INTERNATIONAL MONETARY FUND

The Labor Market Implications of Healthy Aging

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WP/25/229

2025
NOV

WORKING PAPER

 WP/25/229

IMF Working Paper
Research Department

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Prepared by Bertrand Gruss, Eric Huang, Andresa Lagerborg, Diaa Noureldin, Galip Kemal Ozhan

Authorized for distribution by Deniz Igan
November 2025

ABSTRACT: This paper provides new cross-country evidence on healthy aging—the extent to which populations age in better health across successive birth cohorts—and how this shapes labor market outcomes for older workers. Using harmonized microdata on individuals aged 50 and above in 41 countries over 2000-22, we document that physical, cognitive, and mental health have improved systematically across cohorts. To estimate causal effects, we instrument individual health with chronic disease incidence. Better health increases labor supply along both the extensive and intensive margins and raises labor earnings and labor productivity. The results are economically significant: a decade of cohort health gains in cognitive abilities raised older individuals' labor force participation by about 20 percentage points, weekly hours by around 6, productivity by roughly 30 percent, and total labor earnings by roughly 35 percent. These results suggest that healthy aging can meaningfully bolster labor supply and productivity among older workers, mitigating demographic headwinds for growth and public finances.

RECOMMENDED CITATION: Gruss, B., E. Huang, A. Lagerborg, D. Noureldin, G. K. Ozhan, 2025. "The Labor Market Implications of Healthy Aging". IMF Working Paper, International Monetary Fund, Washington, D.C.

JEL Classification Numbers:	J11, J14, J26
Keywords:	Population aging; demographic change; healthy aging; labor markets
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* We would like to thank Pedro Henrique de Barros Gagliardi for his excellent research assistance. We also thank Sangyup Choi, Gita Gopinath, Pierre-Olivier Gourinchas, Deniz Igan, Petya Koeva-Brooks, Warren Sanderson, Andrew Scott, and many seminar participants for their valuable comments and suggestions.

WORKING PAPERS

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Prepared by Bertrand Gruss, Eric Huang, Andresa Lagerborg, Diaa Noureldin, and Galip Kemal Ozhan[1]

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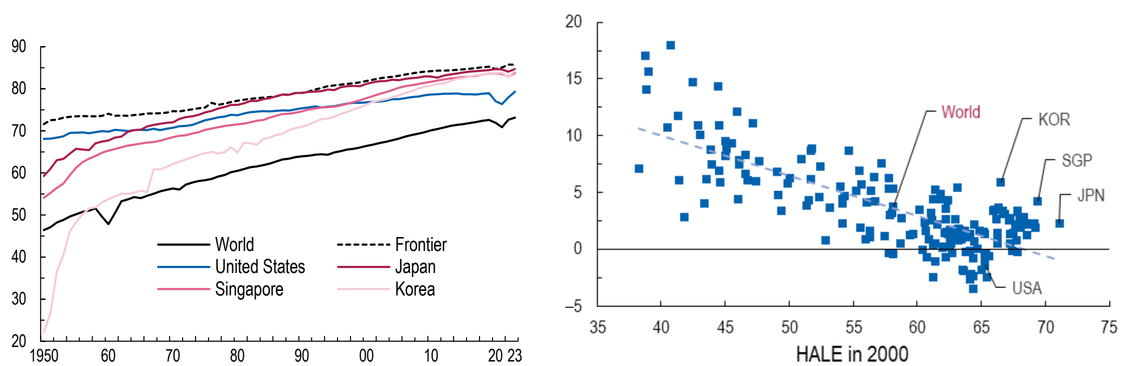
1. Introduction

Population aging—driven by falling fertility and rising longevity—is expected to have profound economic and social consequences worldwide. The prevailing view tends to be a gloomy one. A shrinking share of the working population (defined as aged 15 to 64) weighs on labor supply, exerting a "demographic drag" on economic growth (Bloom, Canning, and Fink, 2010; Maestas, Mullen, and Powell, 2023). A significant fraction of workers exits the labor force between ages 50 and 64, so the shift of the population toward older ages further reduces labor supply and growth. With fewer workers available to cope with rising pension and healthcare spending, public finances become increasingly strained (Rouzet *et al.*, 2019; Bodnár and Nerlich, 2022).

Recent studies, however, highlight a more nuanced picture: individuals are not only living longer, but they are also aging in better health (Kotschy and Bloom 2023; Old and Scott 2023). According to the World Health Organization, 83 percent of the increase in global life expectancy between 2000 and 2021 reflects years a person is expected to live in good health, free from chronic diseases, with larger improvements observed in countries starting from worse initial conditions (Figure 1). If healthy aging enables older workers to remain active in the labor market for longer and to be more productive, it could offset some of the negative impact of changes in the age structure of economies. Against this backdrop, a critical open question is whether rising healthy life expectancy has translated into broad-based improvements in the functional and cognitive capacities of older individuals—and, in turn, into longer and more productive working lives.

Figure 1. Life Expectancy and Healthy Life Expectancy Trends

(a) Life Expectancy at Birth, 1950-2023 (b) Change in HALE, 2000-2021



Sources: United Nations' World Population Prospects dataset; World Health Organization (WHO); and authors' calculations.
Note: HALE = health-adjusted life expectancy (defined by the WHO as the average number of years a person is expected to live in full health, free from chronic diseases).

A large literature—especially over the past two decades—has studied the relationship between health and labor market outcomes, but it has paid limited attention to older individuals and remains skewed toward advanced economies (Pintor, Fumagalli, and Suhrcke, 2024). Within this literature, health status is widely considered a key determinant of labor market outcomes at both the extensive margin (the decision to participate in the labor force) and the intensive margin (hours worked). As a fundamental component of human capital, health can also influence workers' productivity and earnings. However, evidence on older workers close to retirement age remains scarce. This paper fills this gap by studying the extent to which healthy aging—defined as improvements in health across birth cohorts—shapes older individuals' labor market outcomes.

We make two main contributions. First, we provide new cross-country evidence on healthy aging using harmonized microdata for individuals aged 50 and above in 41 countries (29 advanced and 12 emerging market economies) over 2000-2022, covering a range of objective (i.e., measured) and self-reported metrics of physical, cognitive, and mental health. Second, we estimate the causal effect of these health indicators on a wide range of labor market outcomes, including labor supply at the extensive and intensive margins, labor earnings, and labor productivity. To address endogeneity concerns, we employ an instrumental variable (IV) strategy that exploits the variation in the incidence of chronic diseases across individuals that is unexplained by their socio-economic characteristics and lifestyle factors. We argue that this instrument can be considered an exogenous health shock, and validate this approach through a battery of diagnostic checks, alternative instrument specifications, and an alternative re-weighting estimation approach to test robustness.

Our findings reveal broad-based improvements in health indicators over time, with the strongest gains observed for cognitive capacities. Turning to labor market implications, we find that better health, particularly for cognitive functioning, raises labor supply among older individuals—along both the extensive margin (labor force participation) and intensive margin (hours worked)—and boosts total labor earnings and labor productivity, proxied by hourly earnings. Better health is also associated with later retirement, more weeks worked per year, and a lower probability of unemployment. These effects are economically significant: on average, a decade of cumulative improvement in older individuals' cognitive capacities raises the likelihood of participating in the labor force by around 20 percentage points, weekly hours worked by around 6 hours, labor productivity by around 30 percent, and annual labor earnings by around 35 percent. These findings suggest that healthy aging can meaningfully offset some of the economic headwinds of population aging by reshaping the labor market role of older individuals.

We also explore the extent of heterogeneity in healthy aging trends and labor market effects. Wide health gaps are found to exist both within and across countries implying that policies can play a role in improving older individuals' health and, in turn, labor market prospects. For instance, average health scores are lower in emerging markets (relative to advanced economies) and for individuals with lower education, lower household wealth, and those residing in rural areas. We observe that healthy aging trends also differ across subgroups, and while there is evidence of cross-country 'health convergence', whereby individuals in emerging markets exhibit stronger healthy aging trends compared with those in advanced economies, health disparities across other socio-economic dimensions—relating to gender, rural/urban location, education, and wealth—remain persistent. The labor market implications of health conditions are also somewhat heterogeneous: strongest for individuals in their 50s and 60s, precisely when many of them drop out of the labor force, with smaller effects at older ages.

Our study contributes to three main strands of literature. First, we contribute to the literature exploring trends in healthy aging and the health disparities observed across and within countries. Prior work documents cohort-over-cohort improvements in overall age-related health frailty in Europe (Abeliansky and Strulik, 2019), the United States (Abeliansky *et al*., 2020), and the United Kingdom (Old and Scott, 2023), with varying intensity across socio-economic groups.[1] In contrast, some studies point to a rising incidence of chronic diseases and lower health improvements for more recent cohorts in the United States (King *et al*., 2013) and Europe (Börsch-Supan *et al*., 2021). [2] Turning to specific health domains, while various studies—mostly in the field of medicine—discuss evidence of improvements in physical and cognitive capacities, relatively few track the evolution across multiple health metrics.[3] Our analysis documents health improvements across a wide range of objective and self-reported health indicators in a large cross-section of countries, and thus provides a more extensive view of the healthy aging phenomenon.

Second, we contribute to the burgeoning literature exploring the health-labor market nexus, where we zoom in on the group of older individuals closer to retirement age, where health shocks may have a differential impact on labor market outcomes when compared with younger workers. For instance, older workers have fewer margins for adjustment—their human capital is more specialized, opportunities for retraining are scarcer, and health shocks interact with retirement incentives—increasing the likelihood of dropping from the labor force when they experience a health setback (van Rick et al., 2014). A few previous studies have demonstrated that negative health shocks induce retirement or a reduction in labor supply among older workers (Bound *et al*. (1999) on the United States; Riphahn (1999) on Germany; Wing Han Au *et al*. (2005) on Canada; and Disney *et al*. (2006) on the United Kingdom), force younger individuals into inactivity (García-Gómez et al., 2010; García-Gómez and López-Nicolás, 2006), and have persistent employment effects (García-Gómez et al., 2013).[4] Using data for the United States, other studies highlight how individuals in occupations that heavily rely on skills that tend to decline with age are more likely to retire earlier (Belbase *et al*., 2016) or how physical and cognitive decline may exacerbate the ability-skill mismatch and contribute to labor force withdrawals of older workers (Hudomiet *et al*., 2018). Pintor, Fumagalli, and Suhrcke (2024) argue that two of the main gaps in the existing literature relate to the focus being skewed towards high-income countries along with over reliance on self-reported health measures. Our study addresses these gaps by, to the best of our knowledge, providing the broadest cross-country coverage to date—with about a third of the country sample comprising emerging market economies—and using objective health measures alongside self-reported metrics.

Lastly, we contribute to the macro literature that studies the economic consequences of population aging by offering a novel perspective, highlighting the potential silver lining of healthy aging and how it may counter

[1] For instance, Old and Scott (2023) show that a composite frailty health index—capturing general health, mobility and functional difficulties, and cognitive capacities—has been improving over time in the United Kingdom, with the wealthiest individuals seeing the largest gains. For a panel of European countries, health deficits are found to have declined over time, with insignificant differences in rates across countries or by gender (Abeliansky and Strulik, 2019), whereas health deficits have accumulated faster for individuals with low-status occupations (Abeliansky and Strulik, 2023). In the United States, Abeliansky *et al*. (2020) document a steady time trend of health improvements that is the same across regions and for men and women, but significantly lower for African Americans compared to Caucasians.

[2] King et al. (2013) document rising higher rates of chronic disease, disability, and lower self-rated health for baby boomers in the United States. Considering various definitions of a health deficits index, Börsch-Supan et al. (2021) find that health among the middle-aged has stalled in Europe, and in some cases worsened (for more recent birth cohorts), driven mainly by men with wealth and education below the median and highly educated women; the authors observe cohort improvements in functional health (ADLs, mobility), but limited progress in reducing the incidence of certain diseases (e.g. lung disease) and mental health issues in Europe.

[3] Exceptions include Christensen *et al*. (2013) and Ahrenfeldt *et al*. (2018) who document stronger cohort gains in cognitive relative to physical capacities in Denmark and Europe, respectively, while Steiber (2015) reports cognitive improvements but stagnating or declining physical and mental health in Germany.

[4] Several other studies show that, among older workers, poor health is one of the strongest drivers of early retirement: health status is found to play a key role in determining labor supply in the United Kingdom (Blundell et al. 2017), determines whether workers transition into retirement gradually via "bridge jobs" (often part-time or less demanding) in the United States (Cahill et al, 2006), and strongly predicts retirement expectations in the United States (McGarry 2006) and earlier retirement in the United States and Europe (Fisher et al, 2016).

some of the demographic drag on growth. Kotschy and Bloom (2023) study a counterfactual where older individuals retire at an age with only 15 remaining years of life expectancy and assess how this could mitigate the aging-induced slowdown in growth. This paper offers a complementary view by taking into account how health at old age matters not only for the decision to extend working lives, but for the extensive and intensive margins of labor supply closer to retirement age, labor productivity, and total labor earnings. In concurrent work, we integrate our estimates into a global, general equilibrium overlapping-generations model to study the extent to which healthy aging can offset demography's drag on growth (Gruss *et al*., 2025).

The remainder of the paper is organized as follows. Section 2 describes the data, Section 3 outlines the methodology, Section 4 presents the evidence on healthy aging trends, and Section 5 examines the impact of health on labor market outcomes. Section 6 combines these findings to quantify the aggregate labor market implications of healthy aging for older individuals. Section 7 presents additional robustness checks, and Section 8 concludes.

2. Data

This section describes the data used in our analysis, including the sample of countries, health indicators, and labor force status data considered.

2.1. Sample Coverage

Our analysis makes use of 13 distinct household survey datasets that focus on older-age populations living in 41 countries, including 29 advanced economies (AEs) and 12 emerging markets (EMs) during 2000-22 (Table 1).[5] Data for all countries except for Brazil, South Africa, and Thailand are pre-harmonized by the Gateway to Global Aging, the portal through which the data is accessed. We harmonize the data for these three remaining countries ourselves by ensuring that the survey questions and responses match those of the harmonized data (Appendix A provides additional detail on our data harmonization).

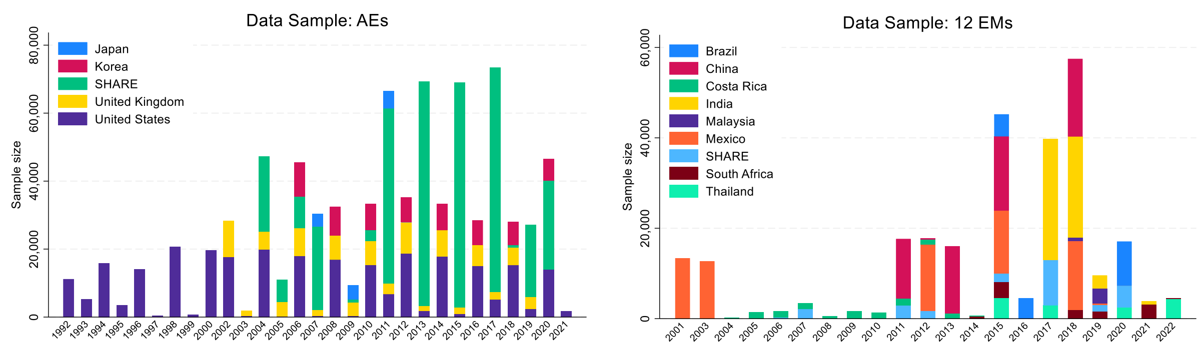
Table 1. Country Sample

Advanced Economies	Emerging Markets
Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom, United States	Brazil, Bulgaria, China, Costa Rica, Hungary, India, Malaysia, Mexico, Poland, Romania, South Africa, Thailand

[5] These microdata surveys include: the *Survey of Health, Ageing and Retirement in Europe* (SHARE) for 28 European countries and Israel, *Japanese Study on Aging and Retirement* (JSTAR) for Japan, *Korean Longitudinal Study of Aging* (KLoSA) for Korea, *English Longitudinal Study of Ageing* (ELSA) for the United Kingdom, the *Health and Retirement Study* (HRS) for the United States, *Brazilian Longitudinal Study of Aging* (ELSI) for Brazil, *China Health and Retirement Longitudinal Study* (CHARLS) for China, *Costa Rican Longevity and Healthy Aging Study* (CRELES) for Costa Rica, *Longitudinal Aging Study in India* (LASI) for India, *Malaysia Ageing and Retirement Survey* (MARS) for Malaysia, *Mexican Health and Aging Study* (MHAS) for Mexico, *Health and Aging in Africa: A Longitudinal Study of an INDEPTH Community in South Africa* (HAALSI) for South Africa, and *Health, Aging, and Retirement in Thailan*d (HART) for Thailand. The choice of countries is based on data availability. The full description of data sources is described in Appendix A.

We restrict the data to start in 2000, as prior to 2001 data is only available for the United States (Figure 2). We also restrict our sample to individuals aged 50-90, to focus on the bulk of the elderly population and avoid tails impacting our results, implying we lose 7 percent of the full sample. Altogether, the data sample we analyze contains close to 1 million observations (around 980,000) and around 355,000 individuals (of which roughly 200,000 are surveyed more than once).

Figure 2. Data Sample



Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.

Multiple survey waves and longitudinal data are available for all countries except India, Ireland, and Malaysia, where data exist for only one wave. This enables longitudinal analysis—tracking a subset of individuals over time—a feature we make use of in part of our analysis. In particular, this longitudinal information can help to address concerns that unobserved individual effects may be correlated with explanatory variables, potentially biasing our regression estimates.

