

Health and Labor Supply over the life cycle: How important is Mental Health?

Hermien Dijk Max Groneck Jochen Mierau

Faculty of Economics and Business
University of Groningen

Motivation

- ▶ Health problems associated with reduced labor supply
- ▶ Health is declining with age
- ▶ Most severe health problems occur at older ages
- ▶ Health-labor supply link mostly studied at older ages
⇒ early retirement, DI, etc.
- ▶ Various mechanisms have been analyzed
- ▶ Health generally thought as *physical* health (often subjective health measure)

Motivation

- ▶ *Mental* health problems major component of overall health impairment
- ▶ Mental health problems associated with significant reductions in labor supply
- ▶ Notable difference: mental health problems start earlier in life than physical health problems
- ▶ Importance of mechanisms might play out to be different compared to physical health

Ideas

1. Human capital and mental health

- ▶ Highlight novel channel of (mental) health on labor supply: reduced human capital accumulation via less experience on the job
- ▶ Analyze effects of mental health on lifetime income and eventually welfare

2. Effects of mental versus physical health on labor supply

- ▶ Three main channels: productivity, preferences (time costs), and survival
- ▶ Explore importance both for mental and physical health

Agenda

Data

- ▶ Show decreasing life cycle profiles of physical health and increasing profile for mental health in the Netherlands
- ▶ Show lower employment rates for people in poor physical and poor mental health
- ▶ Not shown: subjective health measures are more in line with physical and less with mental health [▶ But see here](#)

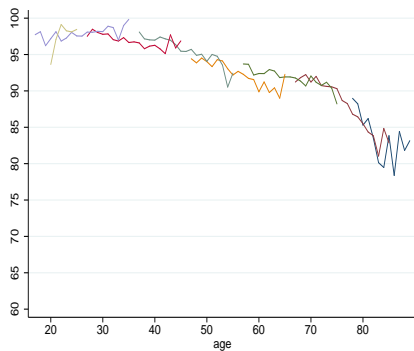
Structural Model

- ▶ Set up life cycle model featuring both physical and mental health uncertainty calibrated to Dutch economy
- ▶ Model features: health affects preferences, productivity, and survival, (not) working induces human capital accumulation (depreciation)
- ▶ Explore impact of the different age profiles of health on lifetime earnings and welfare

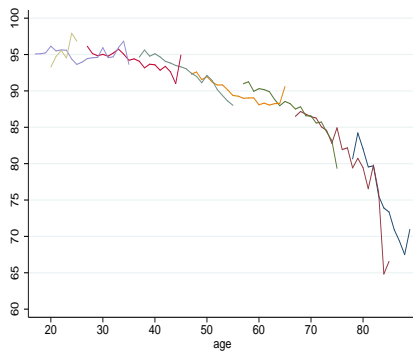
Data

- ▶ LISS panel: representative sample of the Dutch population; very detailed set of health and especially mental health measures
- ▶ *Mental Health*: MHI-5 a (validated) quick population screener to assess mental health [▶ MHI Definition](#)
- ▶ *Physical Health*: Function mobility index [▶ Definition](#)
- ▶ *Subjective health*: “How would you describe your health, generally speaking” between poor and excellent

Physical health age profile by gender



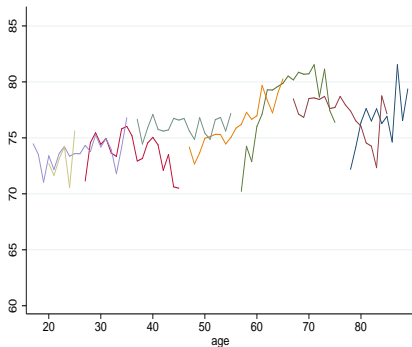
(a) Males



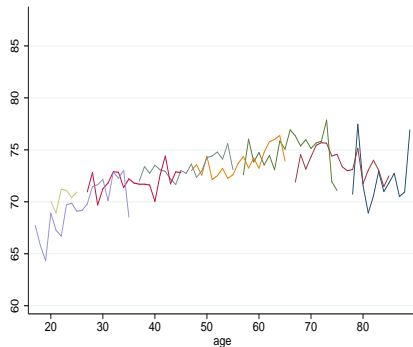
(b) Females

Notes: Functional mobility by cohort and age. 100 = best physical health. 10-year cohorts from 1921-2000.

Mental health age profile by gender



(a) Males



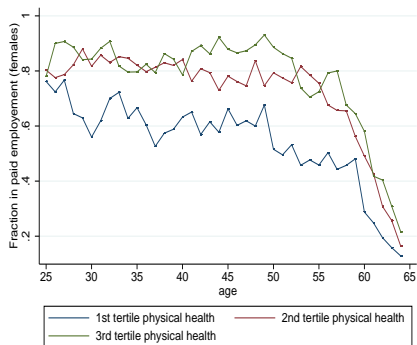
(b) Females

Notes: MHI-5 by cohort and age. 100 = best mental health. 10-year cohorts from 1921-2000.

