Heterogeneity in Returns to Wealth
Evidence from Swiss Administrative Data

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Motivation

- Wealth inequality strongly increased in the past (Saez and Zucman (2016))
  - In our data set the share of net worth held by the top 1% increased from 25% in 2002 to 32% in 2017
- Return on capital seems to be the key factor (Benhabib, Bisin, and Zhu (2011), Piketty (2014), Gabaix et al. (2016), Benhabib, Bisin, and Luo (2019))
  - We find that returns on financial wealth are about four times higher for the top 1% of the financial wealth distribution compared to the bottom 25%.

Our Contribution

Research Question

What drives the heterogeneity in returns to wealth?

- Model the entire distribution of returns on wealth
- Document a strong correlation between return and high net worth (scale dependence) and persistent returns within individuals (type dependence)
- Provide evidence for external validity

Preview of the results

- Simple model that allows for scale and type dependence can explain roughly half of the variations in returns
- Scale dependence particularly strong for households who already hold a substantial amount of financial wealth
- Larger cross-sectional variance on returns for households with high financial wealth

Literature

- Gabaix et al. (2016) show that heterogeneity in returns can replicate the wealth distribution
  - *scale dependence* can replicate the fast change in inequality at the top
  - *type dependence* can explain the persistence of wealth inequality
- Wealth inequality very persistent across individuals in Switzerland (Martínez (2020))
- There is little work on wealth inequality because often survey data must be used (see for example Xavier (2020))
- Growing literature with administrative data that documents the average effect on returns (see for example Fagereng et al. (2019) and Bach, Calvet, and Sodini (2020))

Data Set

- Large administrative panel data set with tax records of individual households from the canton of Bern, Switzerland
- About 1 mio distinct individuals (approximately 12 mio observations)
- Detailed information on the households complete wealth, income and socio-demographics
  - for a subsample of our data we can decompose financial wealth into three broad categories: Equity, bonds and bank deposits

Advantages of Administrative Data

- Unique individual IDs that allow us to track individuals over time
- Covers the entire population, including the very top of the distribution
- Data is checked by tax authorities, hence few measurement errors or unreliable observations
- No over- or underreporting as is often the case with survey data

Data Preparation

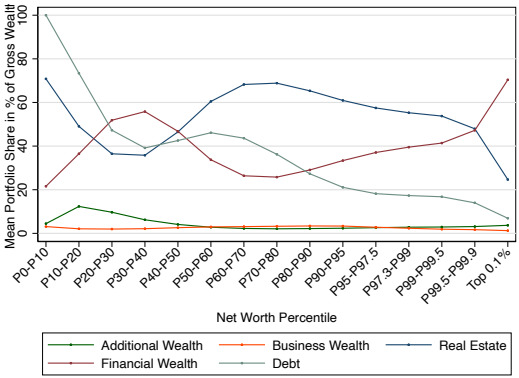
- Split married households into individual observations (Fagereng et al. (2020))
- Drop roughly 9% of observations (4% of individuals) because they are substantially different:
  - Individuals younger than 18 or older than 100
  - Individuals who did not hand in their tax report
  - Individuals who are going abroad or are returning from abroad within a year
  - Sever mistypes in the tax report
  - Individuals with implausible changes in the marital status
- Adjust real estate values to market value based on indicator at municipality level

Summary Statistics — Socio Demographics

	Mean	SD	P10	Median	P90	P99	Obs.
				Panel C: Wealth			
Total Wealth	355,902	5,468,634	2	88,124	746,600	3,155,332	11,962,566
Total Financial Wealth	138,794	4,629,607	0	25,756	243,111	1,383,371	11,962,566
Bank Deposits	85,713	337,118	2,127	30,073	192,925	803,642	1,115,278
Bonds	1,671	21,397	0	0	0	42,528	1,115,278
Equity	29,543	998,596	0	0	30,135	444,931	1,115,278
Real Estate	199,753	1,094,191	0	0	522,748	1,837,412	11,962,566
Additional Wealth	8,849	285,542	0	0	9,100	164,030	11,962,566
Business Wealth	3,494	124,026	0	0	0	78,050	11,962,566
Self-Employed Wealth	5,011	79,239	0	0	0	169,488	11,962,566
Debt	-90,841	419,768	-269,500	0	0	0	11,962,566
				Panel D: Returns on Wealth			
Financial Wealth (%)	0.91	17.37	0.04	0.55	1.76	5.18	8,959,633
Bank Deposits (%)	0.33	29.81	0.00	0.07	0.48	2.18	648,732
Bonds (%)	2.15	7.39	0.39	1.47	3.83	11.43	15,213
Equity (%)	2.81	13.66	0.00	1.50	4.55	26.17	175,152

