

# Wealth Returns Persistence and Heterogeneity

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PRELIMINARY AND INCOMPLETE

# The distribution of returns to wealth

- There is large and growing evidence on the distribution of returns to human wealth across individuals
- In contrast, there is surprisingly little evidence on how returns to financial wealth are distributed across individuals and households
- This is mostly due to data limitations
  - No administrative information on wealth and capital income for a representative sample of individuals or asset classes in the US
  - Population surveys (SCF) lack a consistent longitudinal component and have low response rates at the top

# Motivation: Wealth inequality and concentration

- In many countries, and over long time periods, the wealth distribution is extremely skewed and displays a long thick tail

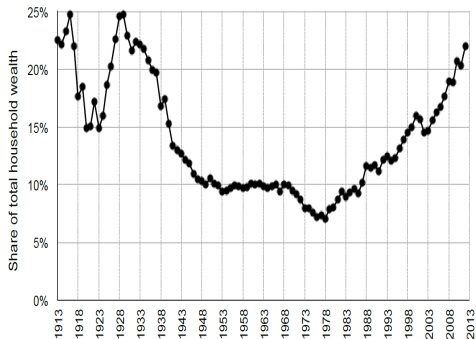


Figure: Top 0.1% wealth share in the US (Saez and Zucman, 2016).

# What explains the long thick tail?

- Idiosyncratic earnings risk/skewness and precautionary saving response
- Savings increasing with wealth (Non-homothetic bequests)
- Heterogeneity in discount rates
- Entrepreneurship
  
- These explanations, in isolation, have trouble fitting the data
  - If they do, it is at the cost of some very strong or counterfactual assumptions

# Stochastic wealth returns

- Benhabib et al. (2016) suggest that to reproduce the long thick tail of the wealth distribution (and the extent of intergenerational correlation) one needs heterogeneous wealth returns (along with some of the features listed before)
- Gabaix et al. (2015) suggest the need of *type dependence* in the growth rate distribution of income (wealth) to explain the speed of changes in tail inequality
- But: Black box
- Important questions:
  - How much heterogeneity in wealth returns?
  - How much persistence?
  - Are returns to wealth correlated with wealth itself?
  - Is there any intergenerational correlation in returns?
- Measurement and conceptual issues
  - This paper: Measurement

# Our contribution and findings

- We have access to population data on wealth and capital income (by broad asset sources) for Norway over two decades
- Tax records: Cover all tax-payers, including the very wealthy, with virtually no concern about measurement error
- We can construct returns to wealth for each individual tax-payer
- In these data, we document the presence of massive returns heterogeneity (more than predictable by standard household finance model), strong correlation with wealth, persistence
  - Persistence is both within persons (strong);
  - across generations (weak);
  - and even intramaritally (weak).

# Roadmap

- Data
- Facts
  - Returns heterogeneity
  - Correlation between returns and wealth
  - Persistence
- Digging on some facts
- Persistence through marriage and intergenerationally

# Our data

- We use Norwegian population tax record data from 1993 to 2013
- Besides income tax, Norwegian residents also pay a wealth tax, so tax records include:
  - Information on income earned (from labor and capital)
    - Capital income distinguished by “broad” source [Details](#)
  - Detailed information on asset holdings
    - Also distinguished by “broad” source [Details](#)
    - For most sources, tax value=market value
    - For unlisted stocks, etc., tax value  $\leq$  market value [Details](#)
- Third-party reports
  - Scope for tax evasion limited



# Advantages of data

- Administrative longitudinal population data
  - Measurement error limited
  - No attrition (apart from death and migration)
  - Even the very top tail is in data set (yes, Olav Thon too)
  - Long panel data
  - Family ID allows us to match parents with children when the latter form independent households
  - We can observe people's records before they form a family unit
- Our definition of wealth excludes housing (for the time being - complete data available only since 2010)
  - But  $\text{Corr}(\text{Fin. Wealth}, \text{Fin. Wealth} + \text{Housing} - \text{Debt}) = 0.98$

# Wealth Returns: Simplest Measurement

- Tax returns include all interest income, all dividends and realized capital gains/losses in calendar year  $t$ :  $y_{it}$
- They also include the stock of wealth at the beginning of year  $t$  ("end of year  $t - 1$ "):  $w_{it}$
- If no accumulation/decumulation of wealth during the year ("passive" portfolio), the return would simply be:

$$r_{it} = \frac{y_{it}}{w_{it}}$$

# Wealth returns measurement: Limitations and Adjustments

- We only observe snapshots of total financial wealth (beginning of each period)
  - We use multiple observation points
- Value of private equity may be understated
  - We show results for all individuals and for non-private equity owners
  - We adjust private equity wealth using comparable publicly traded firms
- Capital gains/losses only observed when shares are sold
  - Our fixed effect strategy will partly remedy this
  - We impute unrealized capital gains/losses

## Issue # 1: Snapshot bias

- Capital income may partly come from assets sold or purchased over the year.
- Suppose individual has  $w_{it} = 100$  and invests it in a  $r_{it} = 0.1$  CD
  - In mid-year, she puts extra savings into it (say, 50)
  - At the end of year, we observe  $y_{it} = 12.5$  and  $w_{it+1} = 162.5$
  - The naive return measure is:  $r_{it} = 0.125 \rightarrow$  too high
- Consider again the same starting scenario
  - But after 8 months, individual cashes half of CD and spends it
  - At the end of the year, we observe  $y_{it} = 8.33$  and  $w_{it+1} = 58.33$
  - The naive measure of return is:  $r_{it} = 0.0833 \rightarrow$  too low

# Adjusting the return for "snapshot" bias

- We re-define our **baseline** returns measure as:

$$r_{it} = \frac{y_{it}}{(w_{it} + w_{it+1}) / 2}$$

- This adjusted return is closer to actual one than the naive measure:
  - Case 1:  $r_{it} = 12.5 / (0.5 * (100 + 162.5)) = 9.5\%$
  - Case 2:  $r_{it} = 8.33 / (0.5 * (100 + 58.33)) = 10.5\%$
- We follow the same approach to measure returns on "safe" assets and on "risky" assets
- Moreover:
  - We drop returns of households with  $< \$500$  equivalent wealth
  - We censor at the top and bottom 0.5% of returns distribution
    - These corrections should, if anything, reduce the extent of returns heterogeneity

## Issue # 2: Valuation of private equity wealth

- Wealth consists of safe assets ( $SA$ ), stock market wealth ( $SMW$ ), and private equity wealth ( $PEW$ )
- The latter is based on an assessed value, the others are measured at market values
- We estimate the year- and industry-specific book-to-market ratio  $\theta_{kt}$  using data from listed firms in sector  $k$
- We re-define private equity wealth as  $PEW_{it} = \frac{B_{it}}{\theta_{kt}}$ , where  $B_{it}$  is the book value of equity

## Issue # 3: Unrealized capital gains/losses

- We estimate unrealized capital gains/losses

- For private equity, we assume they are:  $\Delta PEW_{it+1} = \Delta \frac{B_{it+1}}{\theta_{kt+1}}$
- For public equity, we assume they are:  $\frac{SMW_{it}}{\sum_j p_{jt} q_j} \sum_j \Delta p_{jt+1} q_j$

- The **alternative** measure of return is defined as:

$$r_{it} = \frac{\left( \Delta PEW_{it+1} + \frac{SMW_{it}}{\sum_j p_{jt} q_j} \sum_j \Delta p_{jt+1} q_j - CG_{it} \right) + d_{it} + i_{it}}{(w_{it} + w_{it+1}) / 2}$$

- where  $i$  is interest income from safe assets,  $d$  are dividends,  $w = SA + SMW + PEW$ , and  $SA$  are safe assets.

# Descriptive Statistics: Demographics

Panel A, Demographics:

	Mean	Std. dev	P10	Median	P90
Age	45.10	13.95	26	45	65
Male	0.50	0.50	0	1	1
Fraction married	0.49	0.50	0	0	1
Family size	2.70	1.34	1	2	5
Less than High School	0.19	0.39	0	0	1
High School	0.44	0.50	0	0	1
University	0.37	0.48	0	0	1
Years of education	13.74	3.64	10	13	17
Fraction with Econ/Business degree	0.12	0.32	0	0	1

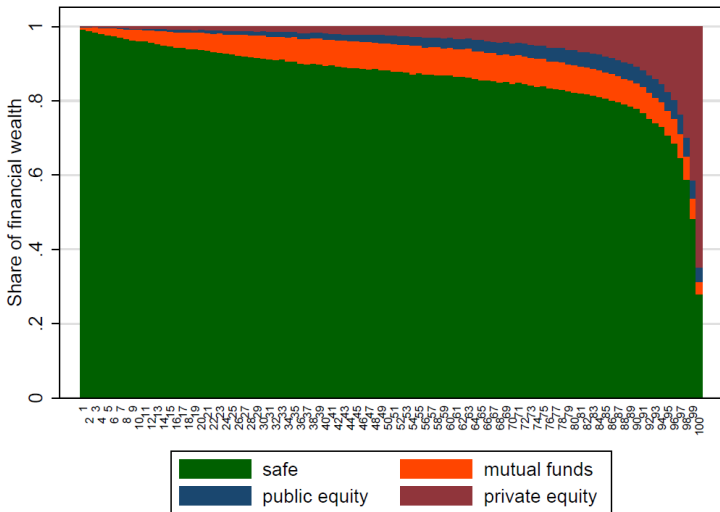


# Descriptive Statistics: Assets Statistics

Panel B, Assets and income:

