The state of the model

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Question(s)

How much does mental health (MH) inequality matter for lifetime earnings inequality?

Eventually: how much does lifetime earnings inequality matter for mental health inequality?

- Estimate a life-cycle model of consumption, labor, wealth with heterogeneous MH
- Run counterfactuals with no MH inequality, compare earnings/labor inequality
- Run counterfactuals with no lifetime earnings/labor inequality, compare mental health inequality

Model in words

- Households (HH) live J periods
- Derive utility from consumption and leisure
- Make continuous choices in labor n, consumption c, and future assets a'
  - Note: may switch to discrete labor choice in future
- Constrained by expendable income and time endowment
- Wage follows a quadratic process in age and agents smooth consumption by saving
- Assets must remain above a borrowing constraint
- Two kinds of types are decided at birth
  - Health type H (bad, good) which effects the total time endowment
  - Labor productivity γ (low, medium, medium high, high) effects the wage process

Utility and time endowment

Individuals derive period utility from consumption and leisure

$$u\left(c_j, l_j\right) = \frac{\left(c_j^{\alpha} l_j^{1-\alpha}\right)^{1-\sigma}}{1-\sigma}$$

where the time endowment is s.t.

$$l_j = 1 - \phi_n n_j - \phi_H \left(1 - H\right)$$

ϕ_n the time cost of work > 1 to account for commuting etc, ϕ_H is the time cost of bad health, $H \in \{0, 1\}$ is health status

Consumption constraints

Choices must be s.t.

$$c + a' = z(\gamma, j, H) \cdot n + a(1 + r); \forall j$$

$$a_0 = a_{J+1} = 0;$$

and

$$a_j > -\kappa, \text{ and } c_j, n_j \geq 0; \forall j.$$

With $\ln z(\gamma, j, H) = w_{0\gamma_i} + w_1 j + w_2 j^2 + w_H H$ where the linear coefficient depends on productivity type γ_i. κ is the borrowing constraint.

HH sequential optimization problem

$$\max_{\{c_j, n_j, a_{j+1}\}} \sum_{j=0}^{j=J} u\left(c_j, 1 - \phi_n n_j - \phi_H \left(1 - H\right)\right)$$

s.t.

$$\sum_{j=0}^{j=J} \frac{c_j - z\left(\gamma, j\right) n_j}{\left(1 + r\right)^j} = 0$$

or equivalently

$$c_j + a_{j+1} = z\left(\gamma, j, H\right) + a_j \left(1 + r\right); \forall j$$

$$a_0 = a_{J+1} = 0;$$

with $a_j > -\kappa,$ and $c_j, n_j \geq 0; \forall j.$

HH recursive optimization problem

The individual's problem:

$$V_j(a,\gamma,H) = \max_{c,n,a'} \left\{ u\left(c, 1-\phi_n n - \phi_H\left(1-H\right)\right) + \beta V_{j+1}\left(a',\gamma,H\right)\right\}$$

s.t.

$$c + a' = z\left(\gamma, j, H\right)\cdot n + a\left(1+r\right); \forall j$$

$$a_0 = a_{J+1} = 0;$$

and

$$a_j > -\kappa, \text{ and } c_j, n_j \geq 0; \forall j$$

Exogenous parameters

The benchmark exogenous parameters are set as follows

- R is set to a reasonable value for the risk free rate
- β is set equal to $\frac{1}{R}$
- σ the CRRA parameter is set close to 1 so utility $\rightarrow \log\left(c_j^{\alpha} l_j^{1-\alpha}\right)$
- ϕ_H the health time cost is taken approximately from Capatina (2015)
- ϕ_n labor time cost is set so that $0.40\phi_n = 0.45$ Capatina (2015)
  - i.e. 40 hour work week requires 5 additional hours commuting etc.
- $\omega_{H=1}$ population weight of the healthy is set to match cutoffs suggested in UKHLS data
- $[w_{0\gamma 1}, w_{0\gamma 2}, w_{0\gamma 3}, w_{0\gamma 4}]$ set at $[5, 10, 15, 20]$

Calibrated parameters overview

The endogenous parameters are calibrated to match data moments as follows

- Wage process parameters
  - The weights on $w_{0\gamma_i}$ are set so that mean and std. dev. of wage match the data at $j = 0$
  - w_1 is set so that wage growth matches that from beginning of life to peak wage
  - w_2 is set so that wage decline matches that from the peak wage to end of life
  - w_H is set so that the wage premium matches the average premium for being healthy
- α is set so that weighted mean hours worked over the lifecycle match mean hours worked in the data

