Saving Behavior across the Wealth Distribution

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Sciences Po, 10 December 2018

What We Do

- Use Norwegian administrative data on income & wealth to examine saving behavior across the wealth distribution

Why Care?

Macro

- Many workhorse models: saving rate $\approx$ independent of wealth (or slightly decreasing with wealth, especially at bottom)
- Related result: aggregate dynamics $\approx$ independent of wealth dist
- Does saving behavior in data look anything like in these models?

Inequality

- Is saving behavior a force toward diverging wealth inequality?

Our Findings

1. Relation between saving rates and wealth depends on whether saving includes capital gains

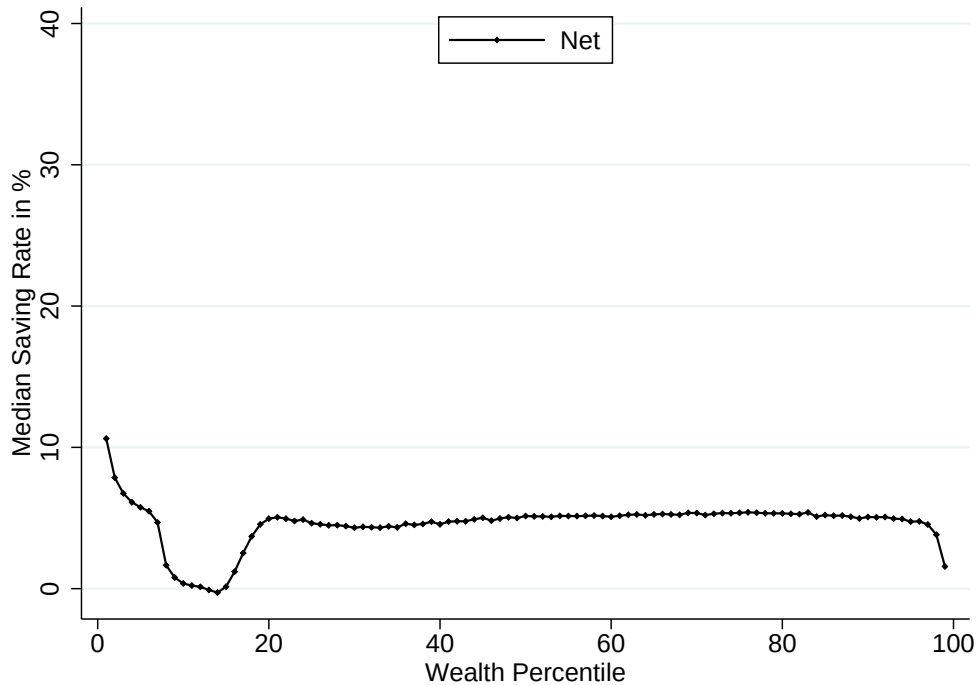
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   (b) saving rates including capital gains ("gross saving")

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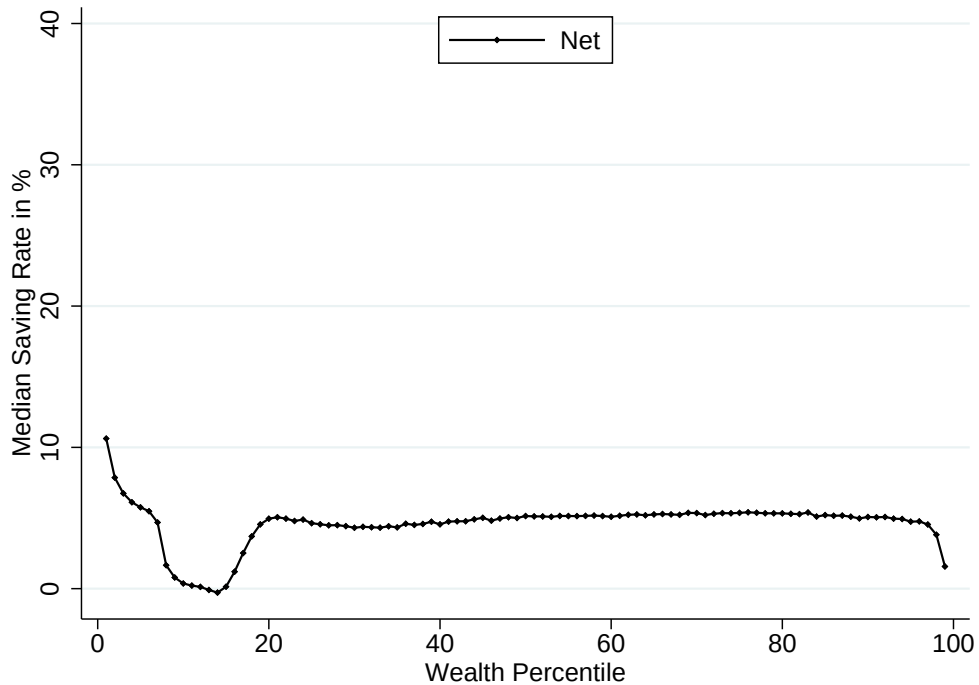
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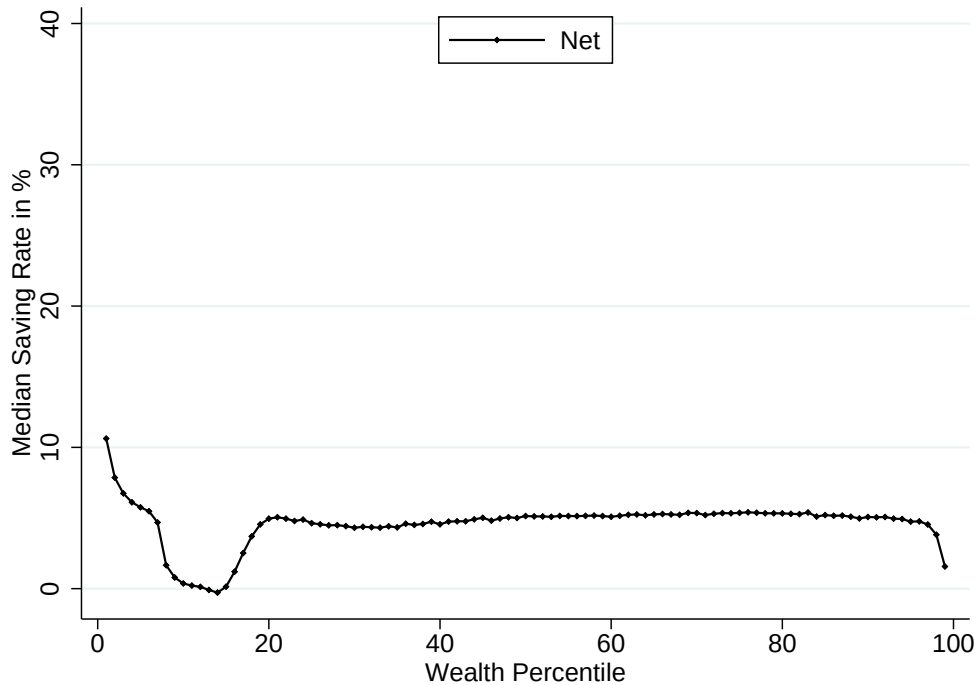


   - seemingly consistent with workhorse models

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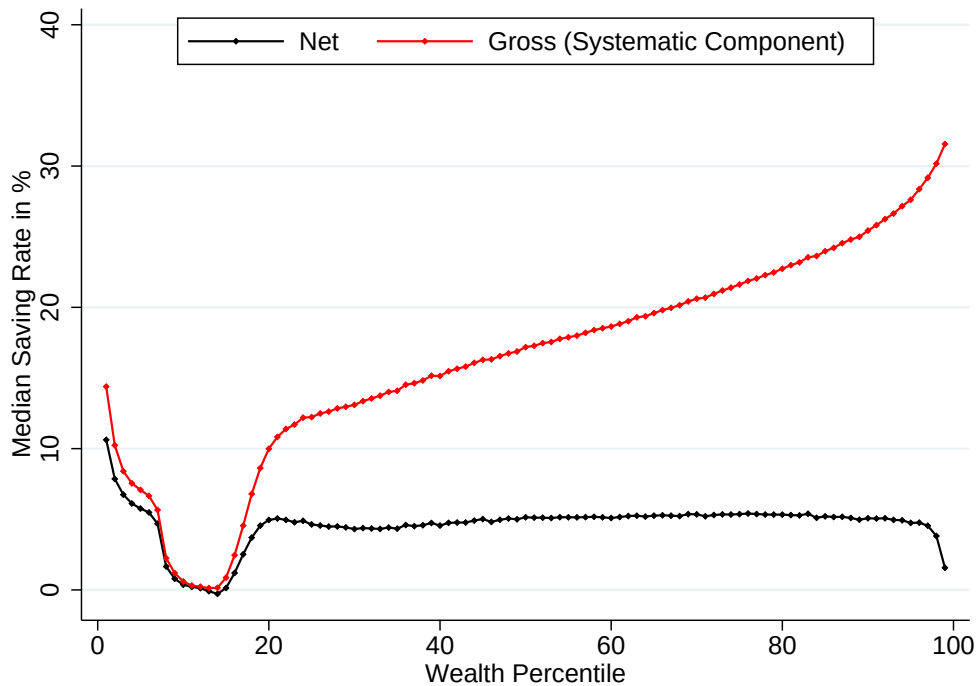
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   - seemingly consistent with workhorse models
   - but: economic theories are not about net saving