	Mean	Std. dev	P10	Median	P90
Fraction w risky assets	0.45	0.50	0.00	0.00	1.00
Risky assets share	0.14	0.24	0.00	0.00	0.54
Cond. risky assets share	0.30	0.29	0.01	0.20	0.78
Fraction w private equity	0.11	0.32	0.00	0.00	1.00
Private equity share	0.05	0.18	0.00	0.00	0.05
Cond. private equity share	0.48	0.41	0.01	0.42	1.01
Fraction w public equity	0.38	0.49	0.00	0.00	1.00
Public equity share	0.09	0.20	0.00	0.00	0.35
Cond. public equity share	0.24	0.27	0.01	0.14	0.65
Risky assets	40,596	1,250,876	0.00	0.00	28,667
Safe assets	44,324	171,733	2,010	15,842	101,248
Total assets	84,920	1,321,363	2,291	19,957	142,451
Income from risky asset	1,979	46,784	0.00	0.00	421
Income from safe assets	1,161	5,115	10	320	2,683
Income from total assets	3,141	47,984	10	373	4,008

# Portfolio Composition, 2013



Position

Industry

Holdings



# Descriptive Statistics: Wealth Returns

Panel C, Portfolio returns, percentages:

Averages of portfolio returns, 2013			
	Total assets	Risky Assets	Safe Assets
Mean	0.030	0.058	0.025
Std. dev	0.050	0.234	0.032

Averages of portfolio returns, 1994-2013			
	Total assets	Risky Assets	Safe Assets
Mean	0.032	0.035	0.030
Std. dev	0.054	0.256	0.033

Value weighted averages of portfolio returns			
	Total assets	Risky Assets	Safe Assets
2013:	0.037	0.049	0.026
1994-2013:	0.050	0.071	0.032

All years

## How much heterogeneity should we expect?

- In standard Merton-Samuelson model individuals have access to the same investments opportunities.
- Differences in preferences for risk determine the share of risky assets in portfolio:

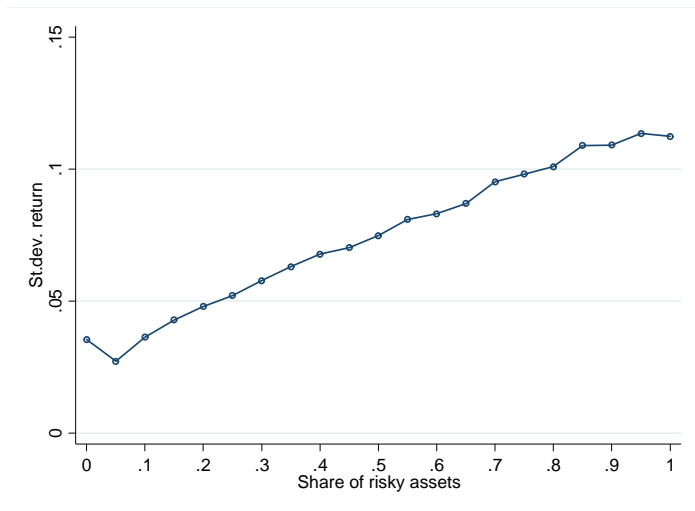
$$\pi_{it} = \frac{r_t^m - r_t^f}{\gamma_i \sigma^2}$$

- The return on wealth is

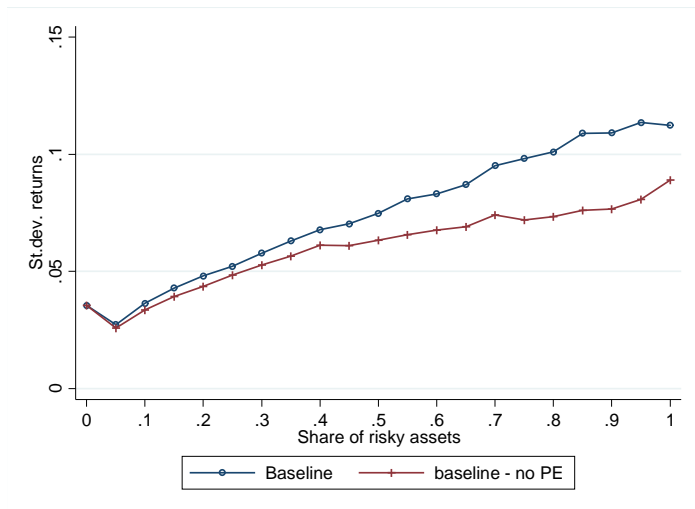
$$r_{it} = r_t^f + \pi_{it} (r_t^m - r_t^f)$$

- Conditioning on the share of risky assets in portfolio, returns should be similar across investors

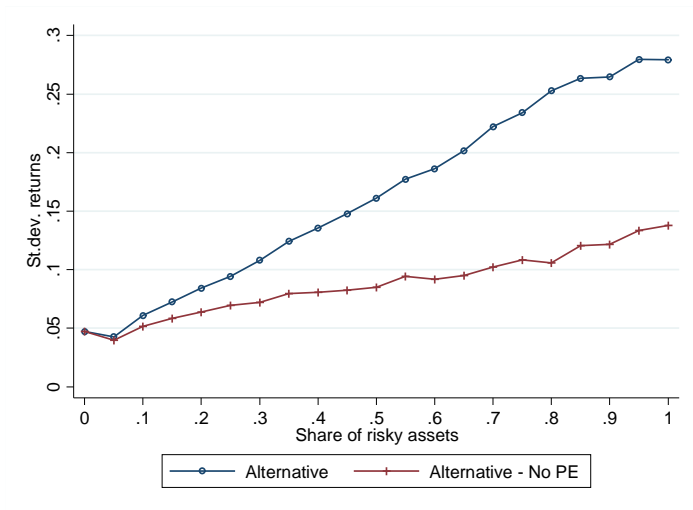
# Returns heterogeneity by share of risky assets in portfolio, 2013



# Returns heterogeneity by share of risky assets in portfolio, 2013



# Using alternative return measure, 2013

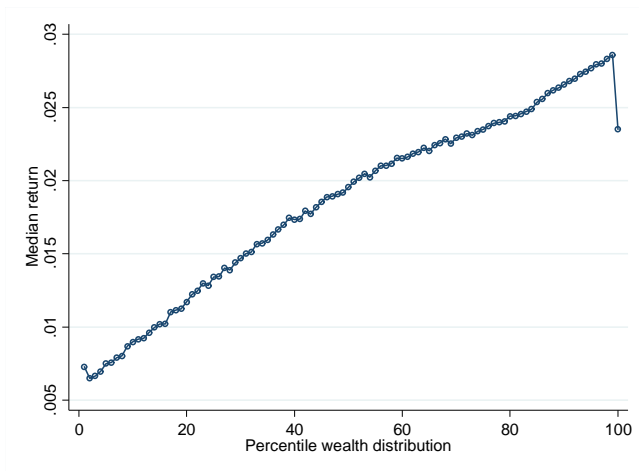


## Are returns correlated with wealth levels?

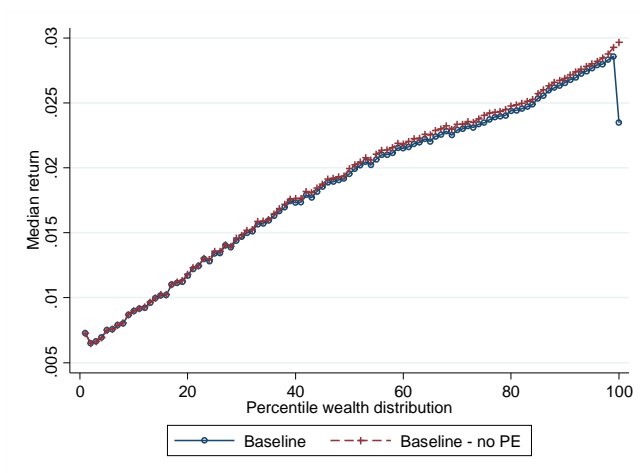
- *"It is perfectly possible that wealthier people obtain higher average returns than less wealthy people.... It is easy to see that such a mechanism can automatically lead to a radical divergence in the distribution of capital"* (Piketty, 2014).
- Wealthy investors may be more risk tolerant
- Wealthy investors can buy the services of "financial experts" (economies of scale in wealth management)
- Wealthy investors have access to different (more lucrative) investment opportunities than retail investors
  - Some (more lucrative?) mutual funds have an entry requirement
  - Return on safe assets have a premium for those depositing above a threshold



