Saving During Retirement

De Nardi, French, and Jones, 2009, 2010, 2016, 2020

By Mariacristina De Nardi

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- Many countries are in similar circumstances

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- More than one-third of total wealth in the United States is held by households whose heads are over age 65 (Wolff 2004)
- Many countries are in similar circumstances
- Why people save during retirement is a crucial question for
  - The elderly's consumption and welfare
  - Policy evaluation

Assets held after retirement

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    - There is lifespan uncertainty
    - People save to smooth their consumption while alive
- Retired low-lifetime income US households reach retirement with no assets and do not save afterwards

Which additional saving motives lie behind this behavior?

- Medical expenses
- Uncertain lifetimes/heterogeneity
- Public insurance programs
- Housing/home ownership
- Bequest motives
- Family structure

Notice that

- The first three factors have to do with risks, and hence affect precautionary savings
  - Medical expenses
  - Uncertain lifetimes/heterogeneity
  - Public insurance programs
- Bequests and family structure are tightly connected to bequest motives

Identifying precautionary savings vs. bequest motives

- But assets are fungible: They can be used to
  - Smooth consumption in presence of shocks
  - Leave bequests

Identifying precautionary savings vs. bequest motives

- But assets are fungible: They can be used to
  - Smooth consumption in presence of shocks
  - Leave bequests
- How to separately identify saving
  - Against risks (precautionary motives)
  - For one's heirs (bequest and family structure motives)?

Goal for this talk

- Document some retirement US facts
- Discuss the role of these forces in shaping retirement savings
  - Medical expenses (DFJ 2010 JPE and 2016 AER)
  - Life expectancy (DFJ 2009 AER P&P)
  - Endogeneity of medical expenditures (DFJ 2010 JPE)
  - Bequests (DFJ work in progress)
- What have we learned and what remains to be done?

Medical Expenses

- Papers:
  - Kotlikoff (1988)
  - Feenberg and Skinner (1994)
  - Hubbard, Skinner, and Zeldes (1994)
  - Palumbo (1999)
  - French and Jones (2004)
  - De Nardi, French, and Jones (2009, 2010, 2013, 2014, 2020)
- Previous structural work: Small effects of medical expenses
- Our work: Large effects of medical expenses (rich data set)

Lifespan uncertainty/heterogeneity

- Papers:
  - Hurd, McFadden, Merrill (2001)
  - Attanasio and Emmerson (2005)
  - De Nardi, French, and Jones (2009)
- Findings: Heterogeneity in mortality is large and is important to understand savings. So is lifespan uncertainty. Important interactions with OOP medical expenses

Government insurance programs

- Papers:
  - Hubbard, Skinner, Zeldes (1995)
  - Scholz, Seshadri, and Khitatrakun (2006)
  - De Nardi, French, and Jones (2010, 2016)
- Previous work: Means-tested insurance programs provide strong incentives for low-income individuals not to save, but have little effect on college graduates
- Our work: OOP medical expenses rise with age and income. Hence government insurance also affects the savings of initially well-off individuals

Housing/home ownership

- Papers:
  - Yang (2009)
  - Nakajima and Telyuokova (2013)
  - McGee (2020)
  - Paz-Pardo (2020)
- Findings: Housing/homeownership play a potentially important role

Bequests

- Papers:
  - Hurd (1989)
  - Kopczuk and Lupton (2007)
  - Ameriks et al. (2011)
  - De Nardi (2004)
  - De Nardi, French, and Jones (2010)
  - Lockwood (2012)
- Conclusion: Mixed evidence, more work is needed. Model couples/singles

Family structure

- Retirement:
  - Blau and Gilleskie (2008)
  - Casanova (2012)
  - Gallipoli and Turner (2010)
- Savings:
  - De Nardi, French, and Jones, in progress

Retirement Savings Facts, DFJ, JPE 2010

- **The elderly's savings**
  - Many elderly individuals keep lots of assets
  - High income singles deplete their assets more slowly than low income individuals
  - High income couples keep accumulating assets during retirement

Retirement Savings Facts, DFJ, JPE 2010

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  - High income couples keep accumulating assets during retirement
- **We focus on singles in this talk**