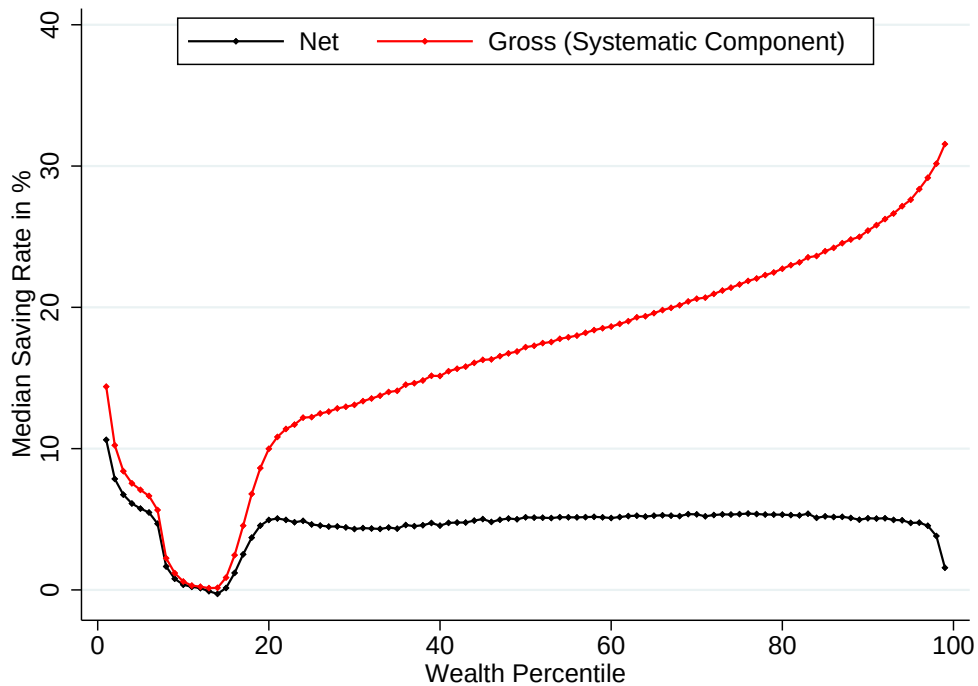
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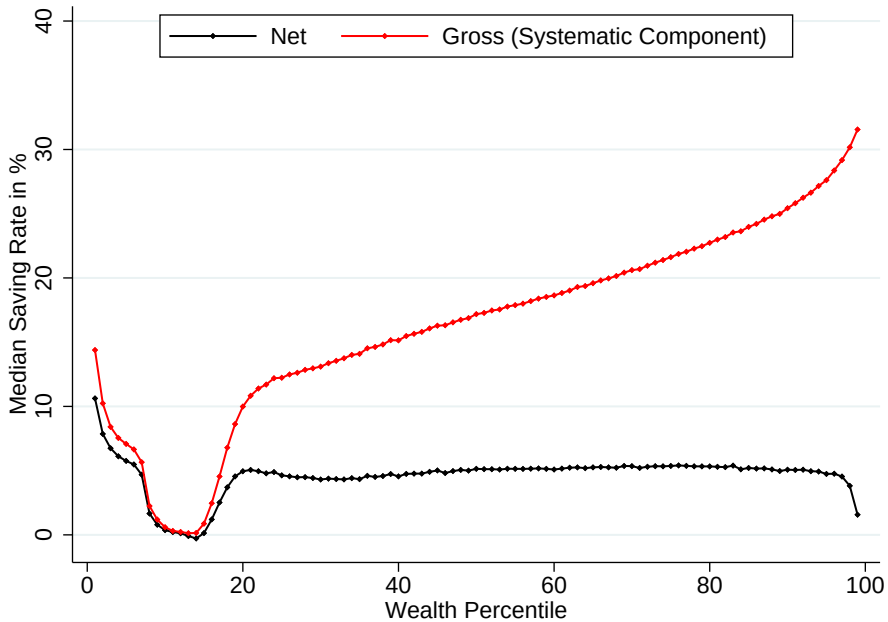
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- rich people hold assets that experience persistent capital gains, do not sell these to consume ⇒ they save more

Our Findings: "Saving by Holding" – Back-of-Envelope

1. Saving rates excluding and including capital gains

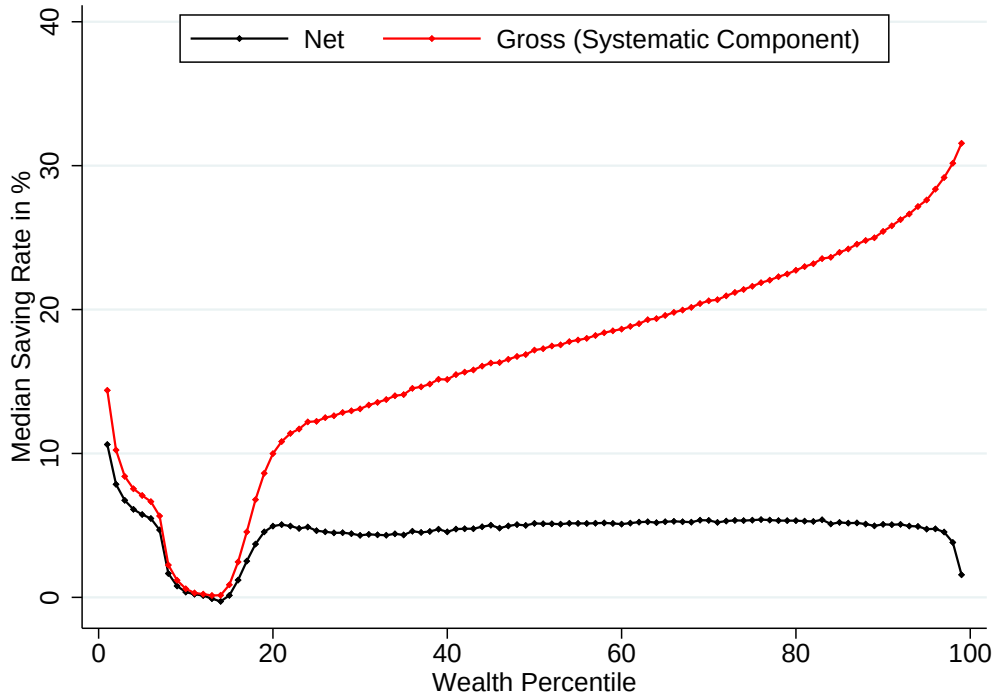


Back-of-envelope example to clarify:

- assume net saving rate = 10%, capital gains on all assets = 2%
- Paul: income (excluding cap gains) = $100,000, assets = $0
  Richie: income (excluding cap gains) = $100,000, assets = $1,000,000
- gross savings are $10,000 and $10,000 + $20,000 = $30,000
- gross saving rates are 10% and $\frac{30{,}000}{100{,}000+20{,}000} = 25\%$

Our Findings

2. Implications for theory:
   - Joint pattern for net & gross saving rates ≠ workhorse models



   - Potential explanations
     - multiple assets + portfolio adjustment "frictions"
     - ... (will discuss a few others)

Related Literature

Empirics:

1. saving across wealth distribution Bach-Calvet-Sodini
2. saving across permanent income distribution Dynan-Skinner-Zeldes, Straub
3. rates of return across wealth distribution Fagereng et al, Bach-Calvet-Sodini

Macro:

- aggregate implications of income & wealth heterogeneity
  Krusell-Smith, Krueger-Mitman-Perri, Quadrini-RiosRull, Kaplan-Violante, Auclert-Rognlie, Straub,...
- consumption response to asset price changes Poterba, Paiella-Pistaferri
  Christelis-Georgarakos-Jappelli, Berger-Guerrieri-Lorenzoni-Vara, Kaplan-Mitman-Violante, Guren et al,...

Inequality:

- theories of wealth inequality at point in time
  Benhabib-Bisin, DeNardi-Fella, Jones, Piketty-Zucman, ...
- wealth inequality dynamics, type/scale dependence?
  Gabaix-Lasry-Lions-Moll, Kaymak-Poschke, Hubmer-Krusell-Smith, Garbinti-GoupilleLebret-Piketty, Gomez, ...

Other areas:

- public finance, particularly capital taxation Saez-Stantcheva, Jakobsen-Kleven-Zucman
- household finance Campbell, Calvet-Campbell-Sodini

Plan

1. Data
2. Theoretical benchmarks
3. Key conceptual issue: how to think about changing asset prices
4. Results
5. Theoretical interpretation

Data

Norwegian Population Tax Record Data

- Sample: roughly 3.3 mio persons per year
- Period: 1993 to 2015 but focus on 2004 to 2015 (12 years) so as to combine with shareholder and housing registries
- Tax records include (Norway has a wealth tax):
  - asset holdings by broad asset class (e.g. deposits, housing)
  - income (labor, business, capital, and transfers)
- Third-party reported: scope for tax evasion limited

- Advantages: long panel data, no attrition, even very top tail in data set, limited measurement errors
- Disadvantages: don't observe individual asset prices/unrealized capital gains directly

Definition of Wealth and Asset Categories ▸ wealth distribution

- Wealth = deposits + stocks + stock fund holdings + informal loans + bonds + housing + private equity + vehicles/boats − liabilities
- For most categories: tax value = market value
- Private equity: tax value $\approx$ book value $\leq$ market value ▸ details
- Housing: use transaction data and house characteristics to estimate market values
- Pensions: not included in wealth or saving (to be estimated)

Why not US or EU data?

- Why not simply use, say, the US Survey of Consumer Finances (SCF) or EU Household Finance and Consumption Survey (HFCS)?

