

# Health Heterogeneity, Portfolio Choice and Wealth Inequality

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# Disclaimer

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# Introduction

- Health  $\iff$  earnings/income/wealth inequality
- Hosseini, Kopecky and Zhao (2021); Capatina and Keane (2023); De Nardi, Pashchenko and Porapakkarm (2024); Mahler and Yum (2024)
- Two health channels address how much households (HHs) save:
  1. **Health-longevity channel**  
health  $\Rightarrow$  survival rates  $\Rightarrow$  HH choices  $\Rightarrow$  savings  $\Rightarrow$  wealth accum.
  2. **Health-income/expenditure channel**  
health  $\Rightarrow$  labor productivity  $\Rightarrow$  labor supply  $\Rightarrow$  income  
health  $\Rightarrow$  health expenditure  $\Rightarrow$  net of OOP income  $\left. \right\} \Rightarrow$  savings/wealth accum.

# This paper

- Add health channel to address **how (where)** households save
  - Household finance: wealth/investment portfolio choice
  - Lit. Surveys: [Gomes \(2020\)](#) and [Gomes, Haliassos and Ramadorai \(2021\)](#)
- **Health-wealth portfolio channel**
  - If portfolio **composition** (ratio of risky assets) differs by health  $\Rightarrow$  **returns** to investment differ by health
  - If health effect is persistent  $\Rightarrow$  compounding of investment returns  $\uparrow$  wealth gap over lifecycle (between health types)
  - Health heterogeneity  $\Rightarrow$  dynamics of **how** (and how much) households save
  - Health-wealth channel  $\Rightarrow$  important implications for wealth inequality
  - Introduces new wealth redistribution role for **health insurance**

# This paper

- Highlight/quantify importance of **health-wealth portfolio** channel
- **Empirical analysis:** US household survey data (PSID and HRS)
  - Document lasting effect of **poor health at 45–55** on **risky asset**-share at 60–70
- **Structural analysis:** model + counterfact. experiments
  - Stochastic lifecycle model: **portfolio choice** (2 assets), **health**, and health insurance
  - Decompose effects of **health** and **portfolio choice** on **wealth gap**
  - Examine role of **HI** on wealth gap in presence of **health-wealth-channel**

# Findings

Empirical: **PSID+HRS data**

- **RA** share of 60–70 olds is negatively correlated with **sick-at-45–55**
- Health effect primarily via extensive (participation) margin in **RA** investments
- Significant differences of lifecycle patterns of **RA** participation by **health-when-young**

Structural: **Lifecycle model**

- Average annual lifetime cost of **sick-at-45–55**: \$3,278
- **Health-wealth portfolio** channel is large
  - Wealth gap (P90/P50) overall ↓ up to 56%
- Expansion of either public or private health insurance
  - Stock market participation: ↑ 4–5%
  - Wealth gap: ↓ 14–24%

# Mechanism of health-wealth portfolio channel

1. Bad health when “young”
  - ⇒ lower surv. prob.+income losses+high medical expenditure
  - ⇒ higher expected future risk (as health shocks are persistent)
  - ↓ stock market participation
2. Health heterogeneity ⇒ heterogeneity in wealth portfolio ⇒ heterogeneous investment returns
3. Compounding of investment returns ⇒ larger wealth gap over time
4. Expansion of health insurance
  - ⇒ ↑ stock market participation ⇒ ↓ wealth gap

# Related literature

- Macro-health economics
  - Hosseini, Kopecky and Zhao (2021); Capatina and Keane (2023); Mahler and Yum (2024); Chen, Feng and Gu (2025)
  - Jeske and Kitao (2009); De Nardi, French and Jones (2010); Capatina (2015); Jung and Tran (2016); Jung and Tran (2023) etc.
- Household finance  $\Rightarrow$  lifecycle portfolio choice models
  - Seminal works: Samuelson (1969); Merton (1971)
  - Surveys: Gomes (2020) and Gomes, Haliassos and Ramadorai (2021)
  - Recent related: Campanale, Fugazza and Gomes (2015); Fagereng, Gottlieb and Guiso (2017); Gomes and Smirnova (2021); Tischbirek (2019)
- Wealth inequality/dynamics literature: Benhabib, Bisin and Zhu (2015); Gabaix et al. (2016); Benhabib, Bisin and Luo (2019)
- Health+Investment Portfolio
  - Yogo (2016) focus on retirees and housing, model starts at 65
  - Lusardi, Michaud and Mitchell (2017) knowledge accum. for "sophisticated" assets, health only affects old
  - Hugonnier and Pelgrin (2013) endog. health, closed form but no lifecycle consideration

**This paper:** health at "45–55"  $\Rightarrow$  generating wealth gap via two assets at 65 & role of health insurance

# Health-wealth portfolio channel: Empirical evidence

# Data

- Data sources: **PSID** 1984–2019 and **HRS** 1992–2018
- Financial wealth
  - Focus on **financial wealth** (no housing, cars, real estate)
  - Collapse 20 asset categories into 2
    1. **safe assets:** checking/savings accts, money market funds, CDs, bonds (government savings bonds, T-bills, corporate, municipal and foreign bonds, bond funds)
    2. **risky assets:** stocks and mutual funds
  - IRAs & 401(k) limited info ⇒ assign 45.8% & 41% of holdings to risky assets ([Tischbirek, 2019](#); [Agnew, Balduzzi and Sundén, 2003](#))
  - PSID does not have info about 401(k)
- Health status
  - Five states: 1 excellent, 2 very good, 3 good, 4 fair, 5 poor
  - Two groups by health status at **age 45–55:**
    - **Sick:** 4-fair and 5-poor
    - **Healthy:** 1-excellent, 2-very good, 3-good health

More details

# Econometric model

- Reduced form: Poor health (Sick 45–55)  $\Rightarrow$  risky asset share

$$y_{it} = \beta + \gamma \times 1_{\{\text{Sick 45–55, } i\}} + \delta \times Z_{it} + \varepsilon_{it}$$

- $y_{it}$  risky asset share (in financial portfolio) at 60–70
- $1_{\{\text{Sick 45–55, } i\}}$  indicator “bad health in at least one survey wave between 45–55”
- $Z_{it}$  controls
- $\varepsilon_{it}$  error term

# PSID: Stock share at 60–70

	(1)	(2)	(3)	(4)	(5)
Sick at 45_55	-0.028*** (0.008)	-0.040*** (0.010)	-0.035*** (0.010)	0.008 (0.017)	0.004 (0.015)
Unemployed at 45_55	-0.004 (0.007)	0.005 (0.009)	-0.004 (0.010)	0.035** (0.015)	0.035*** (0.013)
Uninsured at 45_55	-0.030*** (0.009)	-0.047*** (0.010)	-0.031*** (0.009)	-0.018 (0.028)	0.000 (0.026)
Observations	5625	5625	5625	2335	2335
R <sup>2</sup>	0.323	0.302			0.107
Conditional P(Y>0)	No	No	No	Yes	Yes
Random Effects	No	No	Yes	Yes	No
Weighted	No	Yes	No	No	Yes

# Selection model: PSID

	Stock Share	P(Stocks)	Safe A. Share	P(Safe A.)
Sick at 45_55	0.003 (0.015)	-0.271 *** (0.051)	0.036 *** (0.009)	-0.198 *** (0.058)
Unemployed at 45_55	0.034 *** (0.012)	-0.175 *** (0.047)	0.003 (0.008)	-0.232 *** (0.053)
Uninsured at 45_55	-0.027 (0.026)	-0.382 *** (0.076)	0.044 *** (0.012)	-0.170 *** (0.064)
Observations	5625		5625	

HRS regression results

# Stochastic lifecycle model

# Lifecycle model: portfolio choice, health & HI

- A stochastic lifecycle model of portfolio choice
  - Lifespan: Age 40–94
  - Three skill levels: No high school, high school and college
  - Two assets: Risky (stock) and safe (bond) assets
- Idiosyncratic shocks
  1. Health
    - Longevity
    - Health expenditure
    - Labor productivity
  2. Health insurance/employer type
  3. Labor
- Health insurance (HI)
  - Public HI: Medicaid & Medicare (w/ eligibility criteria)
  - Private HI: Employer sponsored HI (w/ community rating and tax deduct. premium)
- Government
  - Progressive inc. tax, payroll taxes, capital taxes (dividend, cap. gains & interest)
  - Soc. Security, Medicaid, Medicare, min. consumption program

Model details

# Worker problem

- State vec:  $x_j = \left\{ \vartheta, a_j, \epsilon_j^{incP}, e_j^h, e_j^{ehi} \right\} \in \{1, 2, 3\} \times R \times \{1, 2, 3, 4\} \times \{1, 2, 3, 4, 5\} \times \{0, 1\}$
- Expectation  $\Rightarrow \mathbb{E}_{\epsilon_{j+1}^{incP}, e_{j+1}^h, e_{j+1}^{ehi}, \epsilon_{j+1}^s | \epsilon_j^{incP}, e_j^h, e_j^{ehi}}$

$$V(x_j) = \max_{\{c_j, \ell_j, \alpha_j\}} \left\{ u(c_j, \ell_j) + \beta \mathbb{E} \begin{bmatrix} \text{Health-longevity channel} \\ \pi_j(\mathbf{h}(e_j^h)) \\ V(x_{j+1}) + \overbrace{\left(1 - \pi_j(\mathbf{h}(e_j^h))\right)}^{\text{Health-longevity channel}} u^{\text{beq}}(a_{j+1}) \end{bmatrix} \right\}$$

s.t.

$$a_{j+1} = \tilde{R}_{j+1} \begin{pmatrix} \text{Health-inc. channel} & \text{Health-exp. channel} \\ a_j + y_j(\ell_j, \vartheta, \epsilon_j^{incP}, e_j^h) + \text{tr}_j^{\text{si}} - o_j(m_j, e_{j,\vartheta}^{ehi}, y_j^{\text{agi}}, a_j) \\ -1_{[e_j^{ehi}=1]} \text{prem}_j^{ehi} & \underbrace{-\text{tax}_j}_{\text{Health-exp. channel}} - (1 + \tau^c) c_j - 1_{[\alpha_j > 0]} q \end{pmatrix}$$

$$\tilde{R}_{j+1} = \overbrace{\alpha_j \left(1 + \bar{r}_{net,j+1}^s(e_{j+1}^s)\right) + (1 - \alpha_j) \left(1 + \bar{r}_{net}^b\right)}^{\text{Health-wealth portfolio channel}}$$

$$\text{tax}_j = \text{tax}^Y(y_j^{\text{tax}}) + \text{tax}^{\text{ss}}(y_j^{\text{ss}}; \bar{y}^{\text{ss}}) + \text{tax}^{\text{mcare}}(y_j^{\text{ss}})$$

More Details

# Retiree problem

- State vector:  $x_j = \{\vartheta, a_j, \epsilon_j^h\} \in \{1, 2, 3\} \times R \times \{1, 2, 3, 4, 5\}$
- Expectation  $\Rightarrow \mathbb{E}_{\epsilon_{j+1}^h, \epsilon_{j+1}^s | \epsilon_j^h}$

$$V(x_j) = \max_{c_j, \alpha_j} \left\{ u(c_j) + \beta \mathbb{E} \left[ \underbrace{\pi_j(h(\epsilon_j^h))}_{\text{Health-longevity channel}} V(x_{j+1}) + \underbrace{(1 - \pi_j(h(\epsilon_j^h)))}_{\text{Health-longevity channel}} u^{\text{beq}}(a_{j+1}) \right] \right\}$$

s.t.

$$a_{j+1} = \tilde{R}_{j+1} \left( \begin{array}{l} a_j + \text{tr}_j^{\text{ss}}(\bar{y}^\vartheta) + \text{tr}_j^{\text{si}} - \underbrace{o_j(m_j, \epsilon_{j,\vartheta}^{\text{ehi}}, y_j^{\text{agi}}, a_j)}_{\text{Health-exp. channel}} \\ - \text{prem}^{\text{mcare}} - \underbrace{\text{tax}^Y(y_j^{\text{tax}})}_{\text{Health-exp. channel}} - (1 + \tau^c) c_j - \mathbf{1}_{[\alpha_j > 0]} q \end{array} \right)$$

$$\tilde{R}_{j+1} = \overbrace{\alpha_j (1 + \tilde{r}_{\text{net}, j+1}^s (\epsilon_{j+1}^s)) + (1 - \alpha_j) (1 + \tilde{r}_{\text{net}}^b)}^{\text{Health-wealth portfolio channel}}$$

More Details

# Mapping the model to data

# Parametrization, calibration and estimation

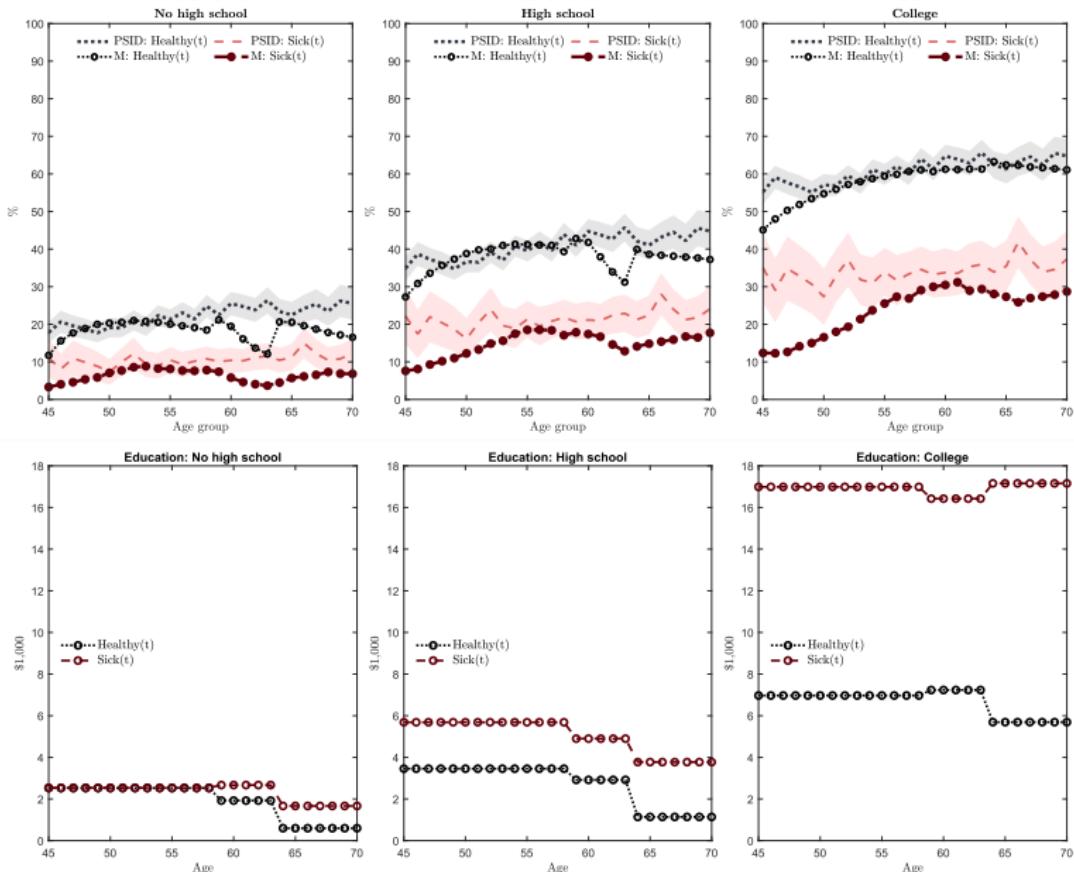
- Data sources:
  - PSID for asset profiles, initial asset distribution
  - MEPS: labor supply, health shocks, health expenditures, coinsurance rates
  - Previous studies: labor productivity process, risk aversion parameter  $\sigma$ , the bequest parameter  $\theta_2$
- Estimation:
  - Paras: time discount factor  $\beta$ , weight on consumption  $\eta$ , strength of bequest  $\theta_1$  and stock market participation costs

$$\Theta = \left\{ \beta, \eta, \theta_1, q(\text{age-group}, \vartheta, \epsilon^h) \right\}$$