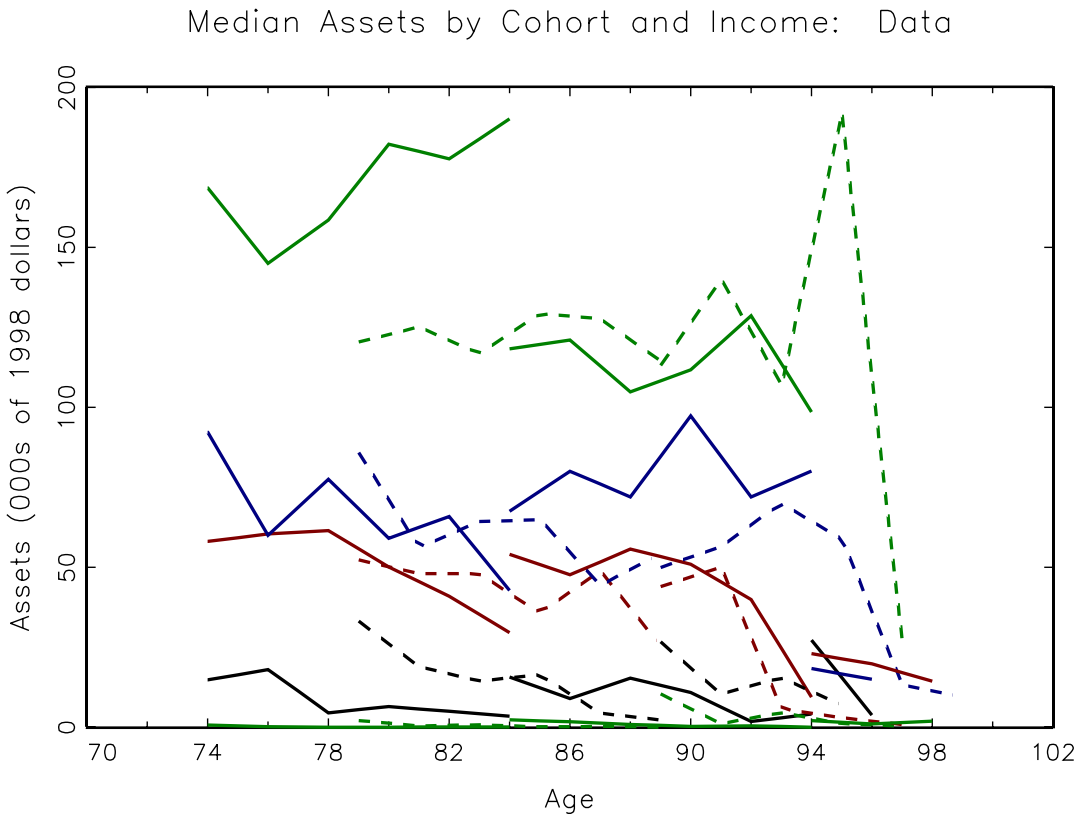
AHEAD data

- Household heads aged 70 or older in 1993/4
- Consider only the retired singles
- Follow-up interviews in 1995/6, 1998, 2000, 2002, 2004, 2006
- Asset data begins in 1996 (1994 asset data faulty), uses 2,688 individuals
- Use full, unbalanced panel

Saving rate by age and wealth, median earnings level

AHEAD data (unbalanced panel)

Saving rate by age and wealth, median earnings level

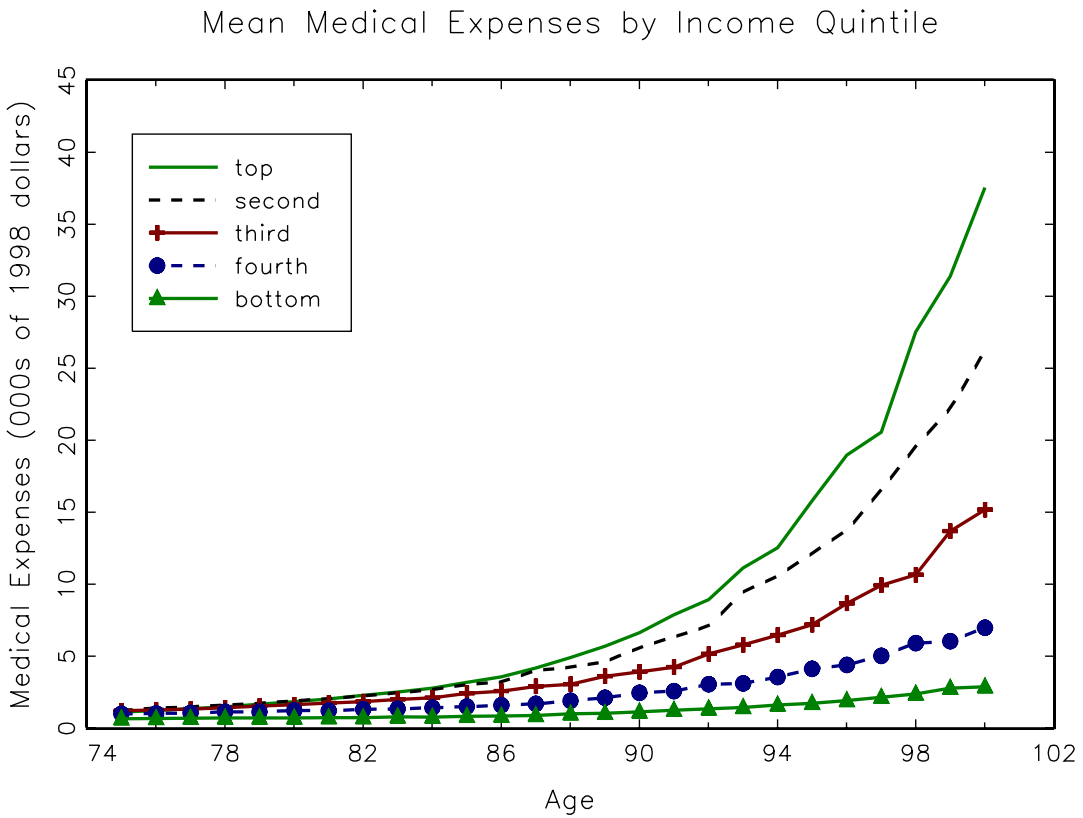


AHEAD data (unbalanced panel)

Medical expenses facts in the US

- Out-of-pocket medical costs rise with age and permanent income

Average medical expenses, AHEAD data



Life expectancy facts in the US

There is a lot of heterogeneity in life expectancy

- Rich people live longer
- Women live longer
- Healthy people live longer

This might have an important effect on retirement savings

Life expectancy at age 70

Income Quintile	Healthy Male	Unhealthy Male	Healthy Female	Unhealthy Female	All
bottom	7.6	5.9	12.8	10.9	11.1
second	8.4	6.6	13.8	12.0	12.4
third	9.3	7.4	14.7	13.2	13.1
fourth	10.5	8.4	15.7	14.2	14.4
top	11.3	9.3	16.7	15.1	14.7
Men					9.7
Women					14.3
Healthy					14.4
Unhealthy					11.6

Heterogeneity

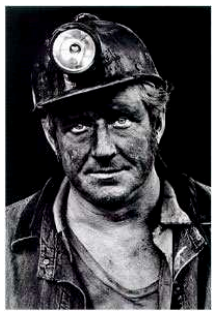
- Data show considerable heterogeneity in
  - Life expectancy
  - Medical expenses
- By:
  - Age
  - Gender
  - Permanent income
  - Health

Heterogeneity implications

- For saving behavior
  - Differential mortality $\Rightarrow$ Heterogenous saving rates, with high PI people and women saving more
  - Medical expenses rise quickly with age $\Rightarrow$ Keep assets for old age
  - Medical expenses rising with PI $\Rightarrow$ High PI people save at higher rate

Heterogeneity implications: continued

- For observed sample: **mortality bias**
  - Sample changes: High PI people + women live longer



  - In an unbalanced panel, this causes observed assets to **increase** with age

How do we address these questions?