- Because they do not fulfill requirements to make our main figure

  1. reliable information on assets, liabilities
  2. panel data
  3. large number of observations

Theoretical Benchmarks

A Series of Benchmark Models

1. The simplest consumption-saving model
2. The simplest consumption-saving model + changing asset prices
3. Labor income risk, borrowing constraints, lifecycle, β heterogeneity
4. Housing

1. The simplest consumption-saving model

- Households solve:

$$\max_{\{c(t)\}_{t\geq 0}} \int_0^\infty e^{-\rho t} \frac{c(t)^{1-\gamma}}{1-\gamma} dt \qquad \text{s.t.}$$

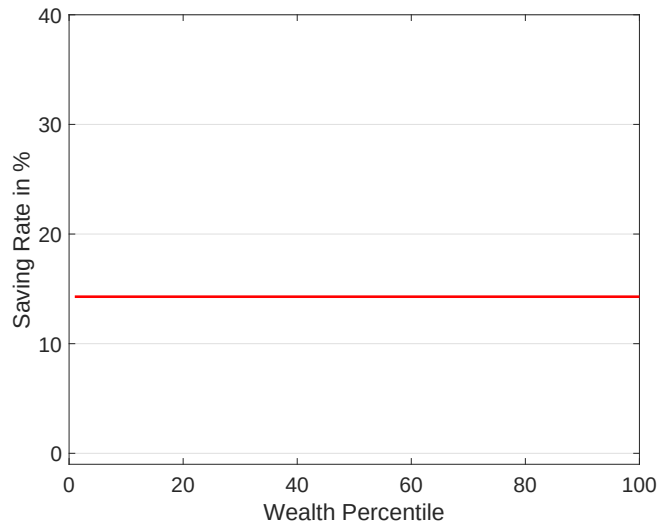
$$\dot{a} = w + ra - c, \qquad a \geq -w/r$$

- Saving policy function is linear in wealth a

$$\dot{a} = s(a) = \frac{r-\rho}{\gamma}\left(\frac{w}{r} + a\right)$$

- Constant saving rate out of total income

$$\frac{s}{y} = \frac{s}{w+ra} = \frac{r-\rho}{\gamma r}$$



- Aside: no clean prediction for saving rate out of wealth (Bach-Calvet-Sodini)

$$\frac{s}{a} = \frac{r-\rho}{\gamma}\left(\frac{w}{ra} + 1\right)$$

2. Changing asset prices

- Consider asset with price p, dividend yield θ

$$c + p\dot{k} = w + \theta pk, \qquad \frac{\dot{p}}{p} = \mu + \varepsilon$$

  μ = "persistent", ε = "transitory"

- Map into previous model by defining wealth $a := pk$

$$c + \dot{a} = w + \underbrace{(\theta + \mu + \varepsilon)}_{r} a$$

- Solution:

$$\dot{a} = s(a, w, \bar{r}) + \varepsilon a \approx \bar{s}\,(w + \bar{r}a) + \varepsilon a, \qquad \bar{r} = \theta + \mu$$

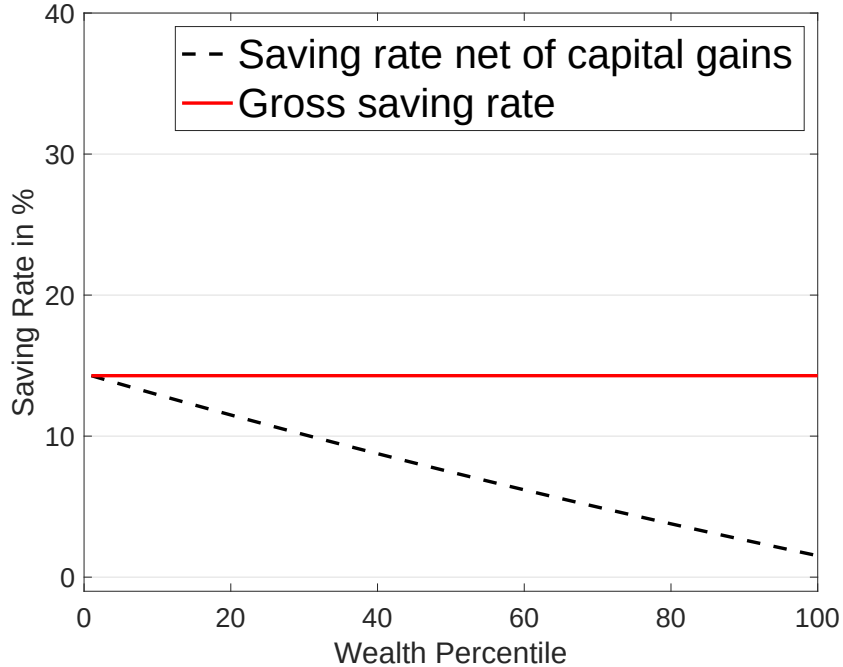
- Unrealized capital gains are income (Schanz-Haig-Simons)...
- ... but different responses to different types of capital gains:
  - transitory $\varepsilon > 0$: 100% saving rate out of these
  - persistent $\mu > 0$: consume part of resulting income flow

(similar logic as transitory vs persistent labor income shocks)

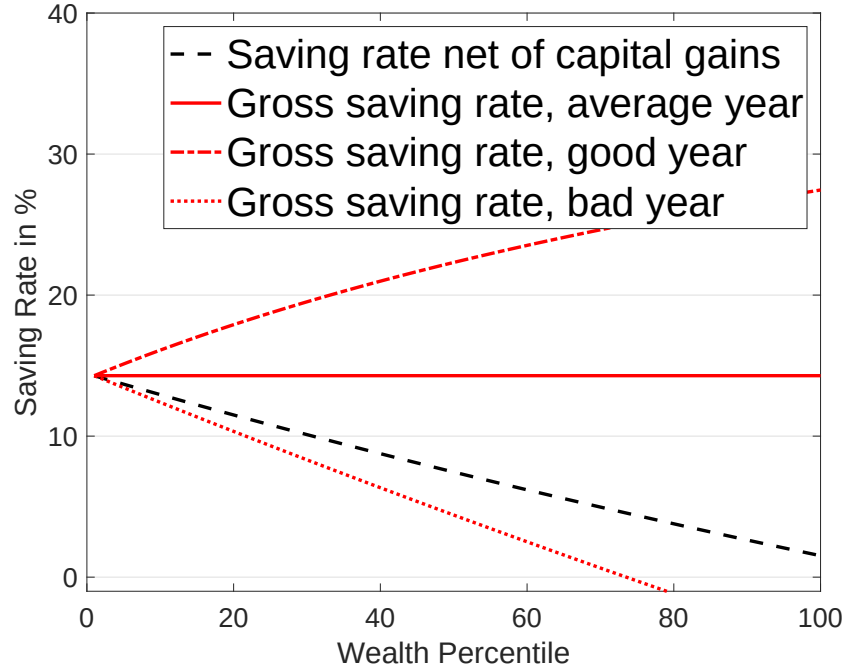
2. Changing asset prices

In cross-section, richer $\Rightarrow$ capital gains = larger fraction of income

- transitory $\varepsilon > 0$: 100% saving rate out of these
- persistent $\mu > 0$: consume part of resulting income flow



(a) Only persistent: $\mu > 0, \varepsilon = 0$



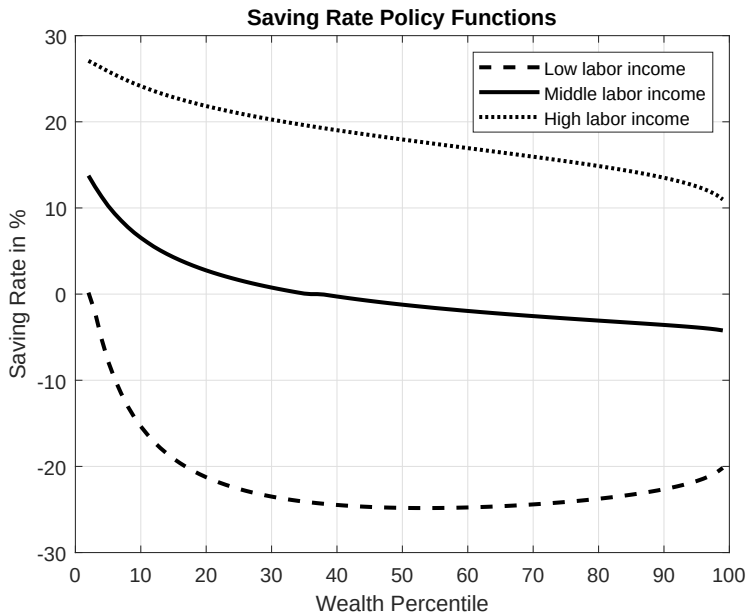
(b) Both: $\mu > 0, \varepsilon \lesseqgtr 0$

1. net saving rate decreasing with wealth (if $\mu > 0$)
2. systematic component of gross saving rate independent of wealth

3. Labor income risk etc ▸ details

(a) Labor income risk and borrowing constraints:

- flat/slightly decreasing saving rate conditional on labor income
- previously noticed by De Nardi & Fella (2017)



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(c) Discount rate heterogeneity:

- flat/slightly decreasing conditional on discount rate

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Overall:

- $\approx$ constant saving rate conditional on observables (age, ...)
- could be $\nearrow$ in cross-section due to spurious correlation
  But our data allows us to control for these!

4. Housing ▸ details

Housing differs from other assets:

1. not just asset but also consumption good (Glaeser, Buiter, ...)
2. indivisibilities/adjustment costs

Lots of people's intuition: (1) by itself $\Rightarrow$ should save $\dot{p} > 0$. Logic:

- $p \uparrow$ means housing more expensive = bad for you
- $\Rightarrow$ should not consume out of $\dot{p} > 0$, even if persistent

We show: (1) by itself is not enough, instead need (2). Without (2):

