side of what is known in the literature as the healthy worker survivor effect, whereby healthier individuals are more likely to enter or remain in physically demanding jobs.²⁷ All these imply an attenuation of the actual causal relationship (Belloni *et al.*, 2022).

To account for selectivity before labour market entry, SHARE offers interesting opportunities. It informs us on educational attainment, as well as health status up to the age of 15 (childhood health). These are endowment items whose level is determined before people pick their first occupation and enter the labour market. Moreover, SHARE informs us about the parents' longevity and death status, which we use in all our baseline results to control for the more heritable part of people's initial health endowment. In our key results tables, Tables 6 and 7 show that, contrary to what would be expected, the inclusion of these pre-labour market entry controls reduces the magnitudes of (health)

²⁷ Healthy workers are better able to take on, or maintain, exposure to physically demanding tasks.

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

Ard. dec.	Without add. controls [*]					With add. controls [*]				
	Levels		Gaps ^a			Levels		Gaps ^a		
	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	32.58	24.49	0.00	0.00	0.00	32.06	23.34	0.00	0.00	0.00
2	32.21	23.61	−0.37	−0.88	0.51	31.73	22.67	−0.33	−0.66	0.33
3	31.78	22.67	−0.80	−1.82	1.02	31.42	21.98	−0.64	−1.36	0.71
4	31.27	21.68	−1.30	−2.80	1.50	31.04	21.25	−1.02	−2.09	1.07
5	30.44	20.55	−2.14	−3.94	1.80	30.44	20.42	−1.63	−2.92	1.29
6	30.44	19.81	−2.14	−4.68	2.54	30.44	19.87	−1.63	−3.46	1.84
7	29.51	18.58	−3.06	−5.91	2.85	29.75	18.96	−2.31	−4.38	2.06
8	28.76	17.49	−3.82	−6.99	3.18	29.22	18.10	−2.84	−5.23	2.39
9	28.00	16.35	−4.58	−8.14	3.56	28.68	17.24	−3.38	−6.10	2.72
10	27.14	15.19	−5.44	−9.29	3.86	28.05	16.40	−4.01	−6.93	2.92

Source: SHARE, O*NET work context items, our calculations.
^{*}Pre-labour endowment variables (parental death status and childhood health, plus educational attainment)
^aRef: 1st decile of career arduousness.
^bLife expectancy.
^cHealthy life expectancy.
^dLife expectancy handicap.
^eHealthy life expectancy handicap.
^fBad health life expectancy handicap.

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

Ard. dec.	Without add. controls [*]					With add. control [*]				
	Levels		Gaps ^a			Levels		Gaps ^a		
	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	39.14	24.86	0.00	0.00	0.00	38.89	24.54	0.00	0.00	0.00
2	38.86	23.76	-0.28	-1.10	0.82	38.61	23.63	-0.28	-0.91	0.63
3	38.53	22.66	-0.61	-2.20	1.59	38.35	22.69	-0.54	-1.85	1.31
4	38.15	21.47	-0.98	-3.38	2.40	38.04	21.74	-0.85	-2.80	1.95
5	37.45	20.18	-1.68	-4.68	3.00	37.45	20.62	-1.43	-3.92	2.48
6	37.45	19.17	-1.68	-5.69	4.01	37.45	19.83	-1.43	-4.71	3.28
7	36.61	17.87	-2.52	-6.99	4.46	36.74	18.68	-2.15	-5.86	3.71
8	35.94	16.62	-3.20	-8.24	5.04	36.13	17.61	-2.75	-6.93	4.17
9	35.14	15.35	-4.00	-9.51	5.51	35.46	16.55	-3.43	-7.98	4.55
10	34.22	14.08	-4.92	-10.78	5.86	34.68	15.44	-4.20	-9.10	4.89

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

^{*}Pre-labour endowment variables (parental death status and childhood health, plus educational attainment)^aRef: 1st decile of career arduousness.^bLife expectancy.^cHealthy life expectancy.^dLife expectancy handicap.^eHealthy life expectancy handicap.^fBad health life expectancy handicap.

life expectancy gaps between the 10th and the 1st decile of career arduousness. The point, however, is that the reduction is relatively small.

Turning to selectivity during people's careers, SHARE also offers opportunities. It enables us to assess the impact of job arduousness at various stages of these careers. Using the O*NET PC score, it is indeed possible to retrieve each respondent's first occupation and the corresponding index. In the robustness analysis [Section 5.2](#), we report our key results when using these as a measurement of arduousness, and it seems reasonable to assume that the intensity of the selectivity bias is more substantial when using the career average arduousness. The point, however, is that we show, for example, in [Tables 12](#) and [13](#) that using the arduousness of the first job does not matter econometrically.

In short, measuring career arduousness correctly is not trivial. Our measure is not perfect due to what we call the arduousness time gap. Non-random selection into arduousness matters also. While the latter problem might lead to an attenuation bias, the former could cause overestimation. Controlling for pre-labour selection and checking for during-the-career selection, we might have limited the magnitude of the selection bias, but not entirely. Simultaneously, the exaggeration bias due to the O*NET time gap remains. So, all in all, the odds are that the results presented hereafter might not be that different from the actual causal impact of the arduousness of (healthy) life expectancy.

5. Results

5.1. Key results

[Figures 1](#) and [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](#). These are excerpts of the fully-fledged arduousness-adjusted life tables to be found in the Appendix ([Section A.3](#), [Tables A2, A3, A4, A5](#)).