Endogenous calibration process

1. Generate weights on $w_{0\gamma_i}$ s.t. that the mean and sd. of wages at $j = 0$ match the data.
2. Calibrate w_1 so that wage growth from the $j = 0$ wage to the max wage matches that in the data
   - Check the tolerance for w_1 and the weighted $w_{0\gamma_i}$moments (which remain unchanged), if not within tolerance go back to step 1
3. Calibrate w_2 so that wage decline from the max wage to the wage at $j = J$ matches that in the data
   - Check the tolerance for w_2, w_1 and the $w_{0\gamma_i}$moments, if not within tolerance go back to step 1
4. Calibrate w_H so that wage decline from the max wage to the wage at $j = J$ matches that in the data
   - Check the tolerance for w_H, w_2, w_1 and the $w_{0\gamma_i}$moments, if not within tolerance go back to step 1

Exogenous parameters 1

Parameter	Description	Value	Source
R	Gross interest rate	1.02	Benchmark
β	Patience	0.9804	$1/R$
σ	CRRA	0.9999	Benchmark
ϕ_n	Labor time-cost	1.125	Benchmark
ϕ_H	Health time-cost	0.1	Benchmark
$\omega_{H=1}$	Healthy pop. weight	0.5	UKHLS
$\omega_{H=0}$	Unhealthy pop. weight	0.5	$1 - \omega_{H=1}$

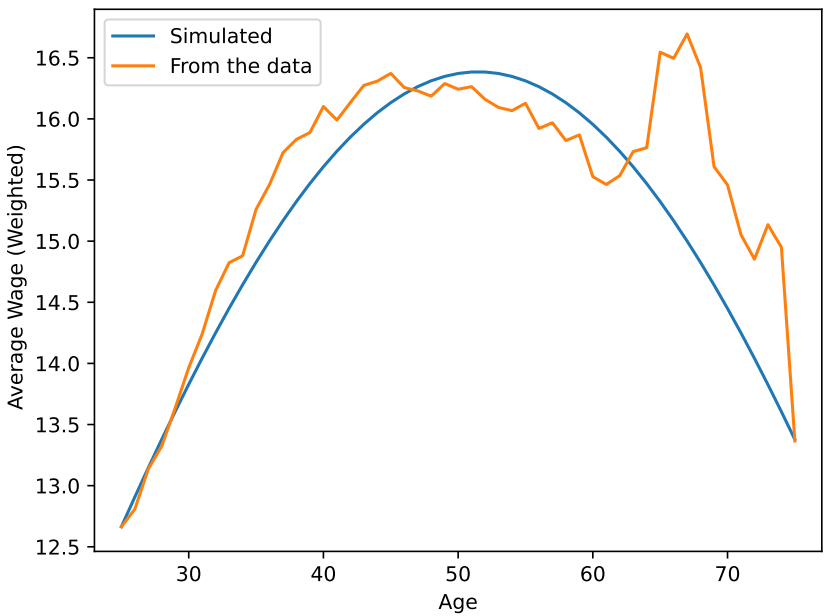
Calibrated parameters 1

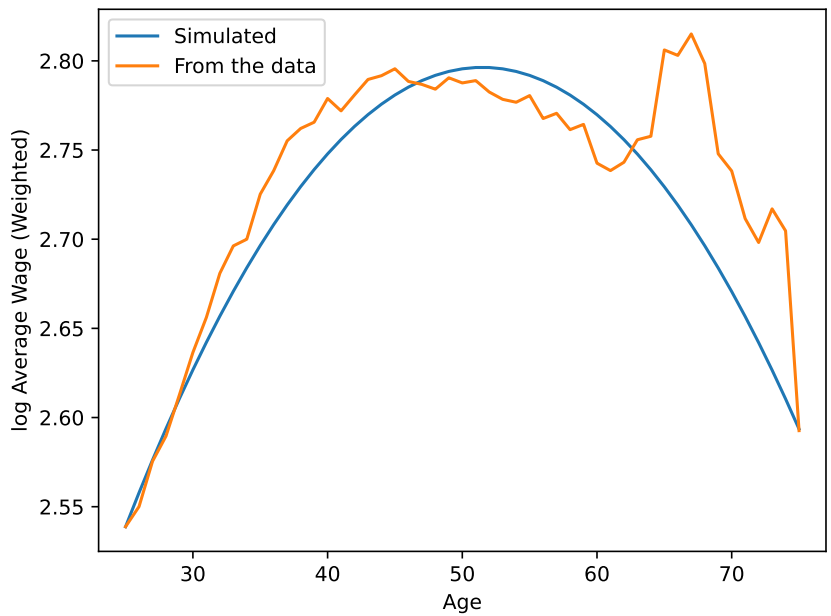
Parameter	Description	Par. Value	Target Moment	Target Value	Model Value
α	c utility weight	0.4004	Mean hours worked	33.85	33.79
w_1	Linear wage coeff.	0.0196	Wage growth	25.68%	25.75%
w_2	Quad. wage coeff.	-0.0004	Wage decay	20.29%	20.27%
w_H	Health wage coeff.	0.0488	Healthy wage premium	4.83%	4.88%