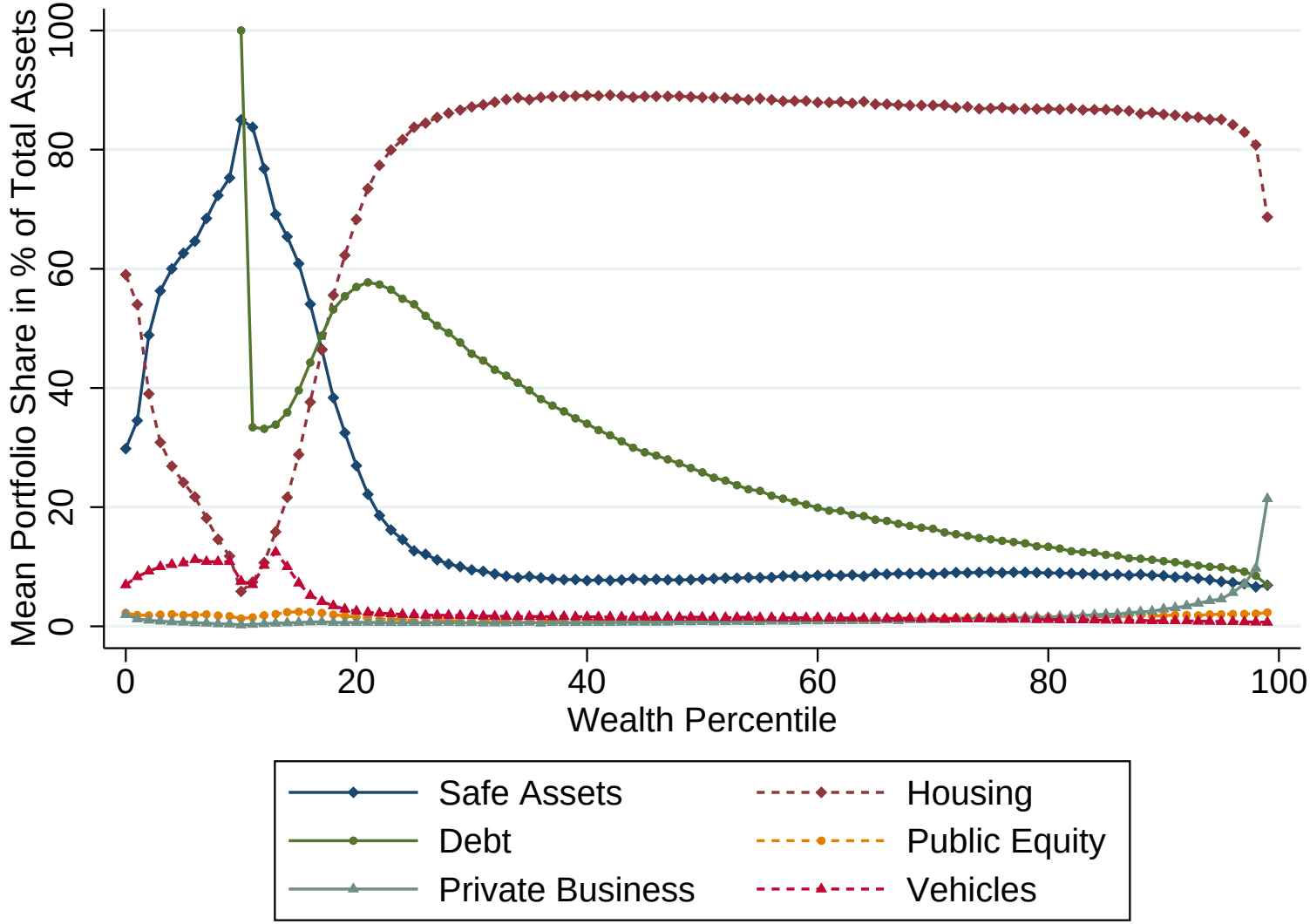
- intuition above is wrong because it ignores intertemporal substitution of housing
- $\dot{p} > 0 \Rightarrow$ buy bigger house now, then gradually sell off over time
- collapses to one-asset model with $\approx$ constant gross saving rate

Takeaway: it's true that housing is different, but because of (2) not (1)

Key Concepts and Definitions with Changing Asset Prices

Portfolio Shares: The Importance of Housing

▸ zoom top 1%



Notes: 12th pctile = 0 net worth. Safe assets = deposits + bonds + informal loans.

▸ participation ▸ U.S. (Campbell) ▸ debt decomposition

Net, Gross and Recurrent Saving

- Two ways of writing consumption + saving = income

$$c + \underbrace{p\dot{k}}_{\text{net saving}} = \underbrace{w + \theta pk}_{\text{disposable income}} \tag{1}$$

$$c + \underbrace{p\dot{k} + \dot{p}k}_{\text{gross saving}} = \underbrace{w + (\theta + \dot{p}/p)pk}_{\text{Haig-Simons income}} \tag{2}$$

- Standard theories only have implications for gross saving in (2)
- Have shown: implications different for transitory vs persistent $\dot{p}/p$
  - expect saving rates to vary strongly with market performance
- $\Rightarrow$ focus on recurrent saving = systematic component

$$c + \underbrace{(\dot{k}/k + \mu)pk}_{\text{recurrent saving}} = \underbrace{w + (\theta + \mu)pk}_{\text{recurrent income}}, \quad \mu := \overline{\dot{p}/p} \tag{3}$$

- Simple benchmark: recurrent saving rate = independent of wealth

Additional Issues with Housing

- Housing is not just asset but also consumption good

$$\underbrace{c + Rh}_{\text{consumption}} + \underbrace{\dot{p}h + p\dot{h} + \dot{b}}_{\text{gross saving}} = \underbrace{w + rb + Rh + \dot{p}h - \delta ph}_{\text{Haig-Simons income}}$$

- Rental-equivalence approach: $R =$ rental rate on similar properties $= 2.88\% \times ph$ (Eika-Mogstad-Vestad)

- Alternative (not today): user-cost approach: $R = (r + \delta - \dot{p}/p)p$

Implementation

1. Separate gross saving into net saving and capital gains
   - housing: use transaction data
   - public equity: use holdings of individual stocks (shareholder registry)
   - private equity: arguably Δ(book value) $\approx$ net saving
   - bonds: compute from arbitrage with treasury rate
2. Estimate persistent capital gains μ
   - mean of realized $\dot{p}/p$ from 1950 or as long as series go back
   - housing: very high price growth 2004 – 2015 $\Rightarrow$ this matters

Asset	Average capital gain	Average rate of return
Public equity	3.25 %	6.18 %
Housing	2.25 %	5.13 %
Bonds	1.06 %	2.03 %

3. Calculate saving rates $\frac{s}{y}$

Saving Rates across the Wealth Distribution

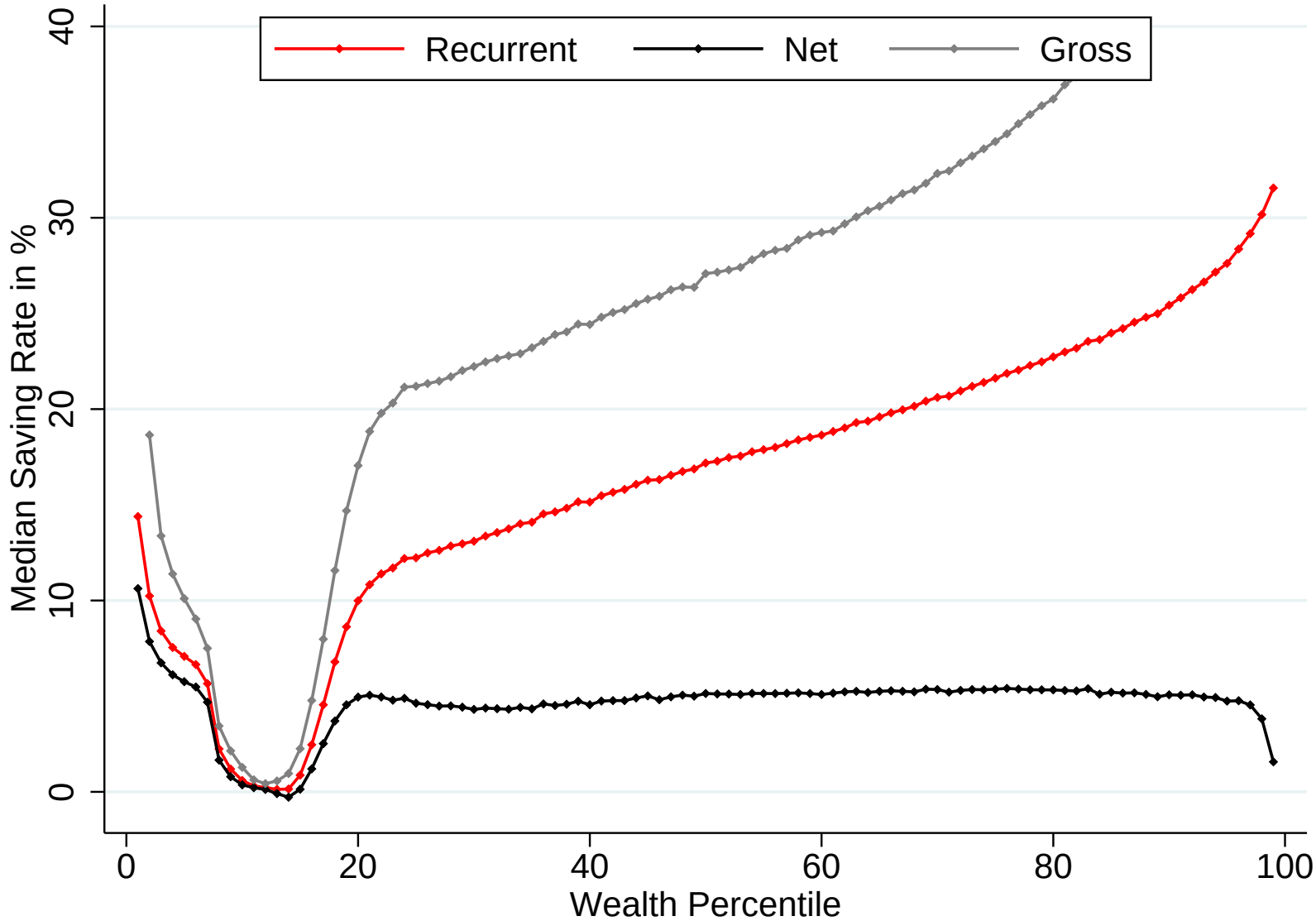
Saving Rates across the Wealth Distribution

- Start with simple descriptive plots using “raw data”

- Afterwards: similar patterns with controls

Median Saving Rates

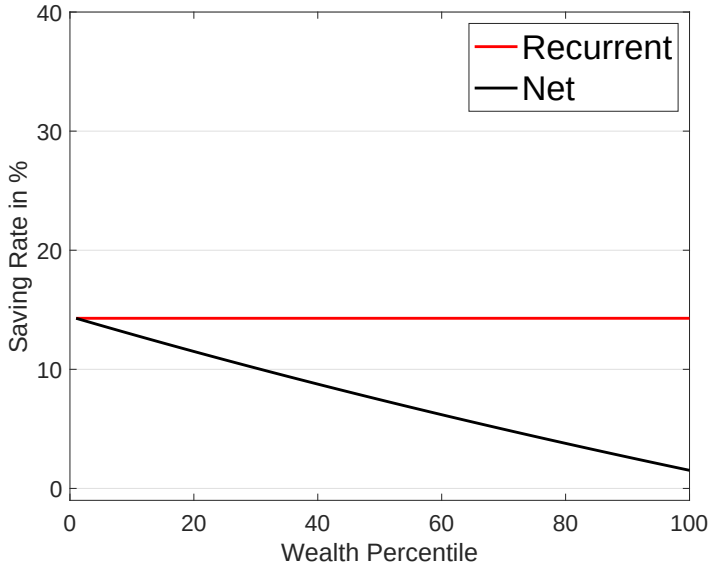
▸ zoom top 1% ▸ bad year ▸ dispersion ▸ sample restrictions