2.2. Health Indicators

The surveys include a variety of indicators of physical, cognitive, and mental health. We distinguish between indicators of measured and self-reported health and focus on the indicators with highest sample coverage and survey question comparability across countries[6]:

- Measured health indicators include physical capacity metrics (grip strength and lung function) and various measures of cognitive ability (memory, orientation, verbal fluency, and basic mathematics). The survey questions comprise the following: respondents' maximum hand grip strength (in kg), maximum lung function breathing test measurement, the number of words respondents can recall from a list (memory), whether respondents correctly report today's date (orientation), the number of animals the respondent can list within one minute (verbal fluency), and how many correct subtractions the respondent can make out of five trials

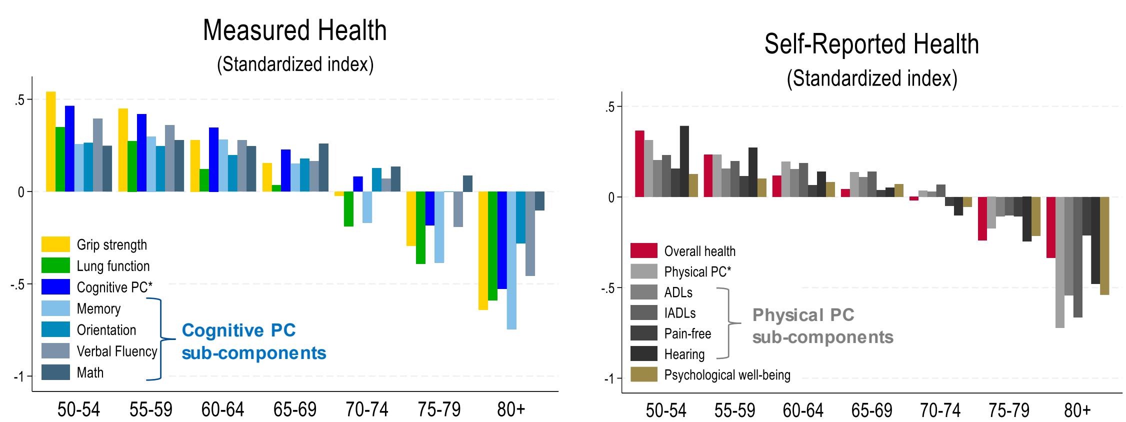
[6] The availability of health indicators is unbalanced across the countries in our sample. Data on self-rated overall health is available for all 41 countries, while data is missing in some cases for grip strength (3 countries), lung function (17 countries), cognitive PC (7 countries), physical PC (7 countries), and psychological well-being (11 countries). Notably, as shown in Appendix Figure A.1, the sample size varies substantially across the health indicators, being highest for self-rated overall health (around 940,000), followed by physical PC (around 720,000), grip strength (around 590,000), psychological well-being (around 430,000), cognitive PC (around 410,000), and lastly lung function (around 250,000).

(math). We summarize the four measured cognitive abilities into a first principal component, which we call "Cognitive PC". [7]

- Self-reported indicators include self-rated overall health, various measures of physical functionality (including ease of performing activities of daily living (ADLs), instrumental activities of daily living (IADLs), the frequency of feeling pain, and hearing ability), and a composite index of psychological well-being. The survey questions comprise the following: respondents rate their own overall health and hearing on a 1-5 scale, whether they experience difficulty in performing a range of ADLs (getting in/out of bed, bathing, dressing, eating, walking across the room) and IADLs (managing money, taking medications, shopping for groceries, and preparing a hot meal), and answer 12 questions that are aggregated into a multi-dimensional measure of quality of life in older adults (the CASP index that comprises four main domains—control, autonomy, self-realization, and pleasure).[8] We summarize the four self-reported physical abilities into a first principal component, which we call "Physical PC".

For ease of comparability, we standardize the different health indicators with a zero mean and unit standard deviation, with higher values indicating better health. As expected, we observe that—for all indicators considered—health tends to decline with age (Figure 3).

Figure 3. Main Health Indicators



Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.

There are pros and cons from using either measured or self-reported indicators of individuals' health. While measured indicators such as grip strength are objective and arguably more reliable, they capture only a narrow dimension of physical health. In contrast, self-reported measures capture individuals' perceptions about their physical condition and their ability to perform basic daily tasks—factors that are likely to be of first-order importance to their willingness and ability to work. To provide a more comprehensive picture, we use both types of metrics in our analysis.

[7] Our analysis focuses on fluid cognitive domains, which tend to decline with age. Cognitive aging has been an active area of medical research and there is consensus on the general pattern of cross-sectional age-cognition relations. On average, fluid abilities (e.g. reasoning, spatial visualization, memory and processing speed) require effortful processing at the time of assessment and decline throughout adulthood (in many cases nearly linearly from early adulthood), whereas crystallized abilities (e.g. vocabulary knowledge) tend to show gains into old age.

[8] To measure ease of ADLs and IADLs, respondents note whether they experience difficulty in performing any of the listed activities, and these are summed together.

The surveys also include information on the self-reported diagnosis of 17 chronic diseases (dummy variables) including: high blood pressure, arthritis, high cholesterol, heart disease, diabetes, psychological disorders, osteoporosis, cataracts, cancer, lung disease, ulcers, stroke, asthma, urinary incontinence, Alzheimer's, kidney disease, and Parkinson's disease.

We also make use of these various health indicators to construct a frailty index, in line with previous studies (Abeliansky and Strulik 2018, 2019; Abeliansky et al. 2020; Old and Scott 2023). Our constructed frailty index essentially aggregates 30 sub-indicators of health, based upon which our six main health indicators are built. For simplicity, and rather than harmonizing cross-country data for all 30 health metrics, our index averages 12 health indicators (grip strength, lung function, memory, orientation, verbal fluency, math, self-rated overall health, ADLs, IADLs, the frequency of feeling pain, hearing ability, and psychological wellbeing)—some of which are composite indicators themselves. The indicators were normalized to a 0-1 scale, where an increase implies a deterioration in health.[9] Unlike frailty indices in previous studies, we do not include the incidence of a chronic disease as part of an individual's health deficit since, for our purposes, the incidence of such a diagnosis matters only to the extent that it affects all of the other included metrics. The frailty index we construct is used throughout our analysis as a robustness check.

In addition, the surveys include data on health behaviors—such as smoking, alcohol consumption, frequency of moderate physical exercise, and body-mass index (BMI)—from which dummy indicators for obesity (BMI above 30) or being underweight (BMI below 18.5) can be constructed, serving as proxies for dietary habits.

2.3. Labor Market Status and Other Socioeconomic Characteristics

The surveys include information about individuals' labor supply, including labor force status at the extensive margin (dummy variables for labor force participation, unemployment, retirement), the intensive margin of work for those employed (hours worked per week, and weeks worked per year), and total annual labor earnings.[10] To proxy for labor productivity, we construct two measures of hourly wages: (i) annual earnings divided by 52 weeks and hours worked per week (denoted "earnings/hr"), and (ii) annual earnings divided by weeks worked per year and hours worked per week (denoted "earnings/hr/wk"). We also make use of cross-country comparable information in some surveys—in particular, the SHARE survey for 29 European countries and Israel—about job types (industry, occupation, and other job characteristics).

[9] In practice, the index can be thought of as a weighted average of the health indicators considered throughout our analysis, where weights are higher for the cognitive and physical principal components, due to having harmonized information for each of their four subcomponents as well. One difference, however, is that even if the cognitive or physical PC is missing (due to missing values for one or more subcomponents), available data for any of the subcomponents is considered. Yet, ADLs, IADLs, and the CASP index are themselves composite indicators (of 20 sub-indicators in total) and hence contain missing values if any of their values are missing.

[10] While related, the decision to participate in the labor market and decision to retire are distinct, as retirement is only one form of labor market inactivity and is typically only applicable beyond a certain age. Notably, the sample size differs substantially across labor market indicators, being highest for the labor force participation dummy indicator (around 930,000) due to its availability for individuals with any labor force status, followed by the employment dummy (around 370,000) due to its availability for only individuals who participate in the labor market, and substantially lower (in most cases below 200,000) for the intensive margin of labor supply (hours and weeks) and labor earnings and productivity, due to data availability only for individuals who are working (Appendix Figure A.1).

Finally, the surveys also report information on various individual socioeconomic characteristics: year of birth, age, gender, rural-urban location dummy, educational attainment (at most primary, secondary, or tertiary), household wealth, and country of residence.

3. Methodology

3.1. Empirical Strategy

Our empirical strategy comprises two parts:

First, to study whether health has been improving across successive birth cohorts, , we regress different health indicators ($H_{i,t}$)—one at a time—on individuals' year of birth[11], controlling for a vector ($\boldsymbol{X}_{i,t}$) of individual socio-economic characteristics (including age, gender, education, and log household wealth) and country fixed effects. Standard errors are clustered at the country level. The pooled ordinary least squares (OLS) specification is given by the following equation, where a positive and statistically significant estimate for the cohort effect α_1 would provide evidence of a healthy aging trend

$$H_{i,t} = \alpha_0 + \alpha_1 YrBirth_i + \boldsymbol{\theta X}_{i,t} + \varepsilon_{i,t} \tag{1}$$

To investigate evidence of heterogeneous healthy aging trends, we allow for cohort effects to vary across different groupings: (i) emerging markets versus advanced economies, (ii) by age, (iii) by gender, (iv) by urban versus rural locations, (v) by educational attainment (at most primary, upper secondary, and tertiary), (vi) by household wealth quintile, and (vii) and by job characteristics.

Following the existing literature (Abeliansky and Strulik 2018, 2019, 2020; Old and Scott, 2023), we also leverage the longitudinal nature of the data and estimate Mundlak (1978) regressions. This approach addresses concerns that unobserved individual effects may be correlated with explanatory variables, potentially biasing OLS and random effects estimates. Unlike fixed-effects models, which discard between-individual variation, the Mundlak approach augments a random-effects model with the within-individual averages of time-varying explanatory variables ($\overline{\boldsymbol{X}}_i$)[12]:

$$H_{i,t} = \beta_0 + \beta_1 YrBirth_i + \boldsymbol{\delta X}_{i,t} + \overline{\boldsymbol{X}}_i + u_i + e_{i,t} \tag{2}$$

Second, we attempt to estimate the causal effect of health on labor market outcomes of older individuals. We use the following estimation strategy:

(i) Correlations. We begin by estimating the association (correlation) between each health indicator ($\boldsymbol{H}_{i,t}$) and each labor market indicator ($\boldsymbol{LMI}_{i,t}$), one at a time, using an OLS regression. The specification controls for a vector ($\boldsymbol{Z}_{i,t}$) of individual socio-economic characteristics (year of birth, age, gender, education, log household wealth) and country fixed effects, as well as a time trend (t):

[11] Controlling for age and year of birth is equivalent to controlling for age and survey year, given that they are linear combinations of one another: survey year = year of birth + age.

[12] The Mundlak regression treats individual-specific effects as partially explained by the means of the explanatory variables over time, effectively providing a middle ground between fixed effects and random effects models. It allows for the interpretation of coefficients on both time-varying (e.g., age, wealth) and time-invariant (e.g., year of birth, gender, education) explanatory variables at the individual level.

$$LMI_{i,t} = \beta_0 + \beta_1 H_{i,t} + \boldsymbol{\theta Z}_{i,t} + \beta_2 t + \varepsilon_{i,t} \tag{3}$$

However, the OLS estimate of β_1 could be biased due to endogeneity problems. If unobserved confounders—such as preferences, early life conditions, or omitted socioeconomic factors—affect both health status and labor productivity or the decision to work, the OLS estimates would be biased—with the sign of the bias depending on the correlations of the omitted variables with both the health and the labor market variables. There may be also reverse causality, where continued employment or delayed retirement for older adults may influence health outcomes. The literature however is mixed as to whether working (or delaying retirement) at older ages has a positive or negative impact on health.[13] If working has positive (negative) effects on health, the OLS coefficient would overestimate (underestimate) the effect of health on, e.g., labor market participation, employment, or productivity. Finally, if the health metrics are measured with noise, the OLS estimate would be downward biased.

(ii) Causal effects. To address endogeneity, we employ an instrumental-variables two-stage least squares (2SLS) framework. We instrument individual health with exogenous health shocks, proxied by the incidence of chronic diseases. Since most chronic conditions are partly attributable to a small set of behavioral risk factors—smoking, poor nutrition, physical inactivity, and excessive alcohol use (Hacker 2024)—we explicitly control for these lifestyle factors in the regressions. Our identification strategy relies on the assumption that a residual component of chronic disease incidence—unexplained by socioeconomic and lifestyle characteristics—is as-good-as randomly assigned. Specifically, in our baseline specification, the instrument is the proportion of chronic diseases in the questionnaire that the respondent reports being diagnosed with (overall, the surveys consider a harmonized list of 17 diseases).

We argue that this instrument satisfies the three core conditions for validity. First, conditional on socioeconomic and lifestyle controls, unexplained variation in the incidence of chronic diseases can be plausibly considered ‘randomly’ assigned, thereby satisfying the exogeneity assumption. Second, it is unlikely that chronic diseases affect earnings or labor supply directly, rather than through their impact on physical, cognitive, and mental health, thereby supporting the exclusion restriction. Thirdly, the instrument is relevant: the incidence of chronic diseases is strongly associated with a deterioration in the health metrics and the first stage F-statistics exceed the Stock and Yogo (2005) rule-of-thumb critical value of 10, ruling out the weakness of the instrument.

3.2. Heterogeneity Analysis

We explore heterogeneity in both the pace of healthy aging and the impact of health status on labor market outcomes along several dimensions. More precisely, we estimate the results across different sub-samples: across different countries, age groups, by gender, level of education, household wealth quintiles, rural/urban location, and job categories by industry and occupation. This allows us to assess the extent of health inequalities and whether these are widening or narrowing across countries and socio-economic groups, and explore whether the labor market effects of better health differ across demographic and socio-economic groups. This also allows for assessing the external validity of our findings.

[13] A literature review by Pilipiec et al. (2020) concludes that “evidence on the effects of an increase of the retirement age on the health and well-being of older workers remains scarce and inconclusive”. The review in Baxter et al. (2021) finds evidence of beneficial or neutral effects from extended working on overall health status as well physical health for many employees. There is, however, mixed evidence in the case of mental health, with reported benefits found to be most likely for males, those working part-time or transitioning to part-time work, and employees in jobs which are not low quality or offer low reward.

3.3. Robustness

We subject our results to a range of robustness exercises:

For the measurement of healthy aging, we consider alternative specifications—using additional controls and allowing for different clustering of the standard errors—and study additional health indicators, including the subcomponents of our physical and cognitive health principal components.

For estimating the impact of health status on labor market outcomes, we additionally employ alternative variations on our instrument, such as the total number of diagnosed chronic diseases, a dummy for the incidence of any chronic disease, and a restricted dummy for the incidence of any of the top 10 chronic diseases which have the largest health impacts. We also explore the impact of adding country-year fixed effects to capture country-level policies that vary over time (e.g. pension reforms or labor market interventions) as well as controlling for job characteristics. Furthermore, we explore additional health indicators (including subcomponents of our physical and cognitive health principal components) and labor market outcomes such as a dummy indicator for retirement.

Next, we also implement an augmented inverse propensity score weighting (AIPW) estimator (Jordà and Taylor, 2015) to address potential endogeneity of the instrument.[14] Intuitively, this approach assigns lower weights to health shocks that are predictable from observables and higher weight to those that are less predictable. The weights are derived from a probit model estimating the probability of experiencing a health shock—defined as being diagnosed with a chronic disease—conditional on the socio-economic characteristics, health behaviors, country fixed effects, and a time trend.

Finally, to benchmark against the existing literature, we replicate our empirical estimates using a composite health frailty index.

4. Healthy Aging Trends

4.1. Healthy Aging Trend Estimates

Our findings provide broad-based and consistent evidence of healthy aging across cohorts. Across a wide set of physical, cognitive, and mental health indicators, later-born cohorts exhibit better health outcomes than earlier-born cohorts, as reflected in the smoothly increasing values for the year-of-birth fixed effects reported in Figure 4. This results from regression equation (1) reported in Table 2 confirm that the year-of-birth coefficient are positive and statistically significant for all health indicators. Importantly, healthy aging gains are largest for cognitive functions as captured by the first principal component of the cognitive indicators—though positive and significant trends are also observed for physical and mental health.

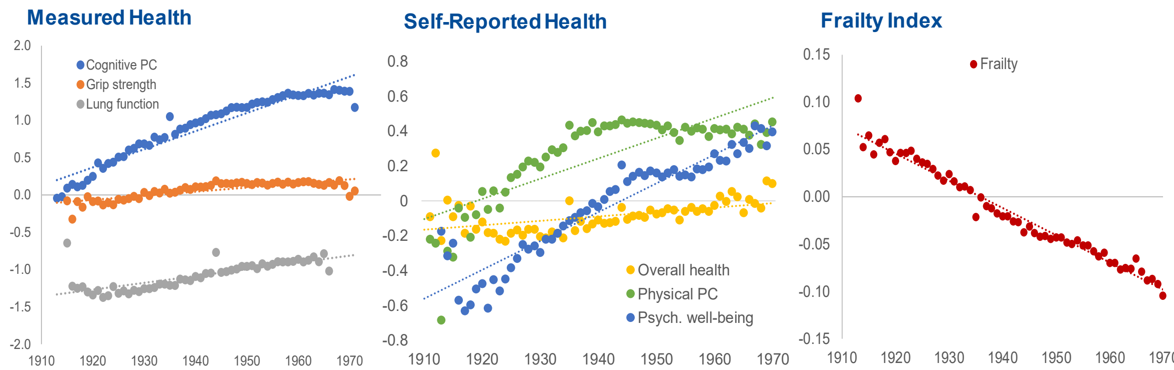
These findings are robust to considering a composite measure of health frailty, in line with the literature, where higher values indicate a deterioration in health. Frailty is shown to have declined over time, consistent with the

[14] AIPW is a 'doubly robust' estimator that combines inverse probability weighting (IPW) with regression control and adjusts the estimator to increase efficiency (Lunceford and Davidian, 2004).

healthy aging phenomenon and in line with previous studies using frailty indices (Abeliansky and Strulik 2018, Old and Scott, 2023).