Portfolio Composition

(a) Across the Net Worth Distribution



Heterogeneity in Returns

- Use total financial wealth, equity, bonds and bank deposits to calculate returns for each percentile of the financial wealth distribution
- Return of household i at time t for asset x is given by

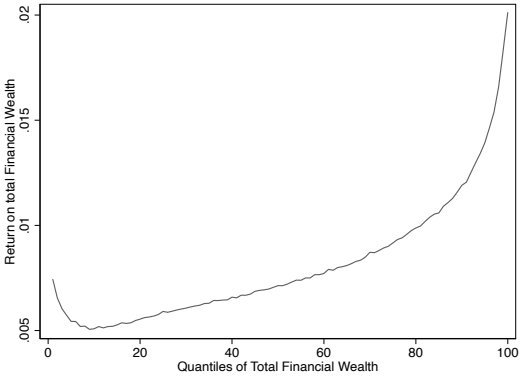
$$r_{it}^{x} = \frac{y_{it}^{x}}{\frac{1}{2}(w_{it}^{x} + w_{it-1}^{x})} \tag{1}$$

where y_{it}^{x} is the income received from asset x in period t and w_{it}^{x} the level of wealth.

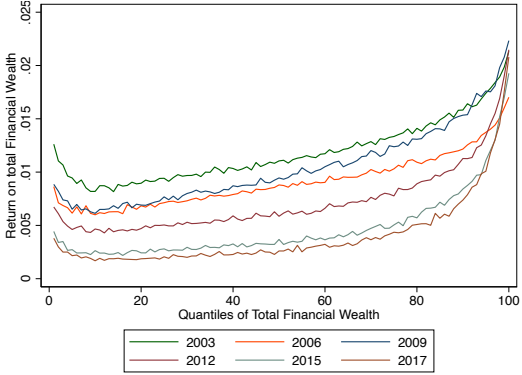
- Do not include capital gains
  1. subject to high risk if capital gain has not been realised
  2. capital gains are not taxed and therefore data quality is limited
  3. conservative, as we underestimate the true heterogeneity in returns

Returns on Total Financial Wealth

(a) Over the entire sample

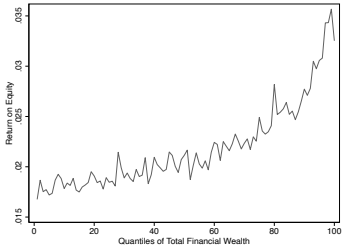


(b) For specific years

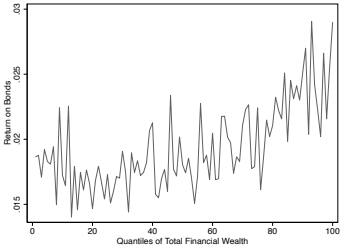


Risk Taking is Important, but...