Calibrated parameters 2: weights and wage constant

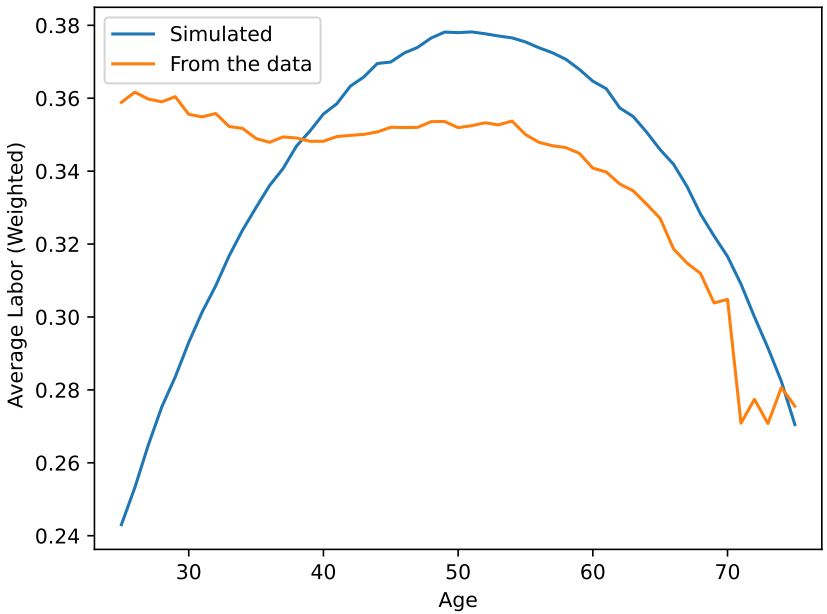
Constant wage coeff.	Ability Level	Value	Weight
$w_{0\gamma_1}$	Low	5	0.02
$w_{0\gamma_2}$	Medium	10	0.52
$w_{0\gamma_3}$	Medium High	15	0.42
$w_{0\gamma_4}$	High	20	0.04
Target Moment	Target Value	Model Value	
Mean wage, $j = 0$	12.664	12.664	
SD wage, $j = 0$	3.135	3.135	