Figure 4. Health Trends by Cohort

(Year-of-birth fixed effects)



Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.

Table 2. OLS Regressions: Determinants of Health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Measured health			Self-reported health		Overall
	Grip strength	Lung function	Cognitive PC	Overall health	Physical PC	Psych. well-being	Frailty
Year of birth	0.004**	0.011**	0.020***	0.005**	0.005***	0.015***	-0.003***
	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.001)
Socio-economic controls:							
Age	-0.031***	-0.016***	-0.006**	-0.015***	-0.020***	0.002	0.001
	(0.002)	(0.005)	(0.003)	(0.002)	(0.001)	(0.003)	(0.001)
Male	1.345***	0.761***	0.009	0.041*	0.036**	0.045**	-0.024***
	(0.025)	(0.030)	(0.029)	(0.020)	(0.015)	(0.018)	(0.004)
Upper secondary education	0.064***	0.097***	0.362***	0.217***	0.127***	0.191***	-0.041***
	(0.013)	(0.031)	(0.034)	(0.024)	(0.019)	(0.021)	(0.004)
Tertiary education	0.081***	0.225***	0.625***	0.422***	0.227***	0.309***	-0.071***
	(0.016)	(0.024)	(0.042)	(0.038)	(0.027)	(0.033)	(0.007)
(Log) Household wealth	0.019***	0.017***	0.029***	0.035***	0.024***	0.040***	-0.004***
	(0.002)	(0.003)	(0.004)	(0.005)	(0.004)	(0.003)	(0.001)
Constant	-7.202**	-21.629**	-39.388***	-8.413*	-8.534***	-30.601***	5.544***
	(3.548)	(8.959)	(6.267)	(4.200)	(3.020)	(6.142)	(1.940)
Observations	460,247	217,712	382,436	731,018	628,729	345,479	755,958
R-squared	0.612	0.341	0.381	0.204	0.129	0.176	0.333
No. countries	38	24	34	41	34	30	41
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.

Estimates from Mundlak specifications reinforce these patterns. The healthy aging trend estimates remain qualitatively robust in terms of sign and significance, with positive and significant annual improvements shown across all health indicators (Table 3). Compared to OLS, Mundlak estimates suggest somewhat stronger trends consistently across all health metrics.

Table 3. Mundlak Regressions: Determinants of Health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Measured health			Self-reported health		Overall
	Grip strength	Lung function	Cognitive PC	Overall health	Physical PC	Psych. well-being	Frailty
Year of birth	0.007***	0.016***	0.022***	0.013***	0.012***	0.021***	-0.004***
	(0.002)	(0.005)	(0.004)	(0.003)	(0.002)	(0.004)	(0.001)
Socio-economic controls:							
Age	-0.034***	-0.024***	-0.011***	-0.025***	-0.028***	-0.008***	0.003***
	(0.002)	(0.008)	(0.004)	(0.002)	(0.001)	(0.003)	(0.001)
Male	1.343***	0.761***	0.006	0.038*	0.034**	0.042**	-0.023***
	(0.025)	(0.030)	(0.028)	(0.020)	(0.014)	(0.018)	(0.004)
Upper secondary education	0.059***	0.092***	0.354***	0.206***	0.119***	0.178***	-0.039***
	(0.013)	(0.030)	(0.034)	(0.024)	(0.019)	(0.022)	(0.004)
Tertiary education	0.072***	0.214***	0.612***	0.399***	0.210***	0.286***	-0.067***
	(0.016)	(0.022)	(0.042)	(0.037)	(0.026)	(0.034)	(0.006)
(Log) Household wealth	0.001	0.007*	-0.003	-0.003	-0.003	0.002	0.002***
	(0.003)	(0.004)	(0.004)	(0.004)	(0.002)	(0.002)	(0.001)
Mean age	0.006***	0.014	0.006*	0.020***	0.017***	0.016***	-0.003***
	(0.002)	(0.009)	(0.004)	(0.004)	(0.002)	(0.003)	(0.001)
Mean (log) household wealth	0.025***	0.015**	0.043***	0.053***	0.038***	0.054***	-0.009***
	(0.003)	(0.007)	(0.007)	(0.008)	(0.005)	(0.005)	(0.001)
Constant	-11.882**	-31.647***	-42.178***	-25.856***	-23.600***	-41.783***	7.765***
	(4.887)	(10.032)	(7.504)	(5.680)	(3.998)	(7.459)	(1.549)
Observations	460,247	217,712	382,436	731,018	628,729	345,479	755,958
R-squared	0.613	0.342	0.384	0.210	0.132	0.181	0.340
No. countries	38	24	34	41	34	30	41
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

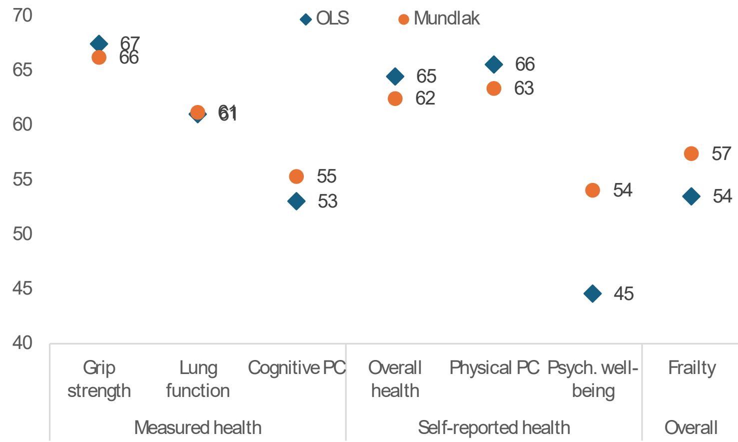
Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This table shows estimates from OLS regressions of health indicators on individuals' year of birth, age, gender, education, and household wealth, as well as individuals' mean age and mean household wealth, with country fixed effects controlled for.

To illustrate the magnitude of health improvements across cohorts over 2000-2022, we translate the coefficients on year-of-birth and age into *age-equivalent health gains* (Figure 5).[15] Our estimates suggest that, on average and after controlling for socioeconomic characteristics and country-fixed effects, the implied improvements are sizable. In terms of physical health, a 70-year-old in 2022 would be comparable to a 67-year-old in 2000 in grip strength, a 61-year-old in lung function, and a 66-year-old in self-rated overall health. Cognitive improvements are even larger: the average 70-year-old in 2022 has cognitive functioning equivalent to that of a 53-year-old in 2000. Notably, the most dramatic gains are observed for psychological well-being, for which age 70 in 2022 became the new 45. Finally, the average frailty of a 70-year-old in 2022 is akin to that of a 54-year-old in 2000. Estimates from Mundlak regressions imply similar age-equivalent gains for most health indicators (discrepancies lie within 3 years of OLS estimates) but smaller gains for psychological wellbeing, for which age 70 in 2000 became the new 54.

[15] In particular, the age-equivalent gains are measured as the coefficient on year of birth (trend improvement effect) multiplied by the number of years in our time sample (2022-2000) and divided by (coefficient on age minus coefficient on year of birth). Similar calculations are made, for instance, in Old and Scott (2023).

Figure 5. Over 2000-22, Age 70 became the new...

(Age-equivalent healthy aging gains)



Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This figure shows age-equivalent gains, measured as the coefficient on year of birth (trend improvement effect) multiplied by the number of years in our time sample (2022-2000) and divided by (coefficient on age minus coefficient on year of birth).

Taken together, these estimates imply that "the 70s are the new 60s" in terms of physical health and "the new 50s" in terms of cognitive and mental health. The strong improvements in cognitive capabilities are particularly relevant, as there is broad evidence that the share of physically demanding jobs—and the share of older workers in such jobs—has been declining, making cognitive abilities more central to sustaining labor force attachment (Acemoglu et al. 2022; Butrica and Mudrazija 2022). Meanwhile, the large age-equivalent gains in psychological well-being may reflect this indicator being self-reported (e.g. unsubstantiated optimism) and/or actual gains reflecting improvements in mental resilience, for instance, accompanying the broader postwar advances in living conditions.[16]

4.2. Heterogeneity in healthy aging by country groups, socio-economic characteristics, sector of employment and by occupation

While the estimated healthy aging trends are encouraging, an important question is how broad-based health gains have been across countries and socioeconomic groups. In particular, have underprivileged segments of the population experienced stronger gains, providing evidence of 'catching up' effects?
Our analysis reveals important disparities in the health of older individuals, both across and within countries. Across countries, average health scores are higher for advanced economies than for emerging markets, and positively associate with the country's GDP per capita, although notable variation remains even after controlling for individuals' socioeconomic characteristics (Appendix Figure B.1 and Table B.1). This residual variation

[16] The age-equivalent gains for psychological well-being appear too large, given that someone aged 70 in 2022 was 48 in 2000. Yet, it is difficult to uncover whether this strong improvement across cohorts is actual or reflects overly optimistic results. On the one hand, excessive gains may reflect this indicator being self-reported and hence not an 'objective' measure of health improvements, thereby potentially capturing that people generally became more optimistic over time. On the other hand, strong gains might also reflect the consequences of the world wars impacting people's *actual* psychological well-being. For instance, a 50-year-old in 2000 was born in 1950, after WWII, while an 80-year-old in 2000 was born in 1920 and suffered the consequences of both world wars.

points to the potential importance of country-specific institutions and policies in shaping health outcomes nationwide.

Within countries, health disparities strongly relate to socioeconomic characteristics. Average health scores are generally higher for individuals with higher education, greater household wealth, and those residing in urban areas.[17] Regression results (Tables 2 and 3 above) confirm these important socio-economic determinants of health, in addition to cohort trends. As expected, health is significantly better among individuals with higher education and wealth. Gender differences also exist: men tend to score higher on physical health metrics (grip strength, lung function, and self-reported scores) and psychological well-being, while no systematic gender gap is observed in cognitive performance.

Employment histories are another source of heterogeneity. Average health scores vary somewhat by job types, even after controlling for other socioeconomic characteristics (Appendix Table B.2). Individuals who have worked in industries such as agriculture, mining, construction, private households with employed persons, or manufacturing tend to score lower across multiple health indicators. By contrast, those with experience in industries such as financial services, trade, public administration, education, and health and social work tend to exhibit better outcomes. This pattern of a strong link between sector of employment and health scores suggests that the nature of the job could affect individuals' health, in line with other studies who find a causal relationship from employment to health.[18]

Next, by interacting cohort trends with these socio-economic determinants, we can investigate whether healthy aging trends are similar across subgroups of the population. Our findings reveal that healthy aging trends differ across countries, but not so much across different socio-economic groups (Table 4). In particular, improvements in health have been faster among emerging markets (compared with advanced economies), pointing to some cross-country "catching up". However, the pace of improvement has been similar across other dimensions, suggesting that wide socio-economic health gaps—in particular, related to education and wealth—have persisted.[19] Health gaps even widened for self-reported physical and mental health across education levels, and for all health indicators across wealth quintiles, where trend differences are small but statistically significant. The rate of health improvements is found to be more or less similar across age groups,. Notably, we also find no evidence of statistically significant differences in healthy aging trends across industries or occupations when considering the subsample of 29 countries that are part of the Survey of Health, Ageing and Retirement in Europe, for which industry and occupation data use comparable classifications.[20]

[17] The dummy indicator for rural vs urban location is excluded from the baseline specification due to missing data for some countries. Nevertheless, our results are robust to controlling for this variable.

[18] Some studies have argued that a causal relationship exists, whereby increasing the retirement age negatively affects health outcomes (Barschkett et al., 2022), and especially so for low-status occupations (Abeliansky and Strulik, 2023), or—to the contrary—that working longer is beneficial for most people, but has negative consequences for some, especially those in low-quality jobs (Calvo, 2006).

[19] Similarly, Old and Scott (2023) find that frailty has decreased over time in the United Kingdom, though at varying rates across socioeconomic groups, with the wealthiest experiencing the largest decreases. Abeliansky and Strulik (2019) show that health deficits have declined over time in a sample of European countries, but health inequalities have persisted. Abeliansky, Erel, and Strulik (2020) find that the time trend of health improvements in the United States is similar across regions and for men and women, but significantly lower for African Americans compared with Caucasians.

[20] In this specification, we drop individuals who report having switched occupations and/or industries across different survey waves. Results are not provided here for brevity.

Table 4. Heterogeneity in Healthy Aging Trends

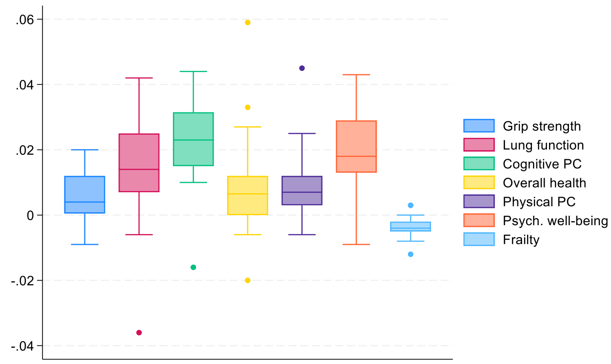
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Measured health			Self-reported health			Overall
	Grip strength	Lung function	Cognitive PC	Overall health	Physical PC	Psych. well-being	Frailty
by country income group:							
Trend x AEs	0.004**	0.010**	0.020***	0.003	0.004***	0.014***	-0.003**
Trend x EMs	0.006*	0.022***	0.033***	0.020**	0.011	0.032***	-0.003
by age:							
Trend x 50s	0.004**	0.011**	0.020***	0.005**	0.005***	0.015***	-0.003**
Trend x 60s	0.004**	0.011**	0.020***	0.005**	0.005***	0.015***	-0.003**
Trend x 70s	0.004**	0.011**	0.020***	0.005**	0.005***	0.015***	-0.003**
Trend x 80s	0.004**	0.011**	0.020***	0.005**	0.005***	0.015***	-0.003**
by gender:							
Trend x Female	0.008***	0.010*	0.022***	0.005**	0.004**	0.015***	-0.003**
Trend x Male	0.001	0.013**	0.018***	0.004	0.006***	0.016***	-0.003***
by location:							
Trend x Urban	0.005**	0.009*	0.021***	0.006**	0.006***	0.017***	-0.003**
Trend x Rural	0.005*	0.014***	0.014**	0.004	0.004*	0.020***	-0.002**
by education:							
Trend x Lower education	0.006***	0.005	0.021***	0.004	0.002	0.010**	-0.002***
Trend x Secondary education	0.003	0.017***	0.021***	0.007**	0.007***	0.018***	-0.003**
Trend x Tertiary education	0.004*	0.012**	0.018***	0.002	0.008***	0.021***	-0.003**
by household wealth:							
Trend x Quintile 1 (lowest)	0.003	0.010**	0.019***	0.003	0.003**	0.012***	-0.002**
Trend x Quintile 2	0.003	0.010**	0.019***	0.003	0.003**	0.012***	-0.002**
Trend x Quintile 3	0.003	0.010**	0.019***	0.003	0.003**	0.012***	-0.002**
Trend x Quintile 4	0.003	0.010**	0.019***	0.003	0.004**	0.012***	-0.002**
Trend x Quintile 5 (highest)	0.003	0.010**	0.019***	0.003	0.004**	0.012***	-0.002**

Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This table shows estimates from OLS regressions of health indicators on survey year interacted with socioeconomic groupings, with individuals' age, gender, education, wealth, and country fixed effects controlled for. Blue (red) denotes values that are statistically higher (lower) from the base group (consisting of the top row values for each socio-economic category).

For countries with enough years of data (e.g. minimum 10 years), we also estimate country-specific healthy aging trends.[21] This results in a smaller cross-section of 22 countries. Figure 6 shows a box plot of the estimates. The level of heterogeneity in the trends is highest for lung function and psychological wellbeing. In line with our earlier results, the highest median trend is observed for cognitive abilities, followed by psychological well-being.

[21] Limited time coverage of health data (spanning only a few survey waves/years) may lead to imprecise trend estimates.

Figure 6. Box Plot of Country-Specific Healthy Aging Trends



Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This figure shows estimates from OLS regressions of health indicators on survey year interacted with country dummies, with individuals' age, gender, education, and wealth controlled for. The plot shows the median (horizontal line), interquartile range (box upper and lower bounds), minimum and maximum values excluding outliers (whiskers), and outliers (outside dots).

5. Impact of Health on Labor Markets

Have healthy-aging gains been associated with improvements in labor market outcomes of older individuals? To shed light on this question, this section investigates the effect of older individuals' health on measures of labor supply and labor earnings.

5.1. OLS estimates

A simple OLS regression analysis reveals that, across the different health metrics, health scores are positively associated with both labor supply and earnings (Table 5). Better old-age health is associated with decisions to increase both the extensive margin of labor supply (labor force participation and probability of employment) and intensive margin of labor supply (hours worked per week and weeks worked per year), as well as with higher total labor earnings and labor productivity.[22]

[22] We also find evidence that better health is associated with retiring at a later age.