In [Table 6](#), men in the first decile of the arduousness display a life expectancy of 32.58 years at the age of 50. By contrast, those in the 10th decile are expected to live only 27.14 years. That corresponds to a life expectancy differential of $[27.14 - 32.58 =] -5.44$ years. The gap in terms of healthy life expectancy is even larger at $[15.19 - 24.49 =] -9.29$ years. Turning to our preferred estimates, obtained by controlling for pre-labour entry and health endowment, we obtain slightly lower gaps between the lowest and highest arduousness deciles. The life expectancy gaps (netted out from the influence of pre-labour market entry features) between decile 10 and 1 are now 4.01 years (-5.44 years without these additional controls). Similarly, the healthy life expectancy gap is now -6.93 years (-9.29 years without additional 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 (Crimmins *et al.*, 2019; Nusselder *et al.*, 2019). More to the point, we observe a gap in arduousness (between the 10th and 1st arduousness deciles) of -4.92 years, which is slightly less than the one estimated for men (-5.44 years). By contrast, the healthy life expectancy gap at -10.78 is larger than that of men, at -9.29 years. Accounting for selection driven by pre-labour-entry endowments reduces the magnitude of these gaps. The life expectancy gap is now -4.20 (compared to -4.92 years for females without additional controls). And the healthy life expectancy drops by 9.10 years (-10.78 years without these controls). Our preferred results suggest that women's healthy²⁸ life expectancy is slightly more impacted by arduousness: the women's gap at arduousness decile 10 is indeed larger than that of men (-9.10 vs -6.93 years).

²⁸Not so much the life expectancy.

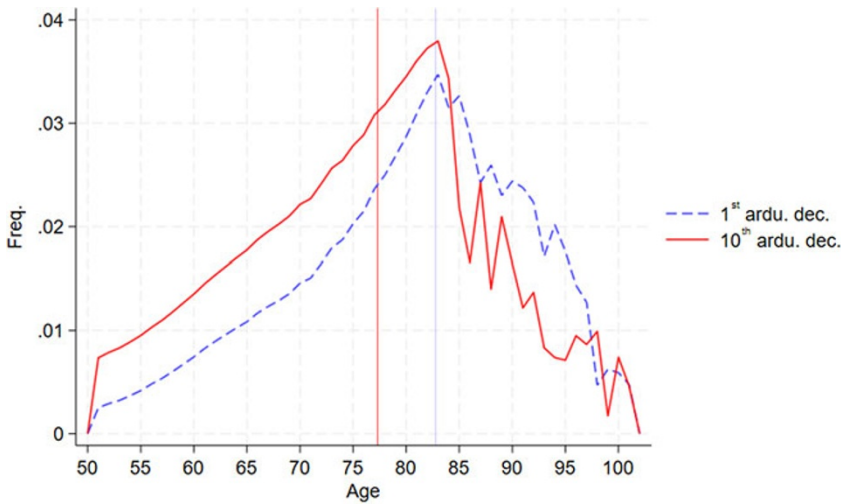


Figure 1. Age of death distribution: 1st vs 10th arduousness decile (M).

Notes: SHARE w8,9,10, O*NET 2020, Work Context Items.

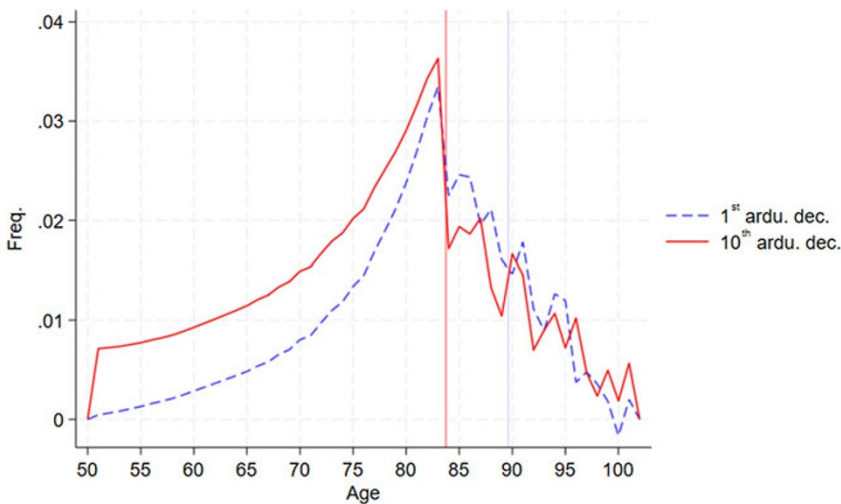


Figure 2. Age of death distribution: 1st vs 10th arduousness decile (F).

Notes: SHARE w8,9,10, O*NET 2020, Work Context Items.

5.2. Robustness analysis

In this subsection, we present a series of robustness checks. The first involves allowing for greater gender differentiation in the key estimates by defining arduousness deciles separately for men and women. The second approach uses a cumulative measure of career arduousness, rather than the average measure used in the baseline analysis. The third robustness check relies on the arduousness of the respondent's first job, instead of the average arduousness across all jobs held.

5.2.1. Gender-specific arduousness deciles

Up to this point, we have used a common distribution of arduousness scores to compute deciles. As shown in Table 2, this approach results in women being systematically assigned to lower deciles than

men. Here, we re-estimate our key (healthy) life expectancy measures using gender-specific deciles—that is, arduousness deciles computed separately for men and women based on split samples. The results are reported in [Tables 8](#) and [9](#). Notably, these estimates are very similar to those based on the baseline weighted average arduousness measure ([Tables 6](#) and [7](#)).

5.2.2. *Cumulative arduousness*

Using the (weighted) average arduousness has the disadvantage of neutralising differences in the length of exposure to arduous work. Consider two respondents—one working full-time and the other part-time—who follow the same sequence of occupations with identical O*NET arduousness indices. While their full-time equivalent career durations will differ (which we control for), they will receive the same (weighted) average arduousness score and thus fall into the same arduousness decile. In other words, our measure of average arduousness neutralises the effect of varying overall work durations. What matters for the score is how the different shares of a respondent's career are distributed across the O*NET indices.