- Method of simulated moments

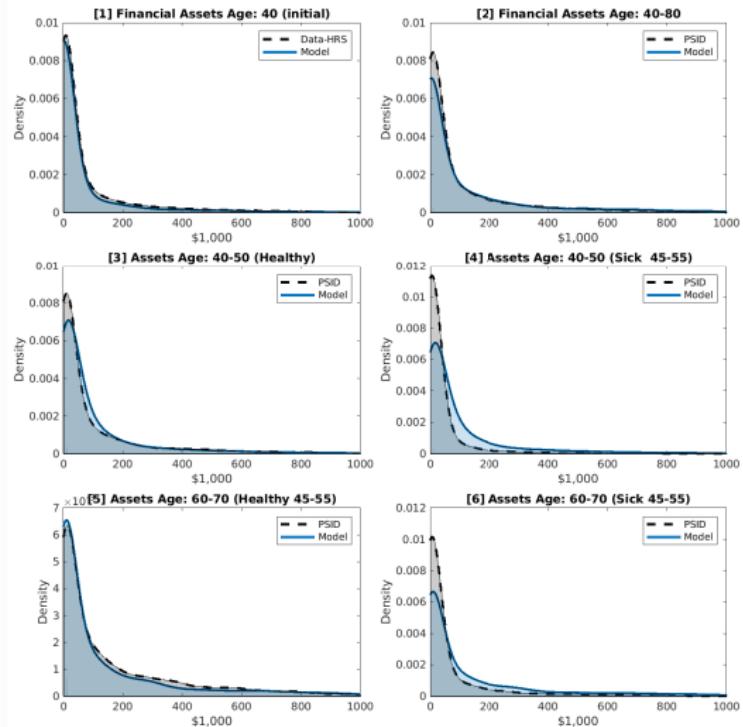
[More calibration/estimation details](#)

# Estimation target: RA participation rate

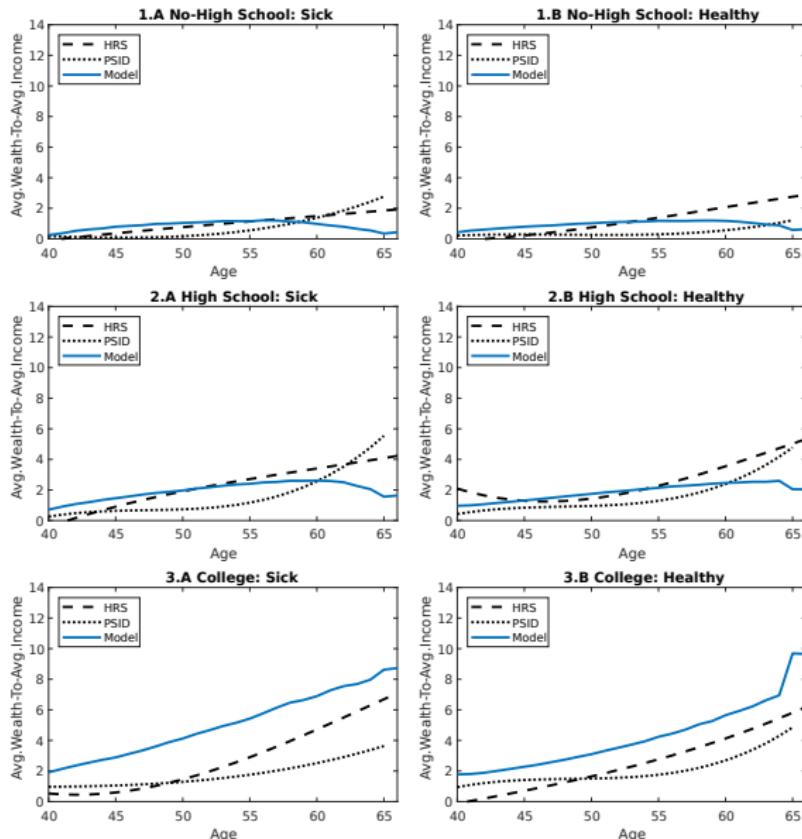


# Performance (not targets)

## Financial asset distribution



# Performance: Wealth-to-income ratio



## Model performance: Selection model

	Model		PSID	
	Stock Share	P(Stocks)	Stock Share	P(Stocks)
Sick at 45_55	0.006*** (0.001)	-0.246*** (0.003)	0.003 (0.015)	-0.271*** (0.051)
Unemployed at 45_55	0.017*** (0.002)	-0.480*** (0.003)	0.034*** (0.012)	-0.175*** (0.047)
Uninsured at 45_55	-0.001 (0.001)	-0.074*** (0.003)	-0.027 (0.026)	-0.382*** (0.076)
Observations	945861		5625	

- Heckman-selection model
- Left: Regression w/ model generated data
- Right: Regression w/ PSID data

# Quantitative Analysis

# Counter factual: Benefits of good health

- Counterfactual
  1. Everybody at age 45–55 draws good health (surprise shock)  
⇒ Simulates control group to individuals who were sick at 45–55
  2. Everybody at age 40–death draws good health
- Keep policy functions unchanged
- Calculate lifetime benefit/cost of good/bad health (annual averages) following [De Nardi, Pashchenko and Porapakkarm \(2024\)](#)

$$\overline{\text{benefit}}_i = \left( \frac{1}{\sum_{j=1}^J 1_{\text{alive}_j}} \right) \sum_{j=1}^J 1_{\text{alive}_j} \times \begin{pmatrix} \text{net of med expens.} \\ \text{always healthy} \\ \overbrace{(y_{ij}^{**} - oop_{ij}^{**})} & - & \overbrace{(y_{ij}^* - oop_{ij}^*)} \\ \text{benchmark} \end{pmatrix}$$

# Counter factual: Benefits of being “Healthy”

	All	By skill level		
		Low	Medium	High
<b>“Healthy” between 45–55</b>				
• % of time in bad health eliminated	8.89%	12.56%	8.10%	5.64%
• Medical cost ↓ + income ↑	\$3,278	\$3,815	\$3,070	\$3,032
• Welfare (CEV)	–	+9.72%	+8.11%	+5.55%
<b>“Healthy” between 40–death</b>				
• % of time in bad health eliminated	16.49%	23.26%	15.24%	10.15%
• Medical cost ↓ + income ↑	\$7,913	\$9,256	\$7,534	\$6,971
• Welfare (CEV)	–	+21.45%	+20.01%	+13.68%

- “Healthy” defined as excellent, very good and good
- Skill types:
  - Low (No high school)
  - Medium (High school)
  - High (College)

# Decomposition: Health-wealth portfolio channel

	Two assets economy		Single asset economy	
	1. Health shocks	2. No-h.s.	3. Hlth shocks	4. No-h.s.
<b>Stock participation</b>				
• Age 65: sick 45–55	34%	n/a	n/a	n/a
• Age 65: healthy 45–55	47%	55%	n/a	n/a
Assets	100	122.2	62.5	71.6
Labor participation	51.40%	68.80%	51.89%	68.42%
Hours (workers)	100	101.98	98.02	102.12
Consumption	100	104.70	98.62	102.15
<b>Wealth-to-income (W/I)</b>				
• W/I at 65: all	4.41	5.42	2.79	3.19
• W/I at 65: sick 45–55	3.12	n/a	2.06	n/a
• W/I at 65: healthy 45–55	5.29	5.42	3.29	3.19

1. **Bench:** Portfolio choice + health shocks (**health-wealth channel active**)
2. Portfolio choice BUT no health shocks (only good health)
3. No portfolio choice + health shocks
4. No portfolio choice AND no h.s. (**health-wealth channel shut off**)

# Decomposition: Wealth gaps

	Two assets economy		Single asset economy	
	1. H.s.	2. No-h.s.	3. H.s.	4. No-h.s.
<b>Wealth gap</b>				
<u>All age groups</u>				
• P90/P50	14.47	8.12 ( $\downarrow 43.9\%$ )	8.92 ( $\downarrow 38.4\%$ )	6.37 ( $\downarrow 56.0\% \) (\downarrow 28.6\%$ )
<u>Age 65</u>				
• P90/P50	15.96	7.72 ( $\downarrow 51.6\%$ )	9.34 ( $\downarrow 41.5\%$ )	5.98 ( $\downarrow 62.5\% \) (\downarrow 36.0\%$ )
<u>Age 65</u>				
<b>No h.s. (45–55)</b>		<b>No h.s. (45–55)</b>		
• P90/P50	15.96	10.23 ( $\downarrow 35.9\%$ )	9.34 ( $\downarrow 41.5\%$ )	6.94 ( $\downarrow 56.5\% \) (\downarrow 25.7\%$ )

Decomposition profiles

# Health insurance expansion

- **Benchmark**
  - Employer-sponsored health insurance (EHI) for workers
  - Medicare for retirees
  - Medicaid for the poor
- **Exp 1: Medicare for all**
  - Expansion of Medicare to all workers and retirees
- **Exp 2: EHI for all workers**
  - Expansion of EHI to all workers while
  - Maintaining Medicare and Medicaid

# Health insurance expansion

Two assets economy w/ health shocks

	Benchmark	Exp1: Medicare for all	Exp2: EHI for all workers
<b>Assets</b>	100	104.3	103.8
<b>Stock participation</b>			
• At 65: sick 45-55	34%	39%	38%
• At 65: healthy 45-55	47%	51%	51%
<b>Wealth gap</b>			
• All age: P90/P50	14.47	10.53 ( $\downarrow 27.2\%$ )	11.23 ( $\downarrow 22.4\%$ )
• At 65: P90/P50	15.96	11.43 ( $\downarrow 28.4\%$ )	12.18 ( $\downarrow 23.68\%$ )
<b>Welfare (CEV)</b>	0	+1.97	+1.93

**Note:** Partial equilibrium results. Reforms are not financed!

# Conclusion

# Conclusion

- Study dynamic effects of health shocks on savings, portfolio choice and wealth accumulation over lifecycle
- Empirical analysis using PSID + HRS and panel regression models
- **Structural lifecycle model** w/ savings (portfolio) decisions, health shocks, health insurance
- Long-lasting effects of bad health (when “young”) on stock market participation, portfolio choice and wealth gaps
- **Health-wealth portfolio channel** is quantitatively important for wealth disparity
- Important role of health insurance for reducing wealth gap over lifecycle

Thank you!

# Supplementary material

# Related literature I

- Lifecycle portfolio investment literature starting with Samuelson (1969); Merton (1971) and recent surveys in Gomes (2020) and Gomes, Haliassos and Ramadorai (2021)
- Health and wealth inequality
  - Medical expenditures and access to health insurance: De Nardi, French and Jones (2010); Nakajima and Telyukova (2024); Chen, Feng and Gu (2025); De Nardi, Pashchenko and Porapakkarm (2024)
  - Health on labor supply and productivity: Prados (2018); Capatina and Keane (2023); Hosseini, Kopecky and Zhao (2021)
  - Lifestyle behaviors: Mahler and Yum (2024)
- Wealth on proportion of risky assets has mixed results
  - positive effect: Wachter and Yogo (2010)
  - minor effect: Brunnermeier and Nagel (2008)
  - negative effect: Liu, Liu and Cai (2021)
- Additional channels
  - stock market entry/adjustment costs: Alan (2006); Bonaparte, Cooper and Zhu (2012); Fagereng, Gottlieb and Guiso (2017)
  - education: Cocco, Gomes and Maenhout (2005); Cooper and Zhu (2016)

## Related literature II

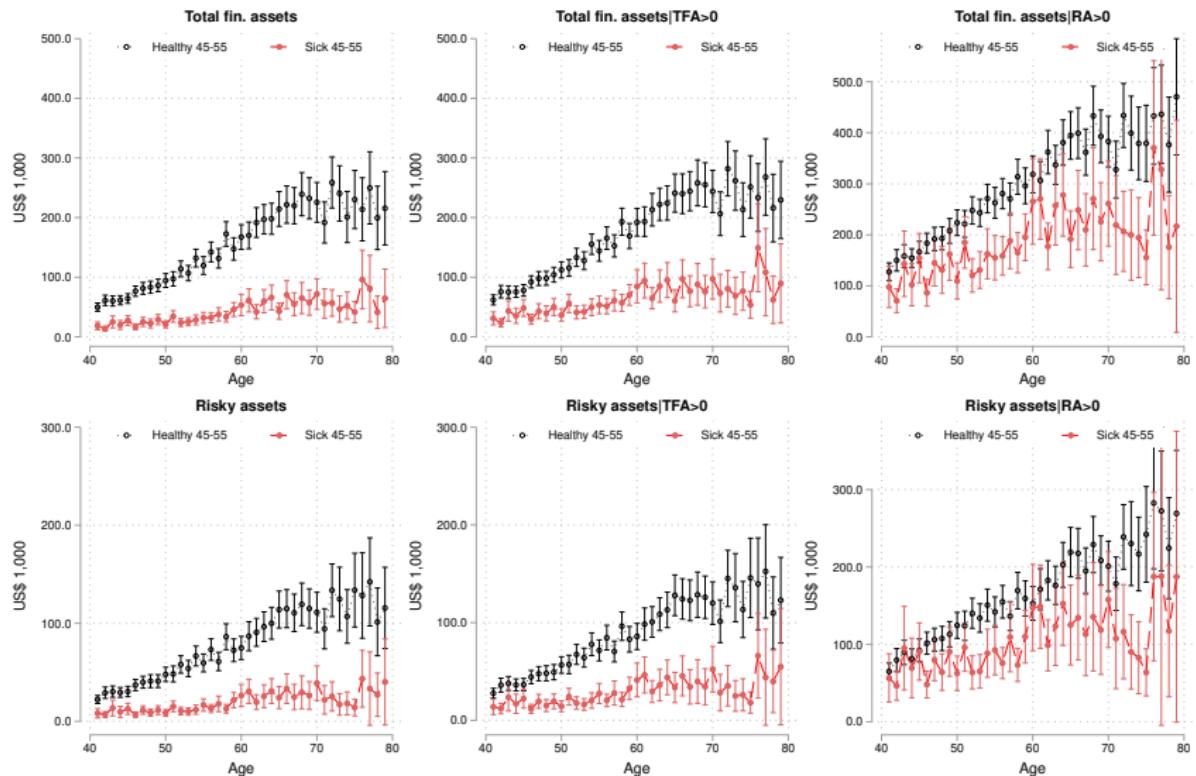
- unemployment: Baglano, Fugazza and Nicodano (2014); Baglano, Fugazza and Nicodano (2019)
- household composition: Inkmann, Michaelides and Zhang (2022)
- demographics and composition of 401k: Egan, MacKay and Yang (2021)
- introduction of Pension Protection Act of 2006: Parker et al. (2022)
- longevity annuities: Zhou, Li and Zhou (2022)
- reverse mortgages: Nakajima and Telyukova (2017); Hambel, Kraft and Meyer-Wehmann (2022)
- cyclicalities of skewness of income shocks: Catherine (2022)
- Estimated structural lifecycle models of portfolio choice and retirement: Yogo (2016); Fagereng, Gottlieb and Guiso (2017); Gomes and Smirnova (2021)
- Calibrated lifecycle models with liquidity costs of stocks and long-term bonds: Campanale, Fugazza and Gomes (2015) and Tischbirek (2019)
- Empirical lit. of **health spending** and **health insurance** on portfolio choice of **elderly**: Goldman and Maestas (2013); Ayyagari and He (2016)
  - Early life health status: Böckerman, Conlin and Svento (2021)
  - Current health status: Rosen and Wu (2004)
  - Subjective health status: Bressan, Pace and Pelizzon (2014)
  - Expected future health shocks: Edwards (2008)

# Related literature III

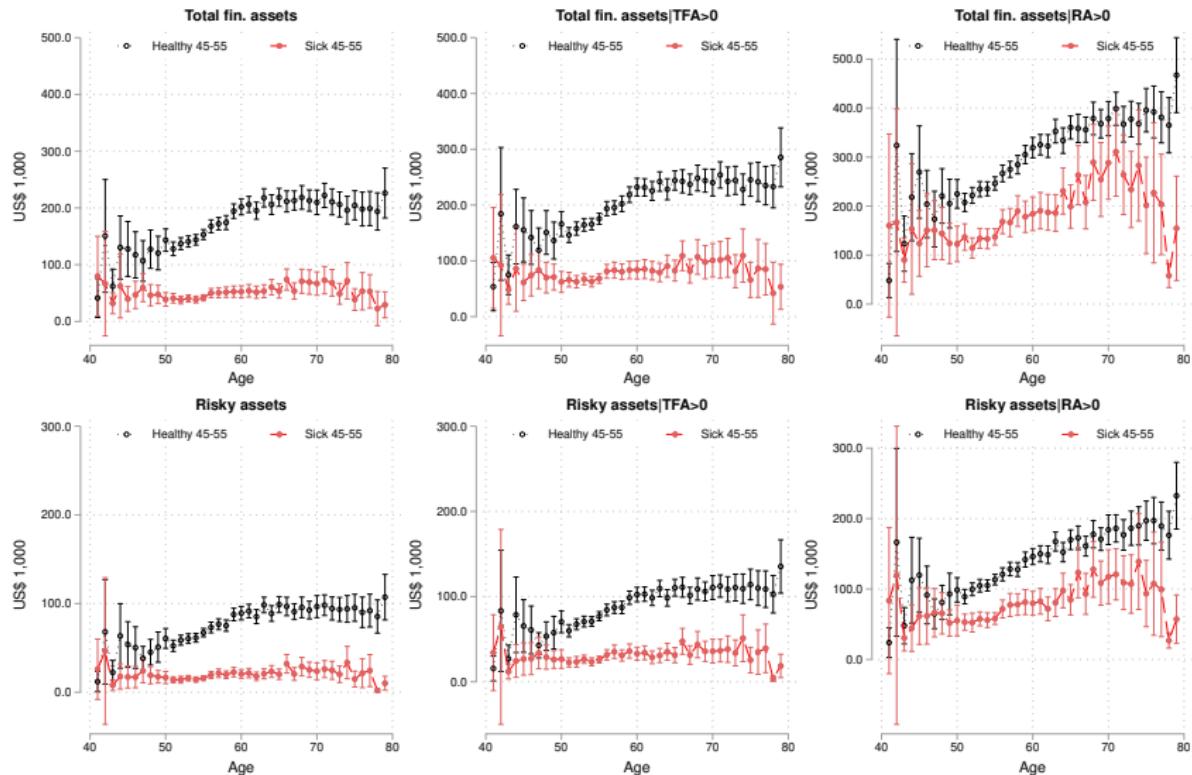
- Empirical **financial literacy**
  - Cognitive abilities and investment decisions: Christelis, Jappelli and Padula (2010); Agarwal and Mazumder (2013); Gamble et al. (2015); Lindeboom and Melnychuk (2015); Mazzonna and Peracchi (2020); Shimizutani and Yamada (2020)
  - Role of financial advising: Rossi and Utkus (2020, 2021)