Table 5. OLS Regressions: Effect of Health on Labor Market Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Extensive margin		Intensive margin		Total	Labor productivity	
	LFP	Employment	Weekly hours	Weeks/year	Earnings	Earnings/hr	Earnings/hr/wk
Measured health:							
Grip strength	0.022***	0.026**	1.069***	0.054	0.078***	0.042**	0.043**
	(0.006)	(0.010)	(0.143)	(0.095)	(0.017)	(0.020)	(0.019)
Lung function	0.012***	0.013**	0.100	0.190**	0.065***	0.053***	0.040***
	(0.004)	(0.006)	(0.183)	(0.073)	(0.013)	(0.014)	(0.013)
Cognitive PC	0.005	0.027***	0.501*	0.189	0.148***	0.137***	0.082***
	(0.005)	(0.005)	(0.269)	(0.119)	(0.025)	(0.025)	(0.022)
Self-reported health:							
Overall health	0.050***	0.026***	0.482***	0.041	0.105***	0.080***	0.068***
	(0.006)	(0.006)	(0.115)	(0.056)	(0.016)	(0.017)	(0.014)
Physical PC	0.020**	0.059**	0.889***	0.430***	0.086***	0.078***	0.081***
	(0.009)	(0.022)	(0.203)	(0.139)	(0.024)	(0.019)	(0.020)
Psych. Well-being	0.011**	0.057***	0.384**	0.176**	0.090***	0.074***	0.069***
	(0.005)	(0.009)	(0.151)	(0.079)	(0.016)	(0.015)	(0.017)
Compositve health frailty:							
Frailty index	-0.282***	-0.248***	-4.933***	-1.677***	-1.218***	-1.017***	-0.765***
	(0.069)	(0.071)	(1.154)	(0.512)	(0.158)	(0.193)	(0.143)
Socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This table shows estimates from OLS regressions of individuals' labor market outcomes on health indicators (one-at-a-time), with socioeconomic factors (year of birth, age, gender, education, and household wealth) and country fixed effects controlled for.

However, these associations may be subject to endogeneity problems and do not necessarily reflect causal relationships. For instance, a reverse relationship may exist whereby working affects health. Some studies have argued that increasing the retirement age negatively affects health outcomes, especially for those in low-status occupations (Barschkett et al. 2022; Abeliansky and Strulik 2023), in which case the OLS estimate may be downward biased. Others find that working longer is beneficial for most people but negative for some, especially those in low-quality jobs (Calvo 2006). In addition, there could be omitted drivers of both health and labor market outcomes that would bias the relationship between the two—with the sign of the bias depending on the correlation of the omitted variable with the health and the labor market variables. Finally, measurement errors in the health indicators could bias the OLS estimates toward zero.

5.2. 2SLS estimates

To address endogeneity concerns and attempt to estimate the causal effect of health on labor market outcomes of older individuals, we instrument health indicators with exogenous health shocks, proxied by chronic disease incidences that are orthogonal to individuals' socio-economic characteristics as well as health behaviors. Lifestyle factors that can impact overall health and the probability of developing chronic diseases—low/high body-mass index, physical inactivity, and smoking—are included as additional control variables in both the first- and the second-stage regressions. These lifestyle factors are indeed shown to be important predictors of chronic diseases (Appendix Table C.2)[23]

Our first-stage regressions indicate that chronic diseases constitute a strong instrument for individuals' health. In addition to our baseline instrument—the incidence of chronic diseases, as defined in section 3.1—we consider the following alternatives as robustness checks: (i) total number of chronic diseases that the respondent reports having, (ii) a dummy indicator for whether the respondent has any chronic diseases, and (iii) a similar dummy indicator for whether the respondent has any of the top 10 chronic diseases that most affect health.[24] Table 6 shows that chronic diseases, regardless of the specific instrument definition, result in a significant drop in physical, cognitive and mental health, using both measured and self-reported indicators. The various instruments also pass the weak instrument test, with the first-stage F-statistic exceeding the Stock and Yogo (2005) rule-of-thumb critical value of 10.

Table 6. 2SLS Stage 1: Health Impact of Chronic Disease Instruments

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Measured health			Self-reported health		Composite
	Grip strength	Lung function	Cognitive PC	Overall health	Physical PC	Psych. well-being	Frailty
Baseline IV:							
Chronic disease incidence	-0.734***	-0.497***	-0.416***	-2.931***	-1.919***	-1.889***	0.324***
	(0.052)	(0.085)	(0.058)	(0.125)	(0.084)	(0.078)	(0.010)
Alternative IVs:							
Number of chronic diseases	-0.054***	-0.035***	-0.029***	-0.223***	-0.141***	-0.133***	0.025***
	(0.004)	(0.007)	(0.004)	(0.005)	(0.007)	(0.006)	(0.001)
Chronic disease dummy (top 10 diseases)	-0.146***	-0.105***	-0.054***	-0.523***	-0.365***	-0.370***	0.066***
	(0.012)	(0.023)	(0.019)	(0.024)	(0.023)	(0.019)	(0.003)
Chronic disease dummy (any disease)	-0.095***	-0.102**	-0.024*	-0.601***	-0.198***	-0.262***	0.051***
	(0.014)	(0.037)	(0.013)	(0.024)	(0.016)	(0.025)	(0.003)
Lifestyle controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country
Weak IV F-stat							
Chronic disease incidence	201.8	34.01	51.18	545.8	515.7	592	1109
Number of chronic diseases	225.3	28.93	47.03	1836	470.6	569.2	606.7
Chronic disease dummy (top 10 diseases)	158.6	21.46	7.815	469.7	248.6	382.8	367.8
Chronic disease dummy (any disease)	44.57	7.681	3.464	649.6	160.3	109.6	341.4

Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.

Note: This table shows estimates from OLS regressions of individuals' health indicators on alternative chronic disease indicators (one-at-a-time), with socioeconomic factors (year of birth, age, gender, education, and household wealth), lifestyle factors (smoking, physical inactivity, underweight, obesity), and country fixed effects controlled for.

The second-stage results show that better physical, cognitive, and mental health (and lower overall health frailty), instrumented by the incidence of chronic diseases, have significant economic implications in terms of raising labor supply, earnings, and productivity (Table 7). The effect of health on labor market outcomes is

[23] These lifestyle factors are significant predictors of the composite frailty index. In particular, smoking, alcohol consumption, physical inactivity, and obesity (or higher body-mass-index) are associated with worse health outcomes.

[24] The top 10 chronic diseases are identified via OLS regressions of health indicators on individual chronic diseases, controlling for individuals' socio-economic conditions, country fixed effects, and a time trend (Appendix Table C.1).

positive and significant for all health indicators, suggesting a broad-based positive impact. Notably, in the 2SLS specification, the impact of health on labor market outcomes is stronger for measured (rather than self-reported) health metrics, and in particular strongest for cognitive abilities. Considering this health metric, one-tenth of a standard deviation improvement in cognitive abilities—equivalent to giving a 67-year-old the cognitive functioning of a 50-year-old—raises the probability of participating in the labor force (and the probability of being employed conditional on participating) by around 10 percentage points, increases weekly hours worked by around 3 hours, raises total labor earnings by 17 percent, and labor productivity by around 21 percent.[25] The magnitudes of the estimated coefficients using our IV approach are substantially larger than those implied by OLS regression estimates. A potential explanation for this finding is that the OLS estimates may be biased towards zero if the endogenous regressor (health indicator, in our case) is measured with error. For instance, this could be the case if the harmonization of measured health indicators (e.g., grip strength, lung function and cognitive health indicators) across different country surveys or survey waves is subject to some measurement error, or if systematic pessimism or optimism affects self-rated health metrics. By comparison, the reporting of the incidence of chronic diseases that underpins our instrument is arguably less sensitive to this problem as it is likely to be informed by medical diagnosis of the chronic disease.[26]

Another potential reason for the larger IV coefficients is that this approach may be correcting a reverse causality from employment to health that is biasing the OLS estimates downwards. For instance, if individuals are forced to remain active in the labor market (due, for instance, to economic need or to changes in pension systems) and this has a detrimental impact on their health, as argued by for instance by Barschkett et al. (2022) and Abeliansky and Strulik (2023), the OLS estimate would underestimate the causal effect of exogenous health shocks on labor market variables.

Finally, it may also be that case that our IV estimates capture “local average treatment effects” that may be larger than average affects. Individuals who experience some of these chronic diseases may suffer a pronounced deterioration in health and thus a large impact on their labor marker outcomes; see, for instance, Lenhart (2019) for corroborating evidence in the case of the UK. In cases where health deterioration is less severe—for instance, when it is not associated with the onset of a chronic disease—the impact on labor market outcomes may be smaller in magnitude. The following subsection exploring the heterogeneity of estimates across different sub-samples can also help assess the external validity of our estimates.

[25] The coefficients can be interpreted as measuring the impact of improving health by one standard deviation on: the probability of participating in the labor force (column 1), the probability of being employed conditional on participating in the labor force (column 2), weekly hours worked in individuals’ main job (column 3), weeks worked per year in individuals’ main job (column 4), the log increase in annual labor earnings (column 5), and the log increase in hourly labor earnings, acting as a proxy for labor productivity (columns 6 and 7). Coefficients in columns 5-7, once multiplied by 100, can be interpreted as percent changes. For the frailty index, instead, the coefficients represent the impact of a unit change in the index, representing almost 7 standard deviations.

[26] Some studies in the literature on the returns to education also find the IV estimates to be larger than the OLS estimates; see, for instance, the discussion in Card (1999).

Table 7. 2SLS Stage 2: Effect of Health on Labor Market Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Extensive margin		Intensive margin		Total	Labor productivity	
	LFP	Employment	Weekly hours	Weeks/year	Earnings	Earnings/hr	Earnings/hr/wk
Measured health:							
Grip strength	0.536***	0.318***	9.841***	1.155	0.774***	0.348**	0.601***
	(0.052)	(0.089)	(2.376)	(1.182)	(0.154)	(0.157)	(0.169)
Lung function	0.802***	0.448	13.570***	2.224	1.951***	1.192**	1.218***
	(0.146)	(0.278)	(4.659)	(2.462)	(0.531)	(0.484)	(0.412)
Cognitive PC	0.990***	0.918**	32.729***	4.021	1.728***	0.770	2.108*
	(0.158)	(0.388)	(10.840)	(4.971)	(0.519)	(0.529)	(1.224)
Self-reported health:							
Overall health	0.141***	0.043***	1.924***	0.214*	0.161***	0.060**	0.102***
	(0.014)	(0.014)	(0.358)	(0.122)	(0.026)	(0.028)	(0.018)
Physical PC	0.216***	0.146***	5.367***	0.450	0.457***	0.236***	0.294***
	(0.018)	(0.044)	(1.073)	(0.291)	(0.069)	(0.077)	(0.056)
Psych. Well-being	0.201***	0.152***	4.003***	0.364	0.349***	0.151*	0.184***
	(0.015)	(0.038)	(1.105)	(0.327)	(0.073)	(0.080)	(0.061)
Compositve health frailty:							
Frailty index	-1.279***	-0.464***	-21.643***	-2.319*	-1.712***	-0.660**	-1.083***
	(0.092)	(0.171)	(4.535)	(1.364)	(0.255)	(0.301)	(0.210)
Socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lifestyle controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This table shows estimates from 2SLS regressions of individuals' labor market outcomes on health indicators (instrumented by chronic disease incidence), with socioeconomic factors (year of birth, age, gender, education, and household wealth), lifestyle factors (smoking, physical inactivity, underweight, obesity), and country fixed effects controlled for.

5.3. Heterogeneous Effects by Socio-economic Characteristics, Job Type, and Country

In this section, we explore whether the labor market implications of health improvements vary by country, socio-economic characteristics, and job characteristics. For this, we run separate regressions for subgroups of our sample. Results reveal heterogeneous effects on labor outcomes depending on country income groups as well as individuals' age, gender, urban-rural location, education, and wealth (Table 8).

Several differences can be found across country income groups. A smaller elasticity of the extensive margin of labor supply to health in emerging markets vis-à-vis advanced economies may reflect the need to work out of necessity (despite sometimes unfavorable health conditions). Instead, the intensive margin of labor supply, total earnings, and labor productivity (proxied by hourly earnings), are more elastic to health in emerging markets than in advanced economies.

Within countries, the elasticity of labor supply to health conditions is found to vary widely across age groups—for instance, with health affecting the extensive margin of labor supply for individuals in their 50s the most, followed by those in their 60s and 70s, and with much lower effects for those aged 80 and above. This suggests that even if the functional capacity of older individuals improves, other factors—such as skills obsolescence, pension scheme incentives, and age discrimination—can still constrain their attachment to the labor market beyond a certain age (Neumark, Burn, and Button 2019; D'Albis 2023). It also suggests, importantly, that improving the functional capacity that individuals have when they reach late adulthood could play a key role in attenuating the large drop in labor force participation of individuals aged 50-64 that we observe in the data for most countries.

Turning to gender, the effects of health on labor force participation are significantly larger for men than for women, suggesting that men's labor supply decisions are more responsive to health status. Differential impacts are smaller according to rural-urban location, education, and wealth. On the other hand, effects on the probability of being employed (conditional on participating in the labor force) are stronger for females and urban locations, suggesting that health is a more important determinant of unemployment for these groups.

Instead, effects of health on the intensive margin of labor supply—measured as weekly hours worked for those who are currently working—are stronger for older age groups, and individuals with higher education, wealth, and in rural locations, with small differences recorded according to gender. Meanwhile, the effect of health on weeks worked per year is generally insignificant.

Finally, total labor earnings are found to be more elastic to health frailty for older age groups (but below age 80), females, and individuals with higher education and wealth, with smaller differences across rural-urban location. Meanwhile, the difference across groups in terms of the effects of frailty on labor productivity, proxied by hourly earnings, is limited.

The negative impact of health frailty on labor market outcomes is generally robust to running separate regressions for each 1-digit NACE industries and ISCO occupations (Appendix Table C.3). However, due to much smaller sample sizes—due both to the reduced country coverage (only 29 countries in the SHARE dataset) and certain industries and occupations having few observations—the significance levels tend to drop and coefficient magnitudes should be interpreted with caution.[27]

The extent to which jobs accommodate the preferences of older workers also seems to make a difference for whether health can impact labor supply. As people age, they become less willing to work in jobs that are considered less 'age friendly'. These are jobs that offer lower job satisfaction, are physically demanding, entail higher stress levels, and are characterized by lack of freedom, and poor job security (Acemoglu et al. 2022). Interestingly, better health (lower frailty) generally has a stronger positive effect on labor market outcomes for jobs that are more age-friendly, suggesting a higher 'voluntary' response of labor supply for these occupations (Appendix Table C.3). [28]

[27] Industries 2 and 15 have fewer than 1,000 observations, while industries 4, 7, 9, 10 have fewer than 5,000 observations. Occupations 1 and 6 also have fewer than 5,000 observations.

[28] This evidence is based on running separate 2SLS regressions for individuals' whose last occupation involved high versus low (self-reported) job satisfaction, physically demanding job requirements, and stress levels, among others. Age-friendly jobs are also generally associated with higher cognitive skill requirements, higher education, and better pay. The baseline 2SLS results (Appendix Table 2.2.4) are also robust to controlling for job characteristics (e.g. industry/occupation fixed effects and dummy indicators for jobs being physically demanding, stressful, and subject time pressure, etc.), addressing concerns of job types potentially being correlated with individuals' health. These controls are not part of the baseline since the data are only available for a subset of countries. Results are available upon request.

Finally, we also estimate the effect of health on labor market outcomes separately for each country.[29] Appendix Table C.4 shows a positive effect of health (negative effect of frailty) on labor market outcomes across the countries in our sample. The effect of health on whether to participate in the labor market (the indicator for which the sample size is largest, at around 930,000 observations), is statistically significant for almost all countries. The statistical significance of the health effects is less broad-based for the probability of being employed (for which the data is constrained to individuals that do participate in the labor market, and hence the sample is smaller) and the intensive margin of labor supply (where observations are available for even fewer individuals in each country, those that are working).

All in all, our results point to some heterogeneity in the effects of health on labor market outcomes across countries and individuals' socioeconomic characteristics. At the same time, they don't appear to be driven by a narrow set of outlier groups or countries.

[29] Note that when controlling for lifestyle factors in our 2SLS regression, three countries dropped from our regression—Japan, Mexico, and Thailand—due to missing data for physical inactivity. Nevertheless, these countries are included in Table 13 by dropping physical inactivity as a control variable when estimating results for these specific countries.

Table 8. Heterogeneous Effects of Health Frailty, by Socio-economic Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Extensive margin		Intensive margin		Total	Labor productivity	
	LFP	Employment	Weekly hours	Weeks/year	Earnings	Earnings/hr	Earnings/hr/wk
Baseline	-1.279***	-0.464***	-21.643***	-2.319*	-1.712***	-0.660**	-1.083***
by country income group:							
AEs	-1.279***	-0.404***	-19.606***	-0.705	-1.770***	-0.700**	-0.986***
EMs	-1.098***	-0.619	-31.146***	-34.234***	-1.688***	-0.953	-3.792***
by gender:							
Female	-1.026***	-0.594***	-22.579***	-0.927	-1.836***	-0.771**	-1.523***
Male	-1.570***	-0.323**	-22.783***	-3.651*	-1.512***	-0.473	-0.571
by location:							
Urban	-1.245***	-0.538**	-19.542***	-2.721*	-1.752***	-0.698*	-1.163***
Rural	-1.302***	-0.217*	-24.984***	-0.905	-1.933***	-0.819**	-0.765***
by education:							
Lower education	-1.063***	-0.321	-17.814*	-5.345	-1.661***	-0.533	-1.053*
Upper secondary education	-1.320***	-0.593**	-20.292***	-2.084	-1.436***	-0.444	-0.653***
Tertiary education	-1.293***	-0.216**	-21.386***	-0.797	-2.299***	-1.427**	-1.688***
by household wealth:							
Quintile 1 (lowest)	-1.361***	-0.535***	-19.854***	3.202	-0.950**	0.020	-0.996*
Quintile 2	-1.350***	-0.215	-16.615*	-2.848	-0.836**	0.024	-0.481
Quintile 3	-1.288***	-0.701**	-24.120***	-7.186	-1.852***	-0.553	-0.548
Quintile 4	-1.405***	-0.463**	-29.184***	-6.053**	-2.725***	-1.638***	-1.546***
Quintile 5 (highest)	-1.093***	-0.174	-22.030***	0.096	-1.984***	-0.664	-1.129**
by age group:							
Ages 50-59	-1.974***	-0.592***	-13.854**	0.312	-1.552***	-0.720**	-0.987***
Ages 60-69	-1.420***	-0.261*	-36.541***	-4.072	-1.995***	-0.456	-0.822***
Ages 70-79	-0.298***	-0.168	-28.844**	-3.277	-3.026***	-1.076	-2.854**
Ages 80+	-0.077***	-0.222	-45.825*	-6.236	-2.432*	-0.270	-1.336
Socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lifestyle controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This table shows estimates from 2SLS regressions of individuals' labor market outcomes on health frailty (instrumented by chronic disease incidence), with socioeconomic factors (year of birth, age, gender, education, and household wealth), lifestyle factors (smoking, physical inactivity, underweight, obesity), and country fixed effects controlled for. Separate regressions are estimated for subsamples based on individuals' socio-economic characteristics relating to country income group, gender, location, education, household wealth, and age group.