# The correlation between wealth and returns to wealth, 2013



# The correlation between wealth and returns to wealth, 2013

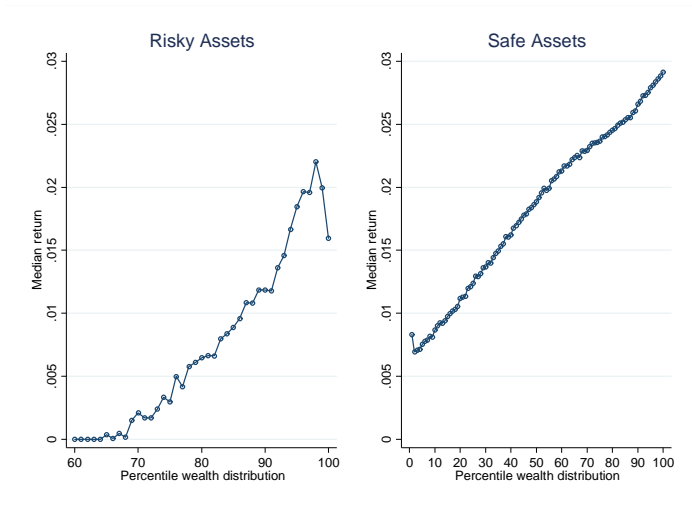


All years

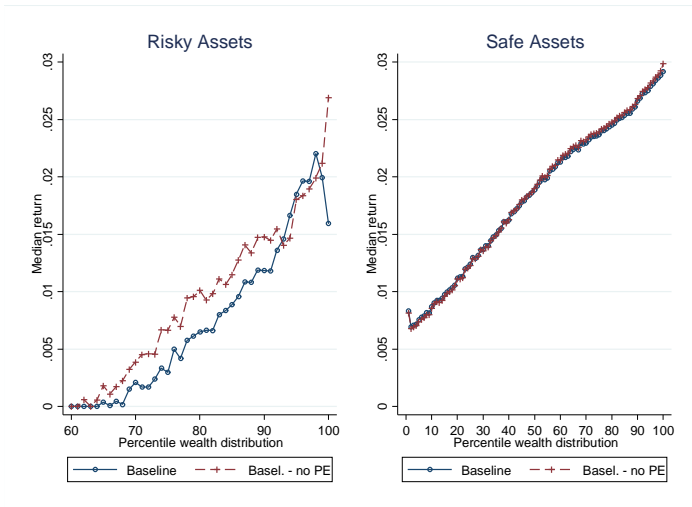
Alternative measure



# Correlation between returns and wealth by asset class, 2013



# Correlation between returns and wealth by asset class, 2013



Averages

S/R

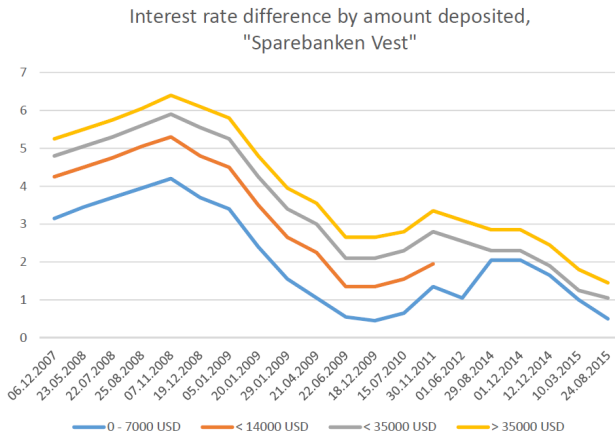
Cohorts

Differentials

Life cycle



# Safe assets



## Previous evidence on the wealth-returns correlation

- In general, hard to come by – but argued since Arrow (1978)
- Feldstein and Yitzhaki (1982) and Yitzhaki (1987) report evidence that corporate stocks owned by high-income investors appreciate faster than stocks owned by lower-income investors
- Kapcerczyk et al. (2014) show that “sophisticated” investors (wealthy individuals, mutual funds, etc.) have higher cumulative returns than “unsophisticated” ones (retail investors)
- Bach et al. (2016) report evidence from Sweden similar to ours

# Is returns heterogeneity persistent?

- Certain individuals may reap persistently higher/lower returns than the average
  - Preferences
    - High risk tolerance leading certain individuals to invest in high-risk/high-return financial instruments (and preferences for risk are very stable over time).
  - Talent
    - Better “stock-picking”
    - Better financial education
    - Business income/private equity: entrepreneurial ability
- Benhabib et al. (2016), Quadrini (2000), Lusardi et al. (2015), Cagetti and De Nardi (2006)

# Modeling returns heterogeneity

- We consider a simple panel data regression model

$$r_{it} = X'_{it}\beta + u_{it}$$

- We break unobservables determinants of returns into a permanent component (a fixed effect  $f_i$ ) and a transitory component  $\varepsilon_{it}$ :

$$u_{it} = f_i + \varepsilon_{it}$$

- How much returns heterogeneity is explained by observables, fixed effects, and remaining unobservables?



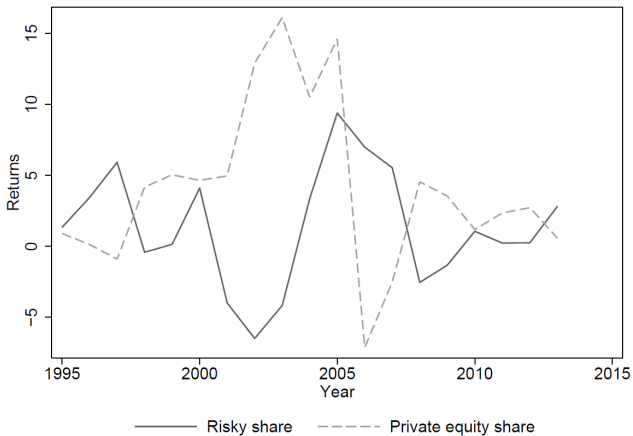
# Observable determinants of wealth returns

- We control for:
  - Common shocks (time effects)
  - (Lagged) wealth, share in risky assets, and share in private equity (plus interactions with year)
  - Time varying demographics (age, geographical indicators, marital status, whether employed)
  - Time invariant characteristics (male, education, type of education - absorbed when including fixed effects)
- These observables explain 7%-11% of the total variation in wealth returns

# Regression results

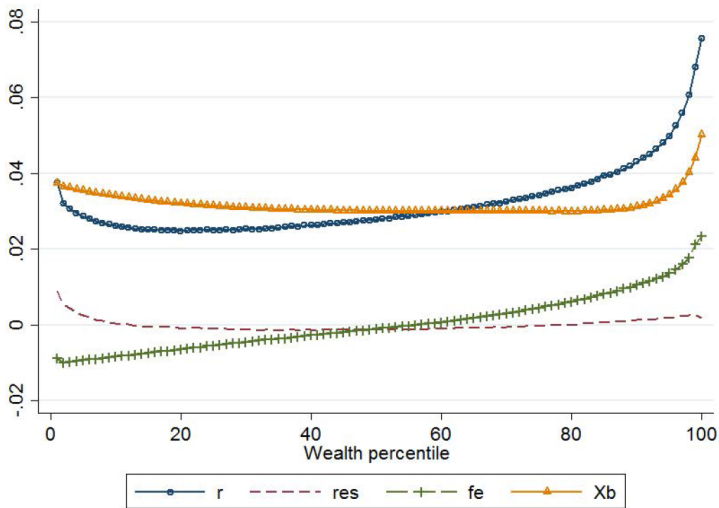
	(1)	(2)	(3)	(4)
	Portfolio return	Portfolio return	Portfolio return	Portfolio return
	b/se	b/se	b/se	b/se
Lagged risky share	0.667*** (0.009)		1.014*** (0.012)	
Lagged private equity share	5.798*** (0.023)		3.554*** (0.024)	
Male	-0.031*** (0.002)	-0.031*** (0.002)		
Employed	0.224*** (0.003)	0.221*** (0.003)	0.011** (0.005)	0.010** (0.004)
Years of education	0.038*** (0.000)	0.039*** (0.000)		
Econ/Business education	0.122*** (0.004)	0.121*** (0.004)		
Individual FE	no	no	yes	yes
Year FE	yes	yes	yes <sup>1</sup>	yes <sup>1</sup>
Age FE	yes	yes	yes	yes
County FE	yes	yes	yes	yes
Demographic controls	yes	yes	yes	yes
Lag. wealth percentile	yes	yes	yes	yes
Lag. risky share*i.year	no	yes	no	yes
Lag. private eq share*i.year	no	yes	no	yes
r <sup>2</sup>	0.077	0.115	0.233	0.267
N	47,686,405	47,686,405	47,686,405	47,686,405

# Coefficients on interactions



# Decomposing average returns by wealth percentile

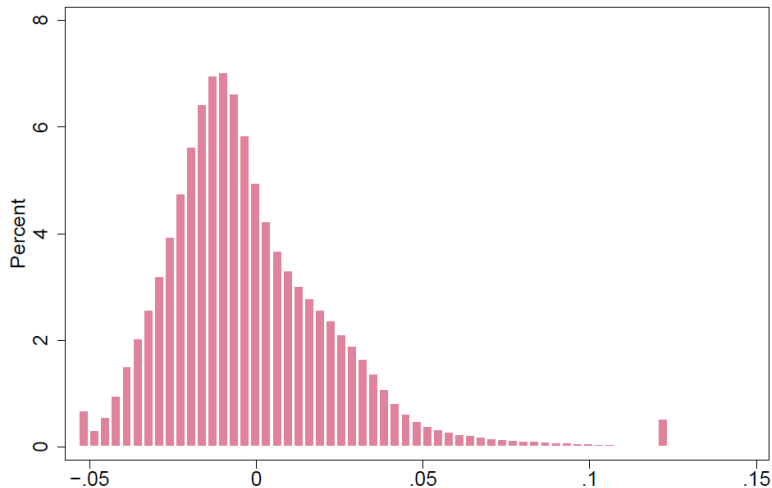
- Plot  $E(r_{it}|P_w) = E(X'_{it}\beta|P_w) + E(f_i|P_w) + E(u_{it}|P_w)$



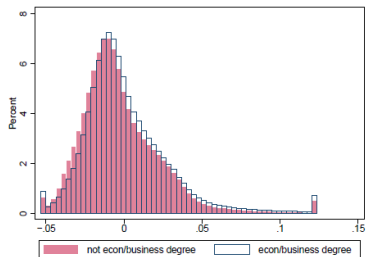
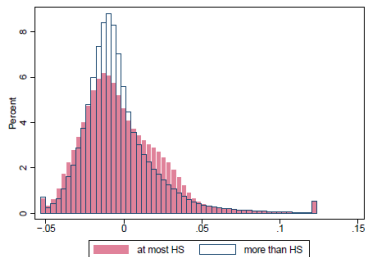
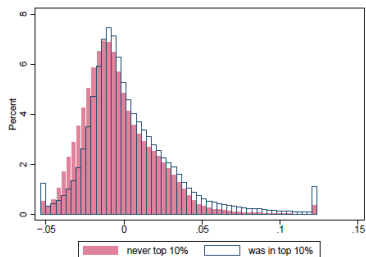
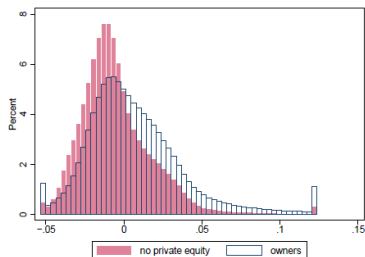
# Evidence on fixed effects