To assess the extent to which this may bias our results, we recompute estimates of (health) life expectancy gaps using a cumulative measure of arduousness. This involves summing the successive O*NET occupation indices, each pre-multiplied by the full-time equivalent duration (in years) of the corresponding occupation. The results obtained using this definition of arduousness are reported in [Tables 10](#) and [11](#). Importantly, they are very similar to those based on the average arduousness measure ([Tables 6](#) and [7](#)), suggesting that the use of average arduousness—which, by construction, neutralises differences in exposure duration—is not substantially underestimating the impact of arduousness.

5.2.3. *Arduousness of first job*

As discussed above, our results may be biased by selection occurring throughout individuals' careers. To assess this risk, we re-estimate our key (healthy) life expectancy results using the decile of the arduousness index corresponding to the first job held. The assumption is that this measure is less affected by the healthy worker bias frequently cited in the literature as a source of attenuation bias. The results obtained using this definition of arduousness are reported in [Tables 12](#) and [13](#). Notably, they are very similar to the baseline results based on average arduousness ([Tables 6](#) and [7](#)), albeit possibly of smaller magnitude—that is, the (healthy) life expectancy gaps between deciles 10 and 1 are somewhat smaller in absolute terms. This pattern does not support the presence of a healthy worker bias; to the contrary.

6. Summary of results and policy implications

The primary response to the challenge of population aging in advanced economies has 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 recognise the diverse levels of work-related strain individuals have encountered.

6.1. *Summary*

This paper thoroughly investigates this issue through detailed microdata analysis, with a focus on Europe. It evaluates (entire) career arduousness by scrutinising 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.

Table 8. Estimates of (healthy) life expectancy at the age of 50 (M), by **gender-specific** decile of **average** career arduousness[£]

Ard. dec.	Without add. controls [*]					With add. controls [*]				
	Levels		Gaps ^a			Levels		Gaps ^a		
	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	32.79	23.74	0.00	0.00	0.00	32.24	22.73	0.00	0.00	0.00
2	32.35	22.86	-0.44	-0.88	0.44	31.89	22.07	-0.36	-0.67	0.31
3	31.87	21.96	-0.92	-1.78	0.86	31.53	21.42	-0.71	-1.31	0.60
4	31.32	20.98	-1.47	-2.76	1.30	31.10	20.73	-1.14	-2.00	0.86
5	30.44	19.85	-2.35	-3.90	1.54	30.44	19.90	-1.80	-2.84	1.03
6	30.44	19.16	-2.35	-4.58	2.23	30.44	19.46	-1.80	-3.28	1.47
7	29.39	18.00	-3.40	-5.74	2.35	29.67	18.56	-2.57	-4.17	1.60
8	28.65	16.93	-4.14	-6.81	2.67	29.09	17.76	-3.16	-4.98	1.82
9	27.78	15.83	-5.01	-7.91	2.89	28.46	16.96	-3.78	-5.77	1.99
10	26.83	14.75	-5.96	-8.99	3.04	27.77	16.15	-4.47	-6.58	2.11

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

£Computing by summing the successive O*NET occupation indices, each pre-multiplied by the full-time equivalent duration (in years) of the corresponding occupation.

^{*}Pre-labour endowment variables (parental death status and childhood health, plus educational attainment)

^aRef: 1st decile of career arduousness.

^bLife expectancy.

^cHealthy life expectancy.

^dLife expectancy handicap.

^eHealthy life expectancy handicap.

^fBad health life expectancy handicap.

Table 9. Estimates of (healthy) life expectancy at the age of 50 (F), by **gender-specific** decile of **average** career arduousness[£]

Ard. dec.	Without add. controls [*]					With add. control [*]				
	Levels		Gaps ^a			Levels		Gaps ^a		
	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	38.88	24.92	0.00	0.00	0.00	38.66	24.42	0.00	0.00	0.00
2	38.62	23.95	-0.26	-0.97	0.71	38.44	23.63	-0.22	-0.80	0.58
3	38.34	23.00	-0.54	-1.92	1.38	38.20	22.82	-0.46	-1.60	1.14
4	38.05	21.99	-0.83	-2.93	2.10	37.95	22.03	-0.71	-2.39	1.68
5	37.45	20.84	-1.43	-4.08	2.65	37.45	21.01	-1.21	-3.41	2.20
6	37.45	19.99	-1.43	-4.93	3.50	37.45	20.29	-1.21	-4.13	2.92
7	36.81	18.85	-2.07	-6.07	4.00	36.89	19.36	-1.77	-5.06	3.30
8	36.27	17.76	-2.62	-7.16	4.55	36.42	18.42	-2.24	-6.00	3.76
9	35.66	16.64	-3.22	-8.27	5.05	35.88	17.49	-2.78	-6.94	4.16
10	34.94	15.54	-3.94	-9.38	5.44	35.28	16.53	-3.38	-7.89	4.51

Source: SHARE, O*NET work context items, our calculations.
 £: Computing by summing the successive O*NET occupation indices, each pre-multiplied by the full-time equivalent duration (in years) of the corresponding occupation.
 *: Pre-labour endowment variables (parental death status and childhood health, plus educational attainment)
^aRef: 1st decile of career arduousness.
^bLife expectancy.
^cHealthy life expectancy.
^dLife expectancy handicap.
^eHealthy life expectancy handicap.
^fBad health life expectancy handicap.