[Back to literature](#)

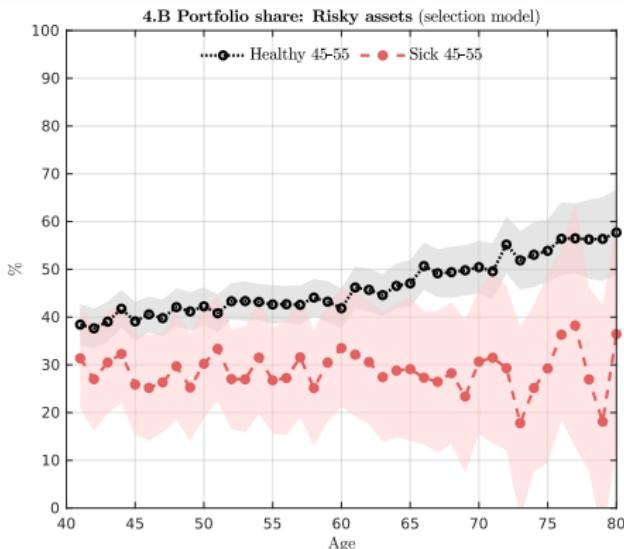
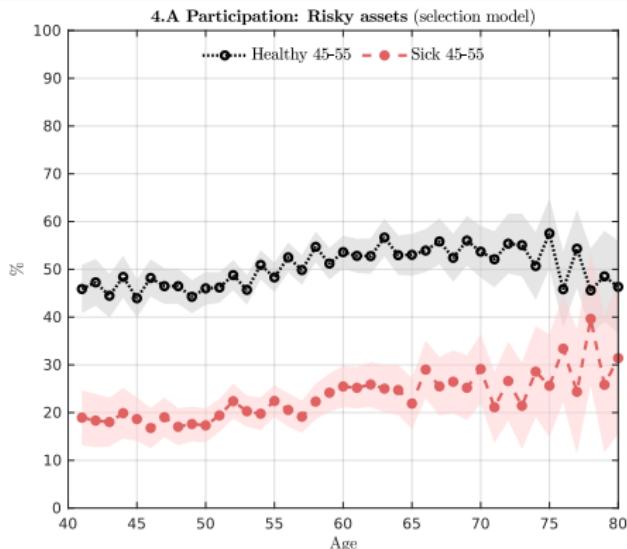
# Financial assets over lifecycle: PSID



# Financial assets over lifecycle: HRS

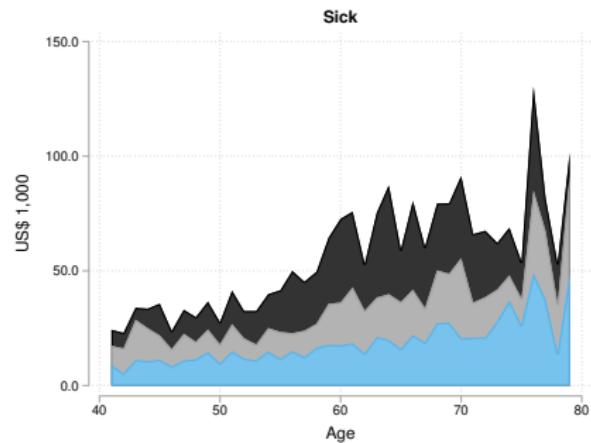
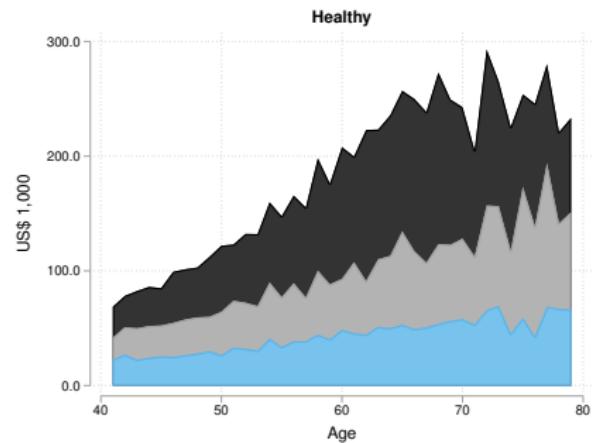


# Stock market activities over lifecycle

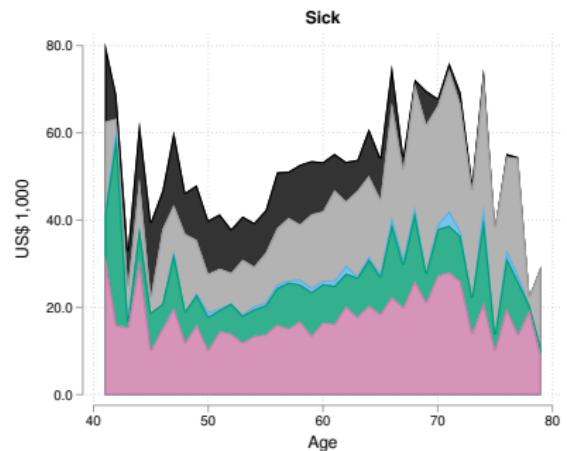
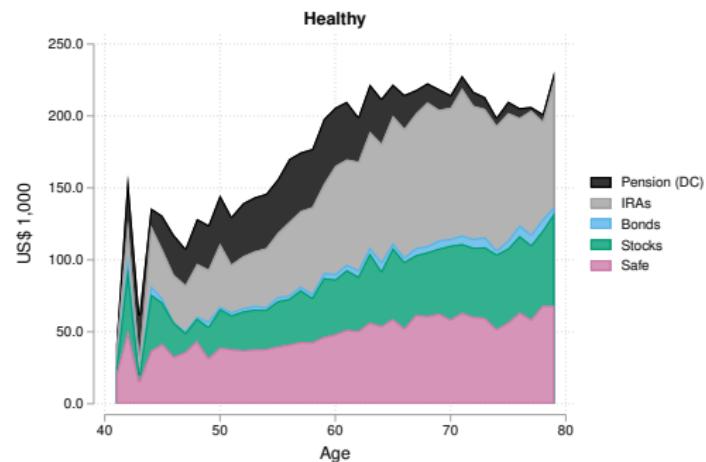


[Back to HRS variable definitions](#)

# PSID - Asset share by health status 45–55



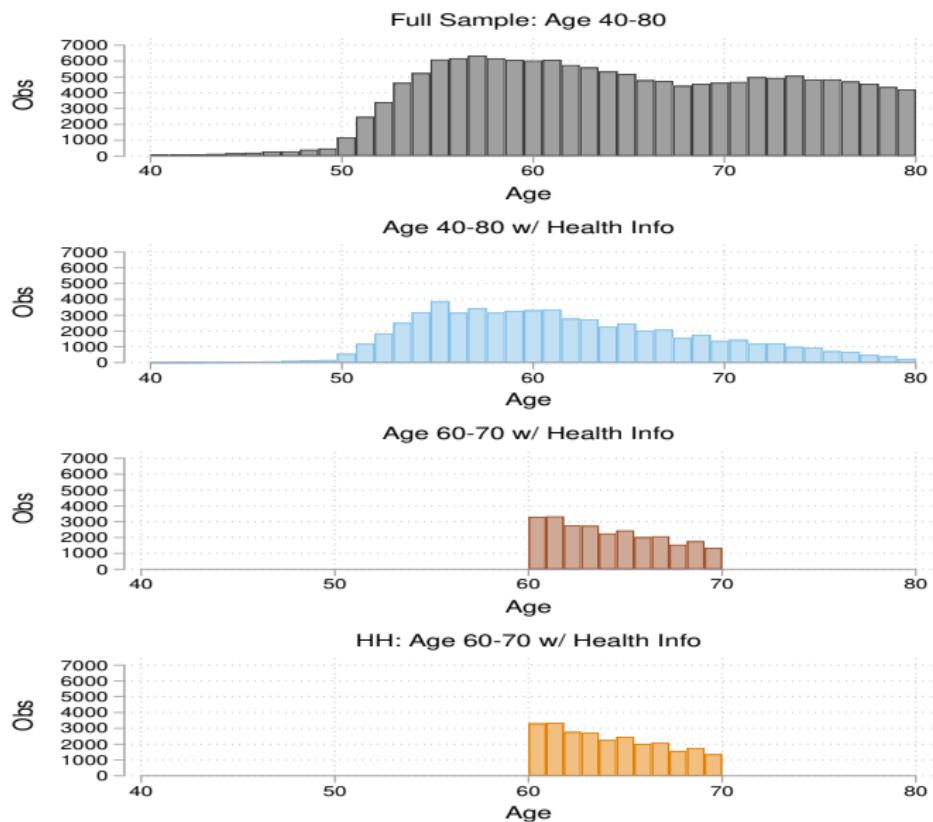
# HRS - Asset share by health status 45–55



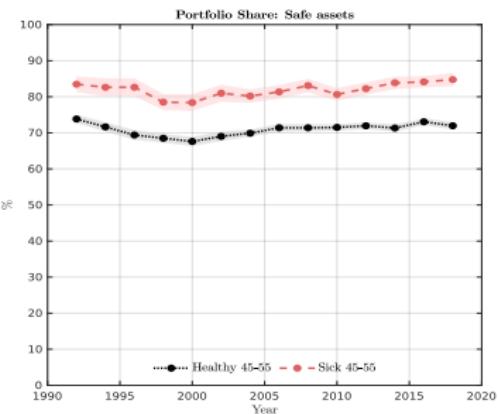
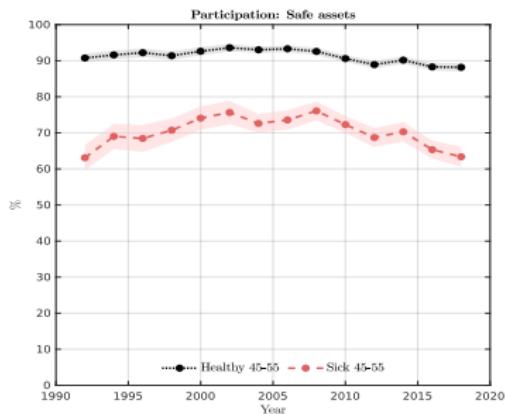
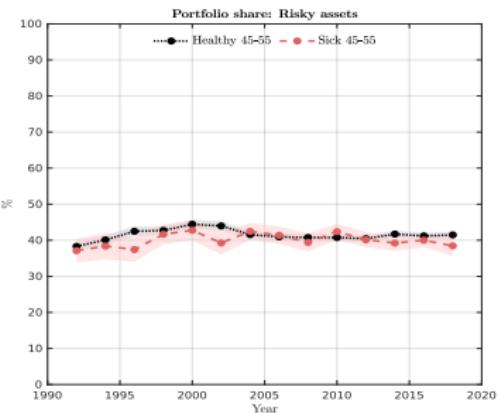
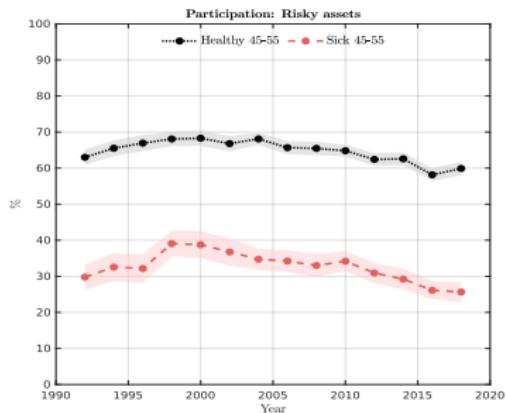
# Health & Retirement Study (RAND-HRS) 1992–2018

- Health and Retirement Study (RAND-HRS) - panel data survey
- The majority of them are between 51–61 years
- Limit sample to heads of households and age group of 40–80 with wealth info
- In regressions we use reduced sample of 60–70 year olds
- Variables: labor market behavior, educational attainment, family background, government program participation, family life, health issues, assets, and income

# HRS: Full and restricted sample



# Asset holdings over time



# HRS summary statistics I

	(1) w/H.Info Age:40-80	(2) Sick 45-55 A:40-80	(3) Alive60-70 A:40-80	(4) All A:60-70	(5) w/H.Info A:60-70	(6) Sick 45-55 A:60-70	H
Sick at 45_55	0.30	1.00	0.28	0.27	0.27		1.00
Health Lim.Wrk at 45_55	0.27	0.62	0.26	0.25	0.25		0.60
Health Limits Work	0.30	0.58	0.31	0.34	0.34		0.63
Spouse: Health Limits Work	0.24	0.32	0.25	0.27	0.27		0.36
Unemployed at 45_55	0.30	0.57	0.28	0.27	0.27		0.53
Uninsured at 45_55	0.29	0.35	0.28	0.27	0.27		0.34
P(Stocks incl. 401k)	0.48	0.26	0.50	0.47	0.49		0.25
P(Safe Assets incl.401k)	0.80	0.63	0.81	0.81	0.82		0.65
Risky Assets incl. 401k (\$1,000)	61.38	19.31	67.08	66.92	73.60		22.46
Risky Assets excl. 410k (\$1,000)	51.35	15.43	57.21	60.65	64.55		19.21
Safe Assets incl. 401k (\$1,000)	79.55	30.16	85.19	86.04	94.45		35.42
Safe Assets excl.401k (\$1,000)	65.13	24.58	70.99	77.01	81.44		30.75
Risky Asset Share	0.20	0.10	0.21	0.20	0.20		0.10
Safe Asset Share	0.60	0.52	0.61	0.62	0.62		0.55
Safe Assets incl. Bonds (\$1,000)	38.30	16.26	41.26	45.96	45.46		19.62
Stocks and mutual funds (\$1,000)	28.69	8.39	32.08	34.41	34.15		9.81
Bonds (\$1,000)	2.76	0.81	3.14	3.70	3.45		1.02
IRA/Keogh net value (\$1,000)	49.50	15.36	54.85	57.29	66.37		20.53
DC pension wealth (\$1,000)	24.44	9.46	24.08	15.30	22.06		7.92
Debt (\$1,000)	6.81	6.97	6.40	5.12	5.75		5.23
Net value of primary residence (\$1,000)	115.08	63.48	121.96	124.29	134.84		74.12
Mortgage (\$1,000)	46.91	27.83	45.72	34.24	43.52		25.76
Other home loans (\$1,000)	3.99	1.89	4.27	3.40	4.31		2.04
Income Risk Aversion	3.20	3.26	3.20	3.29	3.25		3.33
Financial planning horizon	3.11	2.86	3.11	3.03	3.07		2.79
Prob. live to 75	61.35	48.72	62.07	62.78	61.98		49.32