Physical health and Employment



(a) Males



(b) Females

Model overview

- ▶ Life cycle model from age 25 until age 85
- ▶ Uncertain Health
 - Health: poor mental health, poor physical health, or both
 - Induces negative time costs
- ▶ Uncertain Survival depending on health state
- ▶ Uncertain Labor productivity affected by health
- ▶ Decisions:
 - Consumption/saving s.t. a borrowing constraint
 - Labor supply: extensive margin
- ▶ Fixed retirement at age 65

Preferences

Per-period Cobb-Douglas utility over consumption c_t and leisure l_t

$$U(c_t, l_t; h_t) = \frac{1}{1 - \sigma} \left(c_t^\alpha l_t^{1-\alpha} \right)^{1-\sigma}, \quad (1)$$

where l_t depends on health state h_t

$$l_t = 1 - \theta L_t - \Phi_h h_t \quad (2)$$

with

θ - disutility from labor L_t

Φ_h - Health state dependent time costs (disutility) for

$h_t \in \{H, P, M, MP\}$, where H denotes healthy

▶ Recursive Problem

Labor and experience

- ▶ Wages at age t

$$\ln(W_t) = \bar{\mu} + w(t, h_t) + \gamma e_t + \epsilon_t, \quad (3)$$

with

$\bar{\mu}$ - individual fixed effect

$w(t, h_t)$ - deterministic function of health and age

ϵ_t - idiosyncratic shock

- ▶ Experience

$$e_{t+1} = (1 - \delta_e)e_t + L_t. \quad (4)$$

- ▶ Minimum income floor to account for Dutch social insurance system

$$y_t = \max\{W_t, \bar{y}\}$$

- ▶ Out-of-pocket medical expenditures are negligible in the Netherlands and, hence, not modeled

Calibration overview

Processes and parameters to be estimated

- ▶ Transition probabilities for mental and physical health \Rightarrow Data
- ▶ Wage profile \Rightarrow Model?
 - Impact of experience
 - Impact of health and age
 - Idiosyncratic shock
- ▶ Preference parameters: time cost of health etc \Rightarrow Model

Health transition probabilities

- ▶ Estimation of age and gender specific transition probabilities using logistic regressions
- ▶ Ordered logit not preferable (which state is worse/better?)
- ▶ Transitions to poor mental M and poor physical P health states estimated sequentially for each individual i at age t

$$\begin{aligned} \text{Logit}(\tilde{h}_{i,t}|\mathbf{x}_{i,t}) &= \beta_0 + \beta_1 M_{i,t-1} + \beta_2 P_{i,t-1} \\ &+ \beta_3 (M_{i,t-1} \times P_{i,t-1}) \\ &+ \beta_4 t_i + \beta_5 t_i^2 + \beta_6 t_i^3 + \eta_{i,t} \end{aligned}$$

where $\tilde{h} = \{M, P\}$ is lowest percentiles (tertile) in each state. Note, that we estimate $Pr(M_t|\tilde{h}_{t-1})$, $Pr(P_t|H_t, \tilde{h}_{t-1})$, and $Pr(P_t|M_t, \tilde{h}_{t-1})$ which can be used to compute the transition matrix

Wage process and selection

- ▶ Selection problem when estimating return to experience and impact of bad health on wages
 - Only wages of working individuals are observed, no wage offers
 - Selection into employment is non-random: highly educated, healthy, human-capital rich and able individuals are more likely to work
 - Estimation yields biased results
- ▶ Way out: Calibrate (a) returns to experience, (b) depreciation of human capital, and (c) effect of health on wages to match certain data moments
- ▶ Model mimics selection by having endogenous labor supply

Wage equation

Idea for wages

$$\begin{aligned} \ln(W_{i,t}) &= \mu_i + \beta_1 t + \beta_2 t^2 + \beta_3 \mathbf{1}_{L_{t-\tau}=0} \\ &+ (\beta_4 + \beta_5 \cdot t)M_t + (\beta_6 + \beta_7 \cdot t)P_t + (\beta_8 + \beta_9 \cdot t)MP_t + \epsilon_{i,t} \end{aligned}$$

matching moments

- ▶ match age profiles of wages
- ▶ ...over health status
- ▶ ...after periods of non-employment

Calibration

- ▶ Disutility of work θ to match employment of healthy individuals, separately by gender
- ▶ Disutility of bad health Φ_h to match life-cycle employment differences over health status

Counterfactuals

- ▶ shut down mental health, compute loss in lifetime earnings
- ▶ shut down physical health, compute loss in lifetime earnings
- ▶ contrast results with results from our model but with subjective health
- ▶ evaluate importance of each channel (a) productivity, (b) preferences (time costs), (c) survival, and (d) human capital both for physical and for mental health impairment

Questions and Further Ideas

- ▶ Focus on males and/or females? - include exogenous income from spouse
- ▶ Add intensive margin of labor supply (part-time decision, continuous hours choice)
- ▶ Physical health a blue collar worker problem, mental health more a white collar problem
- ▶ disability insurance
- ▶ endogenous retirement decision

Thank you!