Table 10. Estimates of (healthy) life expectancy at the age of 50 (M), by decile of **cumulative** career arduousness[£]

Ard. dec.	Without add. controls [*]					With add. controls [*]				
	Levels		Gaps ^a			Levels		Gaps ^a		
	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	32.57	24.04	0.00	0.00	0.00	32.13	22.96	0.00	0.00	0.00
2	32.17	23.19	-0.40	-0.85	0.45	31.78	22.32	-0.35	-0.64	0.29
3	31.74	22.32	-0.83	-1.72	0.89	31.45	21.68	-0.69	-1.28	0.59
4	31.24	21.41	-1.33	-2.62	1.30	31.06	21.06	-1.07	-1.90	0.83
5	30.44	20.35	-2.13	-3.69	1.56	30.44	20.21	-1.70	-2.74	1.05
6	30.44	19.66	-2.13	-4.37	2.24	30.44	19.76	-1.70	-3.19	1.50
7	29.52	18.54	-3.05	-5.49	2.45	29.74	18.95	-2.39	-4.01	1.62
8	28.83	17.54	-3.74	-6.50	2.76	29.21	18.19	-2.92	-4.77	1.85
9	28.11	16.52	-4.46	-7.51	3.06	28.66	17.47	-3.47	-5.49	2.01
10	27.31	15.49	-5.26	-8.55	3.29	28.08	16.70	-4.05	-6.26	2.21

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

£Computing by summing the successive O*NET occupation indices, each pre-multiplied by the full-time equivalent duration (in years) of the corresponding occupation.

^{*}Pre-labour endowment variables (parental death status and childhood health, plus educational attainment)

^aRef: 1st decile of career arduousness.

^bLife expectancy.

^cHealthy life expectancy.

^dLife expectancy handicap.

^eHealthy life expectancy handicap.

^fBad health life expectancy handicap.

Table 11. Estimates of (healthy) life expectancy at the age of 50 (F), by decile of **Cumulative** arduousness[£]

Ard. dec.	Without add. controls [*]					With add. control [*]				
	Levels		Gaps ^a			Levels		Gaps ^a		
	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	39.05	24.82	0.00	0.00	0.00	38.73	24.30	0.00	0.00	0.00
2	38.78	23.72	-0.28	-1.10	0.82	38.52	23.49	-0.21	-0.81	0.60
3	38.49	22.63	-0.56	-2.19	1.62	38.26	22.60	-0.47	-1.70	1.24
4	38.11	21.48	-0.95	-3.34	2.40	38.00	21.70	-0.73	-2.60	1.87
5	37.45	20.18	-1.60	-4.64	3.04	37.45	20.65	-1.27	-3.65	2.37
6	37.45	19.15	-1.60	-5.67	4.07	37.45	19.85	-1.27	-4.45	3.17
7	36.66	17.83	-2.40	-6.99	4.59	36.82	18.74	-1.91	-5.56	3.64
8	36.04	16.54	-3.01	-8.28	5.27	36.32	17.69	-2.41	-6.61	4.20
9	35.28	15.25	-3.77	-9.57	5.80	35.71	16.63	-3.02	-7.67	4.65
10	34.45	13.95	-4.60	-10.87	6.27	34.97	15.50	-3.76	-8.80	5.04

Source: SHARE, O*NET work context items, our calculations.
£Computing by summing the successive O*NET occupation indices, each pre-multiplied by the full-time equivalent duration (in years) of the corresponding occupation.
*: Pre-labour endowment variables (parental death status and childhood health, plus educational attainment)
^aRef: 1st decile of career arduousness.
^bLife expectancy.
^cHealthy life expectancy.
^dLife expectancy handicap.
^eHealthy life expectancy handicap.
^fBad health life expectancy handicap.

Table 12. Estimates of (healthy) life expectancy at the age of 50 (M), by decile of **first job** arduousness[£]

Ard. dec.	Without add. controls [*]					With add. controls [*]				
	Levels		Gaps ^a			Levels		Gaps ^a		
	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	31.97	23.74	0.00	0.00	0.00	31.50	22.64	0.00	0.00	0.00
2	31.71	23.02	-0.26	-0.72	0.46	31.29	22.10	-0.22	-0.54	0.33
3	31.38	22.23	-0.59	-1.50	0.92	31.07	21.57	-0.43	-1.07	0.64
4	31.02	21.47	-0.95	-2.27	1.31	30.82	21.03	-0.68	-1.61	0.93
5	30.44	20.55	-1.53	-3.19	1.66	30.44	20.38	-1.07	-2.26	1.19
6	30.44	19.93	-1.53	-3.81	2.27	30.44	19.96	-1.07	-2.68	1.61
7	29.79	18.96	-2.18	-4.77	2.59	30.03	19.30	-1.47	-3.34	1.87
8	29.32	18.10	-2.65	-5.63	2.98	29.74	18.73	-1.76	-3.91	2.14
9	28.80	17.19	-3.17	-6.54	3.37	29.39	18.09	-2.11	-4.55	2.43
10	28.23	16.33	-3.74	-7.40	3.66	29.04	17.51	-2.46	-5.13	2.67

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

£Computing by summing the successive O*NET occupation indices, each pre-multiplied by the full-time equivalent duration (in years) of the corresponding occupation.

^{*}Pre-labour endowment variables (parental death status and childhood health, plus educational attainment)

^aRef: 1st decile of career arduousness.

^bLife expectancy.

^cHealthy life expectancy.

^dLife expectancy handicap.

^eHealthy life expectancy handicap.

^fBad health life expectancy handicap.

Table 13. Estimates of (healthy) life expectancy at the age of 50 (F), by decile of **first job** arduousness[£]

Ard. dec.	Without add. controls [*]					With add. control [*]				
	Levels		Gaps ^a			Levels		Gaps ^a		
	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	38.96	24.60	0.00	0.00	0.00	38.70	24.26	0.00	0.00	0.00
2	38.69	23.57	-0.28	-1.03	0.75	38.49	23.39	-0.21	-0.87	0.66
3	38.38	22.45	-0.59	-2.15	1.56	38.26	22.49	-0.45	-1.77	1.32
4	38.03	21.37	-0.93	-3.22	2.29	37.95	21.62	-0.76	-2.64	1.88
5	37.45	20.17	-1.51	-4.43	2.92	37.45	20.64	-1.25	-3.62	2.37
6	37.45	19.20	-1.51	-5.40	3.89	37.45	19.90	-1.25	-4.36	3.11
7	36.76	18.03	-2.21	-6.56	4.36	36.92	18.89	-1.78	-5.37	3.59
8	36.24	16.93	-2.72	-7.67	4.94	36.49	17.97	-2.21	-6.29	4.08
9	35.66	15.79	-3.31	-8.81	5.50	35.95	17.04	-2.75	-7.22	4.47
10	34.98	14.75	-3.99	-9.85	5.86	35.40	16.10	-3.30	-8.16	4.86

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

£Computing by summing the successive O*NET occupation indices, each pre-multiplied by the full-time equivalent duration (in years) of the corresponding occupation.