# HRS summary statistics II

Prob. live to 85	41.30	30.98	41.48	42.84	42.67	30.56
Age	59.85	58.62	61.42	64.63	64.15	63.92
Female	0.31	0.39	0.29	0.34	0.29	0.39
Married/Partnered	0.58	0.47	0.58	0.56	0.58	0.45
Nr. Children Alive	2.91	3.15	2.97	3.19	3.00	3.27
Black	0.22	0.30	0.21	0.21	0.20	0.28
Hispanic	0.13	0.21	0.12	0.11	0.12	0.20
No high school degree	0.25	0.43	0.25	0.30	0.25	0.45
High school degree	0.52	0.48	0.52	0.50	0.51	0.46
College or higher	0.23	0.10	0.23	0.20	0.23	0.09
Labor income (\$1,000)	32.20	16.12	30.46	19.98	23.39	9.80
Pre-govt HH income (\$1,000)	76.37	43.80	76.45	66.74	73.35	40.59
Employed	0.52	0.35	0.48	0.32	0.36	0.21
Receives Social Security	0.72	0.76	0.84	0.90	0.88	0.91
Health Excellent	0.12	0.02	0.12	0.11	0.09	0.02
Health Very Good	0.28	0.07	0.29	0.27	0.28	0.08
Health Good	0.32	0.23	0.32	0.32	0.33	0.27
Health Fair	0.20	0.46	0.20	0.21	0.21	0.41
Health Poor	0.08	0.22	0.08	0.09	0.08	0.22
First rep. health Excellent	0.20	0.02	0.22	0.20	0.22	0.02
First rep. health Very Good	0.28	0.06	0.28	0.27	0.28	0.06
First rep. health Good	0.29	0.16	0.28	0.29	0.29	0.15
First rep. health Fair	0.16	0.52	0.14	0.16	0.14	0.52
First rep. health Poor	0.07	0.24	0.07	0.08	0.07	0.25
Healthy	0.72	0.32	0.72	0.70	0.71	0.37
Body Mass Index	28.95	30.44	28.81	28.50	29.01	30.48
Smoker	0.23	0.31	0.21	0.19	0.19	0.25
OOP health exp. (\$1,000)	3.02	3.70	3.12	3.30	3.34	3.69
Total OOP exp. HH (\$1,000)	4.90	5.30	5.12	5.26	5.54	5.49
Insured	0.83	0.81	0.85	0.88	0.88	0.87
Uninsured	0.17	0.19	0.15	0.12	0.12	0.13

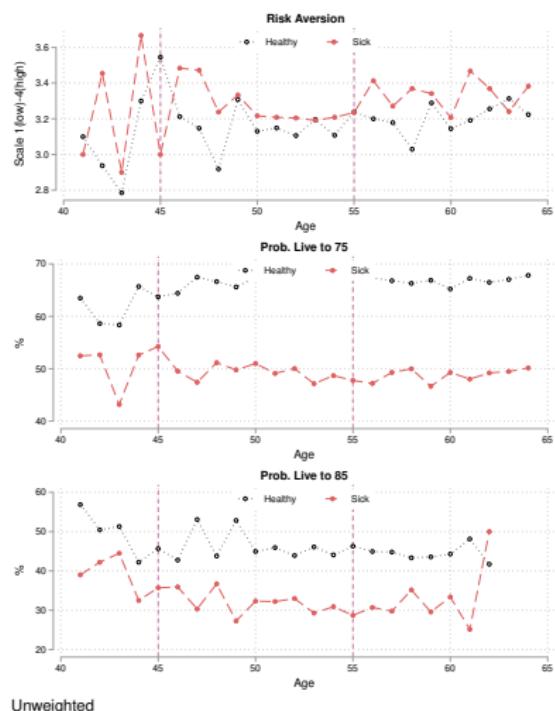
# HRS summary statistics III

Public health insurance	0.32	0.47	0.34	0.42	0.41	0.59
Private health insurance	0.52	0.34	0.51	0.46	0.47	0.28
Observations	73465	22243	59262	54707	24773	6755

# HRS summary statistics IV

[Back to HRS variable definitions](#)

# Preference/belief differences by type



Back to HRS variable definitions

# HRS: Stock share at 60–70

	(1)	(2)	(3)	(4)	(5)
Sick at 45_55	-0.025*** (0.007)	-0.030*** (0.009)	-0.038*** (0.010)	0.003 (0.015)	-0.002 (0.012)
Unemployed at 45_55	-0.026*** (0.007)	-0.027*** (0.009)	-0.029*** (0.010)	0.005 (0.014)	-0.003 (0.012)
Uninsured at 45_55	-0.024*** (0.007)	-0.013 (0.009)	-0.029*** (0.009)	0.006 (0.014)	0.020* (0.012)
Observations	6144	6111	6144	3072	3065
R <sup>2</sup>	0.290	0.284			0.080
Conditional P(Y>0)	No	No	No	Yes	Yes
Random Effects	No	No	Yes	Yes	No
Weighted	No	Yes	No	No	Yes

# Selection model: PSID (top) and HRS (bottom)

	Stock Share	P(Stocks)	Safe A. Share	P(Safe A.)
Sick at 45_55	0.003 (0.015)	-0.271*** (0.051)	0.036*** (0.009)	-0.198*** (0.058)
Unemployed at 45_55	0.034*** (0.012)	-0.175*** (0.047)	0.003 (0.008)	-0.232*** (0.053)
Uninsured at 45_55	-0.027 (0.026)	-0.382*** (0.076)	0.044*** (0.012)	-0.170*** (0.064)
Observations	5625		5625	

	Stock Share	P(Stocks)	Safe A. Share	P(Safe A.)
Sick at 45_55	-0.008 (0.007)	-0.289*** (0.026)	0.040*** (0.005)	-0.200*** (0.027)
Unemployed at 45_55	0.006 (0.006)	-0.248*** (0.023)	0.023*** (0.004)	-0.179*** (0.026)
Uninsured at 45_55	-0.011* (0.006)	-0.317*** (0.023)	0.043*** (0.005)	-0.272*** (0.025)
Observations	24007		24007	

Back to PSID regression results

# PSID - Two Part Model

	Stock Share	P(Stocks)	Safe A. Share	P(Safe A.)
Sick at 45_55	0.000 (0.015)	-0.095*** (0.018)	0.040*** (0.011)	-0.039*** (0.013)
Unemployed at 45_55	0.035*** (0.013)	-0.035** (0.016)	-0.006 (0.010)	-0.039*** (0.011)
Uninsured at 45_55	-0.003 (0.027)	-0.122*** (0.019)	0.052*** (0.012)	-0.097*** (0.021)
Observations	2335	5625	4746	5625

## HRS - Two Part Model

	Stock Share	P(Stocks)	Safe A. Share	P(Safe A.)
Sick at 45_55	-0.003 (0.012)	-0.077*** (0.018)	0.031*** (0.010)	-0.055*** (0.014)
Health Lim.Wrk at 45_55				
Unemployed at 45_55	-0.003 (0.012)	-0.070*** (0.016)	0.036*** (0.010)	-0.011 (0.012)
Uninsured at 45_55	0.018 (0.012)	-0.061*** (0.015)	0.010 (0.010)	-0.046*** (0.012)
Observations	3065	6111	5111	6111

[Back to PSID regression results](#)

# Preferences

- Preferences

$$u(c_j, \ell_j; \bar{n}_j) = \frac{\left( \left( \frac{c_j}{\omega_{j,\vartheta}} \right)^\eta \times [\ell_j - 1_{[0 < n_j]} \times \bar{n}_j]^{1-\eta} \right)^{1-\sigma}}{1-\sigma} + \bar{u}$$

- Warm-glow bequest

$$u^{\text{beq}}(a_j) = \theta_1 \frac{(a_j + \theta_2)^{(1-\sigma)\eta}}{1-\sigma}$$

# Health

- Health:

- 5 idiosyncratic (exogenous) health groups  $\epsilon^h \in \{1, 2, 3, 4, 5\}$
- Age dependent health expenditure  $m(j, \vartheta, \epsilon^h)$
- Health state:

$$h(\epsilon^h) = \begin{cases} \text{healthy} & \text{if } \epsilon^h \in \{\text{excellent, very good, good}\}, \\ \text{sick} & \text{if } \epsilon^h \in \{\text{fair, poor}\}. \end{cases}$$

- Survival probability:  $\pi(h(\epsilon^h))$

- Health and labor income shocks:

$$\Pr(\epsilon_{j+1}^h | \epsilon_j^h) \in \Pi^h(j, \vartheta), \quad \Pr(\epsilon_{j+1}^{incP} | \epsilon_j^{incP}) \in \Pi_j^{incP}$$

# Health insurance

- **Workers:** exogenous employer HI

$$\epsilon_{j,\vartheta}^{\text{ehi}} = \begin{cases} 0 & \text{not privately insured,} \\ 1 & \text{privately health insurance,} \end{cases} \quad \text{for } j \leq J_w$$

- $\epsilon_{j,\vartheta}^{\text{ehi}}$  follows Markov process with  $P(\epsilon_{j+1,\vartheta}^{\text{ehi}} | \epsilon_{j,\vartheta}^{\text{ehi}}) \in \Pi_{j,\vartheta}^{\text{ehi}}$
- Coinsurance:  $\gamma^{\text{ehi}}$
- Premium:  $\text{prem}_j^{\text{Ins}}$
- **Poor:** qualify for Medicaid w/ coinsurance  $\gamma^{\text{maid}}$  if  
 $y_j^{\text{agi}} < y^{\text{maid}}$  and  $a_j < a^{\text{maid}}$
- **Retired**  $j > J_1$  have Medicare w/ coinsurance  $\gamma^{\text{mcare}}$  and premium  $\text{prem}^{\text{mcare}}$

# Out-of-pocket health spending

$$o_j(m_j, \epsilon_{j,\vartheta}^{\text{ehi}}, y_j^{\text{agi}}, a_j) =$$
$$= \begin{cases} \underbrace{1_{[\text{maid-yes}]}}_{\text{primary HI}} \gamma^{\text{maid}} \times m(j, \vartheta, \epsilon_j^h) & \text{if } \underbrace{\epsilon_{j,\vartheta}^{\text{ehi}} = 0 \wedge j \leq J_w}_{\text{working, no private HI}} \\ \underbrace{1_{[\text{maid-yes}]}}_{\text{Medicaid is secondary HI}} \gamma^{\text{maid}} \times \left( \underbrace{\gamma^{\text{ehi}}}_{\text{primary}} \times m(j, \vartheta, \epsilon_j^h) \right) & \text{if } \underbrace{\epsilon_{j,\vartheta}^{\text{ehi}} = 1 \wedge j \leq J_w}_{\text{working, with private HI}} \\ \underbrace{1_{[\text{maid-yes}]}}_{\text{Medicaid is secondary HI}} \gamma^{\text{maid}} \times \left( \underbrace{\gamma^{\text{mcare}}}_{\text{primary}} \times m(j, \vartheta, \epsilon_j^h) \right) & \text{if } \underbrace{j > J_w}_{\text{retired, with Medicare}} \end{cases}$$

# Labor income

- Profile by health type:  $\bar{e}_j = \bar{e}(j, \vartheta, h(\epsilon^h))$
- Exogenous income shock:  $e_j(\vartheta, \epsilon^h, \epsilon^{incP}) = \bar{e}_j(\vartheta, h(\epsilon^h)) \times \epsilon^{incP}$
- Labor income:  $y_j(\ell_j, \vartheta, \epsilon_j^{incP}, \epsilon_j^h) = \widehat{w} \times \overbrace{e_j(\vartheta, \epsilon_j^{incP}, \epsilon^h)}^{\text{Health-dependent income}} \times (1 - \ell_j)$

# Savings/Assets

- Two types of assets
  - risk-free bond  $b$  w/ real return  $r^b$
  - risky stock  $s$  w/ return  $\tilde{r}^s = r^b + \mu^s + \epsilon^s$  and risk premium  $\mu_s > 0$ , stoch. return  $\epsilon^s \sim N(0, \sigma_{\epsilon^s}^2)$
  - assume:  $\tilde{r}^s = \frac{1+\tilde{g}+d}{1+\pi} - 1$
- Net returns (see Gomes, Michaelides and Polkovnichenko, 2009)

$$\bar{r}_{net}^b = \frac{1 + [(r^b + 1)(1 + \pi) - 1](1 - \tau^d)}{1 + \pi} - 1$$
$$\bar{r}_{net}^s = \frac{1 + \tilde{g}(\epsilon^s)(1 - \tau^g) + d(1 - \tau^d)}{1 + \pi} - 1$$

- W/ exogenous parameters
  - $d, \tilde{g}$ : dividend vs. capital gains
  - $\tau^d, \tau^g$ : dividend vs. capital gains tax
  - $\pi$  inflation
- Borrowing limit  $b_{j+1} \geq b$ , stock holdings  $s_{j+1} \geq 0$
- Transaction cost  $q_\theta$  when investing in risky asset

# Taxes and transfers

- Taxes
  - Labor income (Benabou 2002; Heathcote, Storesletten and Violante 2017)
$$\text{tax}^y(y_j^{\text{tax}}) = \max \left[ 0, y_j^{\text{tax}} - \lambda \times (y_j^{\text{tax}})^{(1-\tau)} \right]$$
    - $0 < \tau < 1$  progressivity
    - $\lambda$  scaling
  - Payroll:  $\text{tax}^{\text{ss}}(y_j^{\text{ss}}; \bar{y}^{\text{ss}})$  and  $\text{tax}^{\text{mcare}}(y_j^{\text{ss}})$
  - Consumption:  $\tau^c$
  - Capital:  $\tau^d$  on dividends and  $\tau^g$  on capital gains

- Transfers
  - Social Security:  $\text{tr}^{\text{ss}}$
  - Medicare, Medicaid
  - Lump-sum transfers  $\text{tr}^{\text{si}}$  to guarantee  $c_{\min}$

[Back to model overview](#)

# Worker Problem I

- State vec:  $x_j = \{\vartheta, a_{j,.}, \epsilon_j^{incP}, \epsilon_j^h, \epsilon_j^{ehi}\} \in \{1, 2, 3\} \times R \times \{1, 2, 3, 4\} \times \{1, 2, 3, 4, 5\} \times \{0, 1\}$

# Worker Problem II

- Expectation  $\Rightarrow \mathbb{E}_{\epsilon_{j+1}^{incP}, \epsilon_j^h, \epsilon_{j+1}^{ehi}, \epsilon_{j+1}^s | \epsilon_j^{incP}, \epsilon_j^h, \epsilon_j^{ehi}}$

$$V(x_j) = \max_{\{c_j, \ell_j, \alpha_j\}} \left\{ u(c_j, \ell_j) + \beta \mathbb{E} \left[ \underbrace{\pi_j(h(\epsilon_j^h))}_{\text{Hlth-long channel}} V(x_{j+1}) + \underbrace{(1 - \pi_j(h(\epsilon_j^h)))}_{\text{Health-longevity channel}} u^{\text{beq}}(a_{j+1}) \right] \right\}$$

s.t.

$$a_{j+1} = \tilde{R}_{j+1} \left( \begin{array}{c} \text{Health income channel} \quad \text{Health-expenditure channel} \\ a_j + y_j(\ell_j, \vartheta, \epsilon_j^{incP}, \epsilon_j^h) + \text{tr}_j^{\text{si}} - o_j(m_j, \epsilon_j^{ehi}, y_j^{\text{agi}}, a_j) \\ -1_{[\epsilon_j^{ehi}=1]} \underbrace{\text{prem}_j^{\text{ehi}}}_{\text{Health-exp. channel}} \quad \underbrace{-\text{tax}_j}_{\text{Health-exp. channel}} \quad -(1 + \tau^c) c_j - 1_{[\alpha_j > 0]} q \end{array} \right)$$

$$\tilde{R}_{j+1} = \overbrace{\alpha_j(1 + \tilde{r}_{net,j+1}^s) + (1 - \alpha_j)(1 + \bar{r}^b)}^{\text{Health-wealth portfolio channel}}$$

$$\text{tax}_j = \text{tax}^y(y_j^{\text{tax}}) + \text{tax}^{\text{ss}}(y_j^{\text{ss}}; \bar{y}^{\text{ss}}) + \text{tax}^{\text{mcare}}(y_j^{\text{ss}})$$

$$b \leq b_{j+1}, 0 \leq s_{j+1}$$

# Worker Problem III

- Total taxable income  $y_j^{\text{tax}}$  and payroll tax eligible income  $y_j^{\text{ss}}$

$$y_j^{\text{tax}} = y_j - 1_{[\text{in}_{j+1}=2]} \text{prem}_j^{\text{ehi}}$$

$$- \max \left[ 0, o_j \left( m_j, \epsilon_{j,\vartheta}^{\text{ehi}}, y_j^{\text{agi}}, a_j \right) - 0.075 \times (y_j + r_b b_j + r_s s_j) \right]$$

$$y_j^{\text{ss}} = y_j - 1_{[\text{in}_{j+1}=2]} \text{prem}_j^{\text{ehi}}$$

- Taxes

$$\text{tax}_j = \text{tax}^{\text{y}}(y_j^{\text{tax}}) + \text{tax}^{\text{ss}}(y_j^{\text{ss}}; \bar{y}^{\text{ss}}) + \text{tax}^{\text{mcare}}(y_j^{\text{ss}})$$

$$\text{tax}^{\text{ss}}(y_j^{\text{ss}}; \bar{y}^{\text{ss}}) = \tau^{\text{ss}} \times \min [y_j^{\text{ss}}; \bar{y}^{\text{ss}}]$$

$$\text{tax}^{\text{mcare}}(y_j^{\text{ss}}) = \tau^{\text{mcare}} \times y_j^{\text{ss}}$$