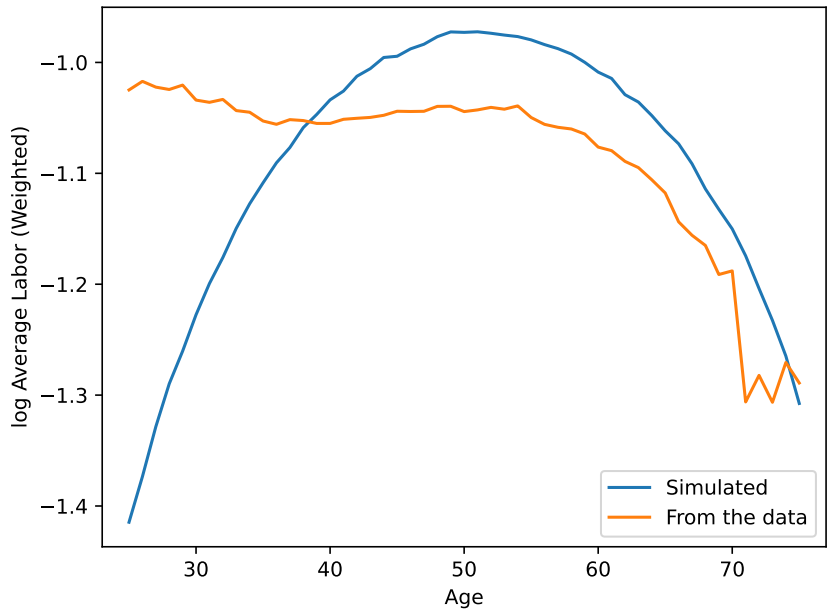
Aggregate wage fit



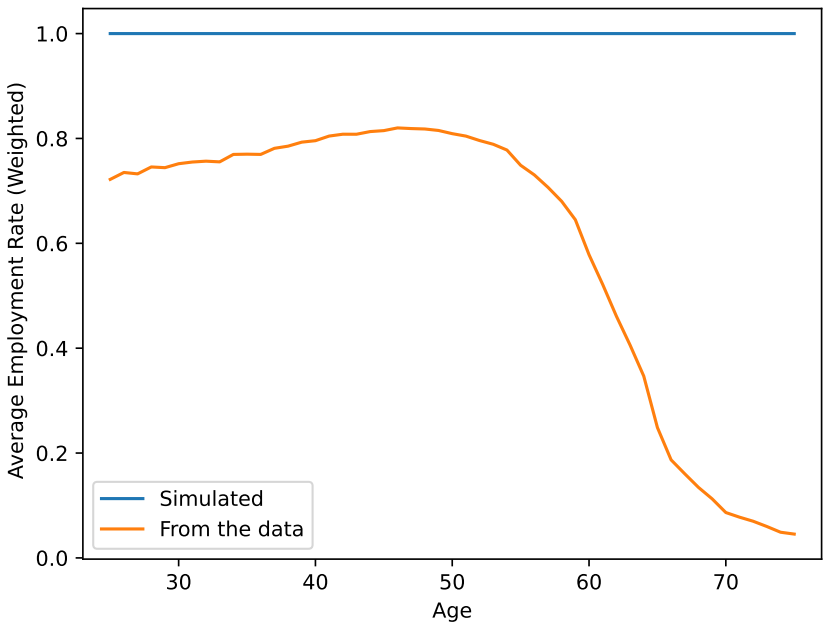


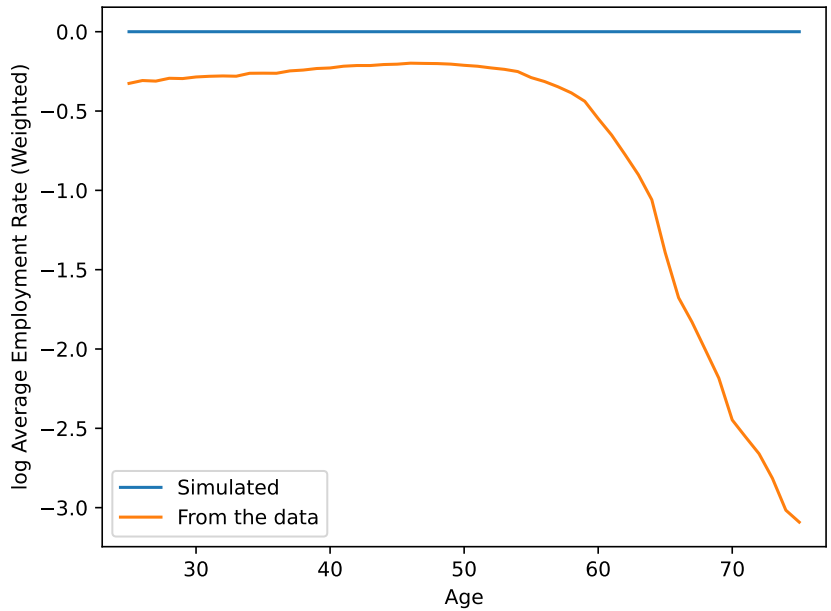
Aggregate labor fit



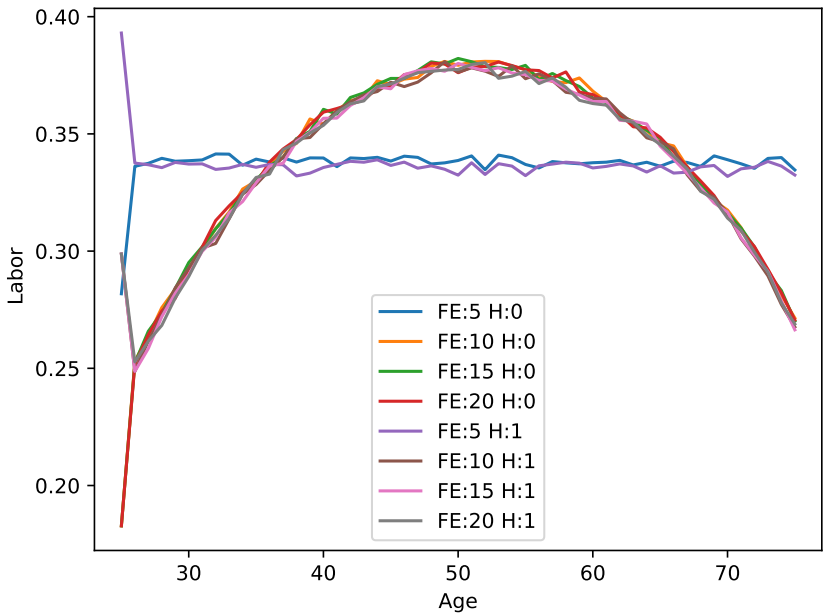


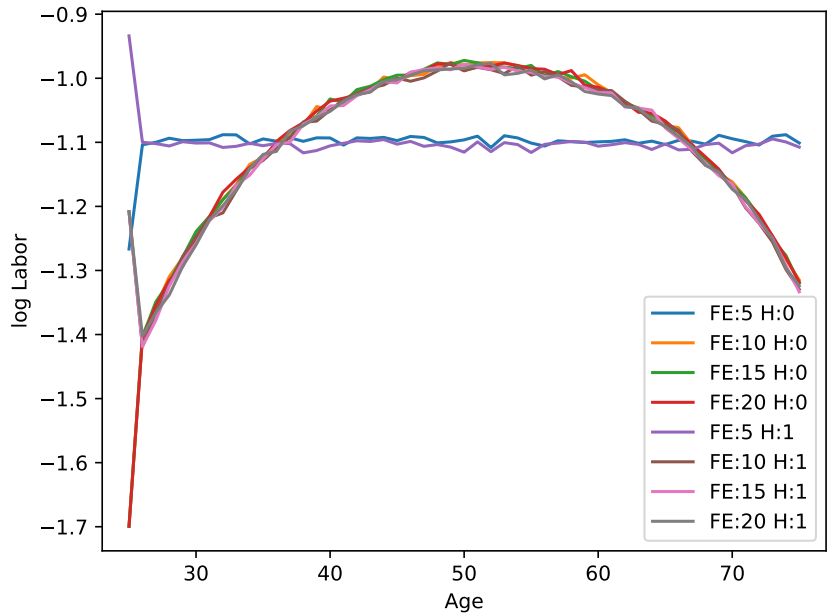
Aggregate employment fit



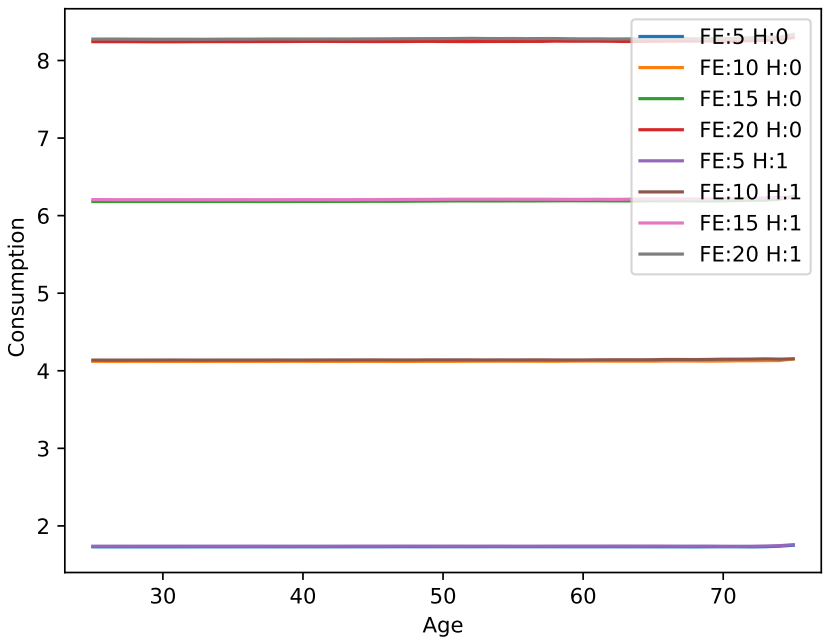


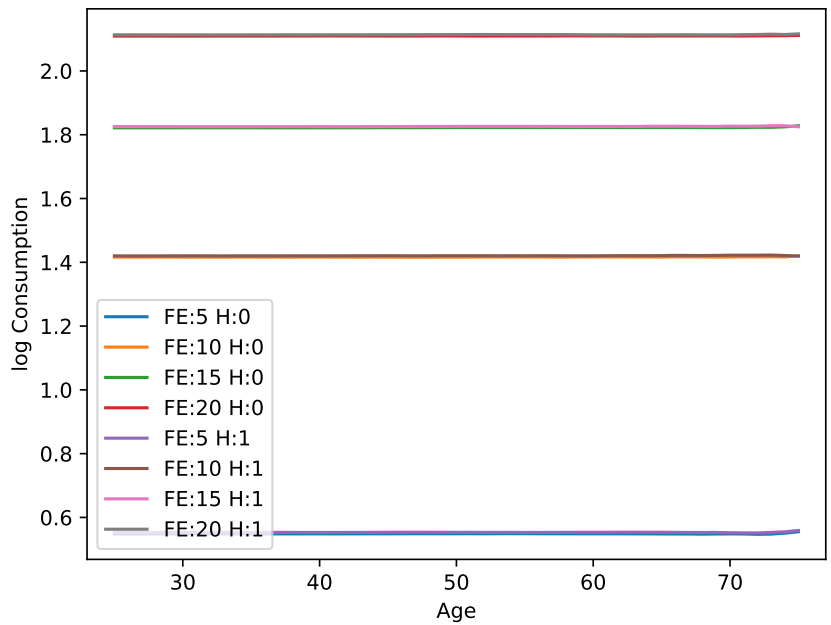
Labor profiles



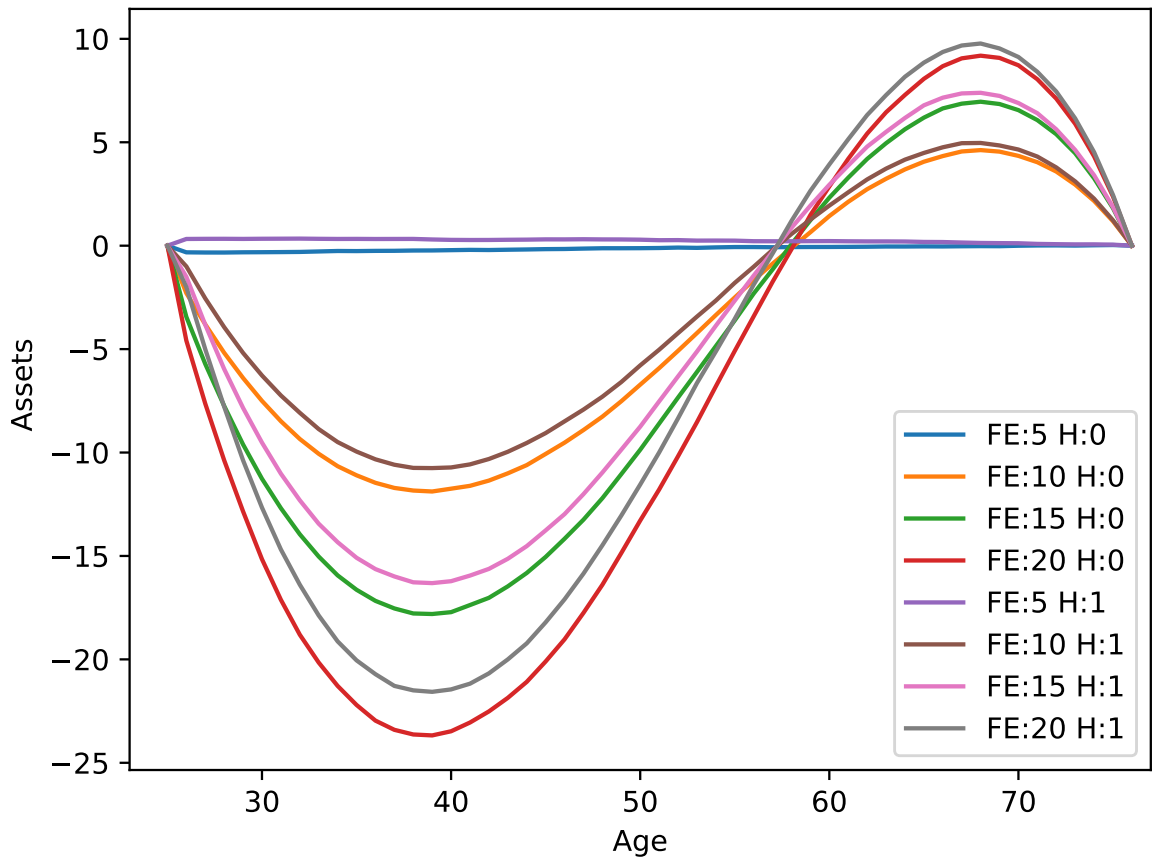


Consumption profiles