^{*}Pre-labour endowment variables (parental death status and childhood health, plus educational attainment)

^aRef: 1st decile of career arduousness.

^bLife expectancy.

^cHealthy life expectancy.

^dLife expectancy handicap.

^eHealthy life expectancy handicap.

^fBad health life expectancy handicap.

The outcomes of this analysis reveal a notable discrepancy in life expectancy between individuals engaged in the least and most physically demanding careers, with the 10th vs 1st arduousness decile gap ranging from 4 (men) to 4.2 years (women), respectively. Disparities in healthy life expectancy are even more pronounced, ranging from 6.9 to 9.1 years for men and women, respectively.

6.2. Policy implications and feasibility

These findings suggest that policy interventions aimed at mitigating the burdens of demanding careers should permit retirement age differences of up to 10 years, with some variation by gender.

But retirement age differentiation also comes with important limitations. As highlighted by Baurin (2021); Vandenberghe (2023b), and Vandenberghe (2024), there are principled concerns tied to the unpredictability of (realised) health deterioration or mortality after age 50 (see Appendix A.4). While our analysis reveals statistically significant differences in outcomes across arduousness deciles, this approach does not fully resolve the issue of how to treat individuals in the remaining distribution. Indeed, the SHARE data (Appendix A.4, Figure A6)) clearly indicates that any broad implementation of retirement age differentiation would remain vulnerable to two types of errors. Type-F errors occur when individuals in poor health²⁹ are denied early retirement (i.e., a failure of treatment), and Type-E errors occur when individuals in good health are granted early retirement unnecessarily (i.e., excessive treatment), as originally conceptualised by Cornia and Stewart (1993). These risks point to a structural limitation of retirement age differentiation: it cannot, on its own, address the full heterogeneity in late-life health outcomes. Therefore, it would need to be complemented by a robust health and disability insurance scheme. However, this raises a critical policy question: might health and disability insurance alone be more effective in addressing longevity inequalities rooted in career arduousness, as suggested by Vandenberghe (2023b)? Also, an alternative—and potentially more straightforward—approach to improving pension equity over the life course would be to frontload pension payments (Vandenberghe, 2024).³⁰

Another limitation stems from the statistical and practical feasibility challenges that policymakers would encounter in attempting to replicate and implement the methodology proposed in this paper. Analysing the relationship between career arduousness and (healthy) life expectancy is highly data- and time-intensive. The first step involves quantifying the arduousness of individuals' entire career trajectories, as captured by the SHARE dataset. It requires collecting and continuously updating detailed data on workers' occupational histories. The SHARE data show that individuals often transition between multiple occupations throughout their lifetimes, making it challenging to track and accurately assess each career spell. Each of these spells must be evaluated for its level of arduousness, which adds further layers of complexity and requires significant analytical and resource investment.

There is also the risk of an arduousness trap. Differentiated retirement ages could inadvertently discourage workers in demanding jobs from transitioning to less arduous ones—something that one would probably want as part of a health and safety prevention strategy to promote a longer career—for fear of losing their eligibility for early retirement.

Finally, legal and political feasibility must be considered. Retirement age differentiation is vulnerable to legal challenges because it invariably implies unequal treatment. For example, differentiating retirement ages differently by gender is likely unlawful in jurisdictions such as the United States or the EU. For instance, the European Court of Justice explicitly prohibits gender-based differences in the legal retirement age. Politically, such reforms could also face significant resistance. An equalisation policy that would entail up to a 10-year difference in retirement age across groups may be seen as

²⁹Or, similarly, individuals who are short-lived.

³⁰One approach to achieving this is through partial deannuitization of benefits, offering larger upfront payments earlier in retirement—similar to practices in some private pension schemes.

inequitable or politically untenable. Moreover, acceptance depends heavily on establishing a robust—and ideally causal—link between career arduousness and adverse health outcomes or mortality. While the methodology presented in this paper offers valuable insights and a solid conceptual foundation, scaling it up for policy implementation would pose some credibility (and thus acceptability) challenges.

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Appendix

Appendix A.1. From jobs spells in SHARE to career arduousness scores

										International occupation codes		
	cnt3	mergeid	agey	yjobs1	yjobf1	yjobs2	yjobf2	yjobs3	yjobf3	isco1	isco2	isco3
1.	AUT	AT-001215-01	78	1956	1957	1958	1958	1958	1984	General office cl	Accounting associ	Nursing professio
2.	AUT	AT-001492-01	65	1969	1971	.	.	.	.	General office cl	.	.
3.	AUT	AT-001492-02	66	1970	1971	1972	1985	1985	2013	Draughtspersons	.	.
4.	AUT	AT-001881-01	87	1944	1987	.	.	.	.	Agricultural and	.	.
5.	AUT	AT-001881-02	93	1943	1945	1945	1984	.	.	Science and engin	Subsistence mixed	.
6.	AUT	AT-002136-01	66	1978	1980	1980	2012	.	.	Dentists	Dentists	.
7.	AUT	AT-002136-03	64	1970	1980	1980	2012	.	.	General office cl	Dental assistants	.
8.	AUT	AT-002525-01	75	1956	1968	1968	1975	1975	2002	Window cleaners	Textile, fur and	Hand launderers a
9.	AUT	AT-002525-02	75	1956	1966	1966	2002	.	.	Bricklayers and r	Mail carriers and	.
0.	AUT	AT-002800-01	66	1973	2014	.	.	.	.	Business services	.	.