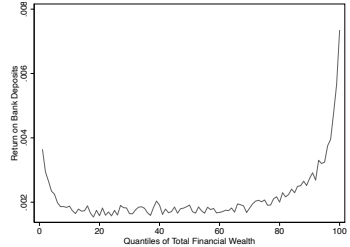
(a) Equity



(b) Bonds



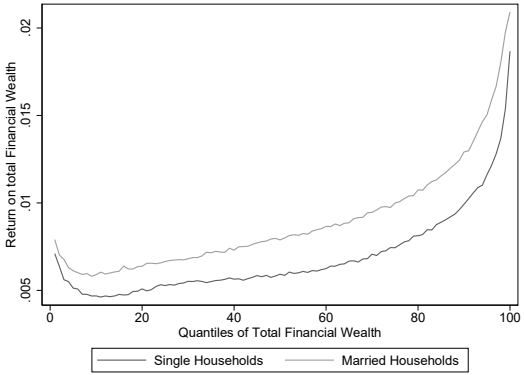
(c) Bank Deposits



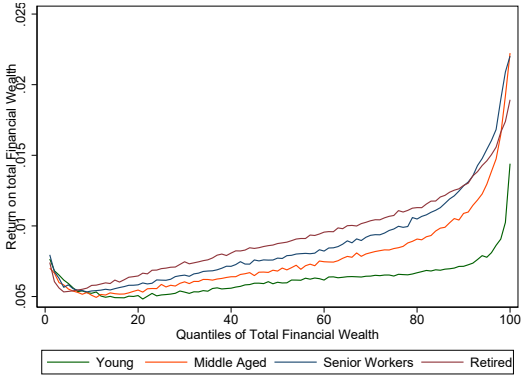
Financial Portfolio Composition

Heterogeneity across Socio-Demographic Variables

(a) Marital Status



(b) Age cohorts



Modelling Average Effects on Return

Outline

1. Model the conditional average effect using an OLS model
2. Measure type dependence
3. Measure scale dependence
4. Model the full distribution of returns

Modelling Average Effects on Return

- We use a simple OLS regression to account for the average effects on the return on wealth

$$r_{it} = X'_{it}\beta + f_t + \epsilon_{it} \tag{2}$$

where X_{it} is a list of time-variant and time-invariant observables and $\epsilon_{it} = \varepsilon_{it} + \bar{\varepsilon}_i$ once we include fixed effects.

- Identify *type* dependence using the OLS model.

Modelling Average Effects on Return

Detailed Assets

	Without Individual FE			Including Individual FE		
	(1) Scale 1	**(2)** Scale 2	**(3)** Scale 3	**(4)** Type 1	**(5)** Type 2	**(6)** Type 3
log(Avg. Financial Wealth (CHF))		0.03814***	0.04315***		-0.05264***	-0.05343***
		(0.001)	(0.001)		(0.005)	(0.005)
log(Labor Income (CHF))		-0.01524***	-0.02174***		-0.01508***	-0.01591***
		(0.001)	(0.001)		(0.003)	(0.003)
Equity Share (%)		0.01731***	0.01729***		0.00708***	0.00705***
		(0.000)	(0.000)		(0.000)	(0.000)
Bonds Share (%)		0.01108***	0.01140***		0.00627***	0.00626***
		(0.000)	(0.000)		(0.001)	(0.001)
Socio-Demographics	no	no	yes	no	no	yes
Year FE	yes	yes	yes	yes	yes	yes
Ind. FE	no	no	no	yes	yes	yes
R^2	0.052	0.125	0.126	0.402	0.662	0.662
adj. R^2	0.052	0.125	0.126	0.335	0.475	0.475
N	8,875,275	806,721	806,721	8,875,275	751,460	751,460

Measuring type dependence

- What do the individual fixed effects capture?
  1. Persistent differences in risk tolerance
  2. Persistent differences in wealth and a positive effect of the scale of wealth on returns
  3. Heterogeneity in financial sophistication
- Large difference in adj R^2 suggests that these three factors co-exist and that type dependence explains a large portion of the heterogeneity in returns

Measuring scale dependence

- We follow Gabaix et al. (2016) and Fagereng et al. (2019) and estimate

$$r_{it} = \theta P(w_{it}^n) + f_t + \bar{\varepsilon}_i + \varepsilon_{it} \tag{3}$$

- where $P(w_{it}^n)$ is the percentile of net worth, f_t a time FE and $\bar{\varepsilon}_i$ an individual FE
- Within individual estimates can be biased if past shocks to return feed into current or future wealth ranks

$$\Delta r_{it} = \theta \Delta P(w_{it}^n) + \Delta f_t + \Delta \varepsilon_{it} \tag{4}$$

- instrument $\Delta P(w_{it}^n)$ with $\Delta P(w_{it-2}^n)$, which is a valid instrument (Anderson and Hsiao (1981)) if past shocks are not serially correlated

Measuring scale dependence

	(1) OLS	(2) IV
θ	0.00545***	0.00843***
	(0.000)	(0.000)
Year FE	yes	yes
N	8,816,910	7,000,860

- Move from 10th to to the 90th percentile:
  - IV: increase in the return of about 0.67%
  - Descriptive: increase in the return of about 0.72%
  - $\Rightarrow$ Indication that a part of scale dependence is due to the type, which is the only other covariate included in the regression.