- Fixed effects are jointly statistically significant
- They increase the explained variation of returns to 23%-27%
- Their distribution differs significantly across key sub-groups
  - Business owners vs non-owners
  - Bottom vs. top 10% wealth distribution
  - Low vs. high years of schooling
  - Econ/Business concentration

# Empirical distribution of fixed effects



# Empirical distribution of fixed effects: Sub-groups

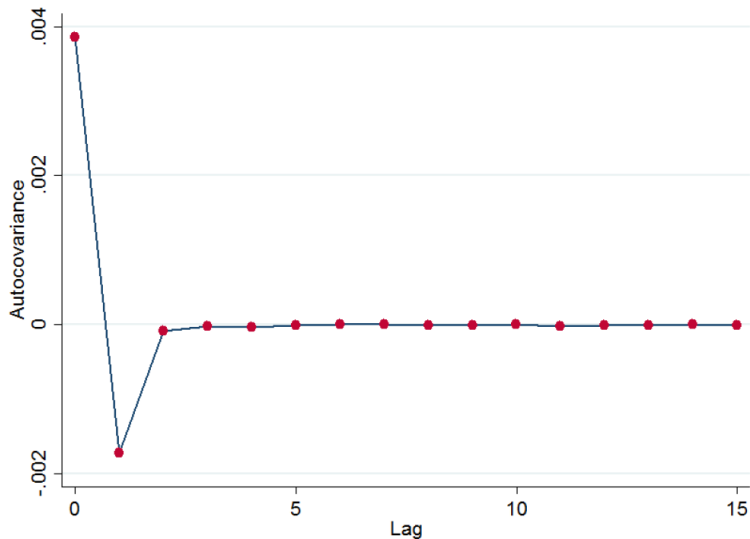


# Serial correlation?

- From  $u_{it} = f_i + \varepsilon_{it}$ , additional persistence in returns may in principle come from  $\varepsilon_{it}$
- We plot  $E(\Delta u_{it} \Delta u_{it-s}) = E(\Delta \varepsilon_{it} \Delta \varepsilon_{it-s})$  for all  $s \geq 0$
- The moments for  $s \geq 2$  are all economically undistinguishable from 0
- Consistent with returns being basically unpredictable once controlling for demographics and fixed effects



## Autocovariance of residuals in first difference



# Sharpe Ratio Regressions

$$\text{Dep. var.: } S_i = \frac{E_i(r_{it} - r_t^f)}{\sqrt{\text{var}_i(r_{it})}}$$

	(1)	(2)
Wealth perc. in 1995	0.548*** (0.002)	0.565*** (0.002)
Age <sub>1995</sub>		-3.589*** (0.044)
Age <sub>1995</sub> <sup>2</sup>		0.065*** (0.001)
Education		1.413*** (0.091)
Education <sup>2</sup>		-0.019*** (0.003)
Econ/Bus degree		3.555*** (0.122)
1-5 years with PE		-5.067*** (0.109)
6-10 years with PE		-8.246*** (0.160)
11-15 years with PE		-6.371*** (0.215)
15+ years with PE		-1.511*** (0.223)
Constant	7.453*** (0.095)	31.175*** (1.019)
Min. panel obs.	19	19
Mean indep. var.	36.97	36.97
St.dev. indep. var.	47.70	47.70
R <sup>2</sup>	0.099	0.160
Obs.	1,006,967	1,006,967

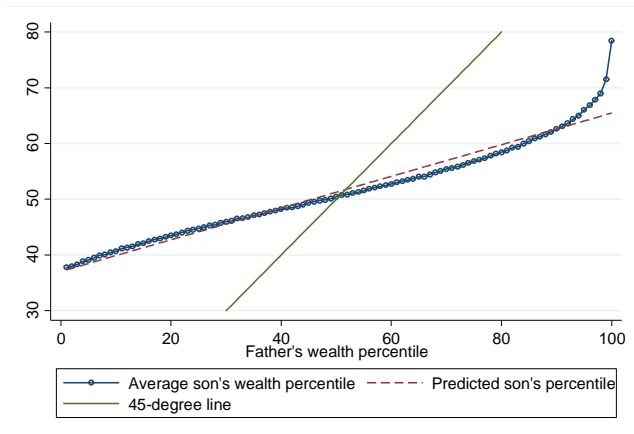
# Other dimensions of persistence in returns

- Across generations
- From singlehood to marriage

# Intergenerational correlation

- Benhabib, Bisin and Luo (2016) assume that returns are stochastic, constant within a generation, and persistent across generations
  - Persistence may be due to sharing a private business, or intergenerational transmission of preferences for risk or talent for investment
  - However, BBL find weak evidence for persistence
- Our data can be used to study mobility (or intergenerational correlation) in wealth-related variables
- We focus on:
  - Wealth levels
  - Overall returns on wealth
  - Persistent component of wealth returns (fixed effects)

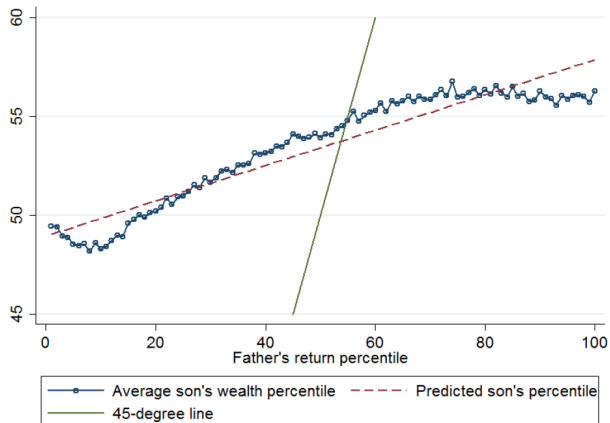
# Intergenerational correlation: Wealth



# Intergenerational correlation: Overall returns



# Intergenerational correlation: Fixed effect returns



# Regression evidence: Percentile ranks

Dep. var.: Son's return percentile

	(1)	(2)	(3)	(4)
Father's return percentile	0.082*** (0.000)	0.058*** (0.000)	0.055*** (0.000)	0.039*** (0.000)
Constant	47.356*** (0.023)	47.029*** (0.140)	41.672*** (0.192)	54.537*** (0.187)
Wealth percentile dummies	N	Y	Y	Y
Year FE	N	Y	Y	Y
Age controls	N	N	Y	Y
Education length and type controls	N	N	Y	N
Individual FE	N	N	N	Y
R <sup>2</sup>	0.007	0.055	0.062	0.373
N	14,548,263	14,548,263	14,548,263	14,548,263



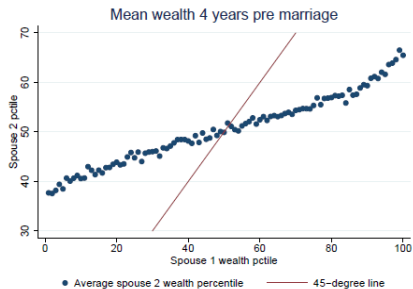
# Intergenerational correlation: Sharpe ratios

	(1)	(2)	(3)
Sharpe Ratio - Father	0.071*** (0.001)	0.063*** (0.001)	0.075*** (0.001)
Age		-0.202*** (0.001)	-0.144*** (0.001)
Age Squared		0.003*** (0.000)	0.002*** (0.000)
Educ. Years		0.008*** (0.001)	0.008*** (0.001)
Educ. Years Squared		0.001*** (0.000)	0.001*** (0.000)
Econ/Business Degree		-0.003** (0.001)	-0.002 (0.001)
Business Owner		-0.045*** (0.001)	-0.040*** (0.001)
Age - Father			-0.115*** (0.001)
Age Squared - Father			0.001*** (0.000)
Educ. Years - Father			0.001 (0.001)
Educ. Years Squared - Father			0.000*** (0.000)
Econ/Business Degree - Father			0.004** (0.002)
Business Owner - Father			0.023*** (0.001)
Constant	0.358*** (0.001)	3.114*** (0.019)	5.255*** (0.029)
Min. panel observations	8	8	8
Min. panel observations Father	8	8	8
Mean Dep. Var.	0.387	0.387	0.387
Sd Dep. Var.	0.509	0.509	0.509
Sd Sharpe Father	0.606	0.606	0.606
R-squared	0.007	0.137	0.162
Observations	870,860	870,860	870,860

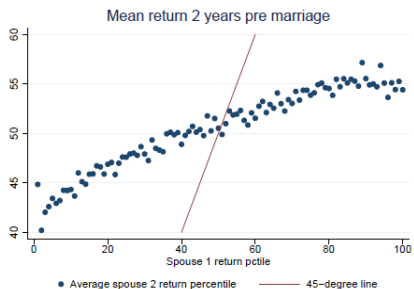
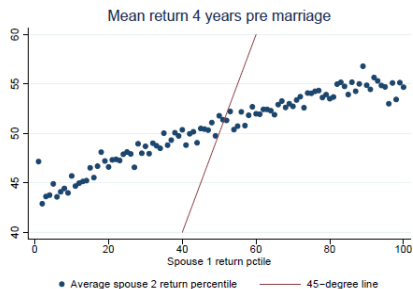
# Assortative mating