Figure A1. SHARE w7: job history/spells (sample).

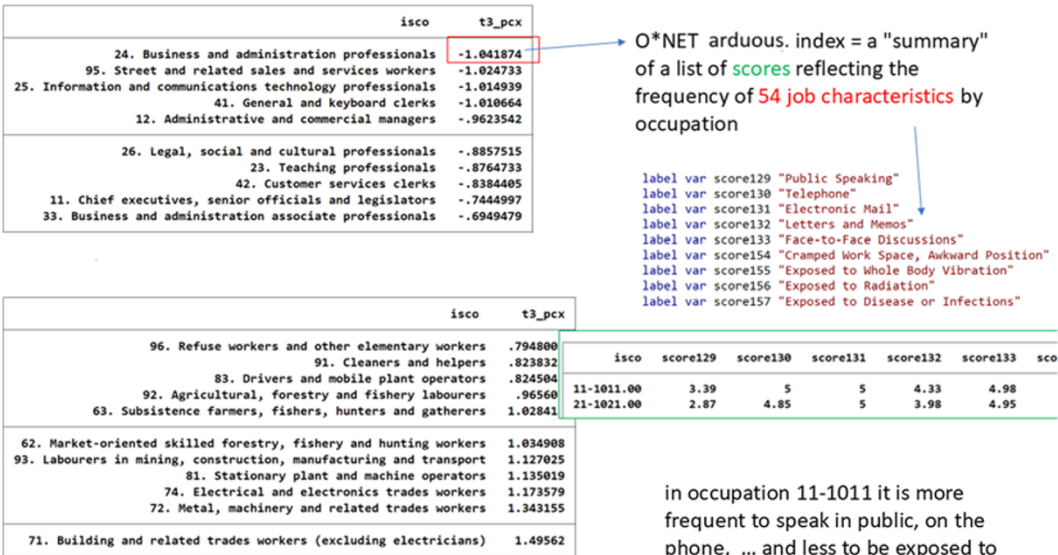


Figure A2. O*NET: a way to quantify arduousness using working conditions items for each occupation.

mergeid	agey	gender	iscd_r	pen_1	pen_2	pen_3	njobs	ngaps	everpa~w	phealth	bmi	chron~7c	xshi_
AT-001215-01	78	2	5	-0.98	-1.02	-0.20	3	0	1. Yes	1	30.06	5	1.31
AT-001492-01	65	2	3	-0.98	.	.	1	0	1. Yes	0	21.05	3	-0.75
AT-001492-02	66	1	4	-0.75	.	.	1	1	1. Yes	0	23.89	2	-1.14
AT-001881-01	87	2	1	0.90	.	.	1	0	1. Yes	0	26.40	2	-0.35
AT-001881-02	93	1	1	0.58	0.91	.	2	0	1. Yes	0	34.66	4	0.78
AT-002136-01	66	1	6	-0.18	-0.18	.	2	0	1. Yes	1	27.13	4	2.05
AT-002136-03	64	2	3	-0.98	0.26	.	2	0	1. Yes	0	23.74	0	-1.14
AT-002525-01	75	2	1	0.57	.	0.36	3	0	1. Yes	1	21.51	3	0.25
AT-002525-02	75	1	3	2.43	0.22	.	2	0	1. Yes	1	26.00	1	0.21
AT-002800-01	66	2	5	-0.78	.	.	1	0	1. Yes	1	22.84	3	0.21

Age, gender, educ

O*Net arduousness index

III health beyond 50

Figure A3. SHARE & O*NET combined: job arduousness history, with each job spell now coming with an arduousness index.

Appendix A.2. O*NET Principal Components, Load Factors

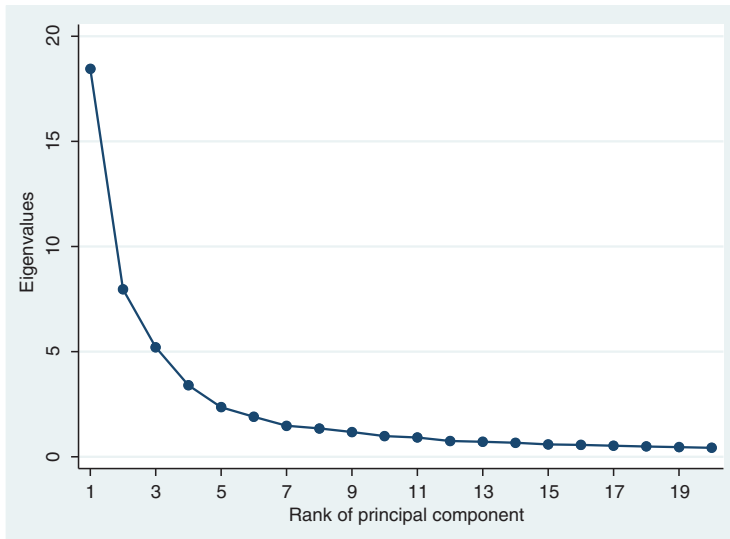


Figure A4. O*NET arduousness items (ISCO4): proportion of variance explained by first (and following) principal components (i.e., eigenvalues)..

Notes: O*NET 2020, Work Context Items.

Table A1. O*NET arduousness items (ISCO4): Loading factors for 1st and 2nd 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

(Continued)

Table A1. (Continued.)

	Load factors	
	Principal Comp. 1	Principal Comp. 2
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.

aOnly the 1st Principal component is used in this paper to compute career arduousness $CAR_{i,j}^{ard}$ in equation (1). The largest positive coefficients in the first column identify the items that are the most associated with (i.e., loading the) arduousness component (e.g., Exposure to Contaminants, Pace (of work) determined by the speed of Equipment, Sounds, noise levels are distracting or uncomfortable, etc.). The second principal component correlates more with managerial vs non-managerial work content, a less relevant dimension in an exercise centred on the health impact of arduousness.