# Worker Problem IV

- Transfers

$$\begin{aligned}\text{tr}_j^{\text{si}} &= \max [0, c_{\min} + o(m_j) - y_j^{\text{at}} - a_j] \\ y_j^{\text{at}} &= y_j - \text{tax}_j\end{aligned}$$

- Average past labor earnings:

$$\bar{y}^\vartheta = \int_{j \leq J_r} w \times e(x) \times n(x) d\Lambda(x_j(\vartheta))$$

[Back to worker problem](#)

# Retiree's Dynamic Optimization Problem I

- State vector:  $x_j = \{\vartheta, a_j, \epsilon_j^h\} \in \{1, 2, 3\} \times R \times \{1, 2, 3, 4, 5\}$
- Expectation  $\Rightarrow \mathbb{E}_{\epsilon_{j+1}^h, \epsilon_{j+1}^s | \epsilon_j^h}$

$$V(x_j) = \max_{c_j, \alpha_j} \left\{ u(c_j) + \beta \mathbb{E} \left[ \underbrace{\pi_j(h(\epsilon_j^h))}_{\text{Health-longevity channel}} V(x_{j+1}) + \underbrace{(1 - \pi_j(h(\epsilon_j^h)))}_{\text{Health-longevity channel}} u^{\text{beq}}(a_{j+1}) \right] \right\}$$

s.t.

$$a_{j+1} = \tilde{R}_{j+1} \left( \begin{array}{l} a_j + \text{tr}_j^{\text{ss}}(\bar{y}^\vartheta) + \text{tr}_j^{\text{si}} - \underbrace{o_j(m_j, \epsilon_{j,\vartheta}^{\text{ehi}}, y_j^{\text{agi}}, a_j)}_{\text{Health-expenditure channel}} \\ - \text{prem}_j^{\text{mcare}} \underbrace{-\text{tax}^Y(y_j^{\text{tax}})}_{\text{Health-exp. channel}} - (1 + \tau^c) c_j - 1_{[\alpha_j > 0]} q \end{array} \right)$$

$$\tilde{R}_{j+1} = \overbrace{\left( \alpha_j (1 + \tilde{r}_{\text{net}, j+1}^s) + (1 - \alpha_j) (1 + \tilde{r}^b) \right)}^{\text{Health-wealth portfolio channel}}$$

$$\underline{b} \leq b_{j+1}$$

$$0 \leq s_{j+1}$$

# Retiree's Dynamic Optimization Problem II

$$y_j^{\text{tax}} = \text{tr}_j^{\text{ss}} - \max [0, (o_j(m_j) + \text{prem}^{\text{mcare}}) - 0.075 \times (r_b \times b_j + r_s \times s_j + \text{tr}_j^{\text{ss}})]$$

$$\text{tr}_j^{\text{si}} = \max [0, c_{\min} + o_j(m_j) + \text{prem}^{\text{mcare}} + \text{tax}^Y(y_j^{\text{tax}}) - a_j - \text{tr}_j^{\text{ss}}]$$

[Back to retired problem](#)

# Estimated parameters

Parameters	Value	Std. error	P-value
Time discount factor: $\beta$	0.9848	0.0006	0.000
Consumption weight: $\eta$	0.2753	0.004	0.009
Strength of bequest motive: $\theta_1$	108.59	24.97	0.025
Stock market participation cost: $q(\text{age-group}, \vartheta, \epsilon^h)$			
Age 40–59	Fig. above		
Age 60–64	Fig. above		
Age 65–80	Fig. above		

Estimation targets:

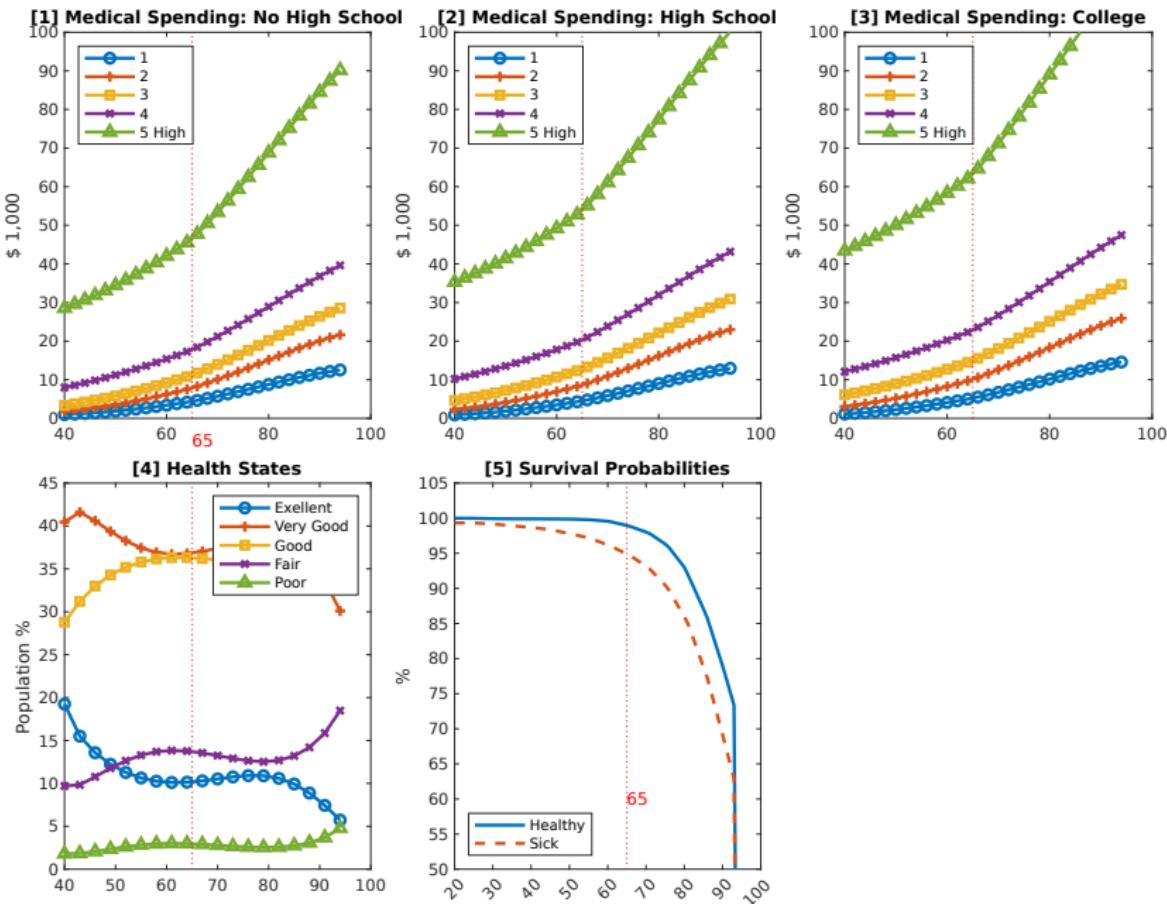
- Wealth-to-income ratio at 65
- Avg. work participation 40–64
- Asset holdings of 85 year olds
- Risky asset market participation rates by education, health and age
  - three education levels (low, medium and high), two health status (sick and healthy), and three age groups (40-59, 60-64, 65-80)

[Back to calibration](#)

# Exogenous parameters

Parameter description	Parameter values	Source
Periods	$J = 55$	
Work periods	$J_w = 25$	Age 40–64
Years modeled	years = 55	Age 40–94
Relative risk aversion	$\sigma = 3$	Standard values between 2.5 – 3.5
Survival probabilities	$\pi_j(h(\epsilon^h))$ see online appendix	İmrohoroglu and Kitao (2012)
Health Shocks	$\epsilon_j^h$ see online appendix	MEPS 1996–2018
Health transition prob.	$\Pi_j^h$ see online appendix	MEPS 1996–2018
Persistent labor shock autocor.	$\rho = 0.977$	French (2005)
Risk premium	$\mu = 0.04$	Mehra and Prescott (1985)
Risk free rate	$r^b = 0.02$	McGrattan and Prescott (2000)
RA log return std. dev.	$\sigma_{\epsilon^s} = 0.157$	Mehra and Prescott (1985)
Variance of transitory labor shock	$\sigma_{\epsilon^{\text{incP}}}^2 = 0.0141$	French (2005)
Bias adjusted wage profile	$\bar{\epsilon}_j(\vartheta, h(\epsilon^h))$ see online appendix	MEPS 1996–2018
Private employer HI	$\gamma^{\text{ehi}} = 0.31$	MEPS 1996–2018
Medicaid coinsurance	$\gamma^{\text{maid}} = 0.11$	MEPS 1996–2018
Medicare coinsurance	$\gamma^{\text{mcare}} = 0.30$	MEPS 1996–2018
Consumption tax	$\tau^c = 5\%$	IRS
Bequest parameter	$\theta_2 = \$500,000$	De Nardi (2004); French (2005)
Payroll tax Social Security	$\tau^{\text{ss}} = 10.6\%$	IRS
Payroll tax Medicare	$\tau^{\text{mcare}} = 2.9\%$	SSA (2007)
Tax progressivity	$\tau_1^i = 0.053$	Guner, Lopez-Daneri and Ventura (2016)
Dividend tax	$\tau^d = 25\%$	Gomes, Michaelides and Polkovnichenko (2009)
Capital gains tax	$\tau^g = 20\%$	Gomes, Michaelides and Polkovnichenko (2009)
Dividend yield	$d = 3.2\%$	Gomes, Michaelides and Polkovnichenko (2009)
Inflation	$\pi^i = 2.8\%$	Gomes, Michaelides and Polkovnichenko (2009)

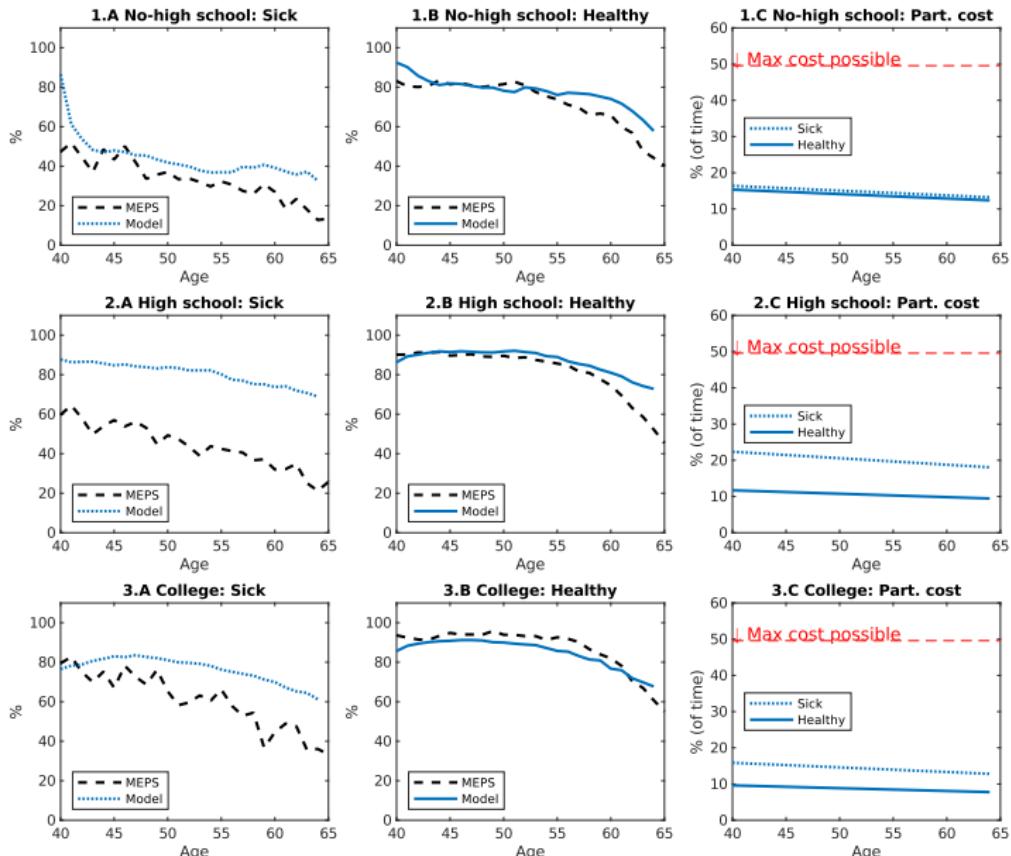
# Exogenous health status



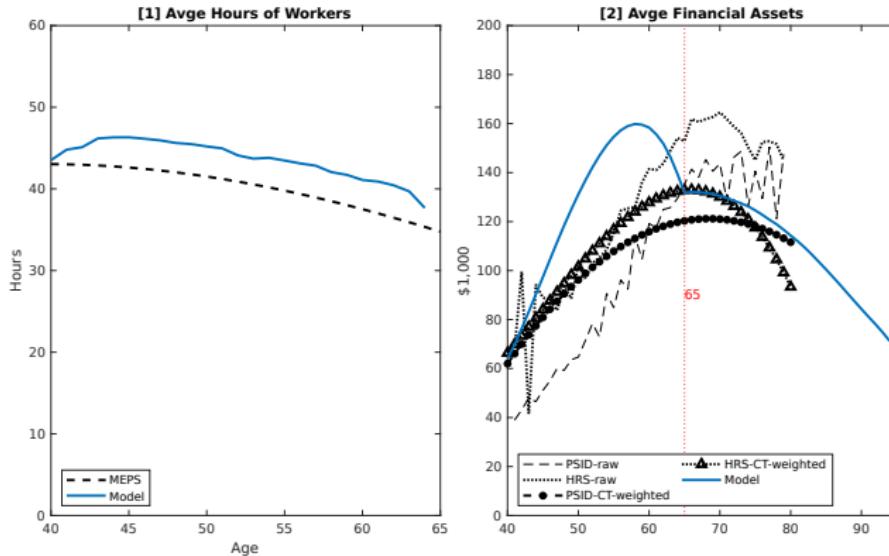
# Internal (calibrated) parameters

Parameters	Values	Calibration target	Model	Data	Source
Fixed cost of work	$\bar{n}_{j,\vartheta}$	Avg. work part.	Pan.2, Fig. 73	Pan.2, Fig. 73	MEPS 1996–2018
Utility constant	$\bar{u} = 10$	VSL of workers	2.5 mill.\$	1–16 mill.\$	Viscusi (1993)
Prog. tax scaling	$\tau_0^i = 1.016$				Jung and Tran (2022)
Medicaid asset test	$\bar{a}^{\text{maid}} = \$75k$	Age 40–64 on Maid	Pan.2, Fig. 74	Pan.2, Fig. 74	MEPS 1996–2018
Medicaid income test	$\bar{y}^{\text{maid}} = \$5.5k$	Age 20–39 on Maid	Pan.2, Fig. 74	Pan.2, Fig. 74	MEPS 1996–2018
Consumption floor	$c_{\min} = \$3.2k$	Frac. net-ass.<\$5k	20% (of popul.)	20%	Jeske and Kitao (2009)

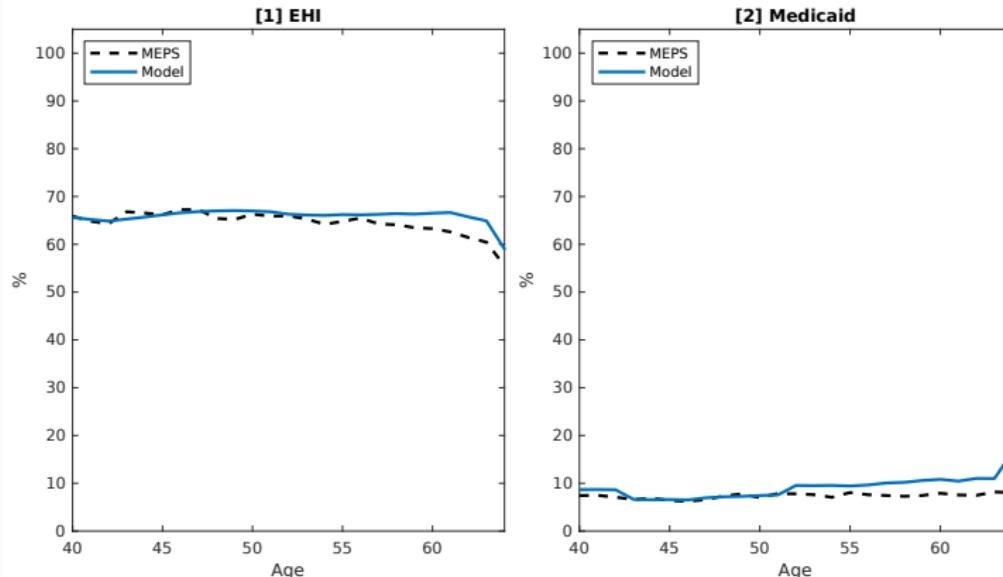
# Calibration target: labor force participation