We write down a structural model, which we estimate in two steps:

- First step: estimate mortality and medical expenses as a function of age, gender, health and permanent income
- Second step: use first step results to estimate our model with method of simulated moments

Benchmark model

- **Singles only,** abstract from spousal survival
- **Households** maximize total expected lifetime utility
- **Flow utility** from consumption (CRRA). Utility can vary with health
- **Rational expectations.** Beliefs about mortality rates, health cost distribution, etc., are estimated from the data
- **Bequest motive.** Functional form follows De Nardi (2004): bequests are a luxury good

Contributions

- Estimate medical expenses using better data and more flexible functional forms
  - Medical expenses rise quickly with age and PI
- Estimate mortality probabilities by age, gender, permanent income, and health
  - Variation is large
- Find that medical expenses and social insurance are important in understanding the elderly's savings
- Results are robust to:
  - Including a bequest motive
  - Making medical expenditures endogenous

Income

$$
\begin{aligned}
y_t &= y(g, h, I, t) \\
g &= \text{gender} \\
h &= \text{health} \\
I &= \text{permanent income}
\end{aligned}
$$

Uncertainty

- **Health status:** age-, gender- and permanent-income-specific Markov chain
- **Survival:** function of gender, age, health status, and permanent income
- **Medical expenses:**

$$\begin{aligned} \ln(m_t) &= m(g, h_t, I, t) + \sigma(g, h_t, I, t)\psi_t \\ \psi_t &= \zeta_t + \xi_t \\ \zeta_t &= \text{AR(1) shock} \\ \xi_t &= \text{white noise shock} \end{aligned}$$

Constraints, key ideas

- Standard asset accumulation equation
- Government transfers support a consumption floor
- Borrowing constraint

Constraints, more detail

- Budget constraint:

$$a_{t+1} = a_t + y_n(ra_t + y_t, \tau) + b_t - m_t - c_t$$

$y_n(.)$ = post-tax income; y_t = "non-interest" income;
τ = tax parameters; b_t = government transfers;
m_t = medical expenses

- Transfers support a consumption floor

$$b_t = \max\{0, c_{min} + m_t - [a_t + y_n(ra_t + y_t), \tau)]\}$$

- Borrowing constraint:

$$a_{t+1} \geq 0$$

Constraints in terms of cash-on-hand

- Budget constraint:

$$\begin{aligned} a_{t+1} &= a_t + y_n(ra_t + y_t, \tau) + b_t - m_t - c_t \\ &= x_t - c_t \end{aligned}$$

- Transfers support a consumption floor

$$x_t \geq c_{min}$$

- Borrowing constraint

$$c_t \leq x_t$$

Recursive formulation

$$V_t(x_t, g, I, h_t, \zeta_t) = \max_{c_t, x_{t+1}} \Bigg\{ [1 + \delta h_t] \frac{c_t^{1-\nu}}{1-\nu} + \beta s_{g,h,I,t} E_t \Big(V_{t+1}(x_{t+1}, g, I, h_{t+1}, \zeta_{t+1}) \Big) + \beta (1 - s_{g,h,I,t}) \theta \frac{(x_t - c_t + k)^{(1-\nu)}}{1-\nu} \Bigg\}$$

x_t = cash-on-hand

g = gender $\quad I$ = permanent income

h_t = health status (0 $\Rightarrow$ bad, 1 $\Rightarrow$ good)

ζ_t = persistent health cost shock

All constraints in terms of COH

$$x_{t+1} = \max\{x_t - c_t + y\big(r(x_t - c_t) + y_{t+1}, \tau\big) - m_{t+1}, c_{\min}\},$$

$$y_{t+1} = y(g, h, I, t+1),$$

$$x_t \geq c_{min},$$

$$c_t \leq x_t,$$

$$\ln(m_{t+1}) = hc(g, h_{t+1}, t+1, I) + \sigma(g, h_{t+1}, I, t+1)\psi_{t+1},$$

$$\psi_{t+1} = \zeta_{t+1} + \xi_{t+1}$$

Method of simulated moments

- Match median assets by permanent income quintile, cohort and age
- 101 moment conditions
- Correct for cohort effects by using cohort-specific moments and initial conditions
- Correct for mortality bias (rich people live longer) by allowing mortality rates to depend on permanent income and gender

Method of simulated moments

- Consider household i of birth cohort c in calendar year t, belonging to the qth permanent income quintile
- Let a_{qct} denote the model-predicted median asset level
- Moment condition for GMM criterion function

$$E\Big(I\{a_{it} \leq a_{qct}\} - 1/2 \mid q, c, t, \text{hh } i \text{ alive at } t\Big) = 0$$

- Convert into an unconditional moment

$$\Big(\big[I\{a_{it} \leq a_{qct}\} - 1/2\big] \times I\{q_i = q\} \times I\{c_i = c\} \times I\{\text{hh } i \text{ alive at } t\} \;\Big|\; t\Big) = 0$$

Estimated structural parameters

Parameter	Benchmark (1)	Health (2)	Bequests (3)	All (4)
ν: coeff. relative risk aversion	3.81 (0.50)	3.75 (0.47)	3.84 (0.55)	3.66 (0.55)
β: discount factor	0.97 (0.04)	0.97 (0.05)	0.97 (0.05)	0.97 (0.04)
δ: pref. shifter, good health	0.0 NA	-0.21 (0.18)	0.0 NA	-0.36 (0.14)
c_{min}: consumption floor	2,663 (346)	2,653 (337)	2,665 (353)	2,653 (337)
θ: bequest intensity	0.0 NA	0.0 NA	2,360 (8,122)	2,419 (1,886)
k: bequest curvature (in 000s)	NA NA	NA NA	273 (446)	215 (150)
Overidentification statistic P-value	82.3 87.4%	80.6 88.5%	81.5 85.4%	77.5 90.5%