Modelling Distributional Effects on Return

- Average effects may vary across different ranks of the distribution
- Introduce a more flexible approach to capture the distributional effects
- Model the conditional distribution using Distribution Regression techniques by Chernozhukov, Fernández-Val, and Melly (2013)

$$F_{r_{it}|X_{it}}(y|X) = \Lambda(X'_{it}\beta(y)) \tag{5}$$

where $F_{r|X}(y)$ denotes the CDF of r_{it} conditional on a matrix of observables X_{it} at threshold y, $\Lambda(\cdot)$ is a logit-link function, and $\beta(y)$ is a coefficient vector varying across the distribution

Modelling Distributional Effects on Return

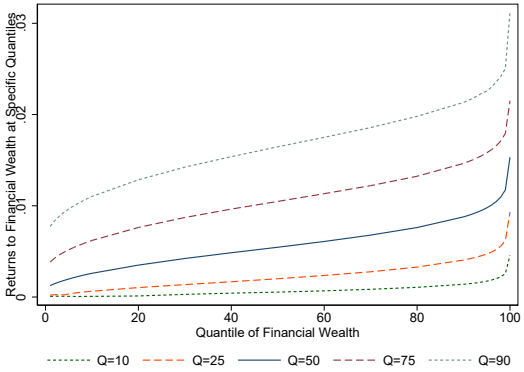
- To draw conclusions on the effect of total financial wealth (w^f) only, we integrate over all covariates except w^f

$$F_{\langle r|w^f=\cdot\rangle}(y) = \int_{\mathcal{X}} F_{r_{it}|X_{it}}(y)dF(\mathcal{X}) \tag{6}$$

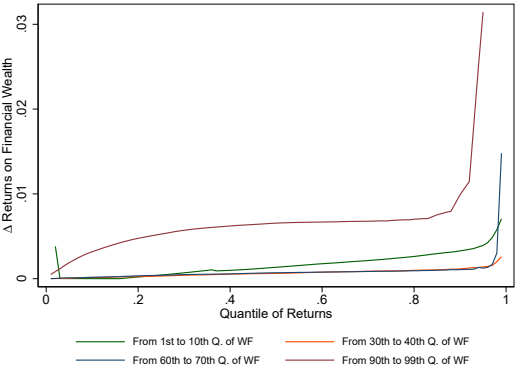
- Equation (6) allows us to compute the unconditional distribution for specific levels of w^f, where $\mathcal{X}$ denotes the modified covariate distribution
- Use different levels of w^f to deduce the effect of financial wealth on the unconditional distribution of returns

Modelling Distributional Effects on Return

(a) Full Distribution of Returns



(b) Difference in Quantile Function



Concluding Remarks

- Literature has shown that heterogeneity in returns is a key driver of wealth inequality
- We find substantial differences in returns on financial assets and document both *scale* and *type dependence*
- *Scale dependence* is very heterogeneous across the distribution of wealth
- Next steps
  1. Check for external validity using the tax data from the canton of Zurich
  2. Use changes in marital status as an exogeneous shock to wealth
  3. Use asset pricing models to estimate risk aversion and patience for different percentiles of the net worth distribution

Thank you!

Summary Statistics - Socio Demographics

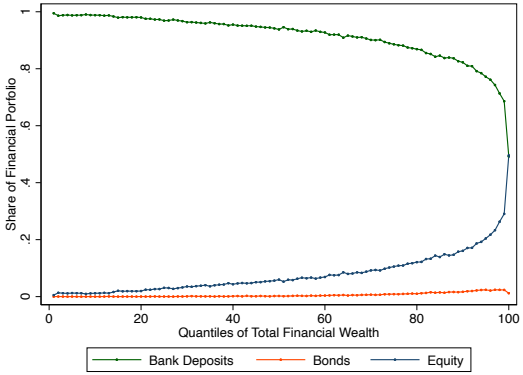
Return

	Mean	SD	P10	Median	P90	P99	Obs.
			Panel A: Socio-Demographics				
Age Main Person	49.89	18.59	25.00	49.00	76.00	90.00	11,962,566
Age Partner	53.60	15.08	34.00	53.00	74.00	86.00	6,425,113
Male Main Person (%)	47.62	49.94	0.00	0.00	100.00	100.00	11,962,566
Married (%)	53.71	49.86	0.00	100.00	100.00	100.00	11,962,566
Number of Children	0.48	0.92	0.00	0.00	2.00	3.00	11,962,566
			Panel B: Income				
Total Income	47,461	96,322	14,152	43,420	80,624	165,212	11,962,566
Total Labor Income	36,835	41,523	0	34,961	77,970	149,662	11,962,566
Employment	33,942	37,327	0	30,963	75,316	134,921	11,962,566
Self-Employed	2,893	20,967	0	0	0	67,676	11,962,566
Total Financial Income	2,043	76,802	0	101	2,498	25,837	11,962,566
Bank Deposits	362	7,540	0	24	356	5,786	1,115,278
Bonds	37	840	0	0	0	813	1,115,278
Equity	1,009	129,063	0	0	370	10,859	1,115,278