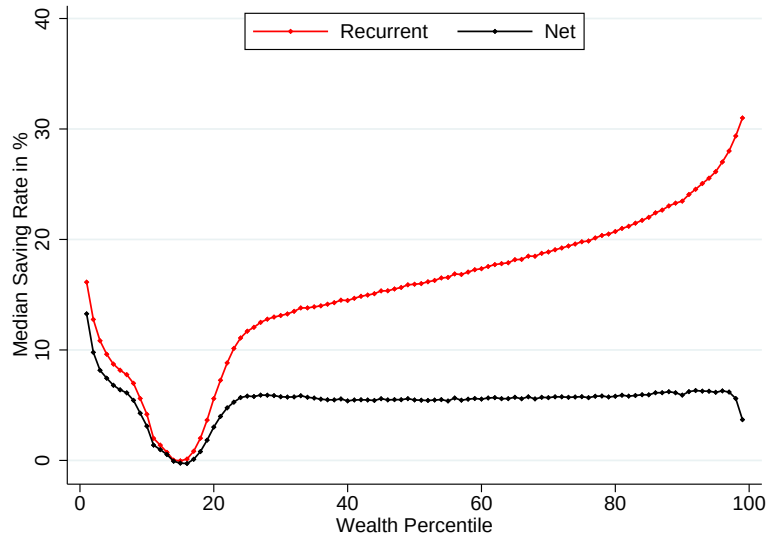
Note: for now, dropped bottom 1st percentile

To be clear

1. Completely different from predictions of simple benchmark model



(a) Benchmark model



(b) Data

2. Not just one lucky year: $\dot{p}/p > 0$ in most years and

Asset	Average capital gain
Public equity	3.25 %
Housing	2.25 %
Bonds	1.06 %

Controlling for the usual suspects

▸ age ▸ inc ▸ educ

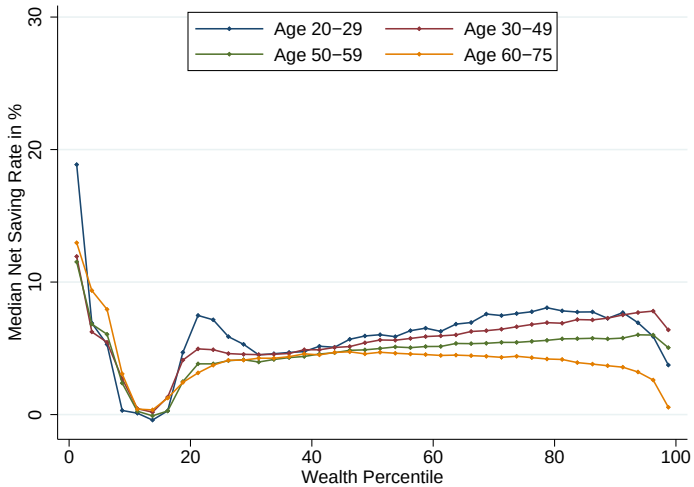
Median regression with controls $\mathbf{x}_{it}$ = age, earnings, education

$$\frac{s_{it}}{y_{it}} = \phi_1 + \sum_{p=2}^{100} \phi_p D_{it,p} + f(\mathbf{x}_{it}) + \mu_t + \varepsilon_{it}$$

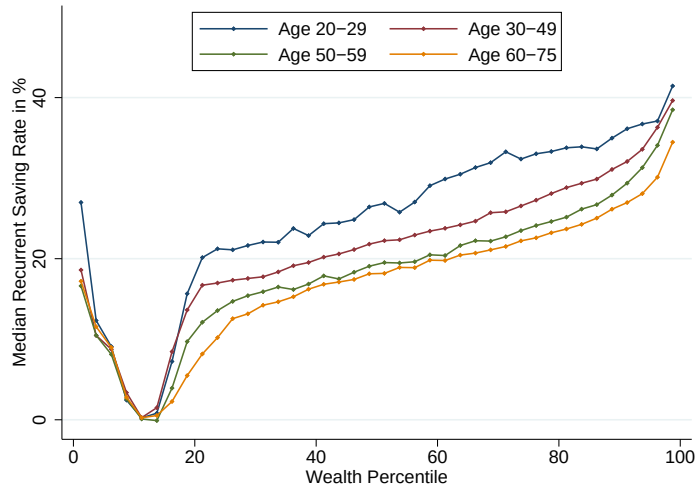


(for now: 5 % sample)

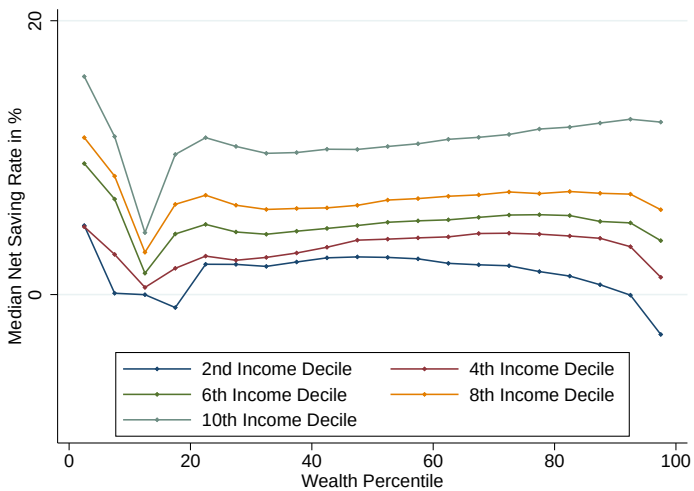
Controlling for age, earnings, and education



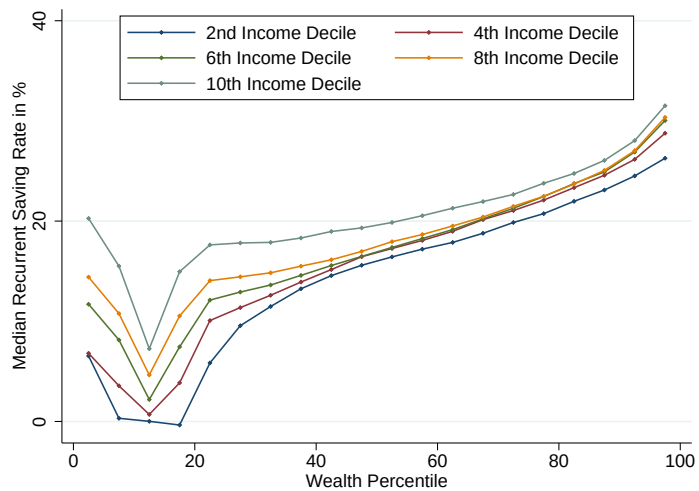
(a) Age, net saving rate



(b) Age, recurrent saving rate



(c) Earnings, net saving rate



(d) Earnings, recurrent saving rate

Is this exclusively a story about housing? No

Question: what if "take out" housing?

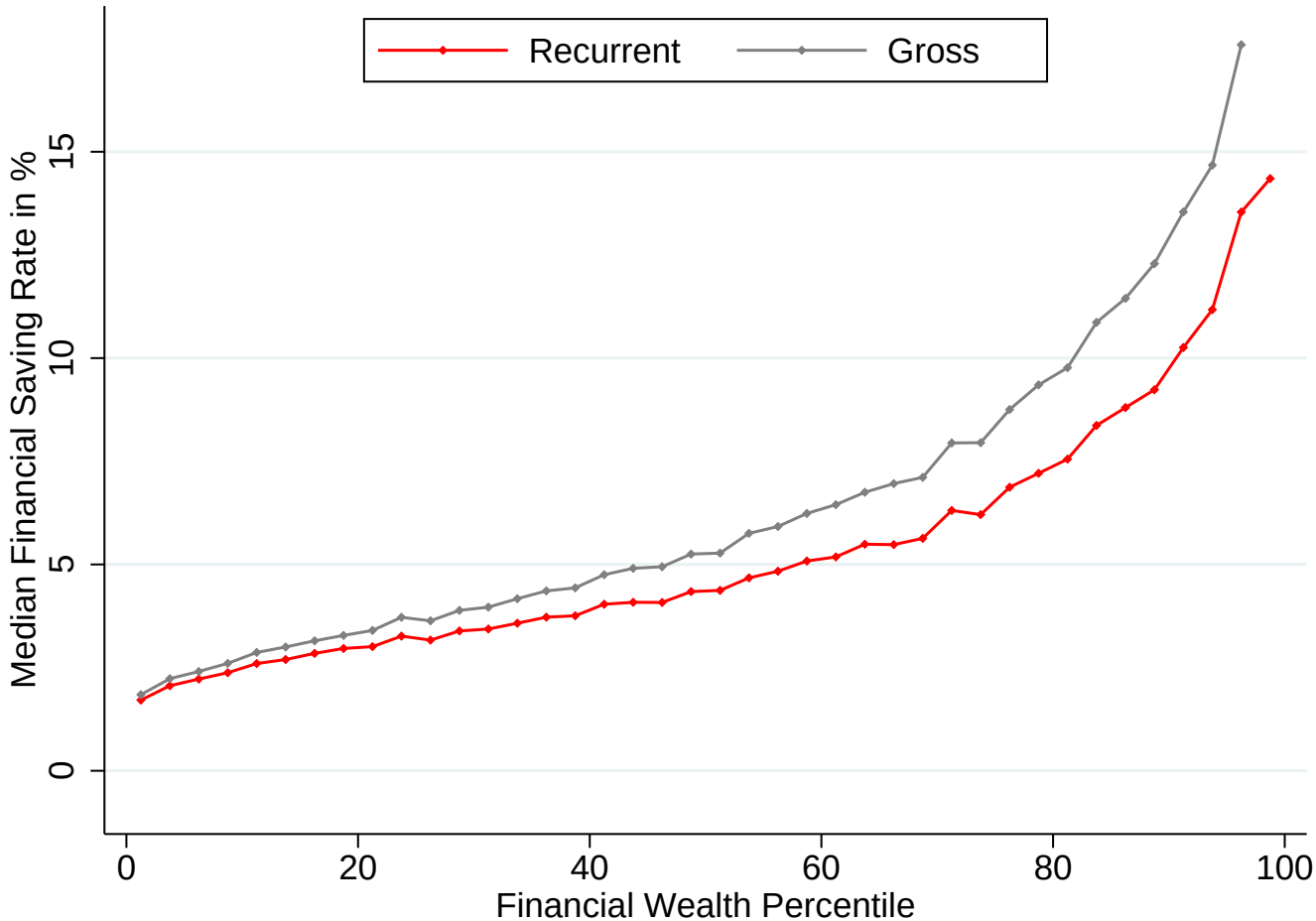
- similar patterns for net and gross saving rates?
- how do households treat capital gains on other assets?