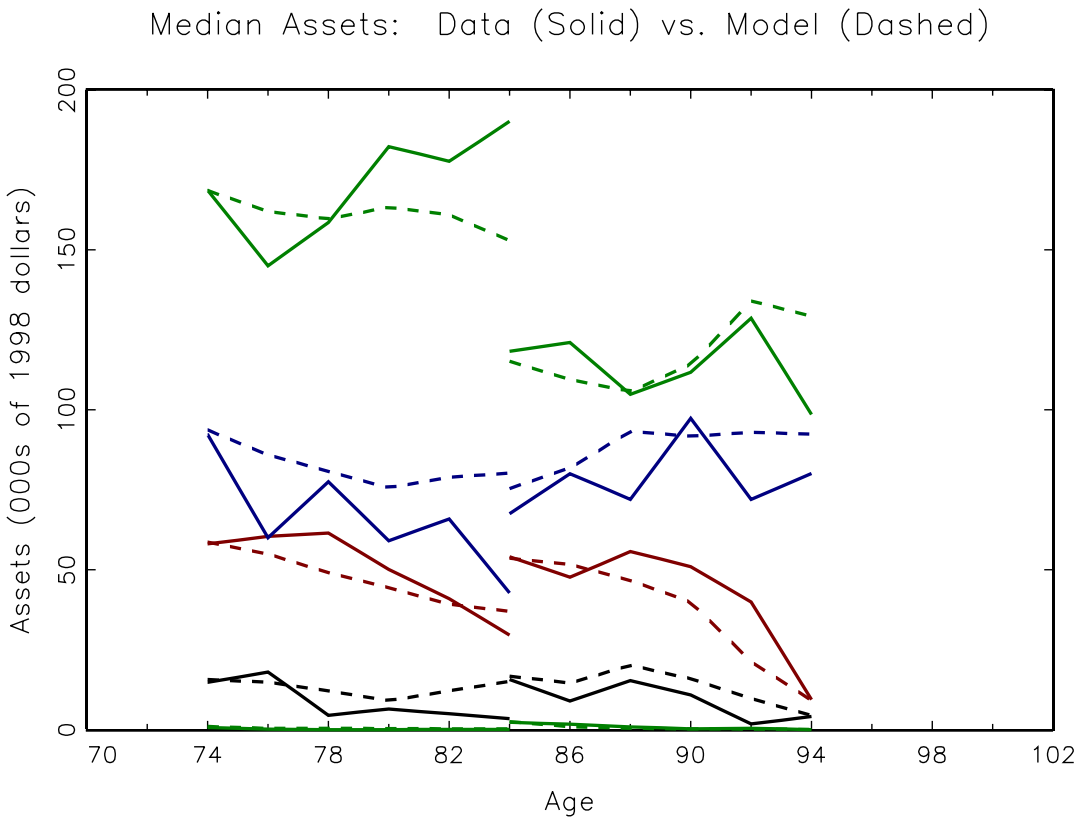
Estimation results

- The model's estimated preference parameters are very reasonable ($\nu = 3.8$, $\beta = 0.97$)
- Estimated government insurance is stingy (consumption floor: \$2,600 a year)
- The model fits the data well
- The model generates similar mortality bias to the one in the data
- In terms of bequests...

Estimation results: bequests

- Bequest motives are large for the richest people, but very imprecisely estimated
  - They do not improve the model's fit
  - They do not not change other parameters
- This does **not** mean bequests are unimportant
  - The estimated bequest motive implies that **the period before certain death** the rich bequeath 88 cents of every dollar
  - Our moments (median assets) likely are not enough to identify bequest motives (See Kaji, Manresa, Pouliot, 2020)

Median assets by cohort and PI quintile: data and benchmark model



Mortality bias

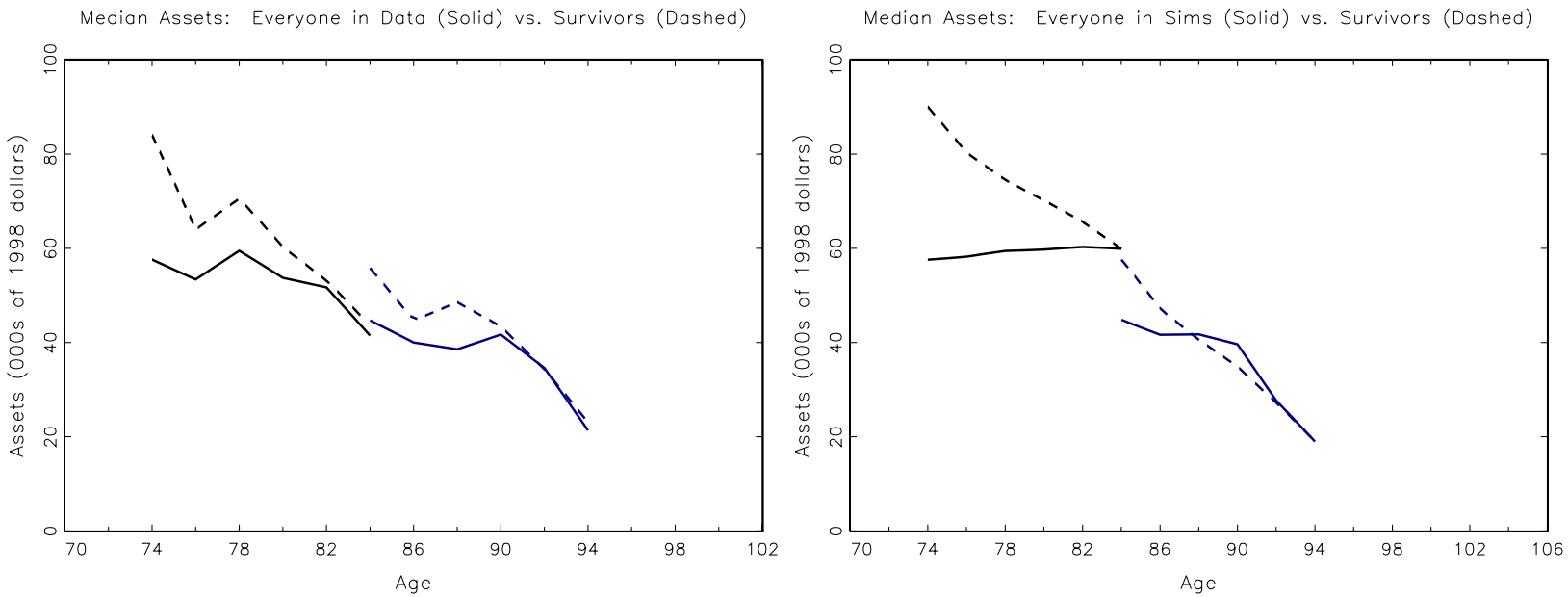
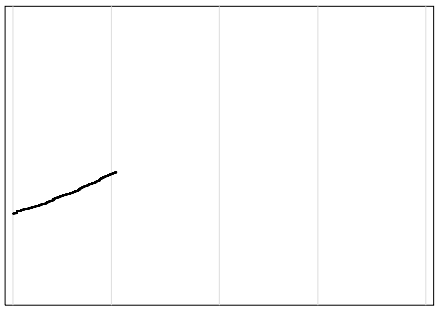