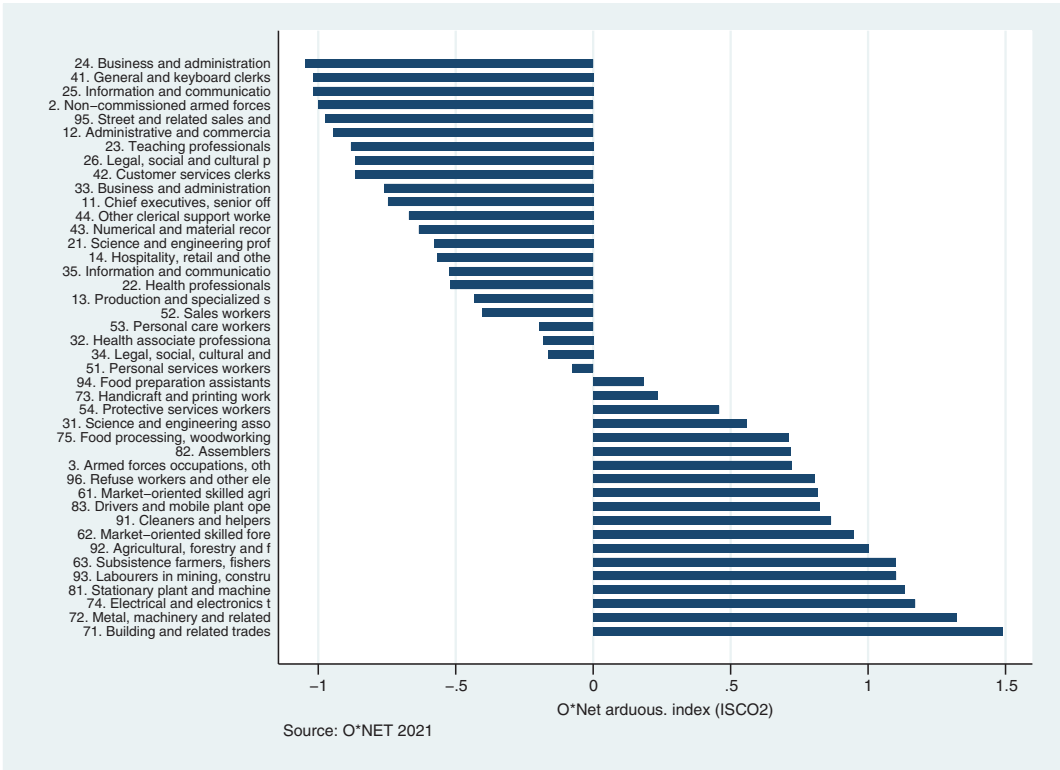


Figure A5. O*NET career arduousness indices (ISCO 2).
Notes: Indices reported on the X axis are First Principal Components of items forming the O*NET Work Context module. More information (1st and 2nd principal components, eigenvalues and loading factors) is available in the Appendix (Figure A.4, Table A.1)

Appendix A.3. Life tables

Table A2. Life table (M): Survival, life expectancy and healthy life expectancy, 1st and 10th decile of career arduousness

	Survival		Life expect.		Health. Survival		Heath. Life expect.	
	Dec 1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10
50	1.000	1.000	0.000	0.000	0.913	0.739	0.000	0.000
51	0.997	0.994	0.999	0.997	0.904	0.722	0.908	0.731
52	0.994	0.987	1.995	1.987	0.895	0.706	1.808	1.445
53	0.991	0.979	2.987	2.970	0.885	0.688	2.698	2.142
54	0.987	0.971	3.977	3.945	0.874	0.671	3.578	2.821
55	0.983	0.962	4.962	4.912	0.863	0.653	4.446	3.483
56	0.979	0.953	5.943	5.869	0.851	0.635	5.304	4.127
57	0.973	0.943	6.919	6.817	0.839	0.616	6.149	4.753
95	0.118	0.031	32.382	27.121	0.110	0.036	24.111	15.067
96	0.088	0.007	32.484	27.138	0.089	0.035	24.211	15.103
97	0.047	0.000	32.553	27.140	0.080	0.025	24.295	15.133
98	0.006	0.000	32.578	27.140	0.058	0.022	24.364	15.155
99	0.000	0.000	32.579	27.140	0.050	0.016	24.417	15.175
100	0.000	0.000	32.579	27.140	0.035	0.006	24.461	15.186
101	0.000	0.000	32.579	27.140	0.010	0.004	24.484	15.190
102	0.000	0.000	32.579	27.140	0.000	0.000	24.487	15.193

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

Table A3. Life table (M with controls): Survival, life expectancy and healthy life expectancy, 1st and 10th decile of career arduousness

	Survival		Life expect.		Health. Survival		Heath. Life expect.	
	Dec 1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10
0	1.000	1.000	0.000	0.000	0.896	0.743	0.000	0.000
51	0.997	0.994	0.999	0.997	0.886	0.729	0.891	0.736
52	0.994	0.988	1.994	1.988	0.876	0.714	1.773	1.457
53	0.990	0.981	2.986	2.973	0.865	0.698	2.644	2.163
54	0.987	0.974	3.975	3.951	0.854	0.683	3.503	2.854
55	0.982	0.966	4.959	4.921	0.842	0.667	4.352	3.528
56	0.977	0.958	5.939	5.884	0.829	0.650	5.187	4.187
57	0.972	0.949	6.914	6.837	0.816	0.633	6.010	4.828
95	0.105	0.048	31.903	28.015	0.090	0.050	23.011	16.230
96	0.072	0.014	31.991	28.046	0.081	0.046	23.097	16.278
97	0.038	0.000	32.047	28.051	0.070	0.039	23.172	16.321
98	0.002	0.000	32.064	28.051	0.052	0.026	23.233	16.353
99	0.000	0.000	32.063	28.051	0.039	0.017	23.278	16.374
100	0.000	0.000	32.064	28.051	0.031	0.016	23.314	16.391
101	0.000	0.000	32.064	28.051	0.009	0.005	23.334	16.402
102	0.000	0.000	32.064	28.051	0.000	0.000	23.338	16.404