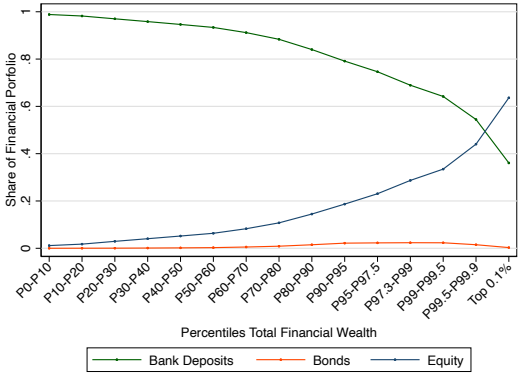
Financial Portfolio Composition

Return

(a) For the complete distribution



(b) For a few selected quantiles



Modelling Avg. Effects on Return - Bank Deposits

Return

	Without Individual FE			Including Individual FE		
	(1)	(2)	(3)	(4)	(5)	(6)
log(Avg. Financial Wealth (CHF))		0.02089***	0.02659***		-0.03932***	-0.03932***
		(0.001)	(0.001)		(0.006)	(0.006)
Equity Share (%)		0.00173***	0.00171***		-0.00122**	-0.00123**
		(0.000)	(0.000)		(0.000)	(0.000)
Bonds Share (%)		-0.00261***	-0.00226***		-0.00300***	-0.00299***
		(0.000)	(0.000)		(0.001)	(0.001)
Socio-Demographics	no	no	yes	no	no	yes
Year FE	yes	yes	yes	yes	yes	yes
Ind. FE	no	no	no	yes	yes	yes
R^2	0.000	0.006	0.007	0.681	0.681	0.681
adj. R^2	0.000	0.006	0.007	0.361	0.362	0.362
N	642,875	642,875	642,875	583,388	583,388	583,388

- Scale dependence barely noticeable for returns on bank deposit

Modelling Avg .Effects on Return - Bonds

Return

	Without Individual FE			Including Individual FE		
	(1)	(2)	(3)	(4)	(5)	(6)
log(Avg. Financial Wealth (CHF))		0.13337***	0.17781***		0.26052	0.24931
		(0.025)	(0.026)		(0.150)	(0.150)
Equity Share (%)		0.00248*	0.00216		-0.01759**	-0.01791**
		(0.001)	(0.001)		(0.006)	(0.006)
Bonds Share (%)		-0.01922***	-0.01761***		-0.00984***	-0.00997***
		(0.001)	(0.001)		(0.002)	(0.002)
Socio-Demographics	no	no	yes	no	no	yes
Year FE	yes	yes	yes	yes	yes	yes
Ind. FE	no	no	no	yes	yes	yes
R^2	0.000	0.045	0.054	0.841	0.842	0.843
adj. R^2	0.000	0.045	0.053	0.681	0.684	0.685
N	15,085	15,085	15,085	12,270	12,270	12,270

Modelling Avg. Effects on Return - Equity

Return

	Without Individual FE			Including Individual FE		
	(1)	(2)	(3)	(4)	(5)	(6)
log(Avg. Financial Wealth (CHF))		0.32637***	0.29594***		-0.09872	-0.10250
		(0.009)	(0.009)		(0.054)	(0.054)
Equity Share (%)		-0.00959***	-0.00908***		-0.00562***	-0.00576***
		(0.000)	(0.000)		(0.001)	(0.001)
Bonds Share (%)		-0.01268***	-0.01421***		-0.01204***	-0.01208***
		(0.001)	(0.001)		(0.003)	(0.003)
Socio-Demographics	no	no	yes	no	no	yes
Year FE	yes	yes	yes	yes	yes	yes
Ind. FE	no	no	no	yes	yes	yes
R^2	0.000	0.023	0.026	0.806	0.806	0.806
adj. R^2	-0.000	0.023	0.026	0.612	0.612	0.612
N	171,495	171,495	171,495	151,862	151,862	151,862

- Type dependence is a crucial factor to explain returns on equity