Figure: Left panel → AHEAD data; right panel → Benchmark model

Distribution of bequests: data and model



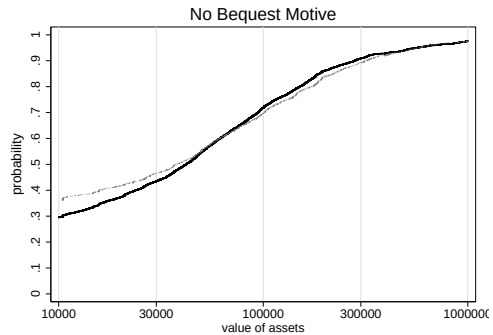


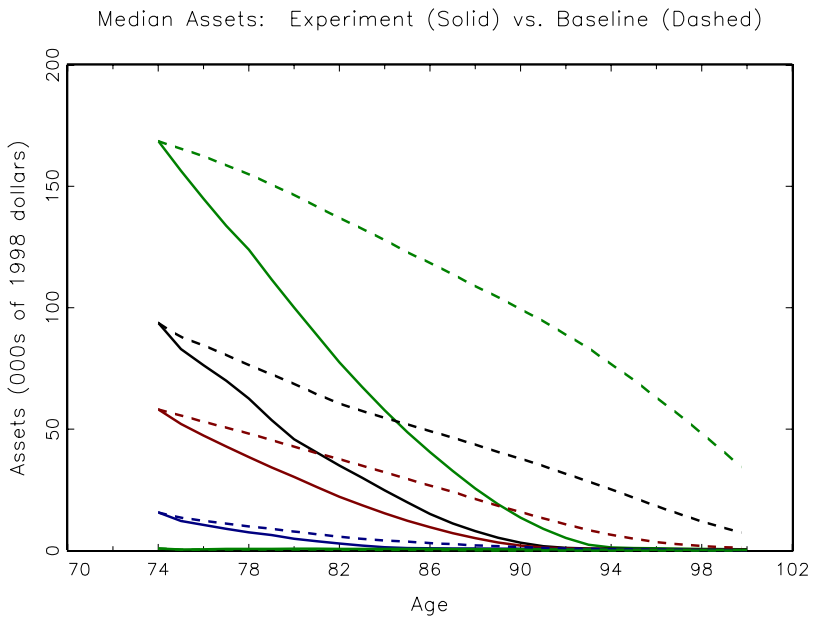
Figure: Cumulative distribution function of assets held 1 period before death. Left, model with bequest motives. Right: model without. Solid line: model, lighter line: data

How do we use the model? Experiments

- Fix preference parameters at baseline estimates, vary other parameters
- Eliminating out-of-pocket medical expenditures has a big effect on savings
- Eliminating medical expense risk has a small effect
- Lowering the consumption floor by 20% has a big effect on savings, even for the rich

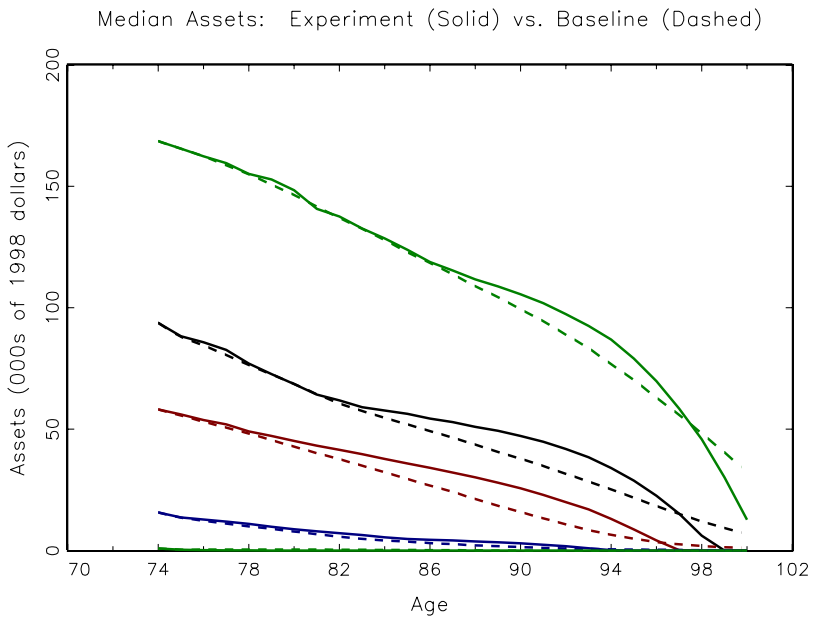
Eliminating medical expenditures

- Eliminating out-of-pocket medical expenditures has a big effect on savings



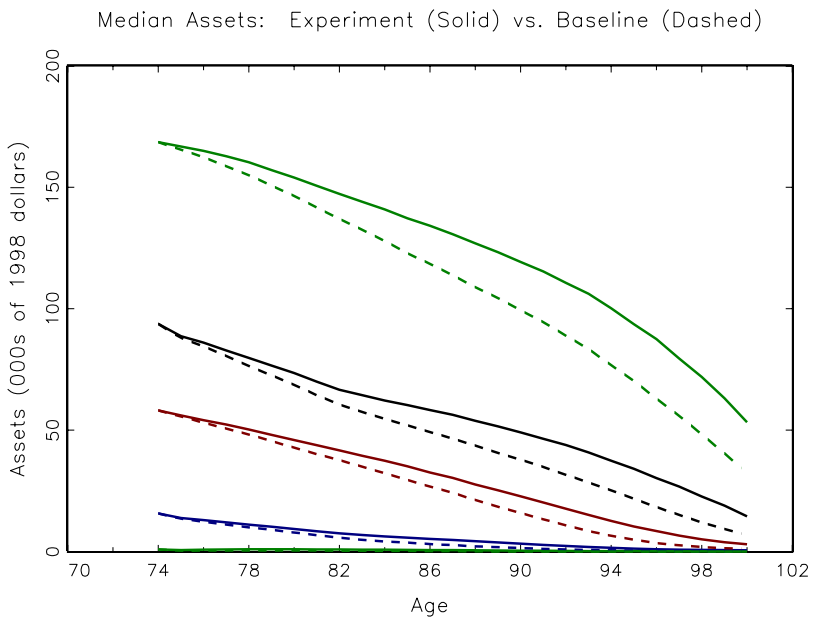
Eliminating medical expenditures risk

- Eliminating out-of-pocket medical expenditures risk has a small effect on savings