# Calibration targets



# Calibration targets (only Medicaid is a target)

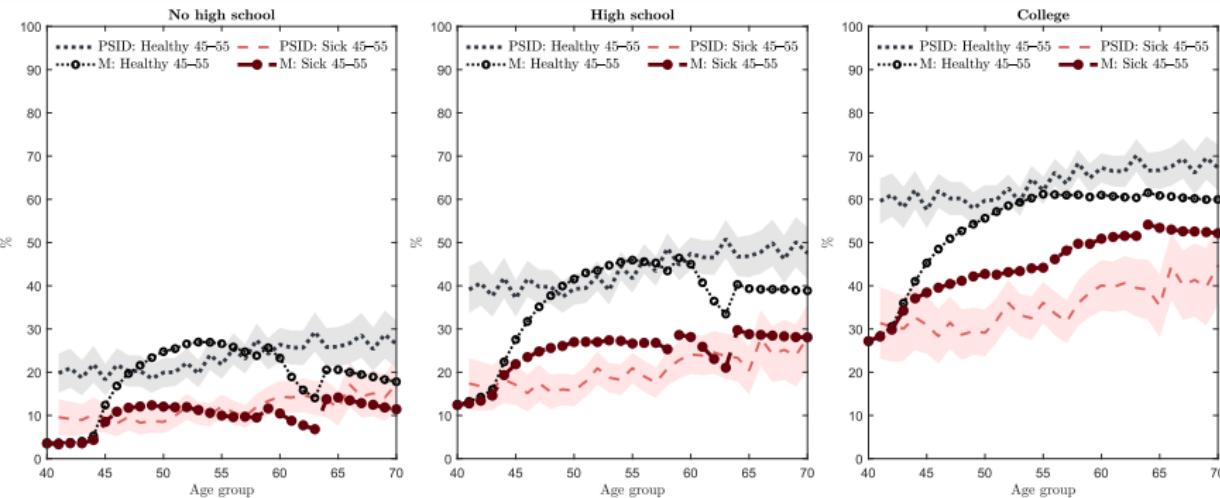


Note: only Medicaid take-up is a target

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# Performance (not targets)

## Risky assets participation by health-at-45-55

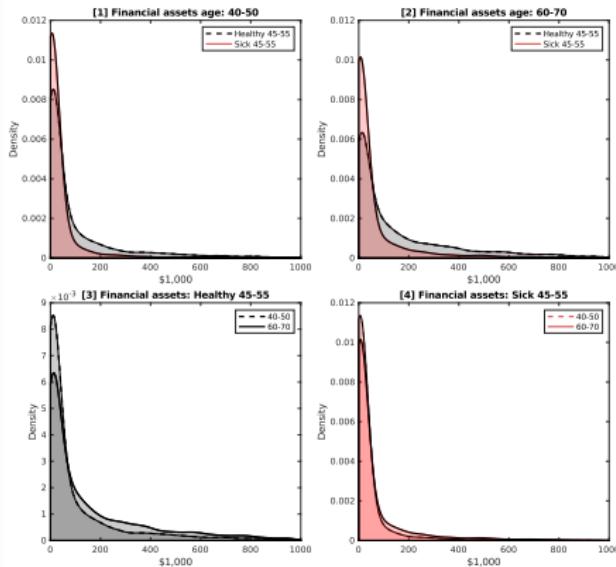


- Model replicates RA participation pattern by health-at-45–55 ⇒ this was not a target

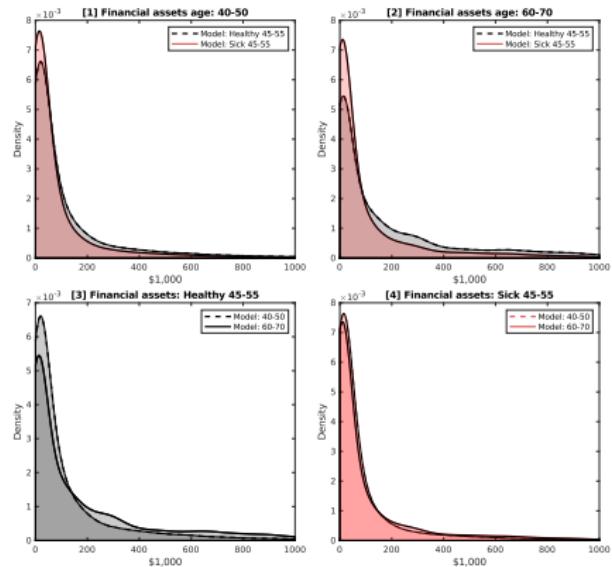
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# Performance (not targets)

Data



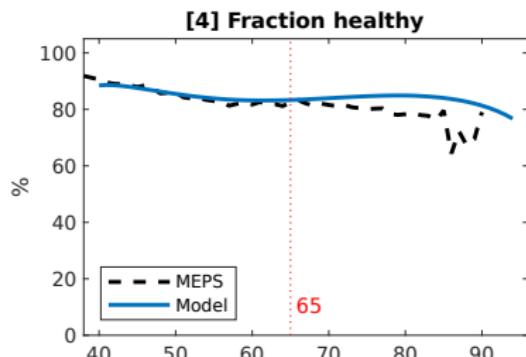
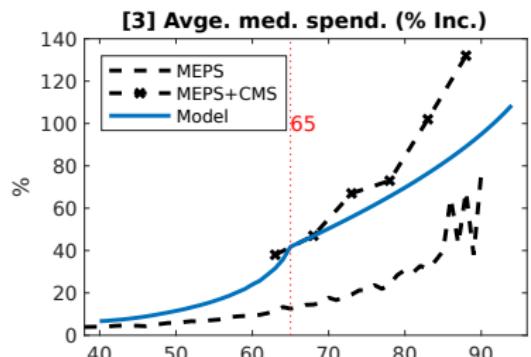
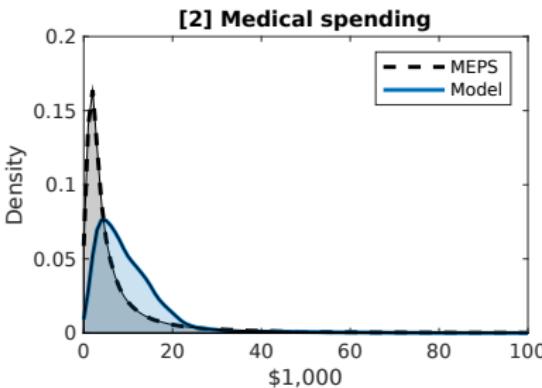
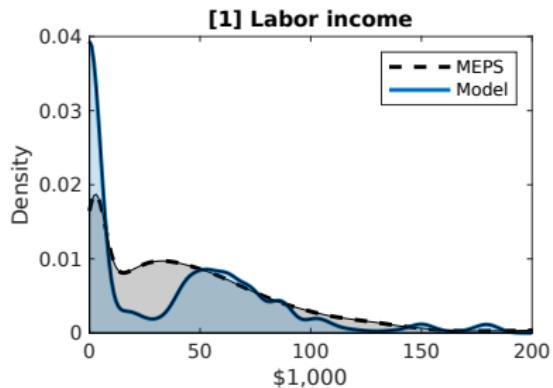
Model



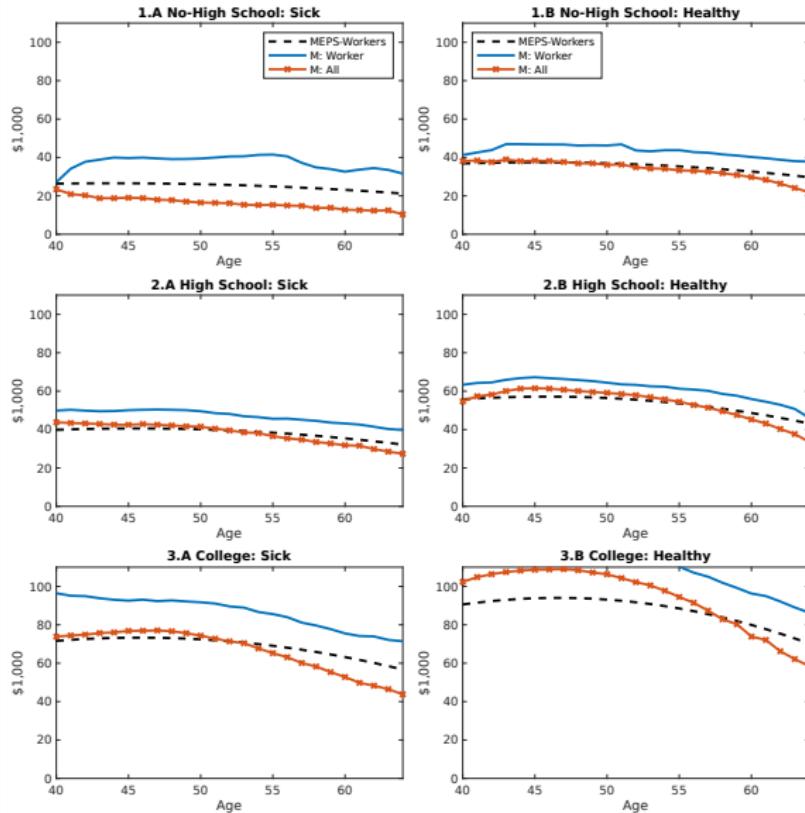
## Bench. model: Risky assets by health at age 45–55

	Healthy at 45–55	Sick at 45–55
- Risky asset share $\alpha$ (at 65)	50%	31%
- Stock part. (at 40)	32%	26%
- Stock part. (at 65)	51%	32%
- Wealth-to-inc (at 65)	5.07	3.29

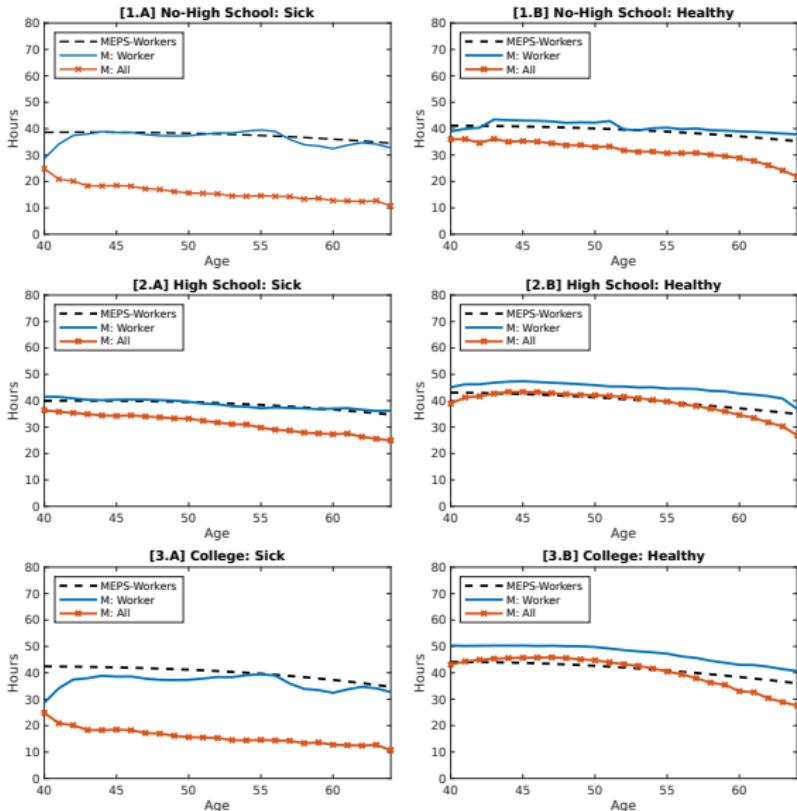
# Model performance (not targets)



# Model performance: labor income (not targets)



# Performance: hours worked



# Model performance (not targets)

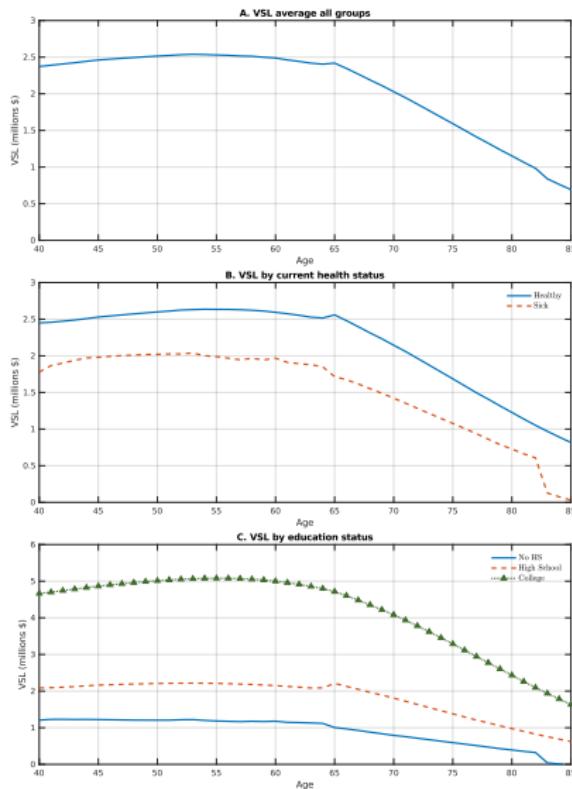
Moments	Model	Data	Sources
Medical exp/income	Figure 11	Figure 11	MEPS 1996–2018
Gini medical spending	0.56	0.60	MEPS 1996–2018
Gini gross income	0.40	0.46	MEPS 1996–2018
Gini labor income	0.55	0.54	MEPS 1996–2018
Gini financial assets	0.73	0.76	PSID 1984–2019
Frisch labor supply elasticities	1.19–1.51	1.1–1.7	<a href="#">Fiorito and Zanella (2012)</a>
Avge. interest rate: $r$	5.9%	5.2 – 5.9%	<a href="#">Gomme, Ravikumar and Rupert (2011)</a>
Wealth: P90/P50 at 65	14.47	16.84	PSID 1984–2019

# Risky asset shares regressions

	No-HS		HS		College	
	Stock Sh.	P(Stocks)	Stock Sh.	P(Stocks)	Stock Sh.	P(Stocks)
Sick at 45_55	-0.023*** (0.004)	-0.143*** (0.007)	-0.011*** (0.002)	-0.263*** (0.004)	-0.001 (0.001)	-0.162*** (0.006)
Unemployed at 45_55	-0.106*** (0.017)	-0.912*** (0.008)	-0.010*** (0.003)	-0.381*** (0.004)	0.000 (0.002)	-0.346*** (0.006)
Uninsured at 45_55	-0.017*** (0.003)	-0.078*** (0.008)	-0.001 (0.001)	-0.072*** (0.004)	-0.002*** (0.001)	-0.034*** (0.007)
Observations	214841		429942		200359	

- Risky asset shares: model w/ initial health condition controls
- Sample of individuals who are healthy at age 40

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VSL details

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# Value of statistical life I

- The VSL is the monetary value corresponding to reduction in mortality risk that prevents **one** statistical death
- Follow Aldy and Smyth (2014)
  - Consider small increase in surv. probability  $\Delta\pi_j(\varepsilon_j^h)$  so that surv. prob. is  $\pi_j(\varepsilon_j^h) + \Delta\pi_j(\varepsilon_j^h)$
  - Using this new surv. prob. solve HH with otherwise identical paras  
 $\Rightarrow V^*(\vartheta, a_j, \epsilon_j^{\text{incP}}, \epsilon_j^h, \epsilon_j^{\text{ehi}})$
  - Search additional wealth  $\Delta a_j$  so that

$$V(\vartheta, a_j + \Delta a_j, \epsilon_j^{\text{incP}}, \epsilon_j^h, \epsilon_j^{\text{ehi}}) = V^*(\vartheta, a_j, \epsilon_j^{\text{incP}}, \epsilon_j^h, \epsilon_j^{\text{ehi}})$$