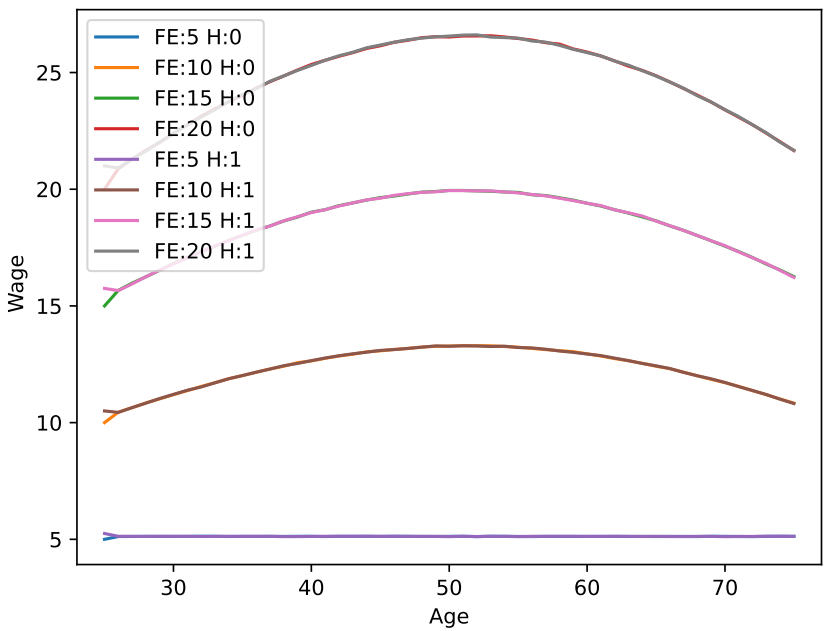


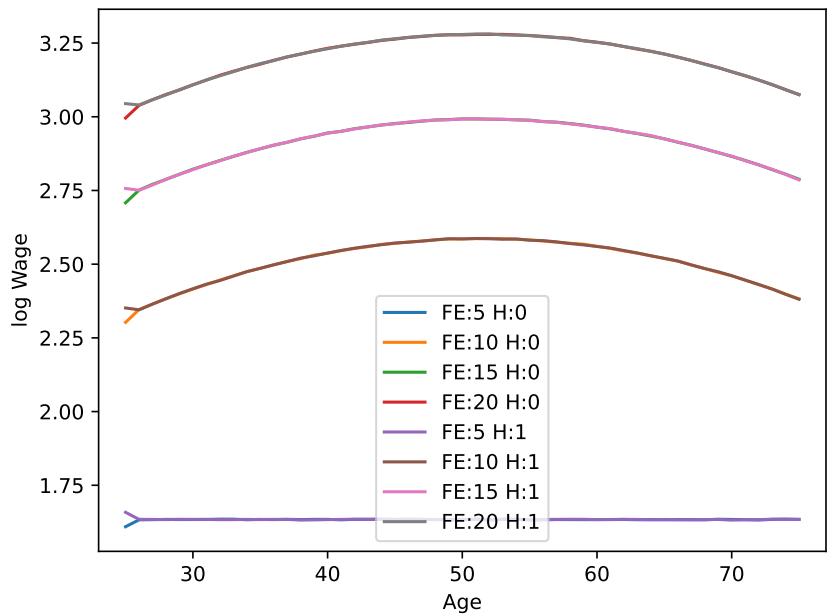


Asset profiles

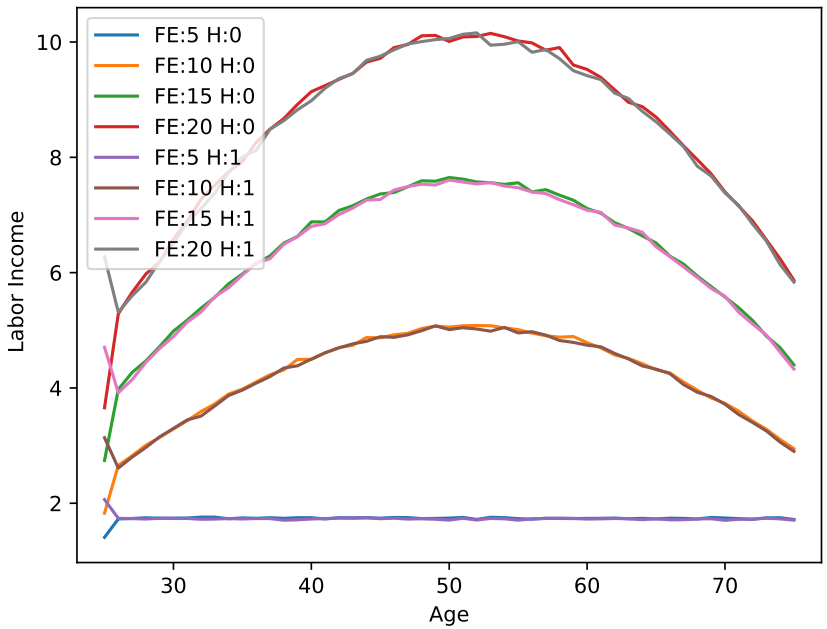


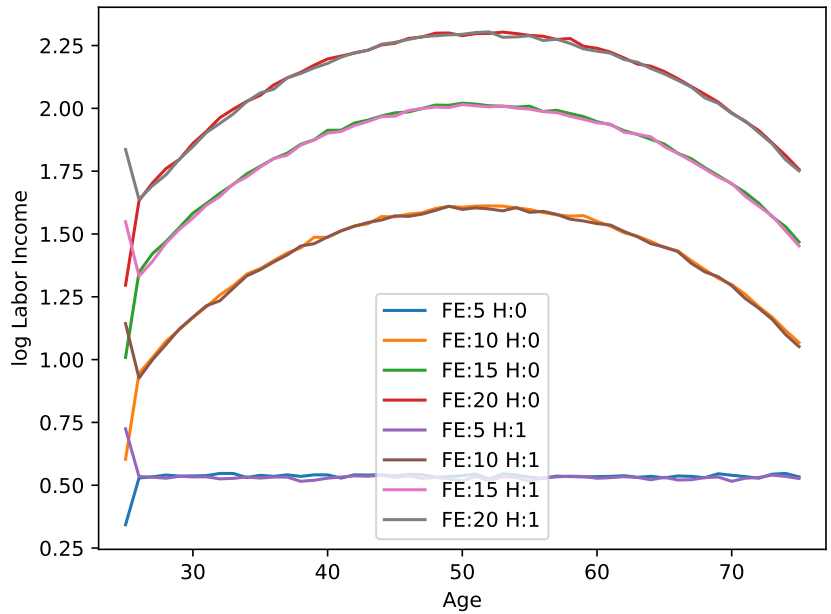
Wage profiles





Labor income





Mental Health: Next steps

- AR(1) process for health
  - $H = \rho_H H + \varepsilon_H, \varepsilon_H \sim \mathcal{N}(\mu_{\varepsilon_H}, \sigma_{\varepsilon_H})$
  - Estimate $\rho_H, \mu_{\varepsilon_H}, \sigma_{\varepsilon_H}$