- In the literature there is evidence of assortative mating by education, income, and parents' wealth (Eika et al., 2014; Lam, 1988; Charles et al., 2013)
- Our data can be used to study assortative mating by individual wealth and returns to wealth
- In the data:
  - we observe couples before they get married (or have children)
  - we find assortative mating by wealth
  - we also find some (weaker) assortative mating on returns to wealth (conditional on assortative mating on wealth)

# Assortative mating on wealth



# Assortative mating on returns to wealth



# Regression results

	(1)	(2)	(3)	(4)	(5)	(6)
	Wealth ptile	Return ptile	Return ptile	Return ptile	Return ptile	Return ptile
	b/se	b/se	b/se	b/se	b/se	b/se
Wealth ptile spouse	0.240*** (0.002)					
Return ptile spouse		0.118*** (0.002)	0.083*** (0.002)	0.068*** (0.002)	0.067*** (0.002)	0.067*** (0.003)
Wealth Controls:						
Poor&Rich				-0.001 (0.002)		
Rich&Poor				0.145*** (0.002)		
Rich&Rich				0.151*** (0.002)		
Constant	0.380*** (0.001)	0.441*** (0.001)	0.206** (0.074)	0.164* (0.076)	0.136 (0.075)	0.244*** (0.074)
Wealth controls		no	no	Rich x Poor	5 x 5	100 x 100
Age ind.		no	yes	yes	yes	yes
Marital year ind.		no	yes	yes	yes	yes
Education length/type ind.		no	yes	yes	yes	yes
r2	0.058	0.014	0.062	0.123	0.145	0.202
N	165,860	165,860	165,860	165,860	165,860	165,860

# Assortative mating on wealth and returns to wealth

- Why may people want to sort on returns to wealth?
  - Similarity of traits - preferences for risk, etc.
  - To preserve whatever wealth they have
- Whether this matters depends on who manages the household resources
  - If  $r_i^{post} = \max \{ r_w^{pre}, r_h^{pre} \}$ , then assortative mating on returns shouldn't matter
- We consider a simple regression:

$$r_i^{post} = \beta_0 + \beta_1 \max \{ r_w^{pre}, r_h^{pre} \} + \beta_2 \min \{ r_w^{pre}, r_h^{pre} \} + e_i$$

# Regression results: Post-marital household wealth return

	(1)	(2)	(3)	(4)
$\min \{r_w^{pre}, r_h^{pre}\}$	0.020*** (0.005)	0.037*** (0.005)	0.036*** (0.005)	0.046*** (0.007)
$\max \{r_w^{pre}, r_h^{pre}\}$	0.190*** (0.002)	0.191*** (0.002)	0.190*** (0.002)	0.155*** (0.004)
Age at marriage, wife			-1.478*** (0.152)	
Age at marriage, husband			1.147*** (0.151)	
$\min \{r_w^{pre}, r_h^{pre}\} * \mathbf{1}\{\text{Male highest}\}$				-0.025*** (0.009)
$\max \{r_w^{pre}, r_h^{pre}\} * \mathbf{1}\{\text{Male highest}\}$				0.054*** (0.005)
Year of marriage dummies	N	Y	Y	Y
Age at marriage dummies	N	N	N	Y
R <sup>2</sup>	0.028	0.034	0.034	0.035
N	245,999	245,999	245,999	245,999

# Implications of returns heterogeneity

- Implications of the evidence presented so far:
  - Can it explain the extent of wealth inequality and concentration?
    - Returns heterogeneity as input, not output
  - What does it say about whether capital income taxation is preferable to wealth taxation? (Guvenen et al., 2016)
  - Does it have an impact on measurement of wealth inequality and concentration based on the capitalization approach? (Saez and Zucman, 2016)
- Our previous paper (Fagereng et al., 2016) focuses on the latter.
- Another paper (TBW) focuses on the first question.

Summary



# Conclusions

- Not much is known about the distribution of returns to financial wealth across individuals and households
- This paper provides some evidence using population tax records from Norway
- Returns exhibit massive heterogeneity, are correlated with the level of wealth, and are persistent over time for the same individual and across generations
- Private equity wealth seems key

# Definitions: Stocks (all as of 12/31)

- Safe Assets:
  - Deposits in Norwegian banks
  - Deposits in foreign banks
  - Cash
  - Capital in bond funds and money market funds
  - Outstanding receivables
- Risky assets
  - Taxable assets in unit trusts (mutual funds)
  - Tax value of Norwegian shares, equity certificates, bonds in VPS (listed)
  - Capital value of shares and other securities not in VPS (unlisted)

# Definitions: Capital Income

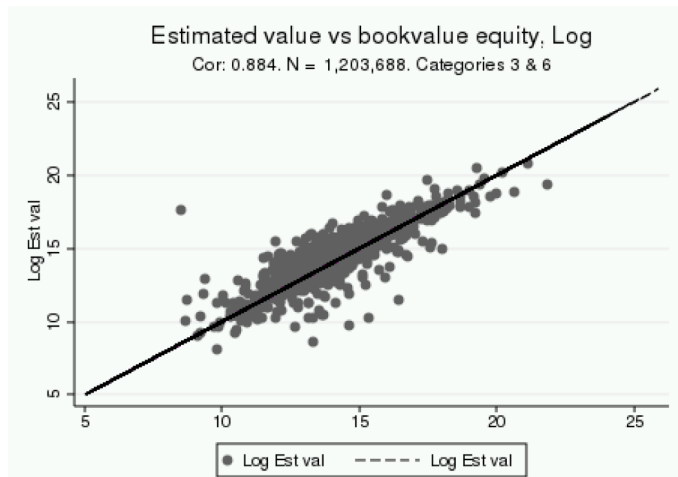
- Safe Assets:
  - Interest on bank deposits
  - Other interest income received (from personal loans)
  - Interest on loans to companies
  - Yields from endowment insurance
- Risky assets
  - Taxable share dividends
  - Taxable yields from unit trusts
  - Other taxable dividends
  - Taxable gains from sale of shares
  - Taxable gains from sale of units in securities funds
  - Other taxable gains from sale of shares
  - Losses from sale of shares
  - Losses from sale of units in securities funds
  - Other losses from sale of shares

# Valuation of unlisted stocks

- In addition to balance sheet information, unlisted companies have to submit a statement to the tax authorities detailing the “Estimated total value of the company” (“Beregnet samlet verdi bakaksjene i selskapet”)
- This may differ from the company’s book value of equity (although  $\rho = 0.88$ ) [Graph](#)
- The estimate does not include net present value calculations or goodwill
- Companies with  $>5M$  NOK (approx. \$500k) are subject to an audit obligation in the following financial year

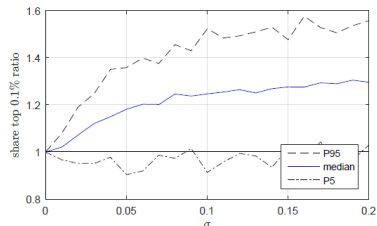
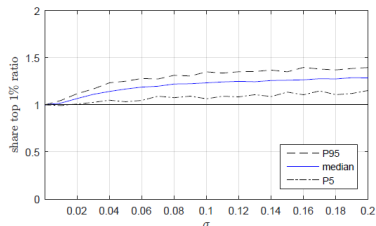
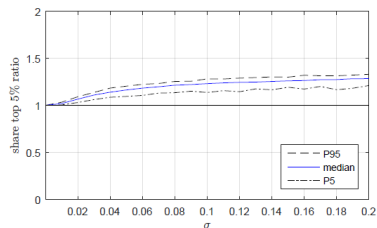
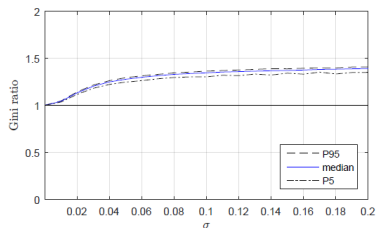
[Back to Data](#)

# Tax value vs. Book value of equity

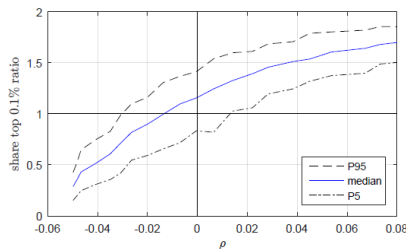
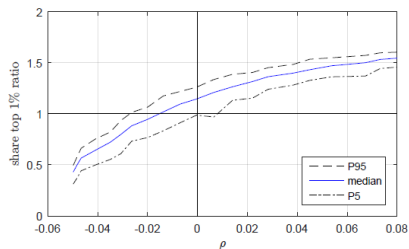
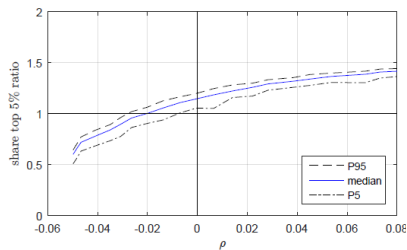
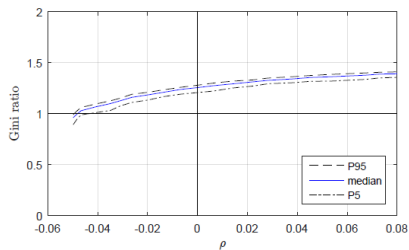


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# The effect of return heterogeneity (for $\rho = 0$ )