- Calculate VSL as

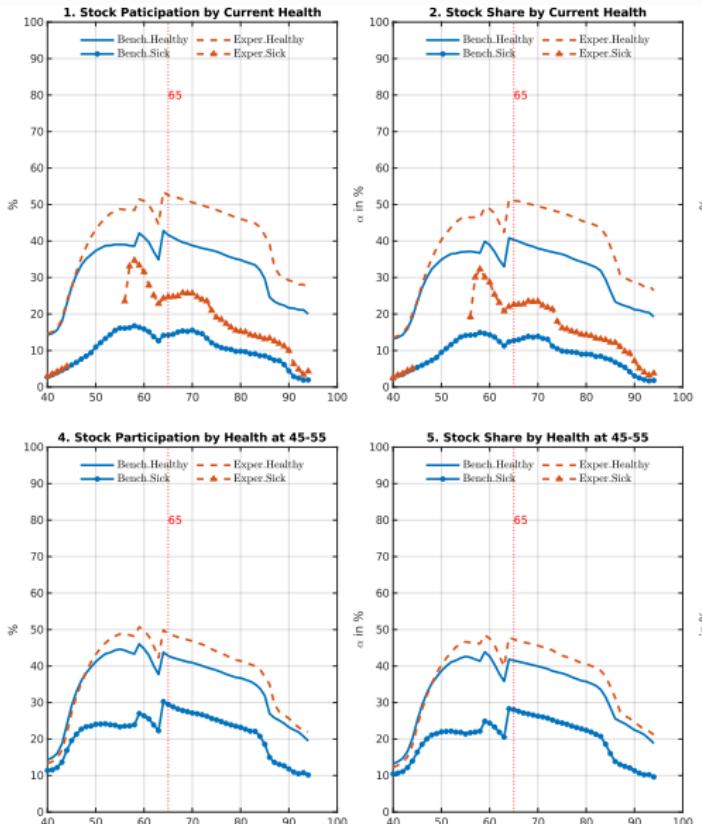
$$\text{VSL}_j(\vartheta, a_j, \epsilon_j^{\text{incP}}, \epsilon_j^h, \epsilon_j^{\text{ehi}}) = \frac{\Delta a_j}{\Delta\pi_j(\varepsilon_j^h)}.$$

## Value of statistical life II

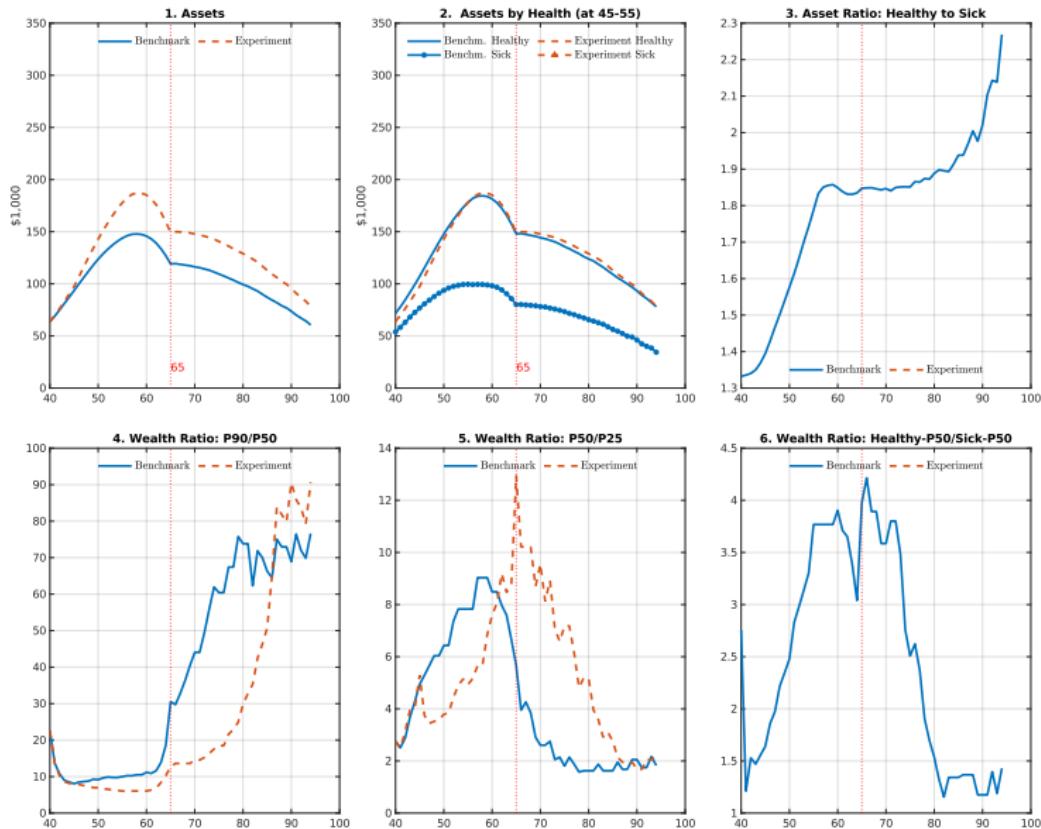
- Intuitively, the VSL is the marginal rate of substitution between wealth and survival probability
- VSL range between 1–16 million USD according to a survey by Viscusi (1993)
- We target 2.5 million USD for the working age population of 40–65 year olds

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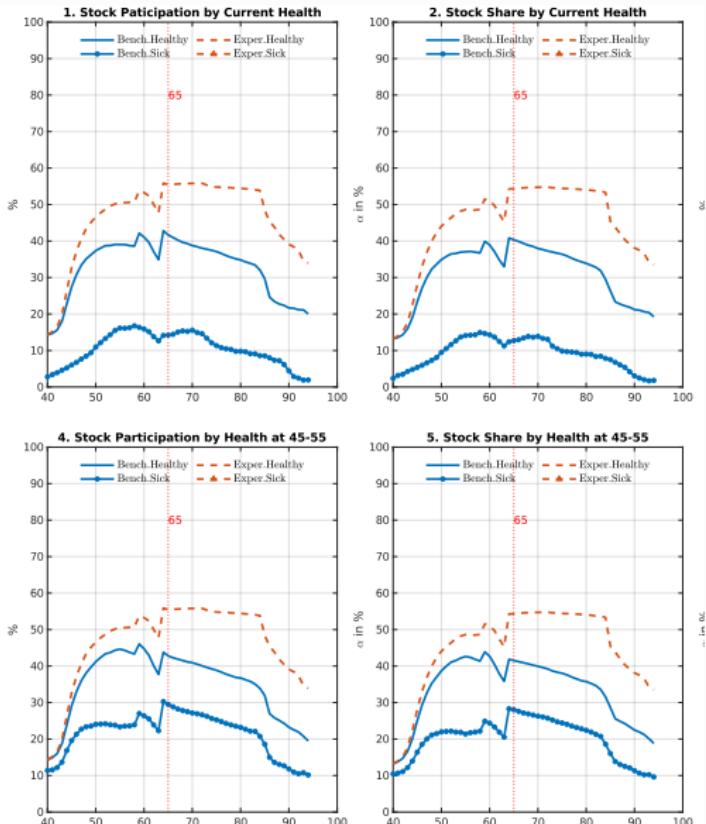
# Exp. 8 (no bad health at 45–55): RA participation



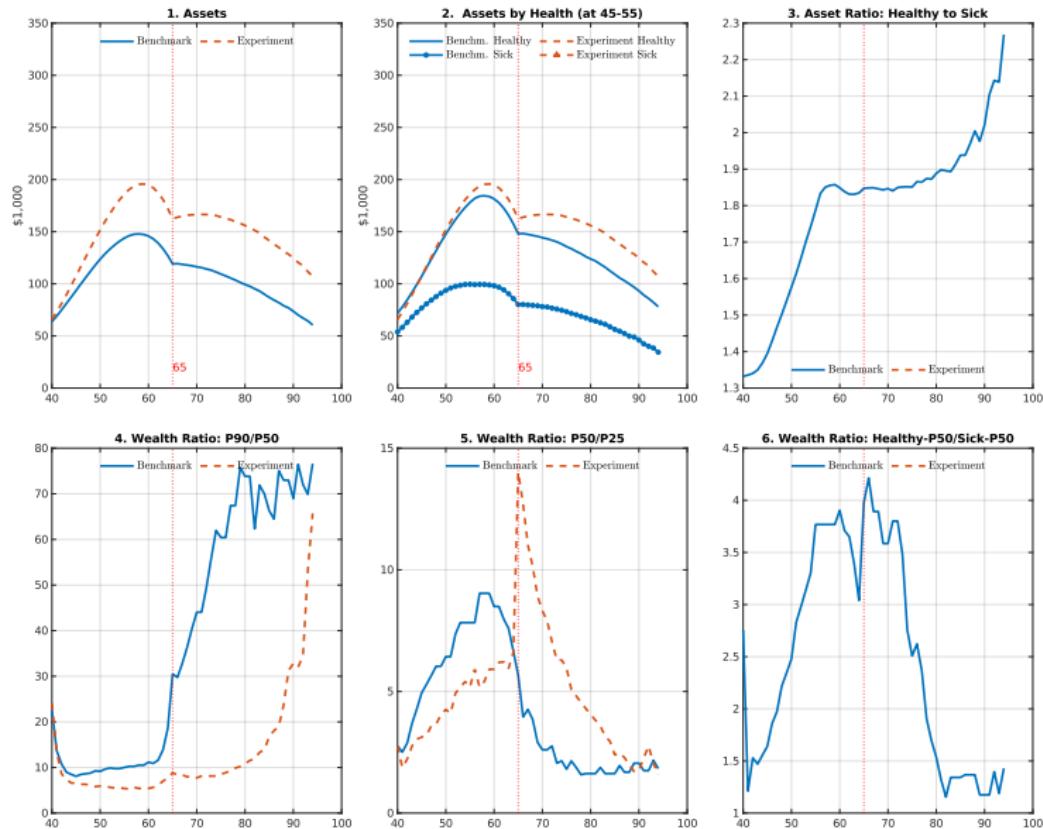
# Exp. 8 (no bad health 45–55): Asset profiles



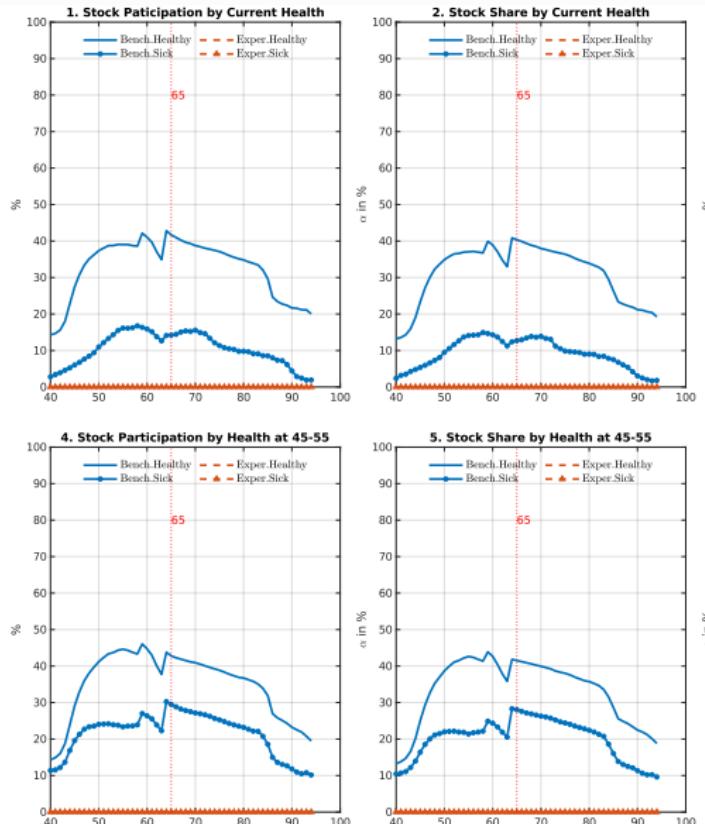
# Exp. 7 (no bad health–death): RA participation



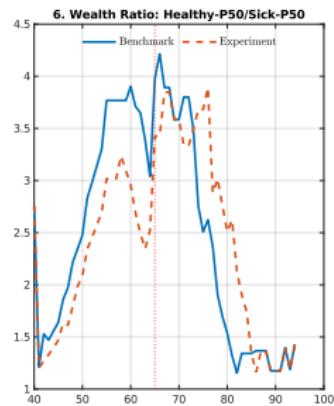
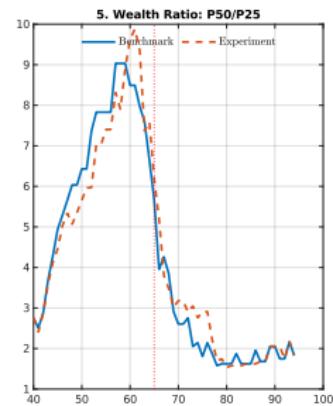
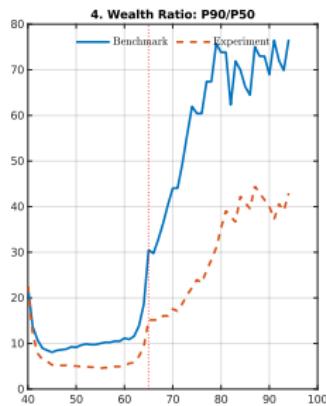
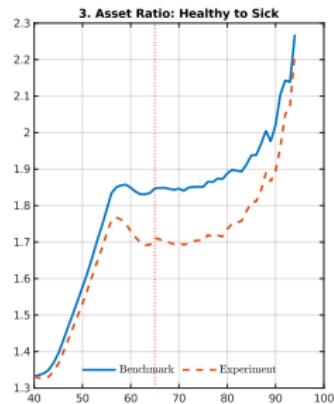
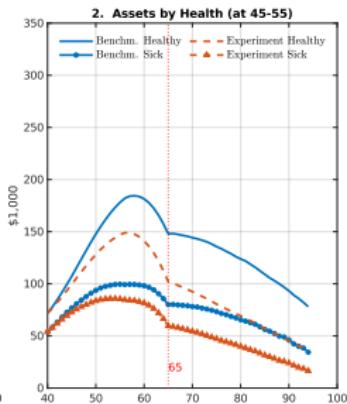
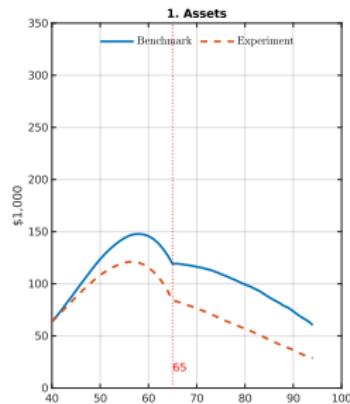
# Exp. 7 (no bad health-death): Asset profiles