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

Table A4. Life table (F): life expectancy and healthy life expectancy: 1st and 10th decile of career arduousness

	Survival		Life expect.		Health. Survival		Heath. Life expect.	
	Dec 1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10
50	1.000	1.000	0.000	0.000	0.852	0.640	0.000	0.000
51	0.999	0.994	1.000	0.997	0.845	0.627	0.849	0.633
52	0.998	0.988	1.998	1.988	0.838	0.613	1.690	1.253
53	0.997	0.982	2.996	2.973	0.831	0.599	2.525	1.859
54	0.996	0.975	3.993	3.951	0.823	0.585	3.352	2.451
55	0.994	0.968	4.988	4.923	0.815	0.571	4.171	3.029
56	0.992	0.961	5.981	5.888	0.806	0.556	4.982	3.592
57	0.990	0.954	6.972	6.845	0.797	0.542	5.784	4.141
95	0.396	0.314	37.099	32.442	0.119	0.049	24.422	13.926
96	0.371	0.304	37.482	32.750	0.108	0.041	24.536	13.972
97	0.338	0.292	37.837	33.049	0.087	0.031	24.634	14.008
98	0.311	0.271	38.160	33.331	0.067	0.022	24.711	14.034
99	0.291	0.254	38.462	33.594	0.052	0.015	24.770	14.052
100	0.265	0.241	38.738	33.839	0.039	0.009	24.816	14.064
101	0.237	0.228	38.997	34.082	0.021	0.009	24.847	14.073
102	0.000	0.000	39.135	34.215	0.000	0.000	24.857	14.078

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

Table A5. Life table (F with controls): life expectancy and healthy life expectancy: 1st and 10th decile of career arduousness

	Survival		Life expect.		Health. Survival		Heath. Life expect.	
	Dec 1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10	Dec 1	Dec 10
50	1.000	1.000	0.000	0.000	0.833		0.000	0.000
51	0.999	0.994	1.000	0.997	0.827		0.830	0.647
52	0.998	0.988	1.998	1.988	0.820		1.653	1.281
53	0.997	0.982	2.996	2.974	0.813		2.470	1.904
54	0.996	0.976	3.992	3.953	0.805		3.279	2.514
55	0.994	0.970	4.987	4.926	0.797		4.080	3.112
56	0.992	0.963	5.980	5.892	0.789		4.873	3.696
57	0.990	0.956	6.971	6.851	0.780		5.658	4.268
95	0.390	0.326	36.878	32.890	0.129		24.095	15.251
96	0.359	0.311	37.253	33.208	0.109		24.215	15.304
97	0.330	0.292	37.596	33.510	0.089		24.314	15.348
98	0.311	0.273	37.917	33.792	0.070		24.393	15.381
99	0.289	0.264	38.218	34.062	0.057		24.457	15.408
100	0.261	0.236	38.490	34.309	0.032		24.501	15.428
101	0.238	0.227	38.748	34.549	0.021		24.527	15.440
102	0.000	0.000	38.887	34.683	0.000		24.539	15.441

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

Appendix A.4. Bad health beyond 50: still a lottery

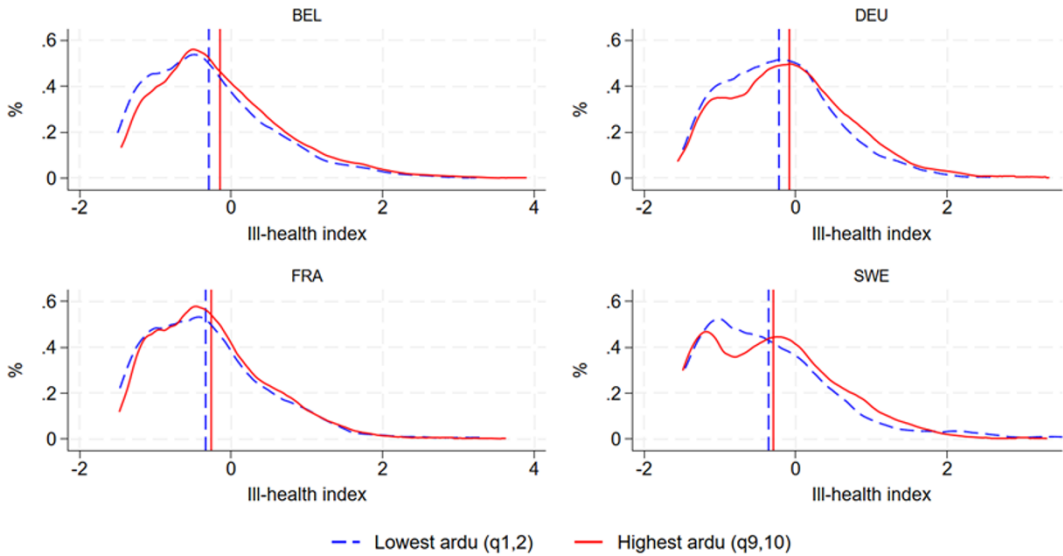


Figure A6. Beyond the career arduousness decile: ill health is still a lottery illustration: Belgium, Germany, France, Sweden (55-64)..

Notes: SHARE w7, O*NET 2020. The horizontal axis displays the ill-health index computed using several items and Principal Component dimensionality reduction as in Vandenberghe (2023a). The distance between the two vertical bars corresponds to the expected difference in ill/poor health that can be attributed to career arduousness decile differences. The full distribution curves inform about the **realised** health. One notices the importance of the dispersion and also the extent of the overlap. In particular, the risk of ill health, although lower among individuals in the lowest deciles of career arduousness, is not null.