Reducing the consumption floor by 20%

- Lowering the consumption floor has a big effect on savings, even for the rich



Making medical expenditures endogenous

- Retirees receive utility from medical goods
- Medical expenses do not affect health and/or survival: RAND experiment (Brook et al., 1983); Fisher et al. (2003); Finkelstein and McKnight (2005); Khwaja (2009)

Endogenous medical expenditure model

- Flow utility:

$$u(c_t, m_t, h_t, \zeta_t, \xi_t, t) = \frac{1}{1-\nu} c_t^{1-\nu} + \mu(t, h_t, \zeta_t, \xi_t) \frac{1}{1-\omega} m_t^{1-\omega},$$

$\mu(\cdot)$: medical "preference shifter"
m_t : **total** medical expenditures
$q(t, h_t)m_t$: out-of-pocket medical expenditures

- Transfers: set to guarantee a minimum level of utility, and thus depend on $\mu(\cdot)$:

$$b(t, a_t, g, h_t, I, \zeta_t, \xi_t) = \max\{0, b^*(t, a_t, g, h_t, I, \zeta_t, \xi_t)\}.$$

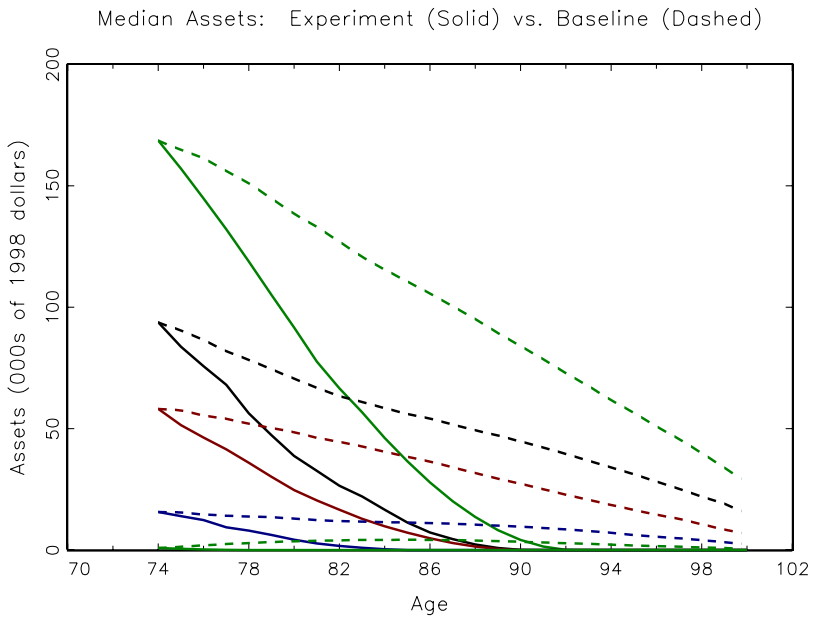
Expanded estimation

- In addition to matching asset profiles, we now match:
  - mean and 90^{th} percentile of medical spending, conditional on age and permanent income
  - 1^{st} and 2^{nd} autocorrelations of logged medical spending

Results for endogenous expenditure model

- Estimated parameters: $\nu = 2.15$; $\omega = 3.19$; $\beta = 0.99$
- Model does a reasonable job of fitting the asset data
- Model fits the medical expenditure data better than baseline model
- **Medical spending is still important:** Eliminating out-of-pocket medical expenditures still has a big effect on savings
- The effect of reducing the consumption floor is smaller than before, but still important at all income levels