6. The Cumulative Impact of Health Improvements on Labor Market Outcomes: The Role of Older Individuals' Cognitive Health

Combining our 2SLS second stage results with our earlier evidence of cohort health effects allows us to estimate the effects of healthy aging on labor market outcomes during 2000-22. To this end, we normalize the results to reflect the effect of health gains realized over one decade.

Our findings highlight the important role played by improvements in older individuals' cognitive abilities (Figure 7). Figure 8 also reports the results for cognitive capabilities when using our baseline estimation and two alternative specifications: the Mundlak regression estimates of healthy aging trends, and the 2SLS specification for the effect of health on labor market that includes country-year fixed effects—which can capture changes in country policies over the period. Considering the lower point estimates—to provide a somewhat conservative benchmark—the estimates suggest that the average cognitive health improvements observed across cohorts over a decade raised the likelihood that individuals aged 50 and above participate in the labor force by up to 20 percentage points, raised their average weekly hours worked by up to around 6 hours, raised their annual labor earnings by up to around 30 percent, and raised their labor productivity by up to around 35 percent.

Figure 7. Effect of 1-Decade Health Improvements on Labor Market Outcomes

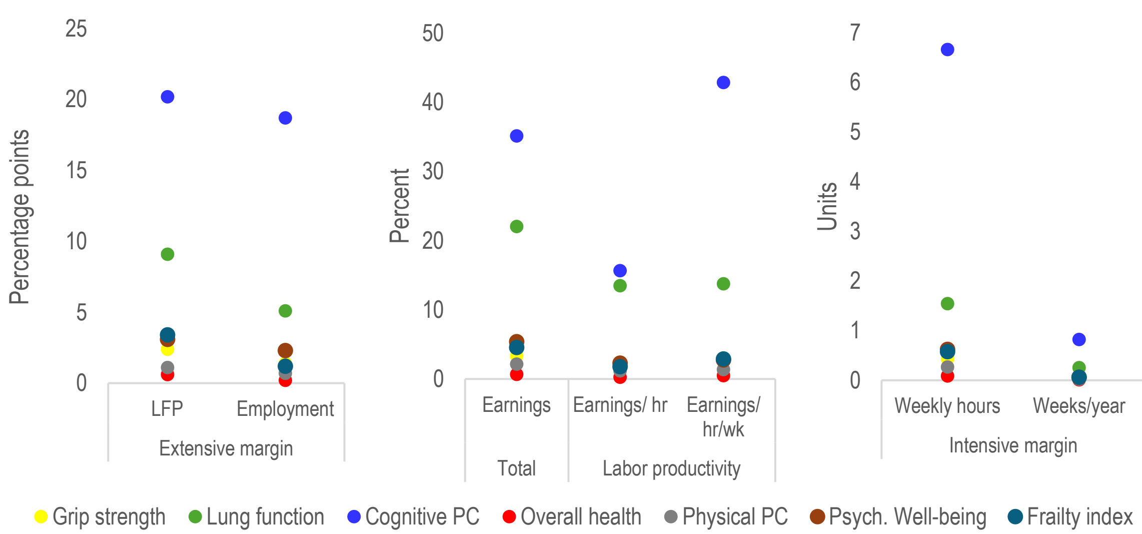
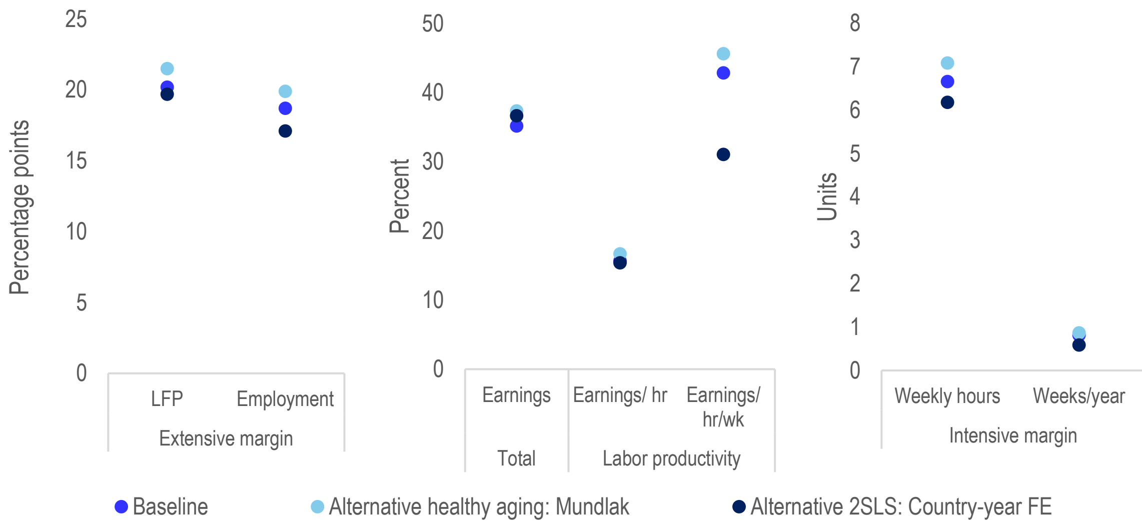


Figure 8. Effect of 1-Decade Cognitive Health Improvements on Labor Market Outcomes: Robustness



Throughout our analysis, cognitive health has stood out as both (i) experiencing the largest healthy aging trend, and (ii) being the dimension of health that most impacts individuals' labor market outcomes. The combination of these two results explains the much larger role played by improvements in cognitive functioning—compared to improvements in other health domains—in shaping older individuals' labor market outcomes.

Our empirical analysis in Section 4 provides robust evidence that the largest healthy aging gains across cohorts are for cognitive abilities. This holds not only for our baseline OLS specification (Table 2), but also Mundlak regressions that account for individual unobservables (Table 3), and survives alternative specifications used as robustness checks (Section 7). This finding also appears to hold across most countries (Figure 6).

Our finding of strong healthy aging improvements in cognitive functioning is consistent with the literature at large. Improvements in cognition in later-born cohorts echo a phenomenon known as the Flynn effect—referring to the observed rise in IQ scores over time (Flynn, 1999). These positive trends are found to persist into late adulthood and are robust across measures and samples (Trahan et al, 2014). Moreover, a growing number of empirical studies focusing on older adults have documented improvements in cognitive functioning across birth cohorts in specific advanced economies (Christensen el al. 2013; Steiber et al. 2015; Ahrenfeldt et al. 2018; Beard et al., 2025) and emerging markets such as China (Kuang et al., 2020; Beard et al., 2025).

The stronger cohort improvements in cognitive health—compared to physical health—are also consistent with a few other existing studies that provide such a comparison, although evidence remains scant. For instance, some studies found sizeable healthy aging trends for cognitive functioning despite limited improvements in physical functioning in Europe (Ahrenfeldt et al 2018) and Denmark (Christensen el al. 2013).[30] Similarly, Beard et al. (2025) focus on England and China and find postive cohort effects in intrinsic capacity across all health domains studied, with stronger gains for cognitive, locomotor, and vitality capacities, and espacially for more recent cohorts.

In addition to showing the strongest healthy aging gains, cognitive health also emerges as the dimension with the greatest impact on older individuals' labor market outcomes (Section 5). Beyond having the highest correlation in our baseline OLS specification (Table 5), this relationship appears causal, as evidenced by our 2SLS estimates that instrument health with the incidence of chronic diseases (Table 7). This result remains robust across multiple checks discussed in Section 7.

This finding aligns with a growing body of evidence that links cognitive health—encompassing fluid and crystallized abilities—to a wide range of labor market outcomes, including employment, occupational sorting, hours worked, hourly wages, annual earnings, lifetime income, and retirement behavior. These studies consistently show that higher cognitive skills predict better labor market outcomes, even after conditioning on schooling. Earlier contributions estimate sizable returns of cognitive ability to wages and employment and document that both cognitive and noncognitive skills shape educational attainment, occupational sorting, and lifetime earnings (Heckman and Vytlacil 2000; Heckman et al., 2006). More recently, Lin et al. (2018) find that returns to cognitive abiity are substantial, driven by both higher hours and hourly wages, and rise with age; decompositions suggest the effects operate through both productivity and job assignment (e.g., into more cognitively demanding, better-paid roles). Recent work in emerging markets using fluid intelligence measures also finds positive earnings gradients. [31]

For older individuals, a central question is how age-related cognitive decline interacts with job demands to shape labor supply and retirement decissions. As workers age, cognitive abilities become more salient because many transition to supervisory and managerial roles that are less physically demanding but require stronger cognitive capacities. The documented rise of age-friendly jobs over 1990-2020 suggests that work has become more attractive to older workers, with tasks increasingly emphasizing cognitive over physical demands (Acemoglu et al., 2022). Yet, cognitive deterioration with age, or due to disease, poses work-limiting constraints and can accelerate retirement (Bonsang et al, 2012), especially when jobs are cognitively intensive, consistent with mismatch mechanisms (Hudomiet et al., 2018).[32]

[30] Comparing two birth cohorts in Europe (individuals aged 50 and older in 2004 versus 2013), Ahrenfeldt et al (2018) find that later-born cohorts have substantially better cognitive functioning than earlier-born cohorts (across all European regions, with average difference of approximately one-third standard deviation), whereas improvements were less clear for physical functioning, with small improvements in grip strength and IADLs in Northern and Southern Europe (but decrease in Central Europe) and no significant improvements in ADLs. Meanwhile, comparing individuals older than 90 years born in 1905 verus 1915 in Denmark, Christensen el al. (2013) finds evidence of significant improvements in cognitive functioning (considering a composite of five cognitive tests that are sensitive to age-related changes) whereas the cohorts did not differ consistently in the physical performance tests (grip strength, chair stand, and gait speed).

[31] A *meta*-analysis of returns to wages from cognitive ability in low- and middle-income countries suggests that a standard deviation increase in cognitive test scores was associated with a 4.5% increase in wages (Ozawa et al, 2022).

[32] Cognitive decline is more consequential in high-cognition jobs, increasing separation risks or inducing task reallocation and reduced hours before retirement.

Notably, the literature also points to bidirectional causality: cognition not only affects work but is also affected by it.[33] For instance, longitudinal evidence links time out of work to subsequent cognitive deficits, consistent with scarring effects of unemployment on later cognitive performance (Leist et al., 2013). Various studies also conclude that retirement accelerates cognitive decline, especially in fluid domains, with economically meaningful effects (Rohwedder & Willis, 2010; Mazzonna & Peracchi, 2012; Bonsang et al., 2012; de Grip et al., 2015).[34] The upshot is that cognition supports continued work, while cognitively stimulating work, in turn, slows cognitive decline—a potential virtuous cycle with policy salience for pension and employment reforms. Meanwhile, Coe et al. (2012) report contrasting evidence: no clear relationship between retirement and subsequent cognition performance for white-collar workers and, if anything, a positive relationship for blue-collar workers. Our 2SLS and AIPW estimation approaches are designed to address this potential bidirection causality.

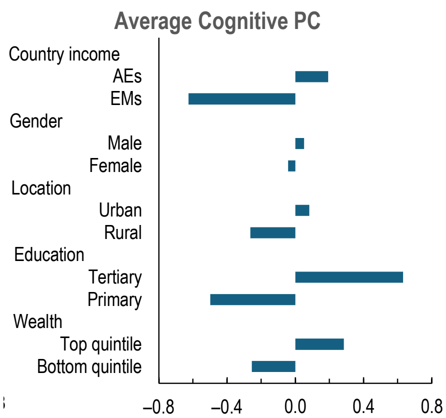
Additionally, the important role played by cognitive abilities in shaping older individuals' labor market outcomes, stresses the importance of not only improving cognitive healthy aging trends but also narrowing cognitive health gaps. Cognitive health disparities are sizable both across country income groups—with EMs lagging behind AEs—and within countries by education, wealth, rural-urban location, and job type (industry and occupation) (Figure 9). Individuals with lower education and/or household wealth, those in rural locations, and workers in more physically-demanding industries (e.g. private households, mining, construction, and hotels and restaurants) or occupations (elementary occupations, skilled agriculture and fishery, craft and related trade, or plant and machine operators or assemblers), tend to score lower on various cognitive health metrics. While cross-country cognitive health disparities appear to have narrowed somewhat, within-country gaps have persisted, as indicated by similar estimated health trends (Figure 9). This underscores the role for policies to improve cognitive health outcomes—especially for disadvantaged groups.

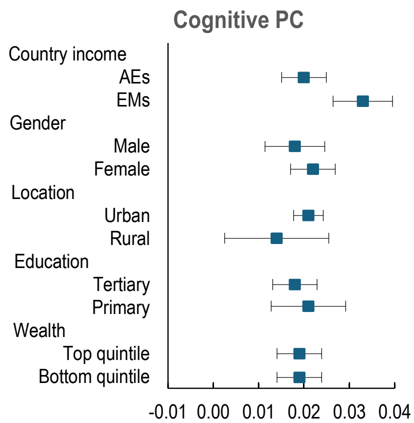
[33] Methodologically, endogeneity is a central challenge: poorer cognition may *cause* earlier retirement or nonemployment, but selection into less demanding jobs (or retirement) may also reflect unobserved traits. To tackle this, several studies deploy cross-country policy variation in retirement ages, longitudinal fixed-effects with lagged cognition, and instruments for retirement timing (e.g. Social Security eligibility ages).

[34] Rohwedder and Willis's (2010) "mental retirement" hypothesis argues that retirement lowers cognitive stimulation and thereby accelerates decline; exploiting cross-country differences in retirement incentives, they find that earlier retirement causally depresses cognition in the early 60s. Studies using European data show similar patterns: retirement leads to faster decline in fluid abilities and delayed recall, after accounting for selection and age trends (Mazzonna and Peracchi, 2012; Coe and Zamarro, 2011). In addition, complementary evidence from Europe and the Nordics indicates that cumulative exposure to cognitively complex work over the 30s-60s is associated with lower risk of mild cognitive impairment (MCI) and dementia after age 70 (Edwin et al., 2024).

Figure 9. Cognitive Health: Health Inequalities and Heterogeneous Trends, by Socio-Economic Group

(a) Average health scores (b) Trend coefficient estimates





Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: The left figure shows average health scores (T-tests indicate that the difference in means are statistically significant for all socio-economic categories). The right figure shows estimates from OLS regressions of health indicators on survey year interacted with socioeconomic groupings, with individuals' age, gender, education, wealth, and country fixed effects controlled for.

In turn, the heterogeneous impact of cognitive health on labor market outcomes also points to uneven implications across socio-economic groups. The effects on labor supply (particularly along the extensive margin) and earnings are larger in advanced economies, among individuals aged 50–59, among men, and among those with higher education and wealth (Appendix Table C.5). This pattern may reflect, for instance, greater scope for voluntary labor-supply responses when in good health (as opposed to working out of necessity despite poor health), as well as skills obsolesence, discrimination, gender gaps, and labor-market and pension-system incentives.

Uncovering the root causes of these heterogeneities is beyond the scope of this analysis but remains an interesting avenue for future research. Nevertheless, as life expectancy rises, policies must account for the fact that people will age with very different health outcomes. Simple age-based policies may not always be appropriate. Instead, adjusting incentives so that older individuals who are phisically and mentally fit and willing to work for longer choose to remain engaged in the labor market can be an important avenue to boost labor supply and mitigate demography's drag on the economy.

More broadly, our findings show that beyond enhancing overall well-being, health gains can have important labor market implications. Taken altogether, our results suggest that as healthy aging continues, and particularly as cognitive functioning improves, older individuals are expected to increasingly contribute to the labor market and benefit from higher earnings. Further strengthening healthy aging trends and reinforcing the health-labor market nexus could amplify these labor market dividends for the older-age population.

7. Additional Robustness Analysis

7.1. Healthy Aging Trends

This section reports robustness analysis for our estimated healthy aging trends, considering alternative specifications and additional health indicators. These additional results are reported in Appendix D.

(i) Alternative specifications. Our main findings regarding healthy aging trends are robust to various changes to our baseline specification (Appendix Table D.1). For instance, when clustering standard errors at the year-of-birth level (instead of country level) as when controlling for a rural location dummy, which is excluded from the baseline specification due to missing data for four countries.[35] Results are also robust when considering only the subset of 29 countries that are part of the Survey of Health, Ageing and Retirement in Europe, for which the survey questions are identical. Moreover, our findings are largely robust to controlling for industry and occupation fixed effects in these 29 countries (using information available in the SHARE survey), although significance weakens for grip strength.[36]

(ii) Additional health indicators. Broad-based healthy aging trends also hold true when examining additional health indicators (Appendix Table D.2). In particular, the coefficient on year of birth remains positive and significant for: (i) all subcomponents of the principal component we constructed for cognitive health—measuring older individuals' memory, orientation, verbal fluency and basic math; (ii) all subcomponents of the principal component we constructed for self-reported physical health—ability to perform activities of daily living and instrumental activities of daily living, lack of frequent pain, and hearing ability; and (iii) an alternative measure of mental health: CESD depression scores.[37] The largest gains seem to have been for cognitive indicators—in particular, memory and verbal fluency (which are also the abilities that tend to decline fastest with age), followed by basic numeracy.