Challenge: Norwegians hold few other assets with capital gains ▸ portfolios

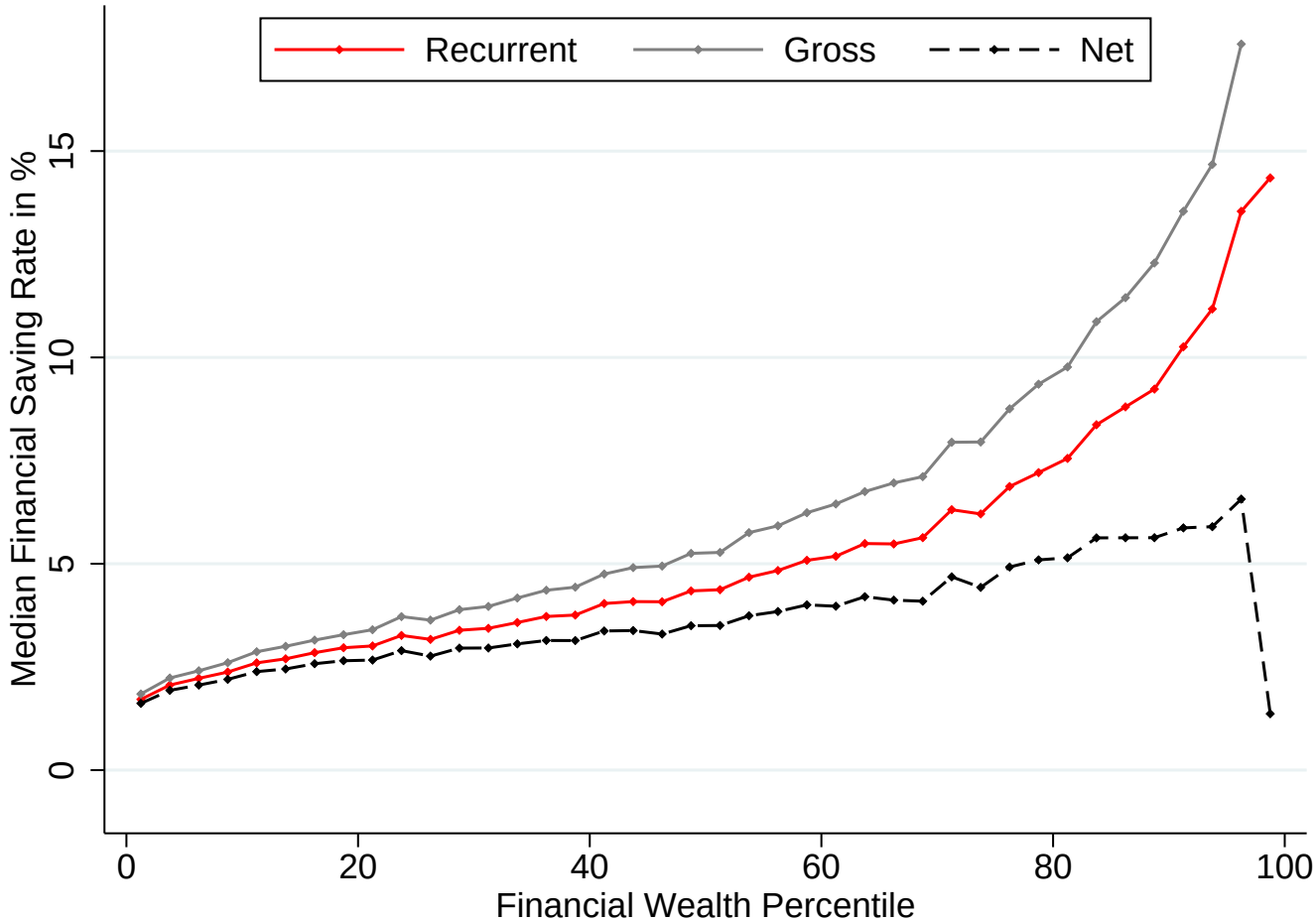
Solution: restrict to households with stocks $> 25\%$ of financial wealth