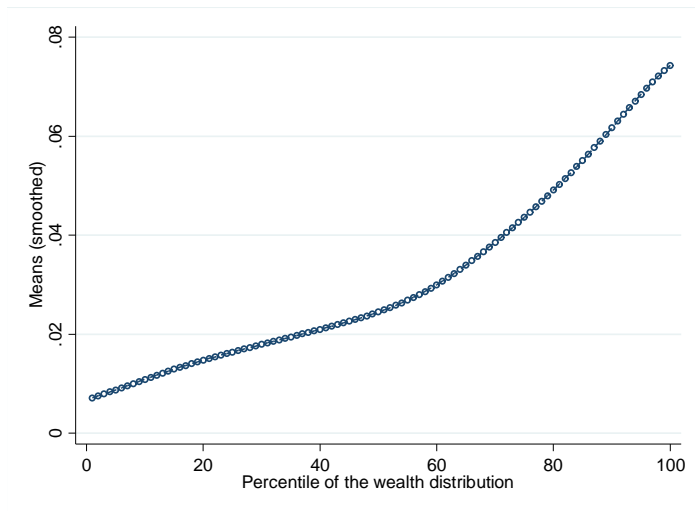
# The effect of $\text{corr}(r,w)$ (for $\sigma = 0.04$ )



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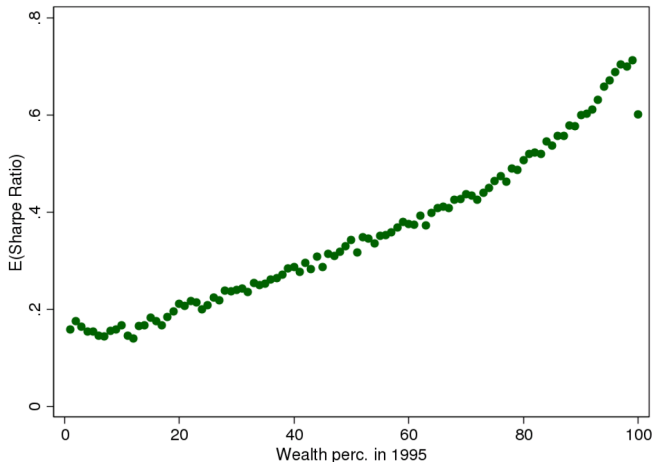
# Correlation between returns to risky assets and wealth: Means



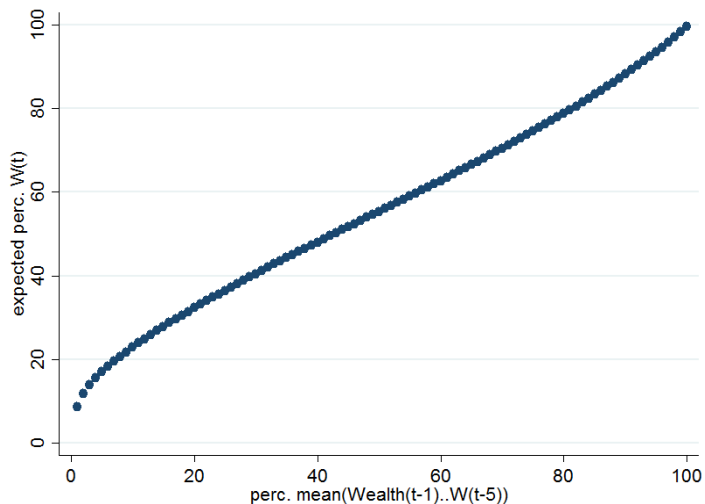


# Sharpe ratio by initial wealth percentile

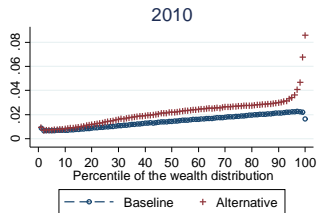
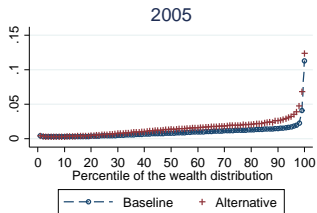
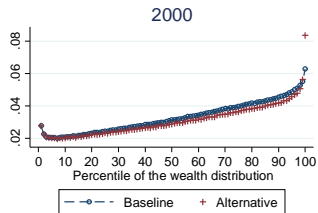
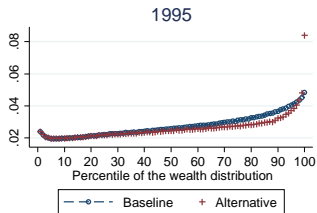
- Compute  $S_j = \frac{E_i(r_{it} - r_t^f)}{\sqrt{\text{var}_i(r_{it})}}$