Benchmark and model with no medical expenditures



Effects of reducing the consumption floor

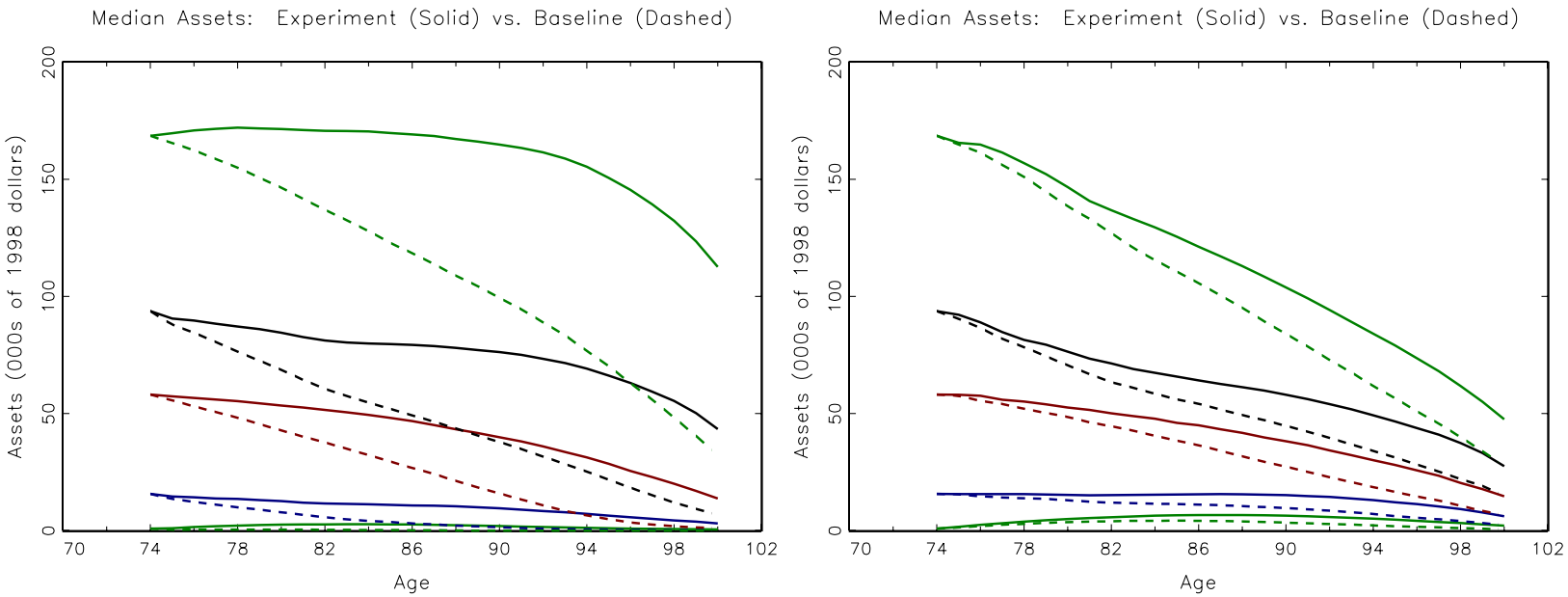


Figure: Median assets: baseline and model with 50% of the consumption floor for the exogenous (left panel) and endogenous (right panel) medical expense models

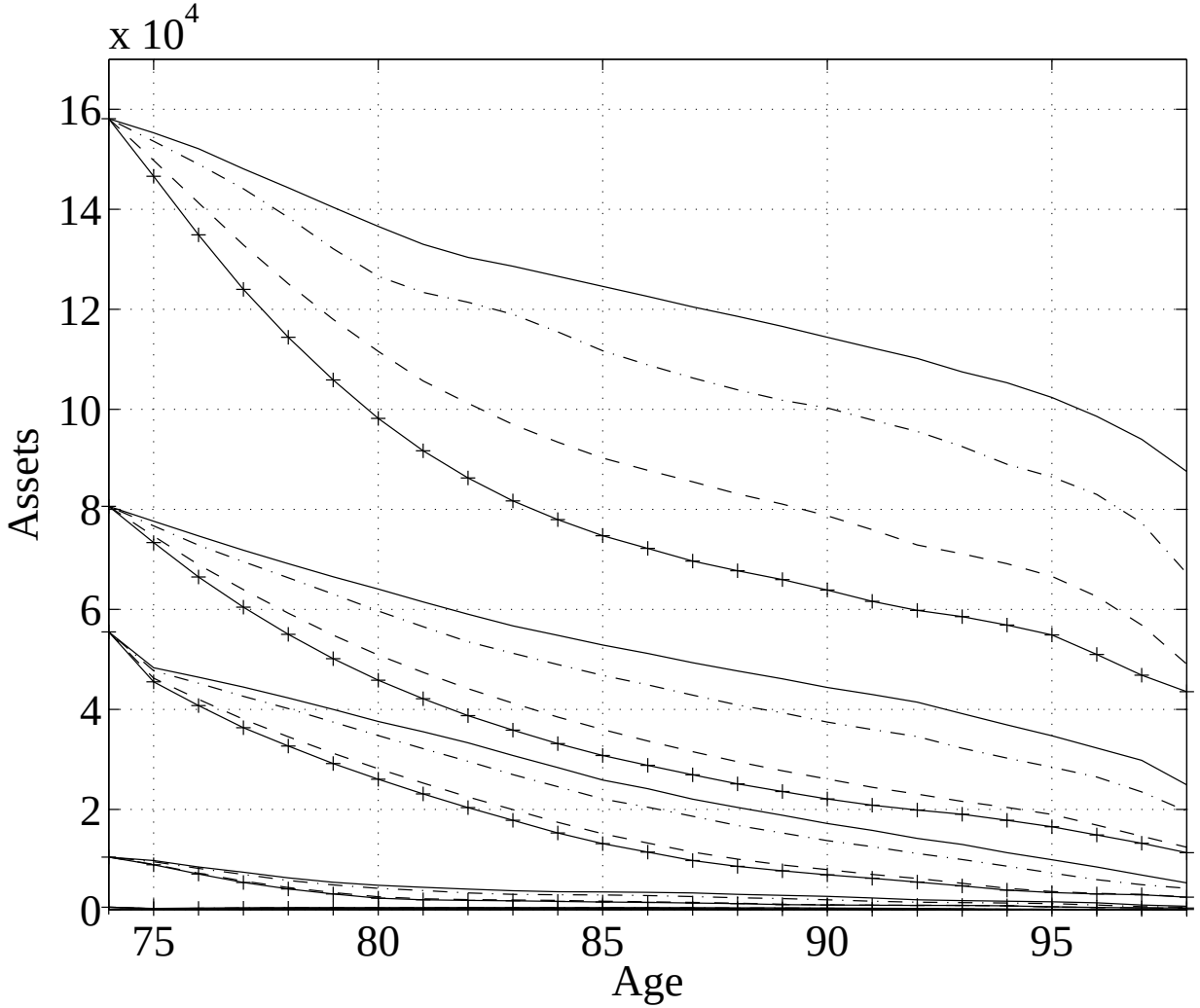
Conclusions from DFJ JPE 2010

- Medical spending that rises fast with income and age goes a long way to explaining savings of single retirees
- Social insurance (from Medicaid) affects savings even of the high income
- Above results robust to allowing for
  - Endogenous medical spending
  - Bequest motives