7.2. Effect of Health on Labor Market Outcomes

Our 2SLS estimates—measuring the impact of health on labor market outcomes—remain robust to a range of sensitivity checks, described below:

(i) Alternative instruments. Results are found to be robust to alternative definitions of the chronic disease instrument such as the total number of chronic diseases, a dummy indicator for whether the respondent reports having any of the chronic diseases, and a dummy indicator for the top 10 chronic diseases that most affect health (Appendix Table D.3).

(ii) Additional control variables. Importantly, coefficient magnitudes are highly robust to controlling for country-year fixed effects (Appendix Table D.4). This suggests that effects on labor market outcomes are not driven by changes in time-varying country-specific policies (e.g. changes in statutory retirement ages). Rather,

[35] We also considered estimating robustness to including higher-order time trends. However, given the relatively short time span of our data (spanning only a few survey waves/years) for many countries, estimating higher-order trends is imprecise. We also find them to be sensitive to the health indicator and regression specification considered.

[36] In this specification, we drop individuals who report having switched occupations and/or industries across different survey waves.

[37] Depression is one of the most common mood disorders in the late-life population.

the observed increases in labor supply may reflect stronger voluntary attachment to the labor market by healthier older individuals. Our results are also robust to controlling for job characteristics, such as occupation fixed effects (Appendix Table D.5), industry fixed effects, and dummy indicators for age-unfriendly jobs characteristics (e.g. physically demanding, high stress, high time pressure, little work freedom, etc.), addressing concerns of job types potentially being correlated with individuals' health.[38]

(iii) Additional outcome variables. In addition to studying the effects of health on labor force participation decisions and outcomes, we can consider the effect of health on the probability of retirement. Appendix Table D.6 shows robustness of our results to a linear probability model where the dependent variable is a retirement dummy variable (equal to 1 if the individual is retired).

(iv) Additional health indicators. Results are robust to considering additional health indicators, namely the individual subcomponents of the cognitive and physical health principal components, as well as an alternative indicator of mental health measuring individuals' depression (Appendix Table D.7). Finally, the strong effects on labor market outcomes are robust across the individual cognitive abilities—relating to memory, orientation, verbal fluency, and basic numeracy—included in the principal component indicator.

(v) AIPW estimation. Finally, in order to purge any remaining endogeneity bias, we turn to augmented inverse propensity score weighting (AIPW) estimation. We are interested in characterizing an average treatment effect (ATE) based on a prediction model of our 'health treatment', the binary indicator for the diagnosis of one or more chronic diseases. We model the AIPW treatment equation using a probit model controlling for socio-economic control factors, lifestyle factors, and country fixed effects. We check that the AIPW overlap assumption is satisfied, whereby for all types of individuals (i.e. all values of observable characteristics), we can find some individuals in the treatment group and some in the control group. Appendix Table C.2 shows that chronic diseases are predictable by socio-economic and behavioral factors.[39] Factors that raise the probability of having a chronic disease include old age, the year (indicating that chronic diseases themselves or their diagnosis have become more common over time), being female, and having less education and household wealth. Lifestyle factors such as smoking, infrequent physical exercise, and higher body weight are also associated with a higher incidence of chronic diseases.

Importantly, the results from the AIPW estimation comparable to our 2SLS results: a negative health shock—defined by the onset of chronic diseases—reduces labor supply, earnings, and productivity (Table 9). In addition, these estimates are qualitatively and largely quantitatively similar to OLS results obtained by regressing labor market outcomes directly on the chronic disease dummy variable (rather than on health indicators). This consistency suggests that the incidence of chronic diseases is exogenous, providing further evidence for the validity of our instrument and 2SLS analysis.

[38] These controls are not part of the baseline since the data are only available for a subset of countries. Results controlling for industry and job characteristic fixed effects are available upon request.

[39] Due to dummy outcome variables, columns 3 and 4 estimate linear probability models since the outcomes are dummy variables.

Table 9. AIPW Regressions: Effect of Chronic Disease Dummy on Labor Market Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Extensive margin		Intensive margin		Total	Labor productivity	
	LFP	Employment	Weekly hours	Weeks/year	earnings	Earnings/hr	Earnings/hr/wk
AIPW Average Treatment Effect:							
Chronic disease dummy (top 10)	-0.071***	-0.018***	-1.235***	-0.371***	-0.099***	-0.039***	-0.014***
	(0.008)	(0.004)	(0.109)	(0.068)	(0.020)	(0.021)	(0.010)
OLS Estimate:							
Chronic disease dummy (top 10)	-0.080***	-0.030***	-0.881***	-0.256***	-0.064***	-0.018	-0.045*
	(0.007)	(0.007)	(0.307)	(0.083)	(0.015)	(0.017)	(0.022)
Observations	571,705	209,535	202,362	128,144	95,349	78,731	45,777
Socio-economic controls	✓	✓	✓	✓	✓	✓	✓
Lifestyle controls	✓	✓	✓	✓	✓	✓	✓
Country FE	✓	✓	✓	✓	✓	✓	✓
SE cluster	Country	Country	Country	Country	Country	Country	Country

Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This table shows estimates from AIPW regressions (alongside OLS regressions) of individuals' labor market outcomes on a chronic disease dummy (for the top 10 most severe chronic diseases), with socioeconomic factors (year of birth, age, gender, education, and household wealth), lifestyle factors (smoking, physical inactivity, underweight, obesity), and country fixed effects controlled for.

8. Concluding Remarks

Our findings provide micro-level evidence of a broad-based healthy aging phenomenon: later-born cohorts are healthier than earlier-born cohorts at the same age. Between 2000 and 2022, successive cohorts across 41 advanced and emerging market economies experienced improvements in physical, cognitive, and mental health dimensions, based on both objective measures—such as grip strength, lung function, and cognitive ability tests—and self-reported indicators of overall health status, physical functionality, and psychological well-being. Cognitive health showed the most pronounced gains: on this metric, the average 70-year-old in 2022 had cognitive ability comparable to that of an average 53-year-old in 2000.

In turn, better health across cohorts has led to increased labor supply and earnings among older individuals. Among health domains, improvements in cognitive functioning have had the strongest impact on labor market outcomes. Our findings are economically significant: a decade of improvements in cognitive functioning across cohorts is estimated to have raised the probability of labor force participation among older individuals by about 20 percentage points, increased their weekly hours worked by around 6 hours, and boosted their productivity by roughly 30 percent and total labor earnings by roughly 35 percent.

Taken together, our findings suggest that healthy aging—where populations age in better health—has the potential to substantially mitigate the economic pressures associated with population aging, particularly a shrinking labor force that weighs on growth and raises fiscal pressures. Health gains can significantly expand the effective labor supply of older individuals through both the extensive margin (higher participation and employment) and the intensive margin (more working hours), as well as through improvements in labor productivity.

Appendix A. Data Sources and Harmonization

Table A. 1. Microdata Country Sample and Sources

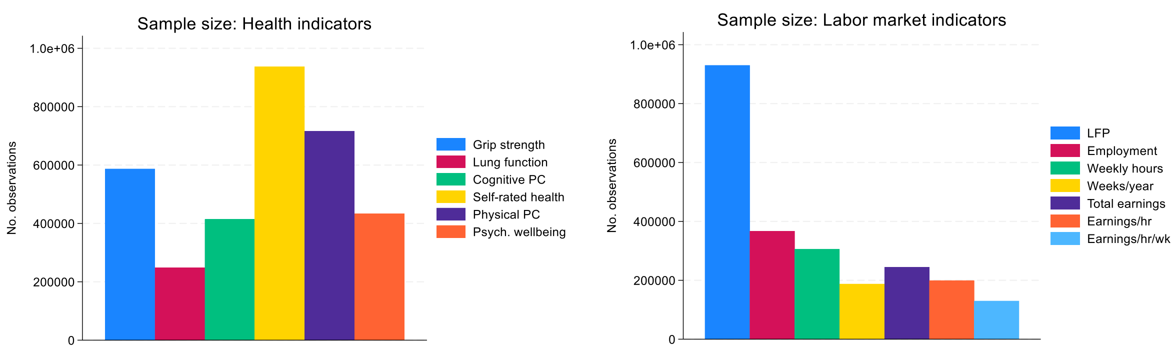
Coverage	Sources
Empirical analysis of healthy-aging	
Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovak Republic, Slovenia, Spain, Sweden, and Switzerland	Wilkens, Jenny, Michael Markot, Ziqi Zhou, Chrys Xie, Aidan Cole, Drystan Phillips, and Jinkook Lee. 2024. Harmonized Survey of Health, Ageing and Retirement in Europe (SHARE). Version G. Accessed through Gateway to Global Aging Database.
Brazil	Lima-Costa, Maria Fernanda, Juliana Vaz de Melo Mambrini, Fabiola Bof de Andrade, Paulo R. B. de Souza, Maurício T. L. de Vasconcellos, Anita L. Neri, Erico Castro-Costa, James Macinko, Cesar de Oliveira. 2023. Cohort Profile: The Brazilian Longitudinal Study of Ageing (ELSI)
China	Phillips, Drystan, Hunter Green, Sarah Petrosyan, Kanghong Shao, Jenny Wilkens, & Jinkook Lee. 2024. The China Health and Retirement Longitudinal Study (CHARLS). Accessed through Gateway to Global Aging Database.
Costa Rica	Rosero-Bixby, Luis ,William Dow, Sandy Chien, Ashley Lin, Drystan Phillips, Jenny Wilkens &Jinkook Lee. 2024. Costa Rican Longevity and Healthy Aging Study (CRELES). Accessed through Gateway to Global Aging Database.
India	Chien, Sandy, Codi Young, Drystan Phillips, Jenny Wilkens, Yuxuan Wang, Alden Gross, Erik Meijer, Marco Angrisani, and Jinkook Lee. 2023. Longitudinal Aging Study in India (LASI). Version A.3. Accessed through Gateway to Global Aging Database.
Japan	Matsuyama, Hirokazu, Drystan Phillips, Sandy Chien, Hidehiko Ichimura, and Jinkook Lee. 2023. Japanese Study of Aging and Retirement (JSTAR). Accessed through Gateway to Global Aging Database.
Korea	Park, Hae Yeun, Yuxuan Wang, Jenny Wilkens, Drystan Phillips, and Jinkook Lee. 2023. Korean Longitudinal Study of Aging (KLoSA). Version E.2. Accessed through Gateway to Global Aging Database.
Malaysia	Mansor, Norma. 2019 . Malaysia Ageing and Retirement Survey,. Social Wellbeing Research Centre (SWRC). Mansor, Norma, Halimah Awang, Nur Fakhrina Ab Rashid, Yamunah Devi Apalasamy, Nurul Diyana Kamarulzaman, Lih Yoong Tan, Kama Firdaus Subbahi, Chin Lung Tan, Drystan Phillips, Jenny Wilkens, and Jinkook Lee. 2024. Malaysia Ageing and Retirement Survey (MARS). Accessed through Gateway to Global Aging Database.
Mexico	Michaels-Obregon, Alejandra, Drystan Phillips, Jenny Wilkens, Rebeca Wong, and Jinkook Lee. 2023. Mexican Health and Aging Study (MHAS). Version C.2. Accessed through Gateway to Global Aging Database.
South Africa	Berkman, Lisa F. 2023. Health and Aging in Africa: A Longitudinal Study of an INDEPTH Community in South Africa (HAALSI). Agincourt, South Africa, 2015-2022. Inter-university Consortium for Political and Social Research.
Thailand	National Institutes of Development Administration. 2015. Well-being of the elderly in Thailand: Health Aging and Retirement in Thailand (HART).
United Kingdom	Wilkens, Jenny, Yuxuan Wang, Giacomo Rebellato, Youngha Oh, and Jinkook Lee. 2024 English Longitudinal Study on Ageing (ELSA). Accessed through Gateway to Global aging Data.
United States	Wang, Yuxuan, Aidan Cole, Hunter Green, Jenny Wilkens, Drystan Phillips, and Jinkook Lee. 2023. Health and Retirement Study in the United States (HRS). Version D. Accessed through Gateway to Global Aging Database.

Table A. 2. Data Harmonization for Brazil, South Africa, and Thailand

Category	Indicator	Brazil	South Africa	Thailand
HEALTH INDICATORS	Physical principal component (adla)	Available	Available	Not found
	CASP quality of life index	Not found	Not found	Not found
	Grip strength	Available	Available	Not found
	Physical principal component (Hearing)	Available	Not found	Needed to reverse the order (6 – original indicator)
	Physical principal component (iadlfour)	Available	Available	Not found
	Cognitive principal component (Orientation)	Available	Transformed the indicator into 4-item summary score by multiplying by 2 the component with highest correlation based on SHARE database	Available
	Physical principal component (Pain frequency)	Available	Available	Created dummy variable for any reported pain in body parts
	Lung function	Not found	Not found	Not found
	Cognitive principal component (Math)	Not found	Not found	Available
	Overall self-rated health	Adjusted range from 0–5 to 1–5 by adding 1 and capping max	Available	Converted year ranges (2015/2017: 0-100, 2020: 0-10, 2022: 1-10) to 1–5 scale
	Cognitive principal component (memory)	Available	Available	Available
	Cognitive principal component (Verbal fluency)	Available	Converted range from 0-150 to 0-100	Not found
LABOR AND WORK INDICATORS	Labor force participation	Available	Available	Available
	Unemployment	Available	Available	Available
	Hours worked per week	Available	Available	Available
	Weeks worked per year	Not found	Not found	Not found
	Annual labor earnings	Needed to multiply by 12 (monthly to annual)	Needed to multiply by 12 (monthly to annual)	Available
SOCIO-ECONOMIC CHARACTERISTICS	Age	Available	Available	Provided only ranges (45-59, 60-69, 70-79, 80+), which needed to be averaged
	Gender	Available	Available	Available
	Educational attainment	Available	Recoded into 3 groups - Levels up to Std6/Gr8 are "less than upper secondary."; Std9/Gr11 to Partial Tertiary are "upper secondary."' and completed tertiary education until university is "tertiary education."	Recoded into 3 groups - 1 to 3 (Not in school to Junior high) are "less than upper secondary."; 4 and 5 (Senior high) are "upper secondary."; and 6 to 8 (Diploma to Postgraduate) are "tertiary education."
	Household wealth	Limited information on assets	Available	Sum of asset components (real estate, stocks, deposits, and business value minus debts and mortgage/house loans)
LIFESTYLE FACTORS	Ever smoked	Available	Available	Available
	BMI	Available	Available	Available
	Frequency of moderate exercise	Available	Available	Not found

Note: Indicators described as "Available" present a description that closely matches with Gateway to Global Aging surveys methodologies or had minimal adjustments before integrating the main database for analysis

Figure A. 1. Sample Size by Health and Labor Market Indicator



Appendix B. Section 4—Healthy Aging Trends

Table B. 1. OLS Regression: Country Fixed Effects for Health, Relative to Austria (Omitted)

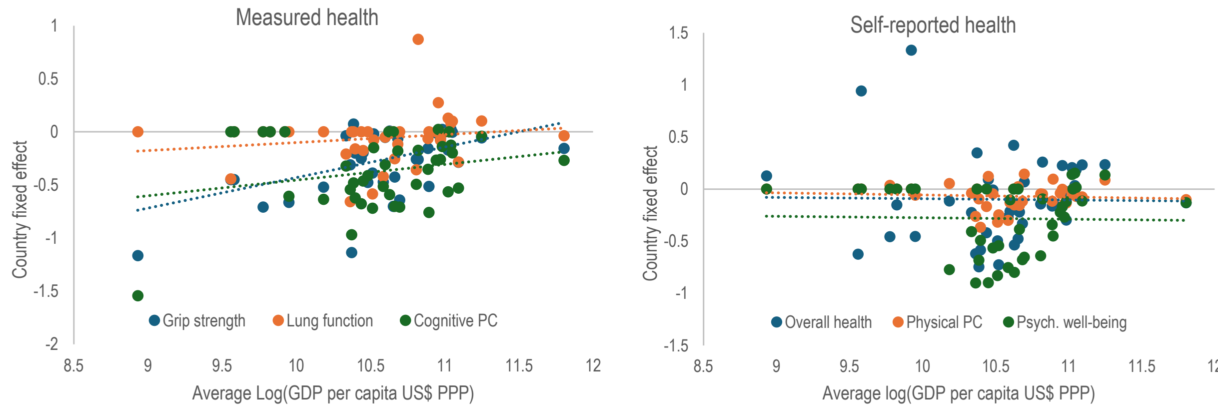
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Measured health			Self-reported health		Overall
	Grip strength	Lung function	Cognitive PC	Overall health	Physical PC	Psych. well-being	Frailty
Belgium	-0.066***	-0.078***	-0.260***	-0.018*	-0.138***	-0.270***	0.028***
Brazil	-0.708***			-0.457***	0.036		0.061***
Bulgaria	-0.520***		-0.635***	-0.115***	0.054***	-0.772***	0.016*
China	-0.450***	-0.444***		-0.624***			0.007
Costa Rica				-0.152***			-0.184***
Croatia	-0.037***	-0.208***	-0.322***	-0.225***	-0.039**	-0.408***	0.020***
Cyprus	-0.643***		-0.709***	0.068***	0.145***	-0.654***	0.009
Czech Republic	-0.066***	-0.117***	-0.180***	-0.331***	-0.117***	-0.678***	0.041***
Denmark	-0.003	0.100***	-0.198***	0.187***	-0.071***	0.015	0.006**
Estonia	-0.018***	-0.076***	-0.150***	-0.726***	-0.248***	-0.544***	0.056***
Finland	-0.011		-0.267***	-0.174***	-0.039***	-0.223***	0.014**
France	-0.156***	-0.064***	-0.353***	-0.164***	-0.117***	-0.341***	0.041***
Germany	0.024***	-0.017***	-0.139***	-0.297***	-0.134***	-0.121***	0.035***
Greece	-0.195***	-0.176***	-0.463***	0.092***	0.122***	-0.899***	0.011***
Hungary	-0.311***	-0.658***	-0.542***	-0.621***	-0.263***	-0.900***	0.060***
India	-1.166***		-1.543***	0.127***			0.076***
Ireland	-0.287***	-0.285***	-0.530***	0.232***	-0.074***	-0.115***	0.023***
Israel	-0.471***	-0.421***	-0.514***	-0.268***	-0.300***	-0.752***	0.058***
Italy	-0.257***	-0.358***	-0.494***	-0.142***	-0.045***	-0.640***	0.041***
Japan				0.421***			-0.172***
Korea	-0.701***			-0.476***	0.022*		0.021***
Latvia	0.074***		-0.481***	-0.746***	-0.095***	-0.682***	0.057***
Lithuania	0.007		-0.591***	-0.537***	-0.152***	-0.799***	0.057***
Luxembourg	-0.156***	-0.037	-0.268***	-0.131***	-0.102***	-0.129***	0.010**
Malaysia	-1.136***		-0.968***	0.348***			0.129***
Malta	-0.513***		-0.760***	-0.130***	0.095***	-0.451***	0.021**
Mexico	-0.663***		-0.607***	-0.455***	-0.058***		-0.011***
Netherlands	0.025***	0.083***	-0.126***	0.033***	-0.009**	0.152***	-0.002**
Poland	-0.201***	-0.161***	-0.623***	-0.584***	-0.367***	-0.492***	0.088***
Portugal	-0.387***	-0.584***	-0.719***	-0.497***	-0.317***	-0.831***	0.085***
Romania	-0.248***		-0.678***	-0.419***	-0.167***		0.057***
Slovak Republic	-0.476***		-0.412***	-0.009	-0.046***	-0.566***	0.014*
Slovenia	-0.051***	-0.049***	-0.308***	-0.214***	-0.130***	-0.104***	0.030***
South Africa	-0.449***			0.941***			-0.065***
Spain	-0.426***	-0.252***	-0.702***	-0.220***	-0.156***	-0.387***	0.064***
Sweden	-0.012	0.276***	0.022	0.227***	-0.001	-0.169***	-0.005
Switzerland	-0.057***	0.102***	-0.040***	0.235***	0.086***	0.136***	-0.016***
Thailand				1.332***			0.009
United Kingdom	-0.260***	0.872***	-0.173***	0.258***	-0.049***	-0.095***	-0.037***
United States	-0.172***	0.130***	-0.565***	0.206***	-0.049***	0.140***	-0.047***

Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.

Note: This figure shows estimates from OLS regressions of health indicators on country fixed effects relative to Austria (omitted), with individuals' year of birth, age, gender, education, and wealth controlled for.

Figure B. 1. Cross-Country Health Differences

(*Country fixed effects*)



Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This figure shows estimates from OLS regressions of health indicators on country fixed effects, with individuals' year of birth, age, gender, education, and wealth controlled for.

Table B. 2. Health Differences Across Job Types

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Measured health			Self-reported health		Overall
	Grip strength	Lung function	Cognitive PC	Overall health	Physical PC	Psych. well-being	Frailty
NACE industry fixed effects (omitted category: 1 - Agriculture, hunting, forestry, fishing):							
2 - Mining and quarrying	0.091	0.099	0.000	-0.070	-0.045	0.221	0.004
3 - Manufacturing	0.051	0.259***	0.187***	0.130***	0.056**	0.179***	-0.023***
4 - Electricity, gas, and water supply	0.133**	0.342***	0.213***	0.153**	0.105***	0.240***	-0.030***
5 - Construction	0.028	0.177***	0.073*	0.122**	0.049**	0.118***	-0.012***
6 - Wholesale and retail trade	0.041	0.199***	0.183***	0.205***	0.111***	0.200***	-0.034***
7 - Hotels and restaurants	-0.137*	0.118**	0.049	0.047	-0.168	0.070	-0.005
8 - Transport, storage, and communication	0.040	0.312***	0.177***	0.133**	0.083***	0.194***	-0.028***
9 - Financial intermediation	-0.097*	0.207***	0.275***	0.323***	0.120***	0.319***	-0.045***
10 - Real estate, renting, and business activities	0.004	0.221***	0.255***	0.160**	0.083***	0.193***	-0.030***
11 - Public administration and defense	0.055	0.292***	0.253***	0.220***	0.102***	0.258***	-0.033***
12 - Education	-0.030	0.231***	0.313***	0.181***	0.091***	0.218***	-0.032***
13 - Health and social work	0.021	0.308***	0.260***	0.291***	0.100***	0.325***	-0.036***
14 - Other community, social, and personal service activites	-0.014	0.192***	0.150***	0.145***	0.085***	0.179***	-0.025***
15 - Private households with employed persons	-0.010	0.238*	-0.295***	0.141	0.114	0.227**	-0.008
ISCO occupation fixed effects (omitted category: 0 - Armed forces):							
1 - Legislators, senior officials, managers	0.135*	0.079	0.161***	0.218***	0.001	0.153**	-0.014*
2 - Professionals	0.037	0.033	0.193***	0.134**	-0.011	0.034	-0.008
3 - Technicians and associate professionals	0.090	0.030	0.100*	0.058	-0.025	-0.006	-0.000
4 - Clerks	-0.004	0.001	0.123**	0.072	-0.005	0.000	-0.004
5 - Sales and services	0.019	-0.036	0.019	-0.043	-0.090	-0.031	0.011
6 - Skilled agriculture and fishery	0.028	-0.285**	-0.179**	-0.166**	-0.128***	-0.241***	0.035***
7 - Craft and related trades	0.088	-0.093	-0.067	-0.123*	-0.102***	-0.163**	0.025***
8 - Plant and machine operators and assemblers	0.066	-0.073	-0.053	-0.148**	-0.121***	-0.184***	0.025***
9 - Elementary occupations	-0.057	-0.178	-0.244***	-0.211***	-0.121***	-0.273***	0.040***
Socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This table shows estimates from OLS regressions of health indicators on 1-digit NACE industry or ISCO occupation fixed effects, with individuals' year of birth, age, gender, education, wealth, rural location dummy, and country fixed effects controlled for. The sample is constrained to the 29 countries available in the SHARE survey. A heat map shows worse health outcomes in darker red and better health outcomes in dark green.

Appendix C. Section 5—Impact of Health on Labor Market Outcomes

Table C. 1. OLS Regressions: Effect of Individual Chronic Diseases on Health

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Measured health			Self-reported health		Composite
	Top 10	Grip strength	Lung function	Cognitive PC	Overall health	Physical PC	Psych. well-being	Frailty
Coefficient:								
Alzheimer's/Dementia	Yes	-0.257***	-0.176***	-0.924***	-0.548***	-1.578***	-1.078***	0.158***
Arthritis	Yes	-0.117***	-0.029	-0.020	-0.419***	-0.305***	-0.249***	0.060***
Asthma	Yes	-0.103***	-0.206***	-0.044	-0.460***	-0.260***	-0.204***	0.041***
Cancer		-0.059***	-0.041***	0.030***	-0.365***	-0.090***	-0.086***	0.020***
Cataracts		-0.072***	0.014	-0.025	-0.219***	-0.197***	-0.146***	0.028***
Diabetes		-0.120***	-0.085***	-0.088***	-0.398***	-0.166***	-0.181***	0.033***
High cholesterol		-0.020	0.002	0.003	-0.265***	-0.085***	-0.109***	0.023***
Heart Conditions		-0.092***	-0.090***	-0.054***	-0.464***	-0.214***	-0.224***	0.039***
High Blood Pressure		-0.031***	-0.049**	-0.026**	-0.307***	-0.085***	-0.119***	0.025***
Kidney disease	Yes	-0.215***	-0.075*	-0.066*	-0.567***	-0.457***	-0.289***	0.055***
Lung Disease	Yes	-0.116***	-0.260***	-0.051***	-0.484***	-0.260***	-0.240***	0.045***
Osteoporosis	Yes	-0.116***	0.013	0.034	-0.339***	-0.282***	-0.201***	0.046***
Parkinsons disease	Yes	-0.305***	-0.183***	-0.354***	-0.718***	-1.126***	-0.597***	0.100***
Psych disorder	Yes	-0.144***	-0.074***	-0.126***	-0.470***	-0.400***	-0.543***	0.061***
Stroke	Yes	-0.204***	-0.113***	-0.092	-0.384***	-0.546***	-0.386***	0.058***
Ulcer		-0.099***	0.002	-0.051***	-0.376***	-0.209***	-0.251***	0.039***
Urinary incontinence	Yes	-0.118***	-0.095***	-0.112**	-0.372***	-0.541***	-0.443***	0.065***
Lifestyle controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Other controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster		Country	Country	Country	Country	Country	Country	Country

Sources: Gateway to Global Aging Data; national microdata sources; and authors' calculations.
Note: This table shows estimates from OLS regressions of individuals' health indicators on chronic diseases (one-at-a-time), with socioeconomic factors (year of birth, age, gender, education, and household wealth), lifestyle factors (smoking, physical inactivity, underweight, obesity), and country fixed effects controlled for. A heat map shows worse health outcomes in darker red and better health outcomes in darker green. The top 10 most severe chronic diseases are indicated in the column next to disease names.

Table C. 2. OLS Regression: Determinants of Chronic Diseases

	(1) Disease incidence	(2) No. diseases	(3) Dummy for top 10	(4) Dummy for any disease
Socio-economic factors:				
Age	0.005***	0.062***	0.011***	0.012***
Year	0.002***	0.030***	0.006***	0.004***
Male	-0.019***	-0.260***	-0.144***	-0.038***
Upper secondary education	-0.009***	-0.135***	-0.044***	-0.022**
Tertiary education	-0.018***	-0.257***	-0.079***	-0.043***
(Log) Household wealth	-0.002***	-0.026***	-0.007***	-0.001**
Lifestyle factors:				
Ever smoked	0.016***	0.211***	0.049***	0.042***
Physically inactive	0.034***	0.438***	0.090***	0.026***
Obese	0.041***	0.529***	0.065***	0.101***
Underweight	-0.009**	-0.129**	0.046***	-0.041**
Constant	-4.972***	-62.742***	-11.651***	-7.231***
Observations	587,651	587,822	587,822	587,822
R-squared	0.257	0.252	0.145	0.122
No. countries	38	38	38	38
Country FE	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country

Table C. 3. Heterogeneous Effects of Health Frailty, by Job Characteristics

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Extensive margin		Intensive margin		Total	Labor productivity	
	No. obs	LFP	Employment	Weekly hours	Weeks/year	Earnings	Earnings/hr	Earnings/hr/wk
Baseline		-1.279***	-0.464***	-21.643***	-2.319*	-1.712***	-0.660**	-1.083***
by NACE industries:								
1 - Agriculture, hunting, forestry, fishing	6,676	-1.836***	-0.324	-31.975*	-12.110	-3.092***	-0.986	-5.641***
2 - Mining and quarrying	769	0.287	-0.048	26.386	-7.121	-2.842	-6.632*	-11.820***
3 - Manufacturing	15,568	-1.323***	-0.354**	-29.456***	-2.624	-1.861*	-1.233	-2.404**
4 - Electricity, gas, and water supply	2,372	-2.146***	-0.393	-23.560	2.393	-2.364	-1.094	1.506
5 - Construction	8,104	-0.953***	-1.480*	-25.264	-20.807	-1.389	-0.222	0.341
6 - Wholesale and retail trade	11,111	-1.322***	-0.796***	7.809	-1.907	-1.438*	-0.433	-0.768
7 - Hotels and restaurants	3,737	-0.579	-0.457	0.289	14.471	-1.277	-1.499	-1.375
8 - Transport, storage, and communication	6,909	-1.516***	-0.451***	-11.522	-7.830	-1.807	-1.662	-0.440
9 - Financial intermediation	3,930	-2.781***	0.415	-24.625	-15.138	-2.676	-1.171	0.422
10 - Real estate, renting, and business activities	4,384	-1.279***	-0.029	-14.494	13.498*	-2.064	-0.668	-0.302
11 - Public administration and defense	9,585	-1.514***	0.097	-6.743	3.331	-1.147	-0.336	-0.586
12 - Education	14,240	-1.088***	-0.313*	-11.445	-1.895	-0.891	-0.803	-1.270
13 - Health and social work	17,385	-1.117***	-0.092	-13.472	11.243**	-1.233	-0.050	-1.575*
14 - Other community, social, and personal service activites	16,209	-0.967***	0.241	-22.205**	2.138	-3.118***	-1.228	-1.417
15 - Private households with employed persons	276	-1.772	2.715	-118.363	-55.189***	-5.787	-0.866	0.221
by ISCO occupations:								
0 - Armed forces	1,308	-0.272	-0.157	-22.249	42.437	-2.265	-4.158	6.615
1 - Legislators, senior officials, managers	10,584	-1.473***	-0.120	8.253	-3.353**	0.785	0.440	0.218
2 - Professionals	19,321	-0.967***	0.110	-3.406	5.042	-1.442	-1.114	-2.417***
3 - Technicians and associate professionals	14,572	-1.303***	0.075	-15.648	13.967	-3.346***	-2.607*	-1.664
4 - Clerks	15,801	-1.445***	-0.375*	-32.223**	-2.729	-2.387***	-1.099	-0.819
5 - Sales and services	20,253	-0.897***	-0.767*	-13.098	2.202	-0.806	0.408	-0.393
6 - Skilled agriculture and fishery	4,746	-1.831***	-0.294**	-10.525	-0.738	-2.325	-1.929	-4.402
7 - Craft and related trades	12,293	-1.110***	-1.119**	-25.663**	-4.698	-1.055	-0.016	0.430
8 - Plant and machine operators and assemblers	6,303	-2.028***	-0.503***	-3.304	-7.893	-1.502	-0.658	-2.537*
9 - Elementary occupations	12,062	-0.971**	-0.549**	-33.926***	-19.186*	-0.860	0.501	-0.546
by job characteristics:								
Low physical demand (age-friendly)	31,464	-0.301***	0.003	-7.542	2.466	-1.801*	-1.239	-1.916**
Physically demanding	26,255	-0.134*	-0.057	-16.120***	-2.760	-1.135*	-0.239	-0.800
Low job stress (age-friendly)	31,279	-0.472***	0.009	-11.345	-0.760	-1.384*	-0.498	-0.903
High job stress	52,623	-0.199*	-0.035	-16.958**	0.992	-1.305*	-0.513	-1.206***
High work freedom (age-friendly)	41,860	-0.227***	0.020	-14.880	1.728	-1.960***	-1.239**	-1.192*
Low work freedom	15,780	-0.191*	-0.098	-5.740	-3.446	-0.793	-0.070	-1.560**
Moderate time pressure (age-friendly)	31,471	-0.221**	-0.024	-19.427*	2.007	-2.082***	-1.004	-1.570**
High time pressure	26,211	-0.267***	-0.035	-9.951**	-2.089	-1.045	-0.498	-0.942
Socio-economic controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lifestyle controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster		Country	Country	Country	Country	Country	Country	Country

Table C. 4. Heterogeneous Effects of Health Frailty on Labor Market Outcomes, by Country

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Extensive margin		Intensive margin		Total	Labor productivity	
	LFP	Employment	Weekly hours	Weeks/year	Earnings	Earnings/hr	Earnings/hr/wk
Baseline (all countries)	-1.279***	-0.464***	-21.643***	-2.319*	-1.763***	-0.691*	-1.160***
Austria	-1.092***	-0.953**	-17.208	12.742*	-1.196	0.059	-1.075
Belgium	-1.508***	-1.737***	-29.197	15.491	-4.353**	-1.545	-2.592
Brazil	-1.336**	-0.817	-28.928		-2.820	-0.525	
Bulgaria	-1.676***	-1.949***	-47.694**		-3.031	-1.806	
China	-1.760***	0.051	-62.258***	-42.761**	-1.859	-4.873**	-5.932**
Costa Rica	-1.630***	0.169*	-60.310*		-0.638	-0.836	
Croatia	-1.392***	-0.821	-30.422*		-2.411	-0.947	
Cyprus	-0.568	-1.652	60.883		-4.829	12.651	
Czech Republic	-1.288***	-0.489**	-30.432**	-9.676	-3.676***	-2.308**	-2.917**
Denmark	-1.404***	-0.645***	-38.321***	-5.171	-1.549**	0.322	-0.172
Estonia	-1.844***	-0.296*	-39.496***	-7.015	-3.551***	-2.213***	-1.785**
Finland	-2.143***	-1.205	-2.597		-1.588	-0.512	
France	-1.083***	-0.354	-44.731***	-0.650	-2.601***	-1.425**	-0.713
Germany	-0.865***	-0.689**	3.506	4.025	-3.914***	-2.314**	-2.930**
Greece	-0.743***	-0.042	-19.092	-4.892	1.810	3.274**	0.384
Hungary	-0.686*	1.011*	5.365	-8.148	-3.638*	-3.291	-4.835**
India	-0.188	0.004	14.173		2.037	1.091	
Ireland	-2.105***	0.046	-85.016*	0.205	-7.469	-3.534	-4.888
Israel	-1.300***	0.134	-55.096***	4.053	-5.348***	-5.327***	-1.482
Italy	-0.492***	-0.460	-6.711	5.103	-1.108	-0.043	-0.823
Japan	-1.075***	-0.872	-76.521***	-53.861			
Korea	-1.681***	-0.156*	-35.103***		-2.564***	-0.830	
Latvia	-2.668***	0.872	25.194		3.391	3.141	
Lithuania	-2.194***	-1.060	-29.152		-0.288	0.990	
Luxembourg	-1.378***	-0.167	0.127	-1.152	-2.562	-1.098	-2.486
Malaysia	-1.946***	-1.312	-4.230		-4.919	2.284	
Malta	-2.460***	-3.098	-348.830		-18.147	-59.704	
Mexico	-1.253*	0.062	-26.963		-8.199*	-10.132*	
Netherlands	-1.393***	-0.440	71.045	1.686	-0.107	0.449	0.990
Poland	-0.710***	-2.744***	-15.717	-38.267	-2.078**	-2.658**	-3.249
Portugal	-0.733***	-1.430	-5.130	-3.598	-2.504	-2.375	-20.882
Romania	-1.118***	0.292	-34.176		0.353	0.968	
Slovak Republic	-1.003***	-2.233**	-44.957*		0.261	1.916	
Slovenia	-0.953***	-0.695	-31.538**	-3.195	-2.100	-0.961	0.161
South Africa	0.637	1.381			20.838	24.521	
Spain	-1.103***	-0.632	-3.856	1.106	1.312	1.633	0.420
Sweden	-0.906***	-0.117	-34.840***	-1.273	-2.852***	-1.122	-0.515
Switzerland	-1.439***	-0.362**	-35.804***	0.479	-0.817	0.885	0.307
Thailand	-1.254	0.064	-183.181		4.947	7.897	
United Kingdom	-1.459***	-0.324***	-18.278***	-1.846	-0.853*	-0.351	-0.673
United States	-1.614***	-0.157**	-14.018**	-0.418	-1.533***	-0.486	0.518
Socio-economic control	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lifestyle controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