▸ Alternative exercise: drop all home owners

Is this exclusively a story about housing? No

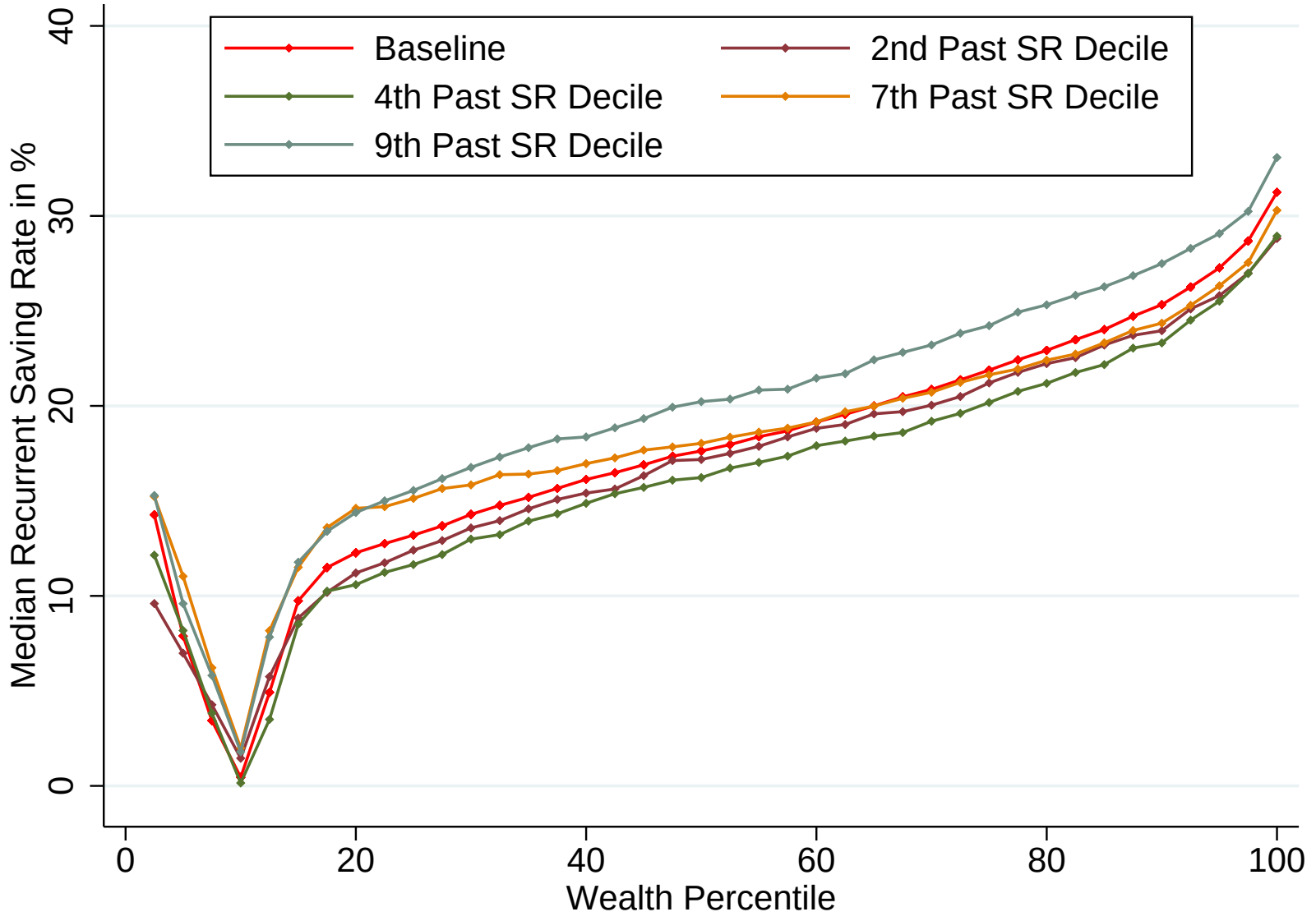


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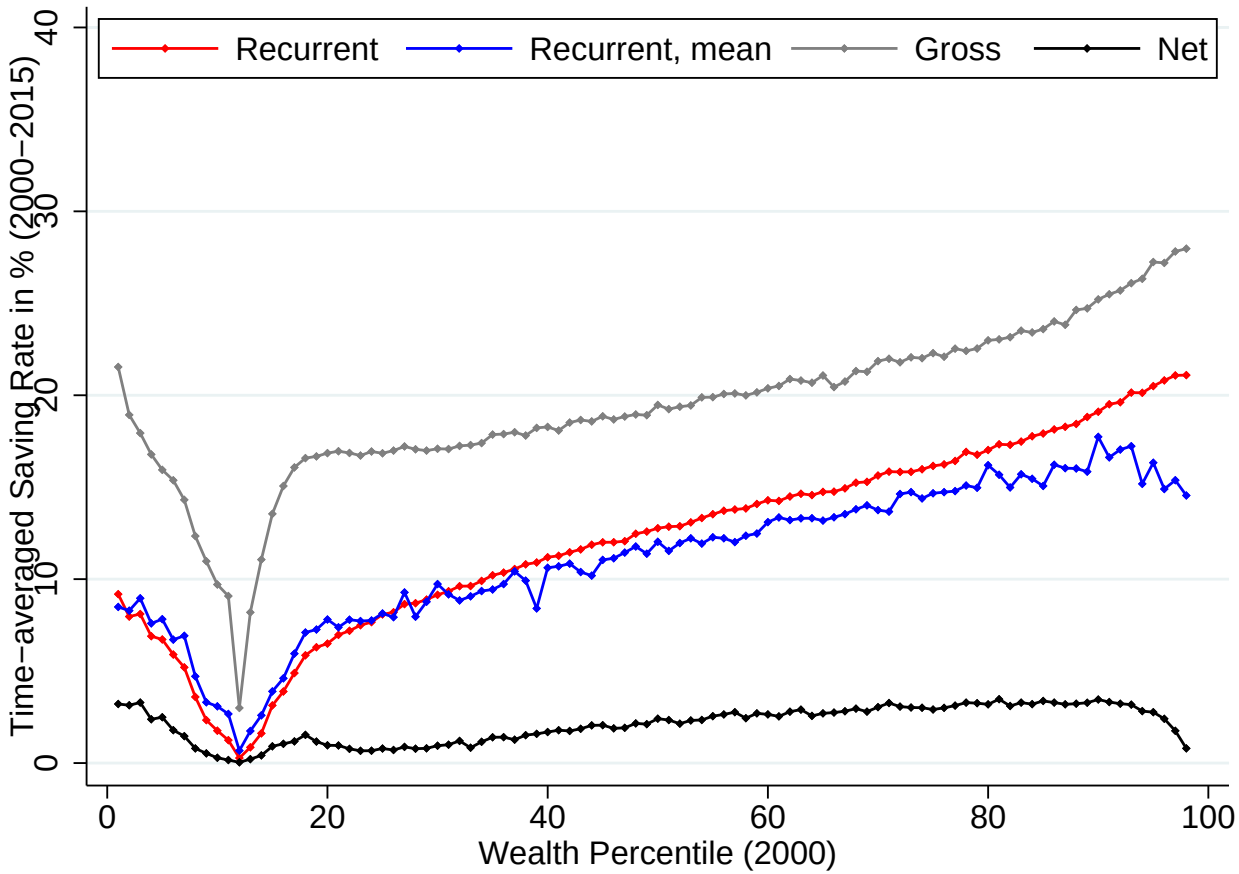
- Caveat: cannot use shareholder registry for stock fund holdings, use aggregate index $\Rightarrow$ net saving biased if $\text{Cov}(a_i, \dot{p}_i) \neq 0$.
- Not just about housing. But smaller capital gains for other assets.

Simply High Saving Rate ⇒ High Wealth? No



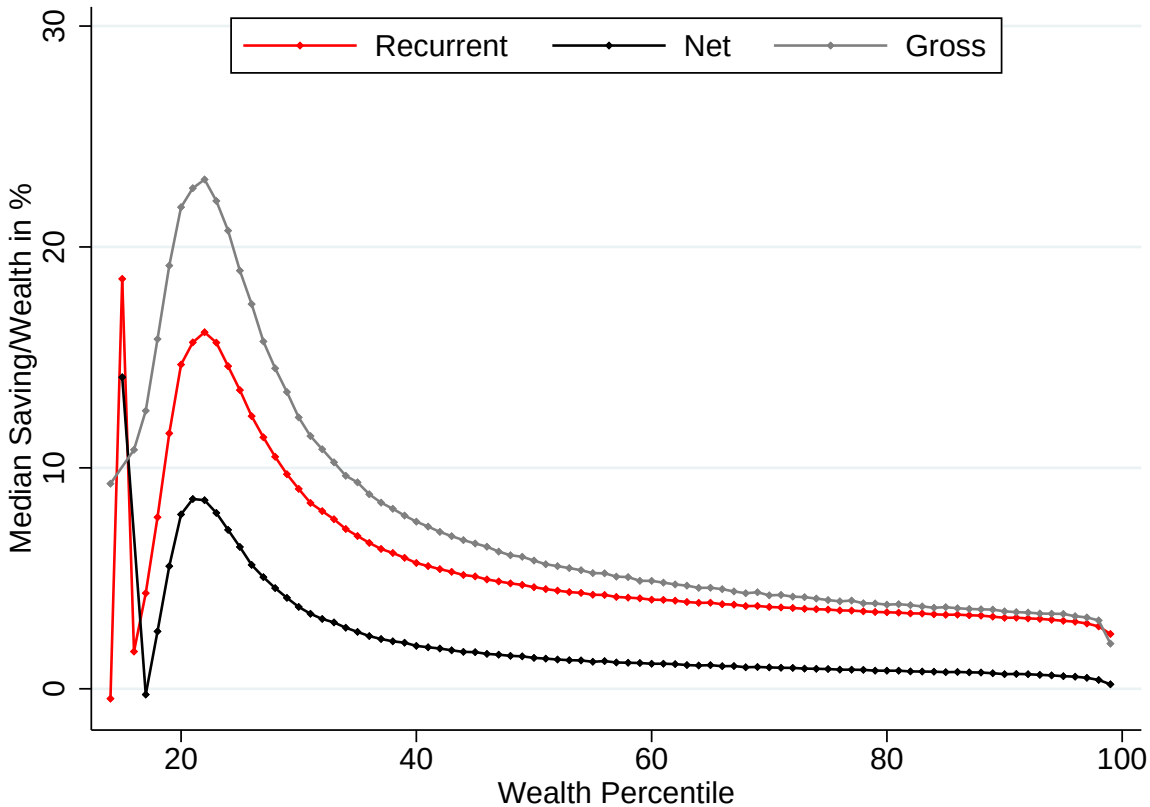
Saving Rates with Time Averaging

- Concern: medians of year-to-year saving rates may get it wrong if expenditure is “lumpy”
- Our solution: time-average saving rates within individuals



Aside: Saving as Fraction of Wealth (Bach-Calvet-Sodini)

$$\dot{a} = \frac{\rho - r}{\gamma}\left(\frac{w}{r} + a\right), \qquad \frac{\dot{a}}{a} = \frac{\rho - r}{\gamma}\left(\frac{w}{ra} + 1\right)$$



▸ Time-averaged

Consumption-Equivalent Saving Rates

- So far: market values of wealth, income, saving
- But: market values may not reflect consumption, welfare
- $\Rightarrow$ try to translate market values into consumption equivalents

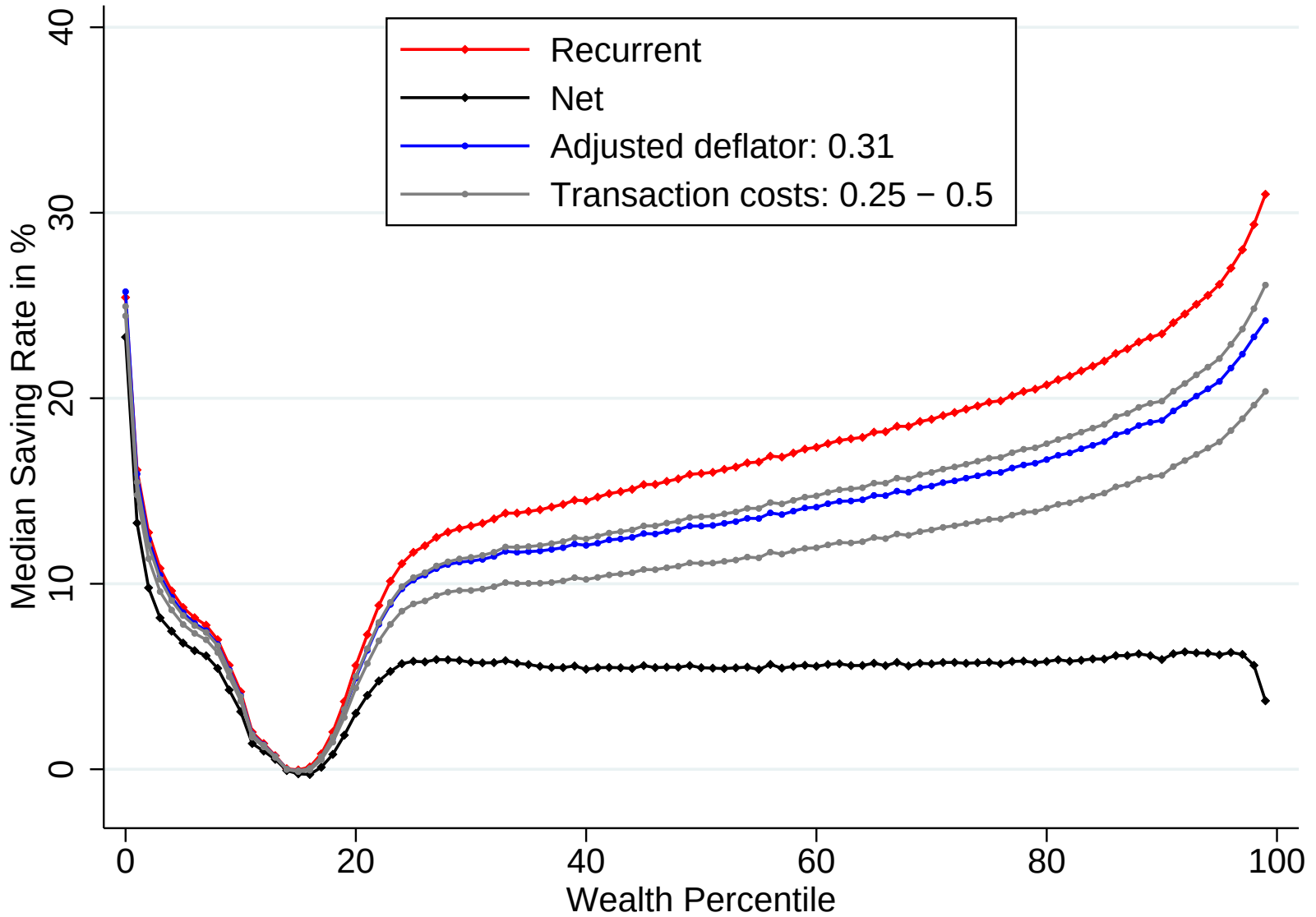
1. Housing is not just asset but also consumption good
   - really a matter of choosing the right deflator (Poterba, 2000)
   - construct new deflator with implicit rent $\propto$ house price index