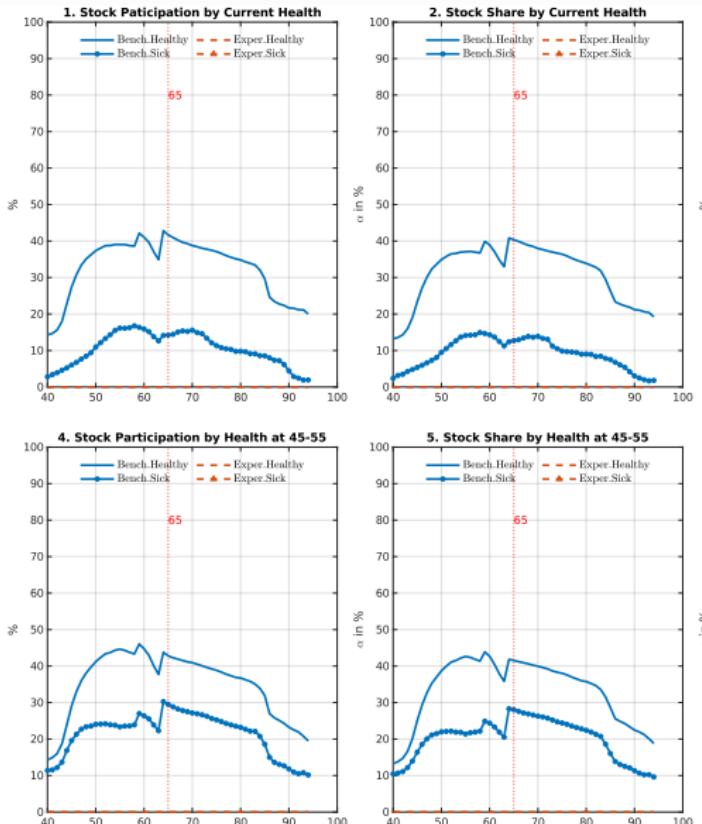
# Exp. 1 (No RA): RA participation



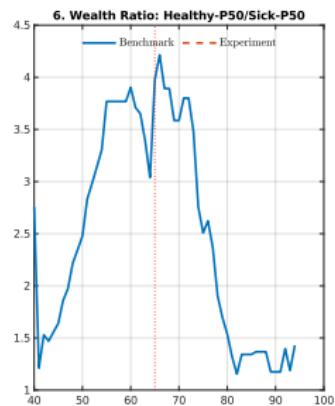
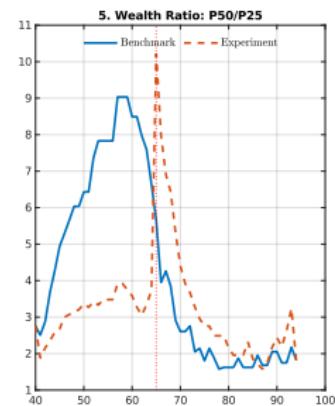
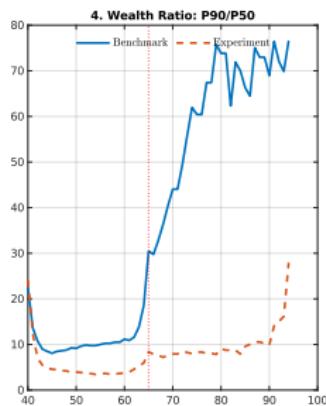
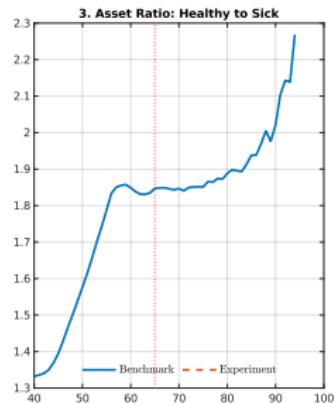
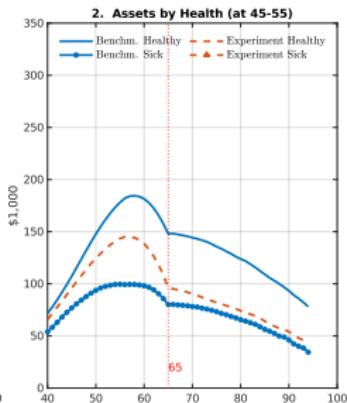
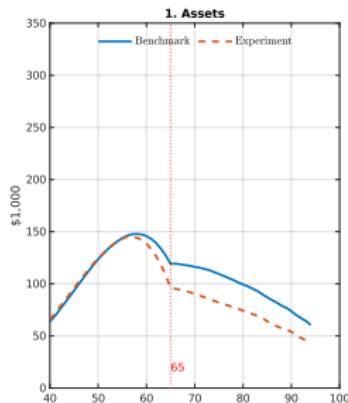
# Exp. 1 (No RA): Asset profiles



# Exp. 9 (no bad health + no RA): RA participation



# Exp. 9 (no bad health + no RA): Asset profiles



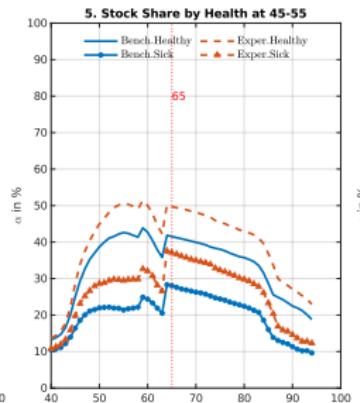
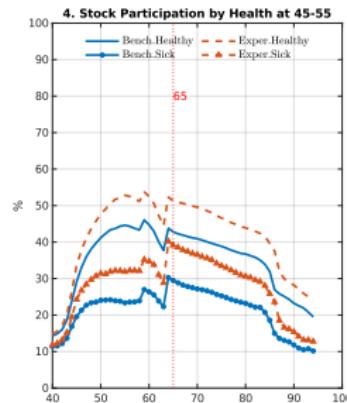
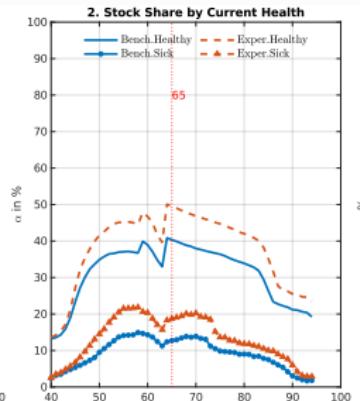
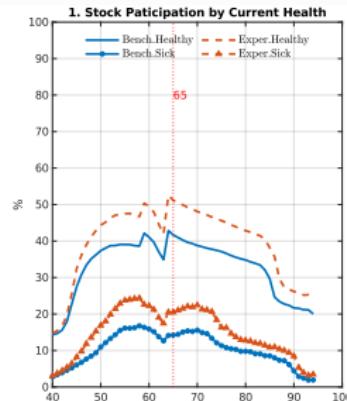
# Decomposition experiments done

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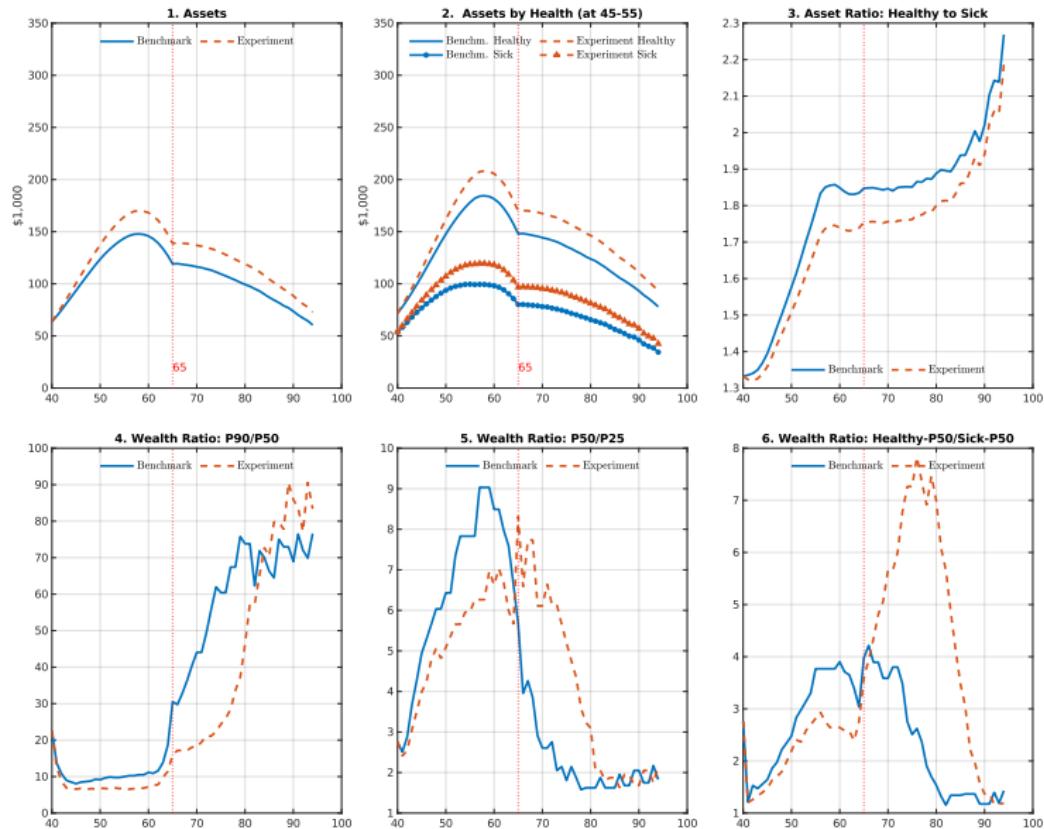
# Policy experiments

- Exp 1: Expansion of **Medicare** to 20–64 year olds (UPHI)
- Exp 2: Expansion of **EHI to all workers**

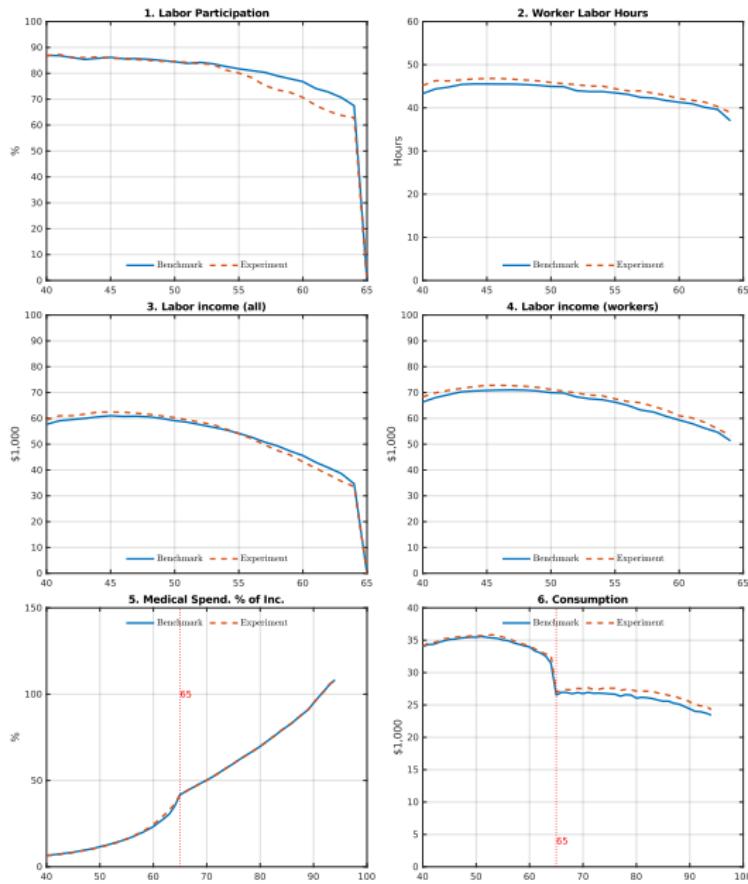
# Exp. 1 (Medicare-for-all): RA participation



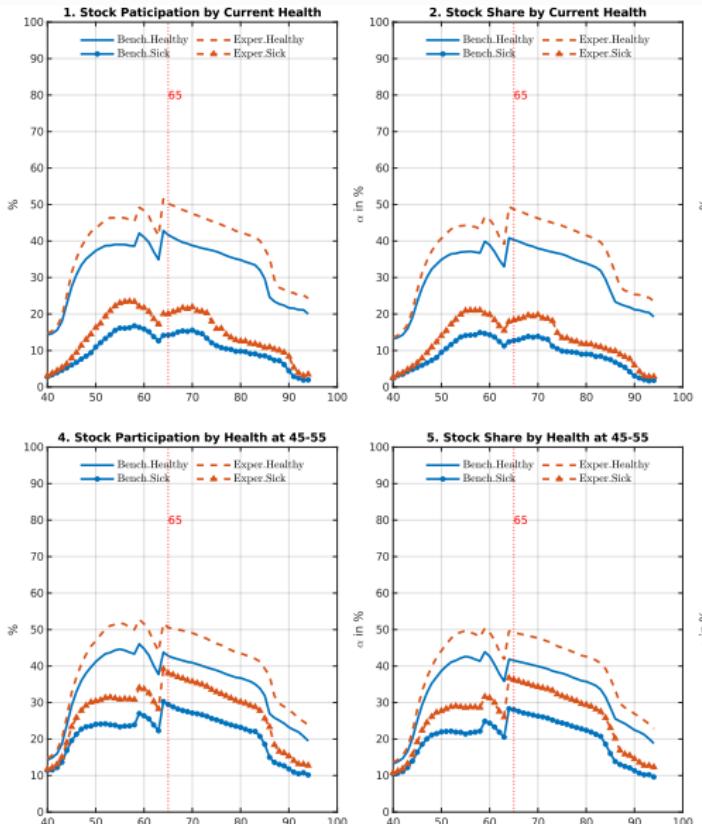
# Exp. 1 (Medicare for all): Asset profiles



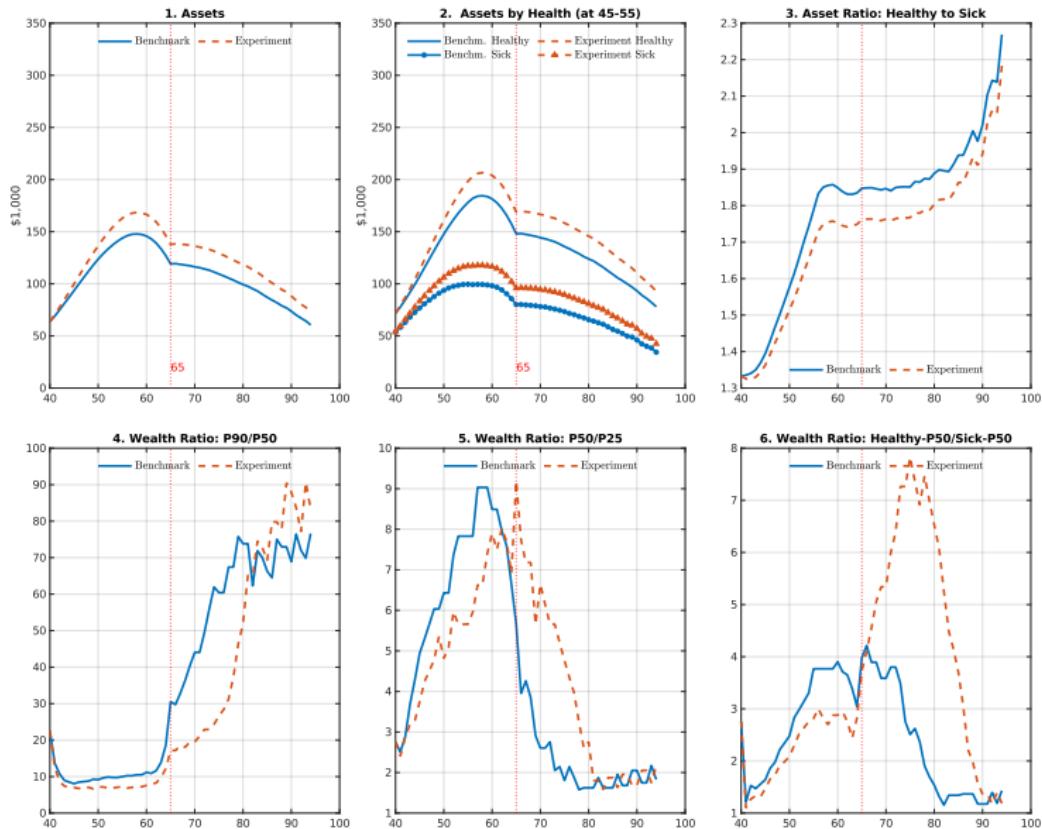
# Exp. 1 (Medicare for all): Labor profiles



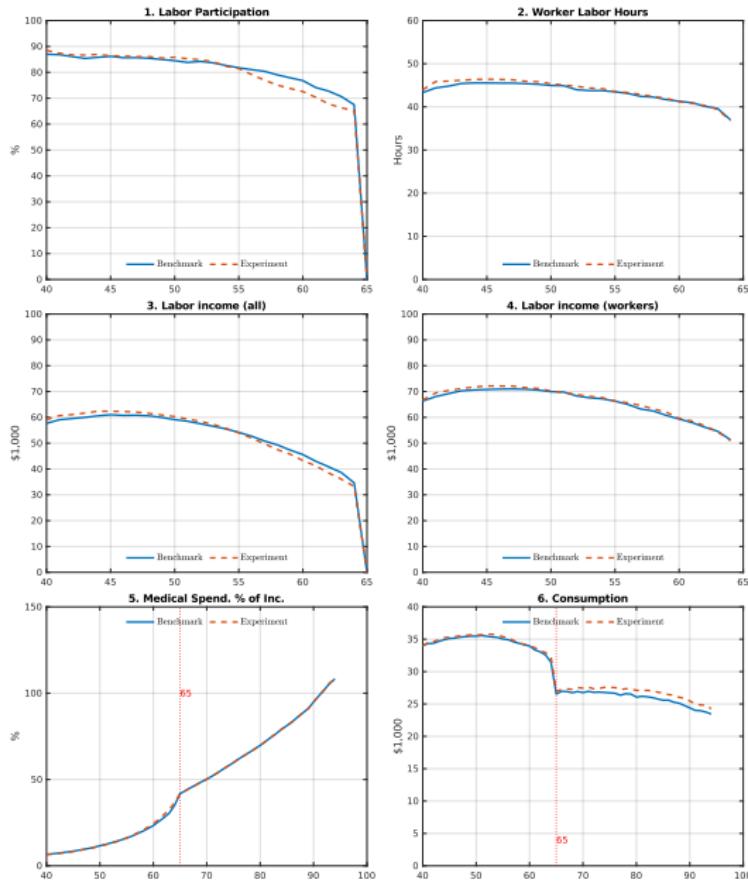
# Exp. 2 (EHI all workers): RA participation profiles



# Exp. 2 (EHI all workers): Asset profiles



# Exp. 2 (EHI all workers): Labor profiles



# HI experiments done

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