Table C. 5. Cognitive Health: Heterogeneous Effects on Labor Market Outcomes, by Socio-Economic Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Extensive margin		Intensive margin		Total	Labor productivity	
	LFP	Employment	Weekly hours	Weeks/year	Earnings	Earnings/hr	Earnings/hr/wk
Baseline	0.990***	0.918**	32.729***	4.021	1.728***	0.770	2.108*
by country income group:							
AEs	0.953***	0.839***	32.421***	0.604	1.817***	0.678	2.692
EMs	1.284	1.121	15.018	19.046***	1.262*	1.621	0.789
by gender:							
Female	0.838***	0.873***	35.733**	0.611	1.729***	0.704	2.721***
Male	1.380***	1.131	38.070*	9.692	1.924*	0.868	1.266
by location:							
Urban	0.932***	0.873**	27.853**	5.952	1.668***	0.814	1.937
Rural	0.994***	0.603	25.087*	-3.918	1.740**	0.994	1.260*
by education:							
Lower education	0.833***	12.333	-71.253	9.850	2.263	4.158	2.258
Upper secondary education	0.884***	0.453***	16.919***	6.861	0.909**	0.170	0.558
Tertiary education	1.315***	0.741	68.871	-15.513	5.113	3.393	12.232
by household wealth:							
Quintile 1 (lowest)	1.010***	0.766*	25.159*	-5.642	0.458	-0.243	1.632
Quintile 2	0.885***	-12.901	472.393	17.873	7.514	4.69	9.305
Quintile 3	1.279***	1.039**	25.996***	10.888**	1.963**	0.539	-0.271
Quintile 4	1.173***	0.340	33.918	5.436	1.451**	1.153	2.441
Quintile 5 (highest)	1.235***	-2.805	52.596	28.704	20.302	-18.113	-5.551
by age group:							
Ages 50-59	1.845***	1.040**	33.659**	6.613	2.089***	0.886	2.168
Ages 60-69	0.793***	0.656**	28.556***	-1.690	1.438***	0.592	2.702
Ages 70-79	0.153***	-2.358	27.347	-11.871	1.623**	-0.064	2.506
Ages 80+	0.073**	-0.207	27.010	6.961	0.872	-2.214	1.519
Socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lifestyle controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

Appendix D. Section 7—Additional Robustness Analysis

Table D. 1. Healthy Aging Trends: Robustness to Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Measured health			Self-reported health		Overall
	Grip strength	Lung function	Cognitive PC	Overall health	Physical PC	Psych. well-being	Frailty
Baseline OLS trend estimate	*0.004***	*0.011***	*0.020****	*0.005***	*0.005****	*0.015****	*-0.003****
	(0.002)	*(0.004)*	*(0.003)*	*(0.002)*	*(0.002)*	*(0.003)*	*(0.001)*
Alternative specifications:							
SE clustering by year-of-birth	0.004***	0.011***	0.020***	0.005***	0.005**	0.015***	-0.003***
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.000)
Controling for rural dummy	0.005**	0.011**	0.019***	0.005**	0.005***	0.018***	-0.003**
	(0.002)	(0.004)	(0.003)	(0.002)	(0.002)	(0.003)	(0.001)
Subsample of 29 SHARE countries	0.005**	0.011**	0.019***	0.006**	0.007***	0.018***	-0.004***
	(0.002)	(0.005)	(0.003)	(0.003)	(0.002)	(0.003)	(0.000)
Controling for occupation and industry FE	-0.000	0.012**	0.013***	0.005**	0.006***	0.018***	-0.004***
	(0.002)	(0.004)	(0.002)	(0.002)	(0.001)	(0.002)	(0.000)

Table D. 2. Healthy Aging Trends: Robustness to Additional Health Indicators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Cognitive PC subcomponents				Physical PC subcomponents			Mental health
	Memory	Orientation	Verbal Fluency	Math	ADLs	IADLs	Infrequent pain	Hearing	Depression-less
Year of birth	0.021***	0.004***	0.020***	0.008***	0.003**	0.002**	0.008**	0.003**	0.004***
	(0.003)	(0.001)	(0.003)	(0.002)	(0.001)	(0.001)	(0.004)	(0.001)	(0.001)
Age	-0.009***	-0.010***	-0.005	-0.000	-0.015***	-0.018***	0.001	-0.024***	0.001
	(0.003)	(0.001)	(0.003)	(0.002)	(0.001)	(0.001)	(0.004)	(0.001)	(0.002)
Male	-0.187***	0.001	0.020	0.137***	0.042***	0.049***	0.203***	-0.200***	0.214***
	(0.021)	(0.022)	(0.024)	(0.026)	(0.010)	(0.012)	(0.024)	(0.026)	(0.033)
Upper secondary education	0.348***	0.144***	0.266***	0.314***	0.081***	0.099***	0.117***	0.101***	0.199***
	(0.018)	(0.033)	(0.035)	(0.041)	(0.015)	(0.016)	(0.024)	(0.016)	(0.028)
Tertiary education	0.625***	0.168***	0.561***	0.443***	0.131***	0.135***	0.247***	0.225***	0.301***
	(0.025)	(0.031)	(0.044)	(0.063)	(0.019)	(0.020)	(0.029)	(0.027)	(0.041)
(Log) Household wealth	0.023***	0.009***	0.023***	0.024***	0.021***	0.019***	0.012***	0.010***	0.047***
	(0.003)	(0.002)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.012)
Constant	-41.294***	-6.707**	-38.818***	-16.009***	-4.979*	-2.954	-16.214**	-4.020	-8.775***
	(6.333)	(2.675)	(6.644)	(4.767)	(2.512)	(1.834)	(7.607)	(2.633)	(2.430)
Observations	664,538	552,179	518,040	497,425	750,480	748,306	698,831	640,257	314,571
R-squared	0.368	0.117	0.325	0.226	0.062	0.090	0.063	0.132	0.113
No. countries	40	40	36	36	40	39	38	36	20
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country	Country	Country

Table D. 3. 2SLS 2nd Stage Regression: Robustness to Alternative Instrument Definitions

		(1)	(2)	(3)	(4)	(5)	(6)	(7)
		Extensive margin		Intensive margin		Total	Labor productivity	
	Instrumental variable	LFP	Employment	Weekly hours	Weeks/year	Earnings	Earnings/hr	Earnings/hr/wk
Measured health:								
Grip strength	No. diseases	0.526***	0.331***	9.917***	1.217	0.785***	0.371**	0.730***
	Dummy (Top 10)	0.507***	0.426***	11.096***	2.492**	0.805***	0.328*	0.620***
	Dummy (Any disease)	1.039***	0.334***	8.425**	-0.388	0.708***	0.459	0.886***
Lung function	No. diseases	0.779***	0.454**	13.896***	2.357	1.847***	1.249**	1.267***
	Dummy (Top 10)	0.612***	0.580***	24.590*	4.025	2.157***	1.309	1.323
	Dummy (Any disease)	0.950**	0.423	17.501**	-0.125	2.377***	1.316	1.360**
Cognitive PC	No. diseases	0.993***	1.036**	36.415***	3.970	2.094***	1.089*	3.344*
	Dummy (Top 10)	1.519**	1.426**	64.137	20.275	2.970**	1.892	18.075
	Dummy (Any disease)	4.508*	0.535**	25.868	-3.835	1.603*	0.806	4.212
Self-reported health:								
Overall health	No. diseases	0.136***	0.050***	1.882***	0.249*	0.165***	0.063**	0.102***
	Dummy (Top 10)	0.153***	0.064***	1.942***	0.578***	0.170***	0.076**	0.142***
	Dummy (Any disease)	0.174***	0.034***	1.190***	-0.069	0.103***	0.043	0.085**
Physical PC	No. diseases	0.212***	0.157***	5.472***	0.598*	0.462***	0.238***	0.297***
	Dummy (Top 10)	0.230***	0.145***	4.273***	1.022***	0.325***	0.156**	0.279***
	Dummy (Any disease)	0.537***	0.139***	3.359**	-0.221	0.376***	0.225	0.308**
Psych. Well-being	No. diseases	0.199***	0.151***	3.833***	0.346	0.370***	0.175**	0.260***
	Dummy (Top 10)	0.206***	0.144***	3.340**	1.002***	0.248***	0.091*	0.216***
	Dummy (Any disease)	0.394***	0.109***	2.394*	-0.046	0.317***	0.196*	0.270***
Compositve health frailty:								
Frailty index	No. diseases	-1.239***	-0.541***	-21.248***	-2.677*	-1.760***	-0.689**	-1.072***
	Dummy (Top 10)	-1.215***	-0.535***	-16.303***	-4.393***	-1.435***	-0.633**	-1.085***
	Dummy (Any disease)	-2.066***	-0.417***	-15.355***	0.634	-1.275***	-0.552	-1.007**
Socio-economic controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lifestyle controls		Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE		Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster		Country	Country	Country	Country	Country	Country	Country

Table D. 4. 2SLS 2nd Stage Regression: Robustness to Country-Year Fixed Effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Extensive margin		Intensive margin		Total	Labor productivity	
	LFP	Employment	Weekly hours	Weeks/year	Earnings	Earnings/hr	Earnings/hr/wk
Measured health:							
Grip strength	0.540***	0.258***	9.663***	0.828	0.822***	0.298*	0.552***
	(0.052)	(0.072)	(2.419)	(1.002)	(0.156)	(0.162)	(0.166)
Lung function	0.769***	0.334**	13.137***	1.447	1.756***	1.017***	1.115***
	(0.138)	(0.158)	(4.286)	(2.049)	(0.417)	(0.360)	(0.348)
Cognitive PC	0.967***	0.840**	30.369***	2.913	1.804***	0.758	1.526*
	(0.133)	(0.343)	(9.148)	(4.214)	(0.520)	(0.513)	(0.861)
Self-reported health:							
Overall health	0.142***	0.033***	1.869***	0.164	0.163***	0.054*	0.097***
	(0.013)	(0.009)	(0.393)	(0.125)	(0.027)	(0.030)	(0.017)
Physical PC	0.217***	0.120***	5.165***	0.327	0.471***	0.210**	0.277***
	(0.017)	(0.032)	(1.172)	(0.315)	(0.069)	(0.080)	(0.052)
Psych. Well-being	0.199***	0.117***	4.064***	0.389	0.360***	0.139	0.184***
	(0.016)	(0.020)	(1.119)	(0.345)	(0.075)	(0.082)	(0.056)
Compositve health frailty:							
Frailty index	-1.302***	-0.359***	-21.008***	-1.687	-1.753***	-0.591*	-1.003***
	(0.088)	(0.114)	(4.966)	(1.371)	(0.274)	(0.312)	(0.194)
Socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lifestyle controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

Table D. 5. 2SLS 2nd Stage Regression: Robustness to Controlling for Job Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Extensive margin		Intensive margin		Total	Labor productivity	
	LFP	Employment	Weekly hours	Weeks/year	Earnings	Earnings/hr	Earnings/hr/wk
Measured health:							
Grip strength	0.471***	0.222*	6.459**	0.501	0.533***	0.287**	0.483**
Lung function	0.879***	0.481	7.449	1.534	2.092**	1.407	1.300
Cognitive PC	1.409***	0.313	25.715**	1.156	1.829***	0.983	2.583
Self-reported health:							
Overall health	0.098***	0.038*	1.242**	0.085	0.122***	0.060*	0.085***
Physical PC	0.279***	0.124**	4.507**	0.281	0.361***	0.200**	0.287***
Psych. Well-being	0.228***	0.097*	2.916**	0.354	0.274***	0.129*	0.171**
Compositve health frailty:							
Frailty index	-1.185***	-0.485*	-16.587**	-1.011	-1.503***	-0.751**	-1.068***
Socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lifestyle controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

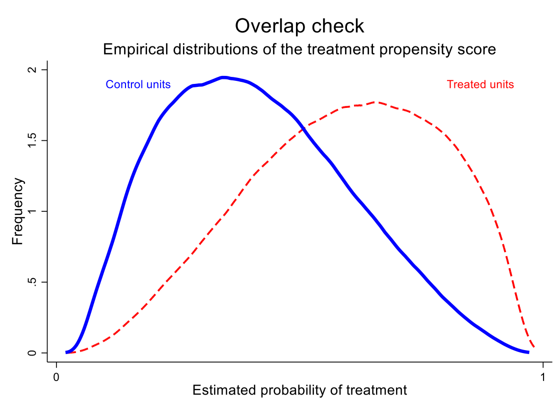
Table D. 6. 2SLS 2nd Stage Regression: Robustness to Retirement Indicator

	(1)	(2)	(3)	(4)
	Baseline	Baseline	2SLS Robustness	
	OLS	2SLS	Country-Year FE	IV: Top 10
Measured health:				
Grip strength	-0.008*	-0.309***	-0.310***	-0.260***
	(0.005)	(0.041)	(0.039)	(0.053)
Lung function	-0.013	-0.515***	-0.497***	-0.286***
	(0.008)	(0.090)	(0.082)	(0.086)
Cognitive PC	0.033***	-0.509***	-0.492***	-0.704*
	(0.005)	(0.128)	(0.107)	(0.373)
Self-reported health:				
Overall health	-0.015**	-0.080***	-0.081***	-0.076***
	(0.006)	(0.018)	(0.017)	(0.020)
Physical PC	0.021**	-0.119***	-0.119***	-0.110***
	(0.010)	(0.026)	(0.025)	(0.029)
Psych. Well-being	0.023***	-0.091***	-0.090***	-0.079***
	(0.005)	(0.015)	(0.014)	(0.018)
Compositve health frailty:				
Frailty index	-0.036	0.730***	0.738***	0.607***
	(0.090)	(0.139)	(0.130)	(0.148)
Socio-economic controls	Yes	Yes	Yes	Yes
Lifestyle controls	No	Yes	Yes	Yes
Fixed effects	Country	Country	Country-Year	Country
SE cluster	Country	Country	Country	Country

Table D. 7. 2SLS 2nd Stage Regression: Robustness to Additional Health Indicators

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Extensive margin		Intensive margin		Total	Labor productivity	
	LFP	Employment	Weekly hours	Weeks/year	Earnings	Earnings/hr	Earnings/hr/wk
Cognitive PC subcomponents:							
Memory	1.073***	0.492*	20.011***	3.400	1.705***	0.689*	1.522***
	(0.159)	(0.283)	(5.370)	(2.375)	(0.496)	(0.399)	(0.399)
Orientation	1.321***	2.066	82.986	31.921	3.413	1.128	11.273
	(0.344)	(4.766)	(81.546)	(32.781)	(2.226)	(1.475)	(16.043)
Verbal fluency	1.207***	0.968**	33.122**	7.776	1.717***	0.886**	2.287
	(0.231)	(0.465)	(14.892)	(8.607)	(0.487)	(0.440)	(1.933)
Math	1.175***	0.918***	43.359*	9.370	2.761*	1.788	2.571**
	(0.298)	(0.322)	(22.476)	(6.798)	(1.539)	(1.491)	(1.304)
Physical PC subcomponents:							
ADLs	0.298***	0.181**	12.553***	1.142*	0.745***	0.388**	0.583***
	(0.023)	(0.076)	(2.819)	(0.641)	(0.156)	(0.179)	(0.120)
IADLs	0.376***	0.298**	23.917***	2.219*	1.325***	0.826**	1.174***
	(0.034)	(0.133)	(6.235)	(1.250)	(0.296)	(0.356)	(0.329)
Infrequent pain	0.183***	0.072***	2.397***	0.209	0.227***	0.095***	0.143***
	(0.017)	(0.024)	(0.473)	(0.149)	(0.037)	(0.036)	(0.026)
Hearing	0.433***	0.196***	6.948***	0.583	0.621***	0.289***	0.353***
	(0.048)	(0.064)	(1.320)	(0.381)	(0.092)	(0.092)	(0.080)
Mental health							
Depression-less	0.285***	0.044**	3.143***	0.354	0.358***	0.143***	0.141***
	(0.044)	(0.022)	(0.380)	(0.447)	(0.034)	(0.028)	(0.024)
Socio-economic controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lifestyle controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
SE cluster	Country	Country	Country	Country	Country	Country	Country

Figure D. 1. AIPW Overlap Assumption



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PUBLICATIONS

The Labor Market Implications of Healthy Aging

Working Paper No. WP/2025/229