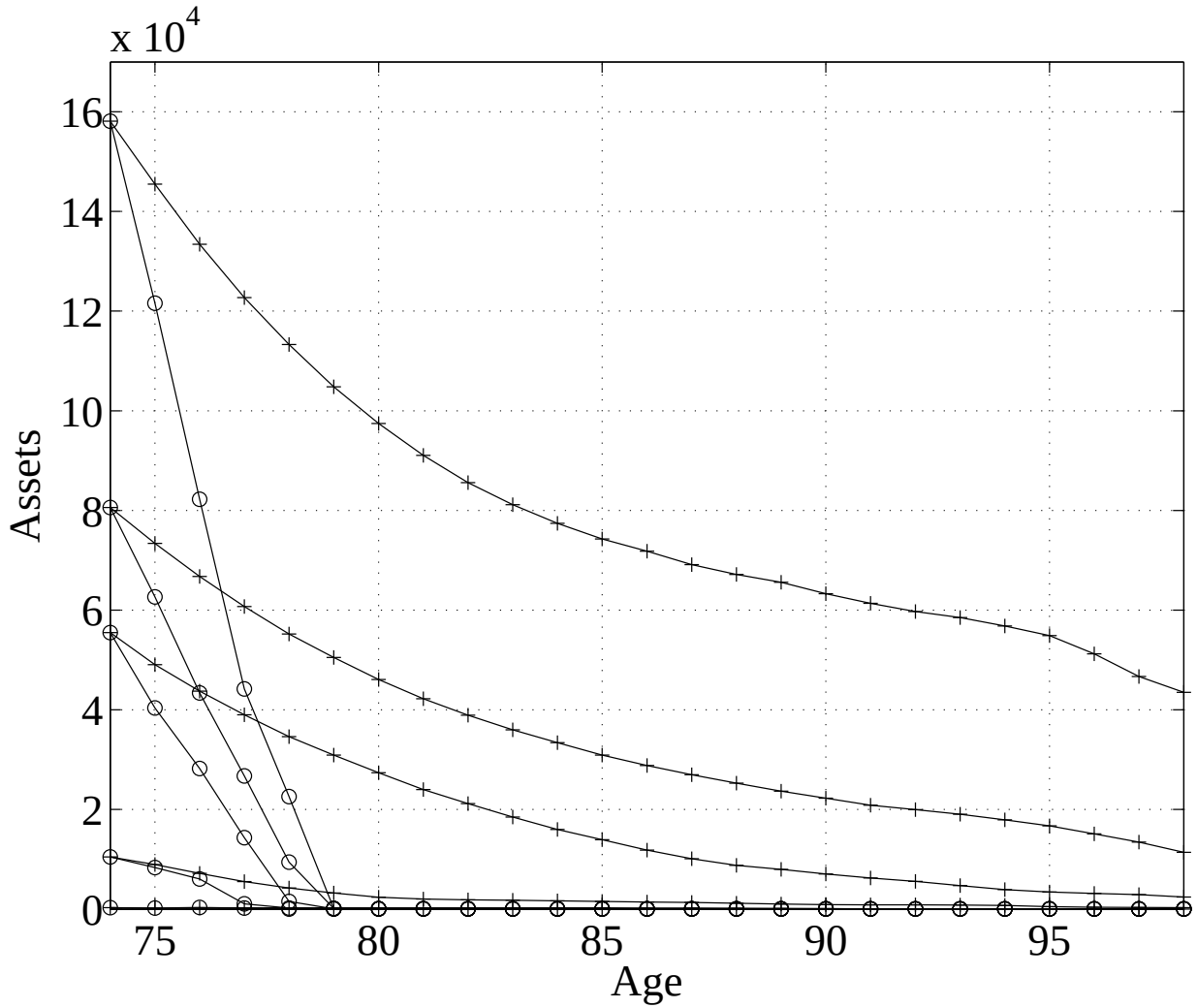
Life expectancy and savings, DFJ AER P&P 2009

How much of the asset accumulation of old rich people is due to longer life expectancy and lifespan risk?

Median net worth, various mortalities



Median net worth: eliminating lifespan risk



Conclusions about life expectancy and savings

- Differences in life expectancy related to health, gender, and permanent income are important to understanding savings patterns across groups
- The effect of each factor is of a similar order of magnitude
- At realistic levels of annuitization the risk of living beyond one's expected lifespan has huge effects on saving

Medicaid paper, DFJ AER 2016

Medicaid was designed to insure the poorest retirees against medical expenses. We ask:

- What is the degree of Medicaid redistribution?
- How much do people value Medicaid insurance?

Medicaid paper, DFJ AER 2016

- We add Medicaid recipiency by age and permanent income to our moment conditions.
- We identify larger bequest motives. Why?
  - Matching Medicaid recipiency identifies a more generous Medicaid.
  - This requires weaker precautionary savings and stronger bequest motives.
- Careful measuring and modeling of both risks and insurance and additional target moments (than assets) are crucial for disentangling saving motives.

Forces working against redistribution

- Heterogeneity in life expectancy and medical expenses
- Two pathways to qualify for Medicaid
  - Having low income and assets: *categorically needy*
  - Being impoverished by large medical expenses, such as long nursing home stays: *medically needy*

Results

- Even richer people receive Medicaid
- Model fits data well
- Richer people value Medicaid more at the margin
- For the currently retired and singles, Medicaid might be about the right size for most

Couple's savings- DFJ's work in progress

- Half of the 70+ people have a partner
- They can pool resources to self-insure
- How do life expectancy and medical expenses compare for couples and singles?
- How about savings?
- To what extent do people care about leaving assets to the surviving spouse?

What have we learned?

- Medical expenses have large effects on savings during retirement, especially for higher income people
- Heterogeneity in mortality is large and important. So is lifespan uncertainty
- Government insurance also affects the savings of initially well-off people
- Careful measuring and modeling of both risks and insurance and additional target moments (than assets) are crucial for disentangling saving motives

Where else is the literature going?

- Assessing the robustness of results to
  - Modeling medical spending: Yogo (2016)
  - Other moment conditions: Lockwood (2012 and 2016), Ameriks et al. (2012 and 2016)
  - Artificial Intelligence Estimation: Kaji, Manresa, Pouliot (2020)
- Medical spending in different contexts
  - Kopecky and Koreshkova (2011): General equilibrium
  - Brown, Kopecky, Koreshkova (2019): Insurance markets
  - French, Gaudecker, and Jones (2019): Retirement
  - De Nardi, French, Jones (2020): Couples

Some ideas for more research

- Evaluating more the role of the family and savings in various contexts. How should we model the family? How does the family affects risks and insurance?
- Do children help parents? Do they do it for money?
- How should be best model health investment? What moments should we match?
- Cross-country comparisons