2. Some assets are illiquid (housing, private firms,...)
   - may not want to count illiquid saving/income at market value
   - define effective saving and income ($\chi :=$ adj cost)

   effective saving $=$ liquid saving $+ (1 - \chi) \times$ illiquid saving

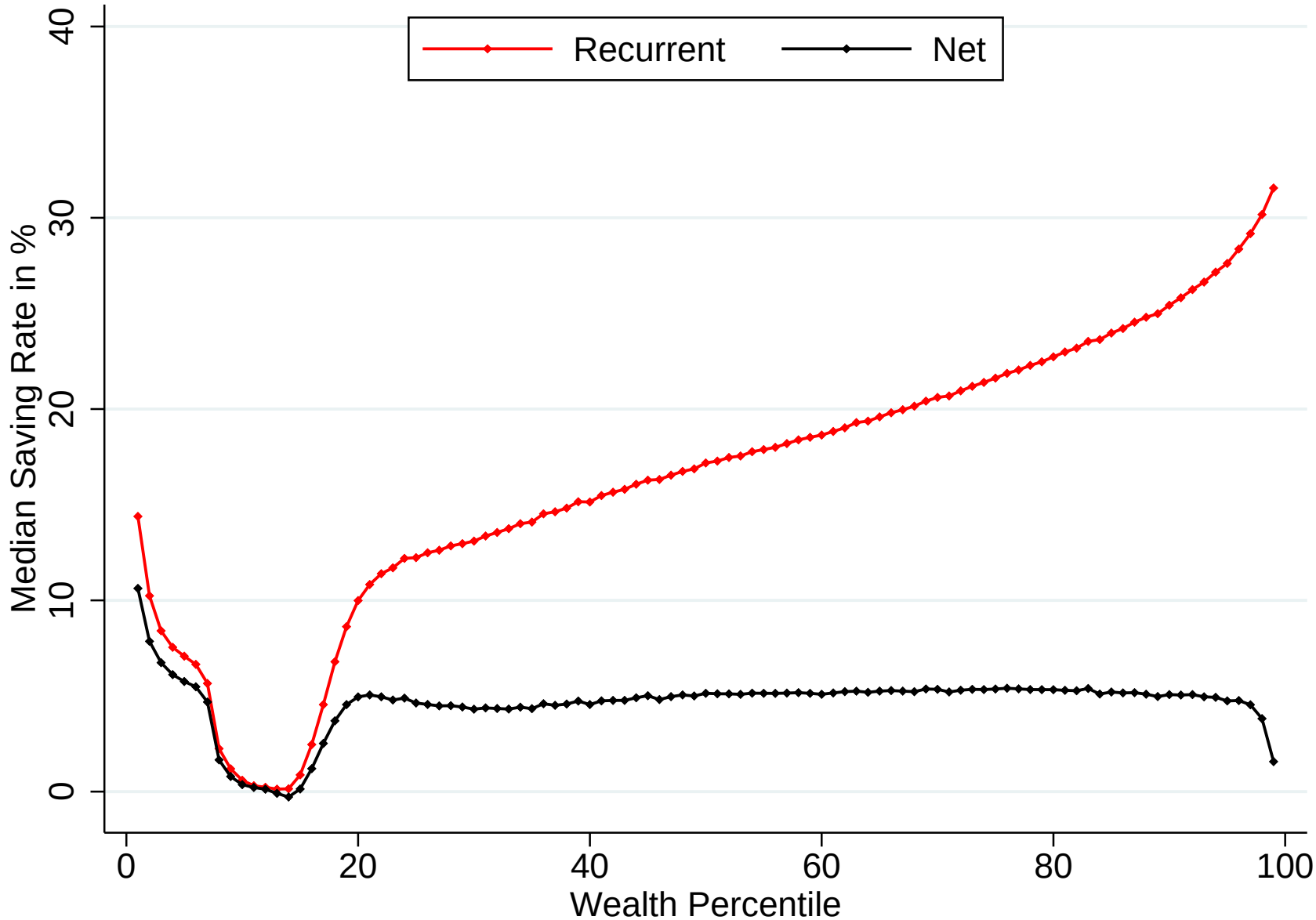
   effective income $=$ liquid income $+ (1 - \chi) \times$ illiquid income

Patterns Remain even with Large Adjustments



Theoretical Interpretation

What explains joint pattern of net & recurrent saving?



What explains joint pattern of net & recurrent saving?

- Reduced form of all our explanations

  gross saving $= s_d$(disp income)$+s_c$(cap gains) $\quad s_d << s_c \approx 100\%$

- Next slide: multiple assets + portfolio adjustment "frictions"

- Other potential explanations (not today)

  1. Capital gains driven by increased demand of asset holders (e.g. home owners experience housing preference shift)
  2. Non-homothetic preferences. But hard to explain flat net saving rate.
  3. (Unlikely) Wrong expectations about asset price changes: perceive all capital gains as transitory (ε rather than μ)
  4. ...

A Model with "Saving by Holding"

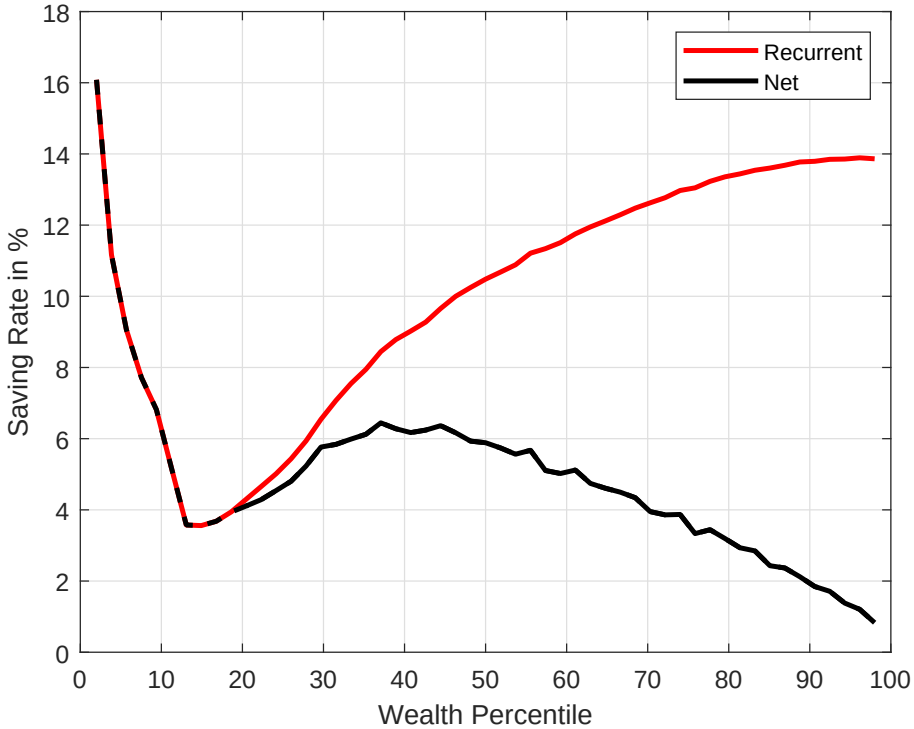
- Kaplan-Violante & Kaplan-Moll-Violante with twist = stochastic asset prices
- Two assets: consumption asset b and investment asset k

$$\dot{b} = w + r^b b + \theta p k - p d - c$$

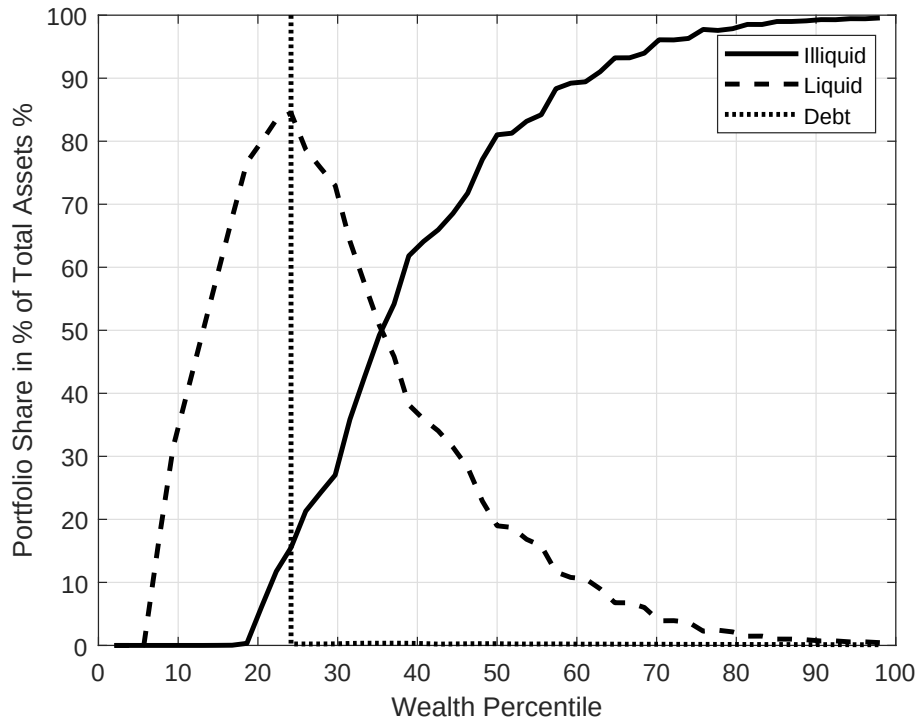
$$\dot{k} = d, \quad \frac{\dot{p}}{p} = \mu + \varepsilon$$

- + some reason for $d = 0$ most of the time
  - e.g. physical transaction cost but could be something else
  - tax on realizing capital gains, inattention, commitment,...
- + wedge between borrowing and saving rates $r_-^b > r_+^b$

The model with "saving by holding" can qualitatively explain the patterns



(e) Saving Rates



(f) Portfolio Shares

Note: assumes $r_-^b > r^a > r_+^b > \rho$ where $r^a := \theta + \mu$

Conclusion

- Little is known about the distribution of saving rates and how these vary across the wealth distribution
- We provide evidence using population tax records from Norway
- Results
  1. net saving rate $\approx$ flat across wealth distribution
  2. gross saving rate steeply increasing with wealth
  3. close to 100% saving rate out of (persistent) capital gains
- Take-aways for theory
  - joint pattern for net & gross saving rates $\neq$ workhorse models
  - fits with multiple assets + portfolio adjustment "frictions"
- Macro & wealth inequality literatures need to take into account changing asset prices!