Subjective health more in line with physical than with mental health



Notes: indices, age 20 = 100. [◀ Back](#)

Mental Health Inventory, MHI-5

The following questions are about how you felt over the past month.

For every question, please choose the answer that best describes how you felt during this past month.

This past month

ch07a011 I felt very anxious

ch07a012 I felt so down that nothing could cheer me up

ch07a013 I felt calm and peaceful

ch07a014 I felt depressed and gloomy

ch07a015 I felt happy

- 1 never
- 2 seldom
- 3 sometimes
- 4 often
- 5 mostly
- 6 continuously

The MHI-5 scale from [0 – 100] is computed by adding all scores (1 to 6) for each question (q1, q2, and q4 in reverse order), and applying $MHI5 = 100 \cdot (\sum score - 5)/25$

Higher scores indicate good mental health. Often cited cutpoint to define a case of common mental disorder is 60

◀ Back

Functional mobility

Below you will find a number of actions that some people have difficulties with.

Can you indicate, for each activity, whether you can perform it without any trouble, with some trouble, with a lot of trouble, or only with the help of others?

This question does not apply to problems which you expect will not last longer than three months.

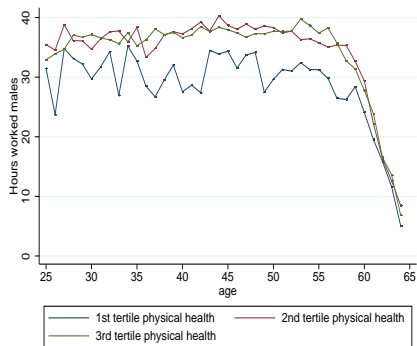
- ch07a023** walking 100 meters
- ch07a024** sitting for around two hours
- ch07a025** getting up from a chair in which you sat for some time
- ch07a026** walking several stairs without resting in between
- ch07a027** walking up a staircase without resting
- ch07a028** crouching, kneeling, crawling on all fours
- ch07a029** reaching above shoulder height or stretching your arms above shoulder height
- ch07a030** moving large objects such as a diningroom chair
- ch07a031** lifting or carrying a weight of 5 kilos, such as a heavy bag of groceries
- ch07a032** picking up a small coin lying on the table

- 1 without any trouble
- 2 with some trouble
- 3 with a lot of trouble
- 4 only with the help of others

Add scores (1-4) in reverse order and re-scaled to [0 – 100]

Higher scores indicate good physical health

Physical health and Hours worked

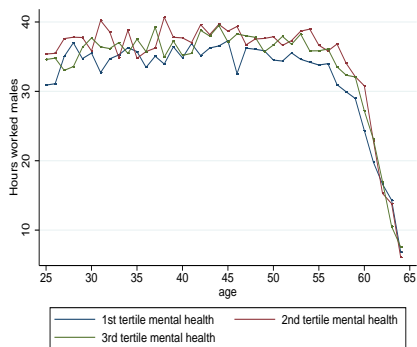


(a) Males

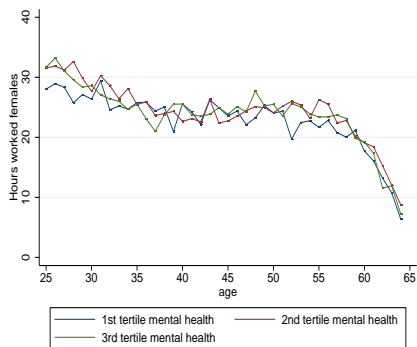


(b) Females

Mental health and Hours worked



(a) Males



(b) Females

Household decision problem

Individuals solve

$$V_t(\Gamma_t) = \max_{c_t, L_t} U(c_t, l_t; h_t) + \beta \mathbb{E} V_{t+1}(\Gamma_{t+1}) \quad (5)$$

s.t. the budget constraint

$$a_{t+1} = (1 + r)a_t + y_t - c_t \quad (6)$$

with the state space at age t : $\Gamma_t = (h_t, a_t, e_t, \bar{\mu}, \epsilon_t)$

◀ Back