# Wealth Mobility in Norway

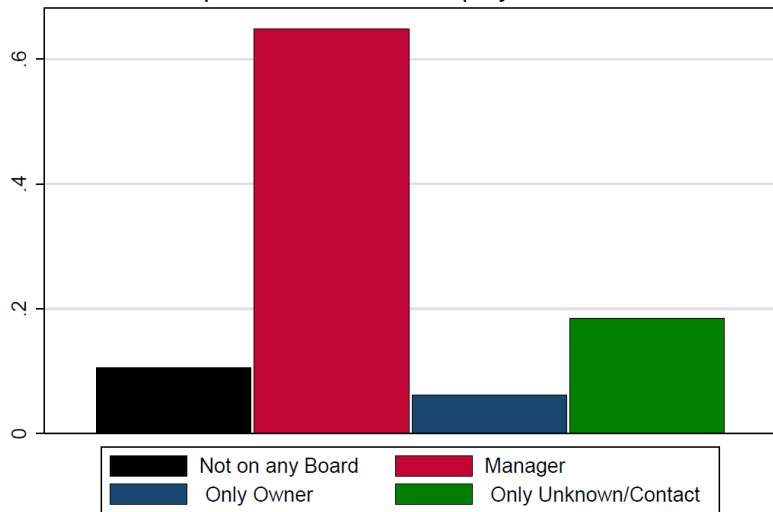


# Other years

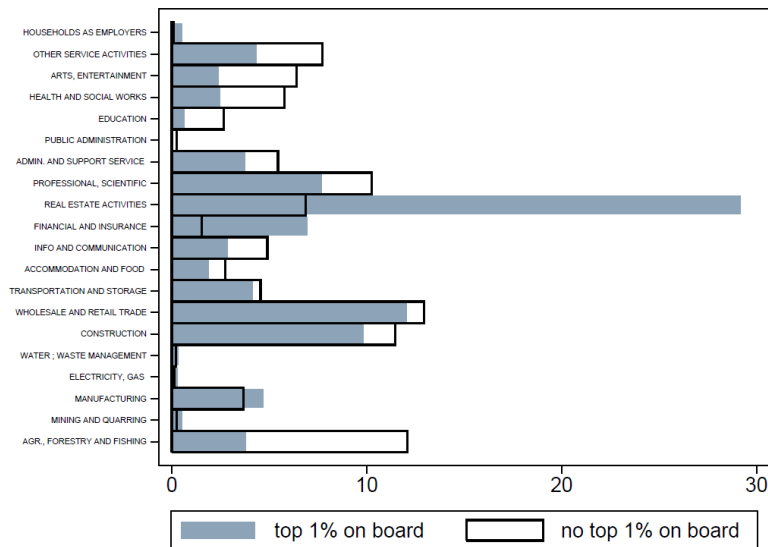


# Position in the company

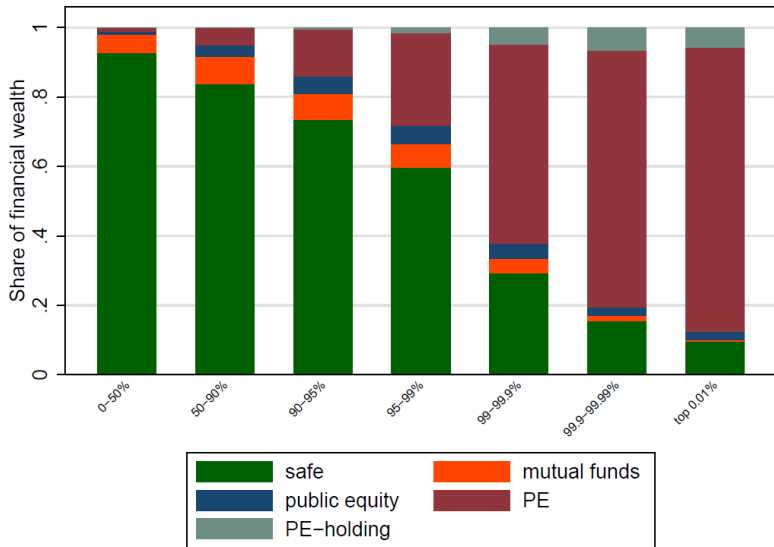
## Top 1% with Private Equity on Boards



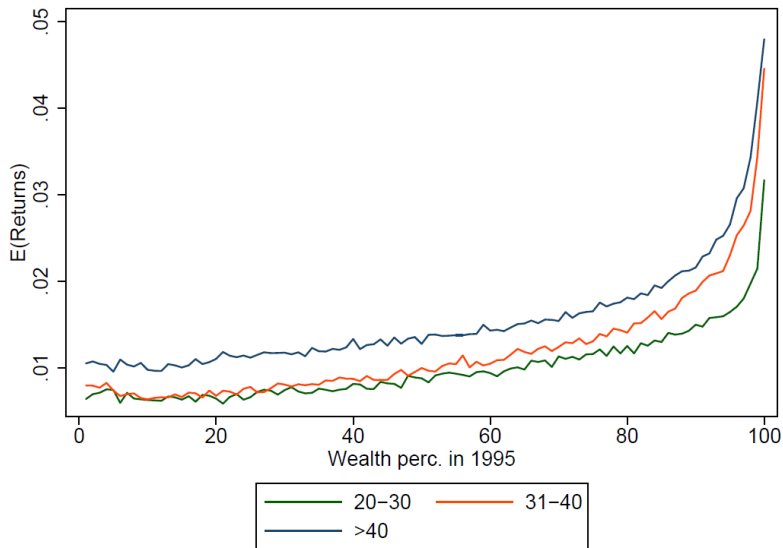
# Industry Composition



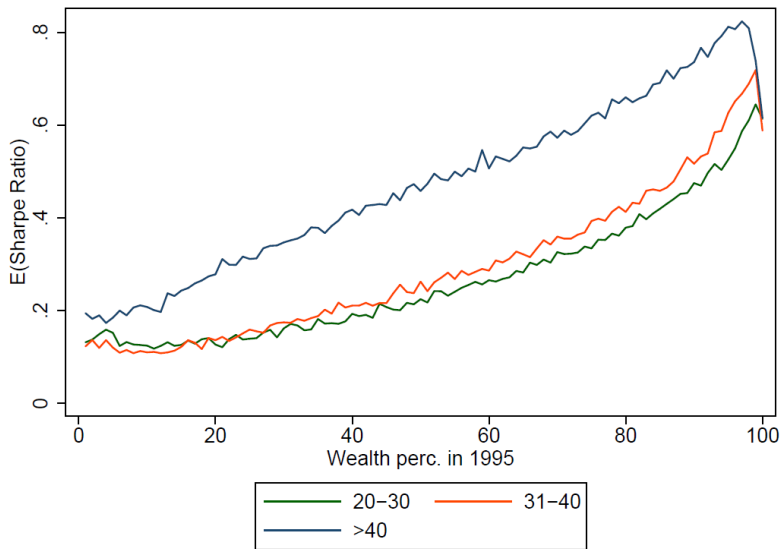
# Further Decomposition



# Mean return by cohort

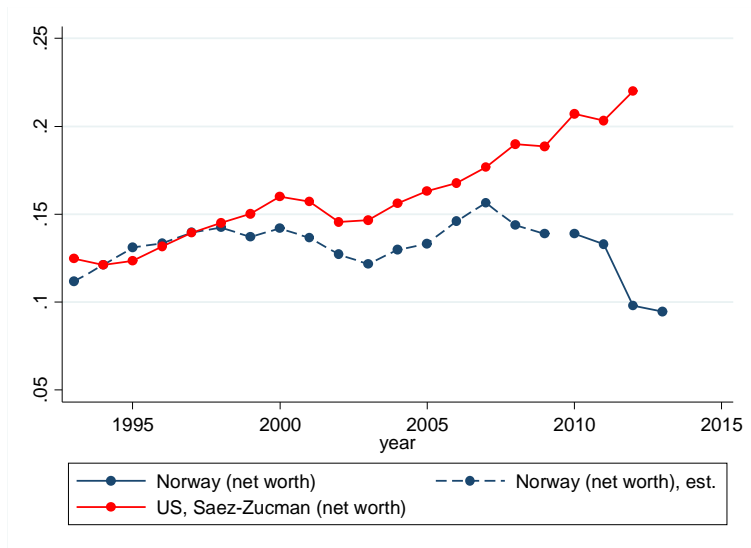


# Sharpe ratio by cohort

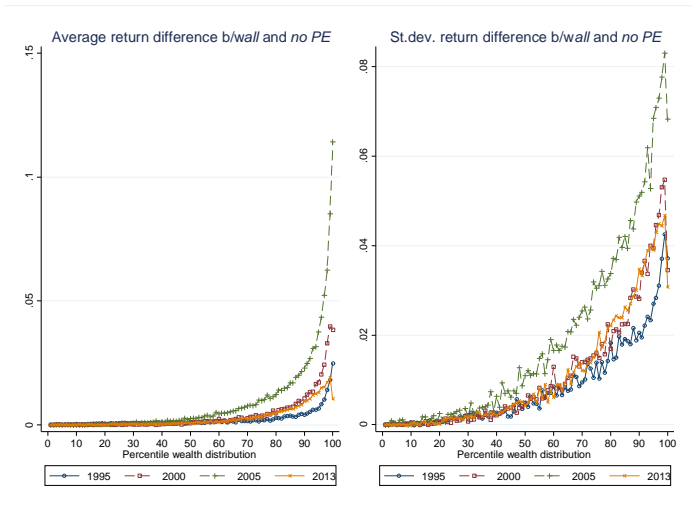




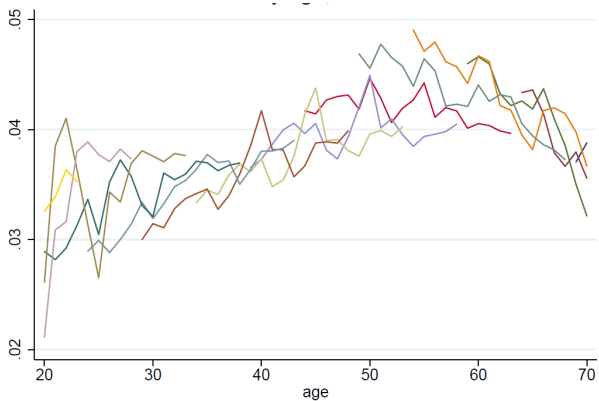
# US vs. Norway (top 0.1% wealth share)



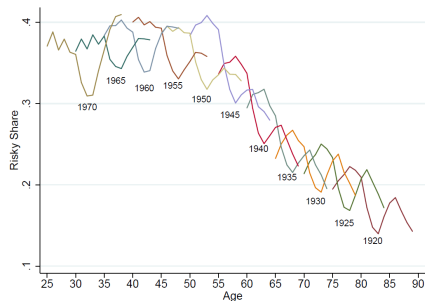
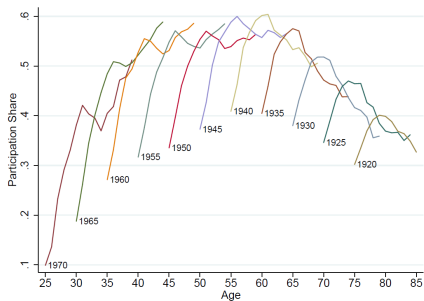
# Difference in average and st.dev. of returns for "All" and "No PE" groups



# Returns over the life cycle



# Participation and risky shares over the life cycle

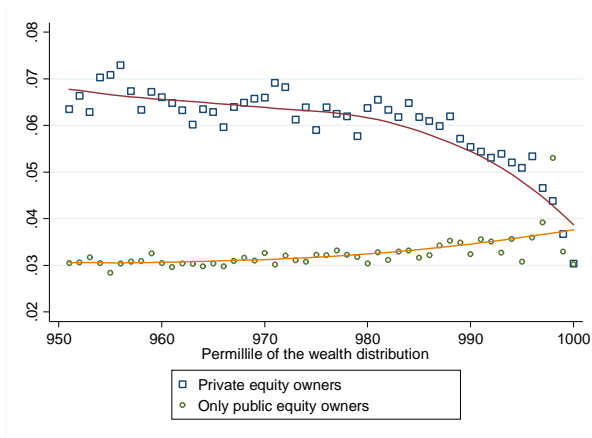


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# Explaining the decline in returns at the very top

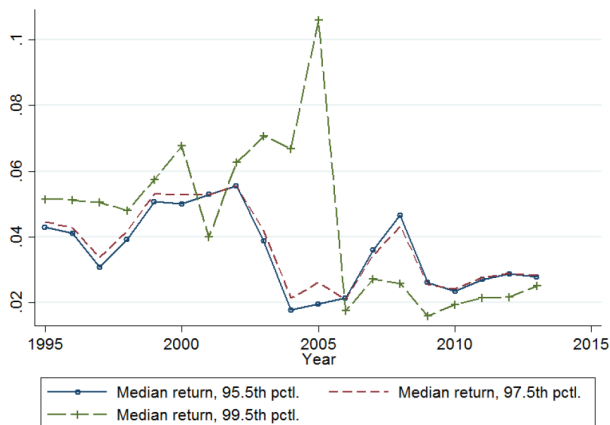
- At the top 1%, more than 60% of wealth is held in private equity (entrepreneurship)
- Three possibilities:
  - tax evasion (Zucman, 2016)
  - "private equity premium puzzle" (Moskowitz and Vissing-Jorgensen, 2002)
  - direct control over dividend policy (Alstadsæter, Kopczuk and Telle, 2014)
- Tests:
  - Return gradient for safe and risky assets (drop only visible for risky assets)
  - Return gradient for those with and without private equity
  - Return gradient before and after 2006 introduction of shareholder tax

# Return gradient for those with and without private equity



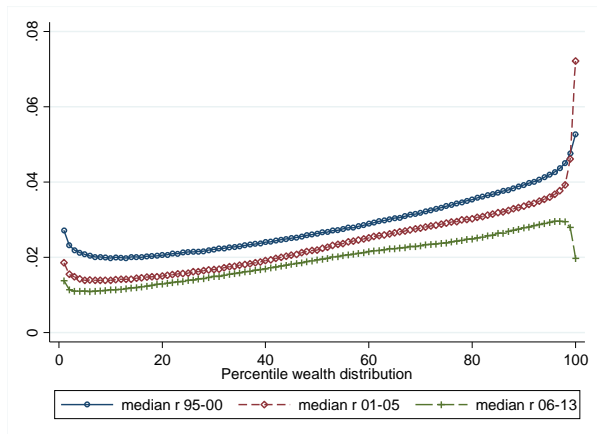
# The effect of the shareholder tax reform on top percentiles