  - "Theory" of evolution of health types?
    - Additive vs multiplicative in the evolution of health?
    - Discrete health types so will be implemented discretely
- Slides on Abramson et al. (2024)

Other steps

- Slides on Jolivet and Postel-Vinay (2020)
- Slides on Cronin et al. (2023), De Nardi et al. (2021), Hosseini et al. (2021)
- Fixed cost of labor
- Survival probabilities
- Feedback between mental health and jobs
  - might emphasize the two way causality angle
  - e.g. unemployment, stress $\Longrightarrow$ poor MH

Thank You!

Thank you!

Any questions? I appreciate your feedback!

References

- Abramson, Boaz, Job Boerma, and Aleh Tsyvinski (Apr. 11, 2024). *Macroeconomics of Mental Health*. DOI: 10.2139/ssrn.4793015. URL: https://papers.ssrn.com/abstract=4793015 (visited on 04/17/2024). Pre-published.
- Capatina, Elena (Sept. 1, 2015). "Life-Cycle Effects of Health Risk". In: *Journal of Monetary Economics* 74, pp. 67–88. ISSN: 0304-3932. DOI: 10.1016/j.jmoneco.2015.06.002. URL: https://www.sciencedirect.com/science/article/pii/S030439321500063X (visited on 11/16/2023).
- Cronin, Christopher J, Matthew P Forsstrom, and Nicholas W Papageorge (2023). "What Good Are Treatment Effects without Treatment? Mental Health and the Reluctance to Use Talk Therapy". In.