- Shareholder tax reform is announced in 2001, but delayed until 2006
- Before 2006, dividends are basically untaxed



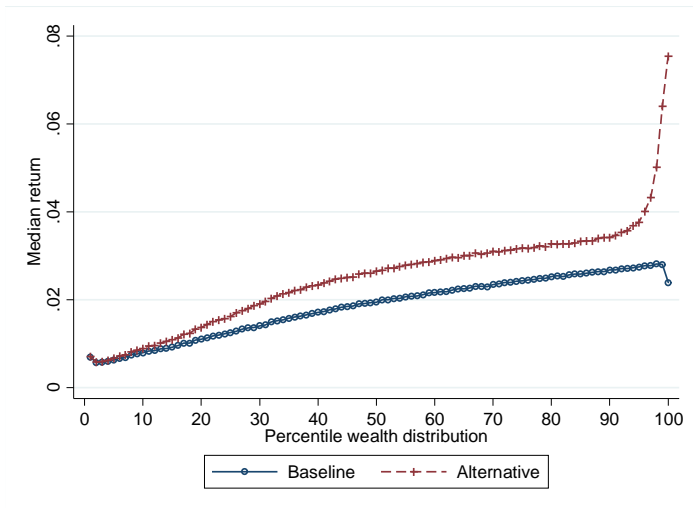
# Time variation: Correlation between wealth and returns

- Divide into three periods: 1995-2000, 2001-2005, 2006-2013





# Correlation between wealth and returns, 2013



Other years



# Measurement of wealth inequality in the US

- Saez and Zucman (2016) have access to IRS tax records on capital income ( $y_{it} = r_{it} w_{it}$ ), but wealth data are not available
- They impute wealth using a capitalization method, imposing returns heterogeneity (within broad asset classes):

$$\widehat{w}_{it} = \frac{y_{it}}{r_t}$$

- If there is returns heterogeneity, and in particular a positive correlation between returns and wealth, the capitalization method overstates the extent of wealth inequality and concentration
- If the correlation increases over time, the rise in wealth inequality and concentration may also be overstated
- In our Norwegian data we can compare *actual* wealth inequality with *imputed* wealth inequality

# Theoretical Results

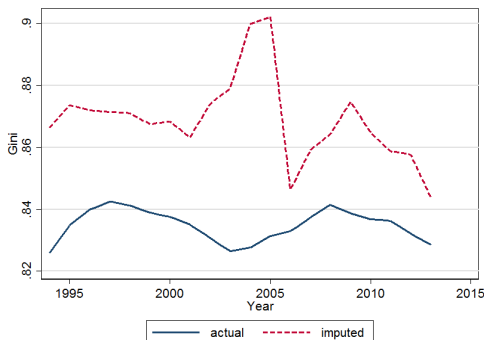
- With independence between returns to wealth and wealth levels, both Gini and top wealth shares are overstated Result 1
- With correlation between returns to wealth and wealth levels, Gini still overstated, while top wealth shares may be overstated or understated depending on the sign of  $\rho$  Result 2

# How large are the biases in practice?

- We replicate Saez and Zucman's capitalization approach to impute wealth (excluding housing, which is of higher quality only after 2010) in the Norwegian case
- We then compute Gini indexes, and shares of wealth owned by the top 5%, 1%, 0.1%
- Results:
  - Gini indexes systematically overstate the degree of wealth inequality
  - For top shares, results depend on how far in the tail we go

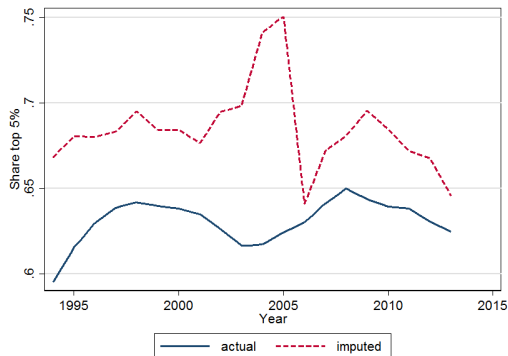
# Gini

- The Gini based on imputed wealth captures sufficiently well the long-term trends in actual wealth inequality
- However, it overstates true inequality by a 1.05 factor on average
- It tends to do significantly worse in the middle of the sample period due to the introduction of a shareholder tax in 2006 (with some announcement effects at work since 2001)



# Top shares

- The evidence on top shares is more nuanced
- The larger the share we consider, the larger the overestimation
- However, the degree of overestimation declines if we consider smaller and smaller fractiles



## Regression evidence

	$G(\hat{w}) - G(w)$		$S_{0.1}(\hat{w}) - S_{0.1}(w)$	
	(1)	(2)	(3)	(4)
St.dev. returns	0.81* (0.44)	-0.15 (0.24)	2.45* (1.37)	-0.39 (0.86)
Corr(returns, wealth)		0.69*** (0.09)		2.06*** (0.31)
Obs.	20	20	20	20
R <sup>2</sup>	0.16	0.83	0.15	0.76

- Between 1978 and 2012, the top 0.1% wealth share increases by 15 p.p. in the US (Saez and Zucman, 2015)
- An increase in the correlation between wealth and returns may overstate the increase in wealth concentration at the very top (i.e.,  $\Delta\rho = 0.07$ )

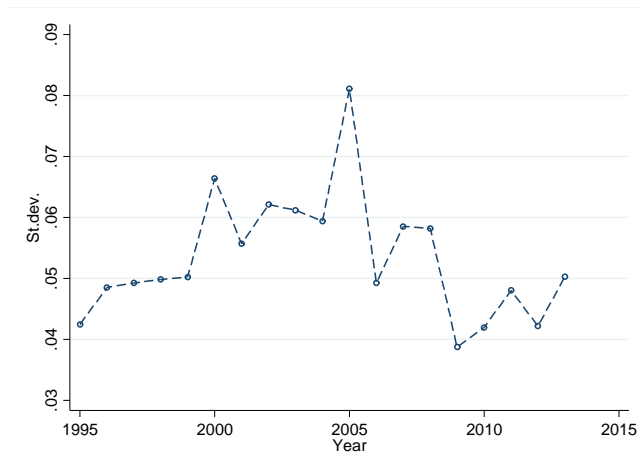
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# Time variation: Mean and median return

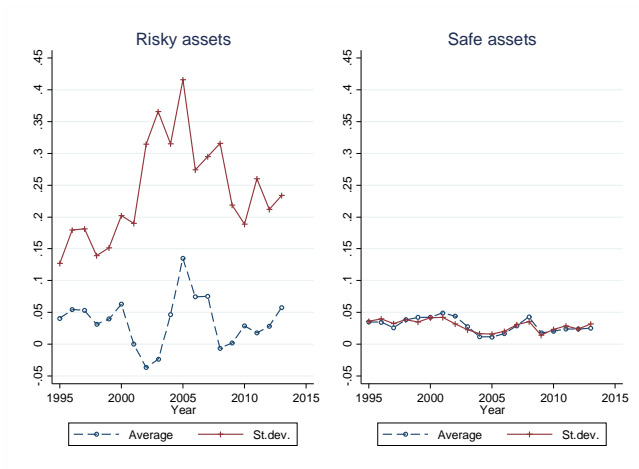




# Time variation: St.dev. of returns



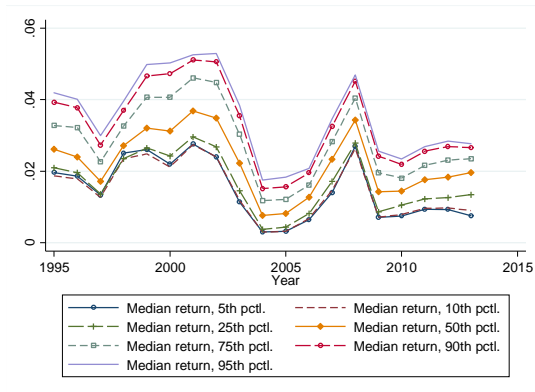
# Time variation: Safe and risky assets



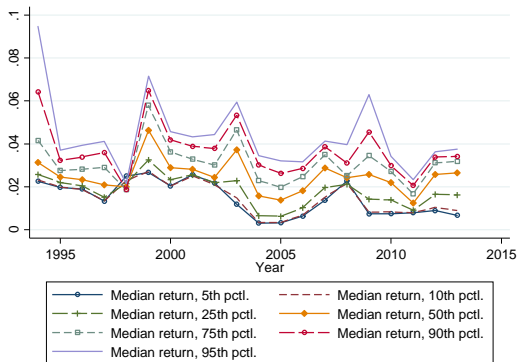
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# Time variation: Correlation between wealth and returns

- Report median return for selected percentiles of the wealth distribution
- Returns are persistently higher when we move up in the wealth distribution



# Using alternative return measure



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# Regression evidence: Returns

Dep. var.: Son's return

	(1)	(2)	(3)	(4)
Father's return	0.075*** (0.001)	0.050*** (0.001)	0.050*** (0.001)	0.046*** (0.001)
Constant	2.675*** (0.002)	3.388*** (0.022)	2.296*** (0.125)	3.087*** (0.031)
Wealth percentile dummies	N	Y	Y	Y
Year FE	N	Y	Y	Y
Age controls	N	N	Y	Y
Education length and type controls	N	N	Y	N
Individual FE	N	N	N	Y
R <sup>2</sup>	0.007	0.051	0.052	0.249
N	14,548,263	14,548,263	14,548,263	14,548,263