Heterogeneity in Returns to Wealth and Consumption Inequality

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Motivation

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- Quantitative models have hard time explaining extent of empirical wealth inequality with traditional explanations (e.g., De Nardi and Fella, 2017)
- Features of the distribution of stochastic wealth returns may play an important role for explaining inequality (Benhabib and Bisin, 2018; Gabaix et al., 2016)
- Empirical wealth returns display type and scale dependence (Fagereng et al., 2020; Bach et al., 2020)

Questions

1. What is the importance of heterogeneous skills endowment in the relation between wealth returns and wealth?
2. What is the quantitative importance of persistent wealth returns heterogeneity on wealth and consumption inequality?

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- Build and estimate a rich life-cycle model of saving and portfolio choice that incorporates novel dimensions of persistent household heterogeneity. Key features:
  - Persistent heterogeneity in returns to wealth
  - Correlated wealth returns and permanent component of earnings

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- Build and estimate a rich life-cycle model of saving and portfolio choice that incorporates novel dimensions of persistent household heterogeneity. Key features:
  - Persistent heterogeneity in returns to wealth
  - Correlated wealth returns and permanent component of earnings
- Conduct counterfactual simulations to explore the quantitative importance of persistent returns heterogeneity and its correlation with earnings on wealth and consumption inequality

Contribution

1. **Type or scale dependence in wealth returns** (Fagereng et al., 2020; Bach et al., 2020)
   - Document strong rank correlation between wealth returns fixed effects and wage fixed effects
   - Unobserved skills key in explaining rank correlation between returns and wealth, especially at the top

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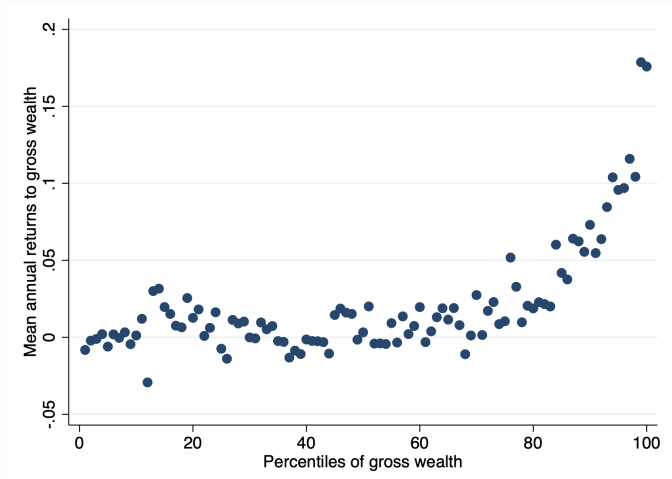
2. **Consumption and wealth inequality** literature (De Nardi and Fella, 2017; Benhabib and Bisin, 2018; Benhabib et al., 2019)
   - Document high rank correlation between wealth returns and consumption fixed effects
   - Embed persistent return heterogeneity, correlated with permanent heterogeneity in wages, within a rich life-cycle model of consumer behavior
   - The estimated model replicates empirical wealth and consumption inequality measures without resorting to preference heterogeneity

Key empirical facts about persistent household heterogeneity

The data

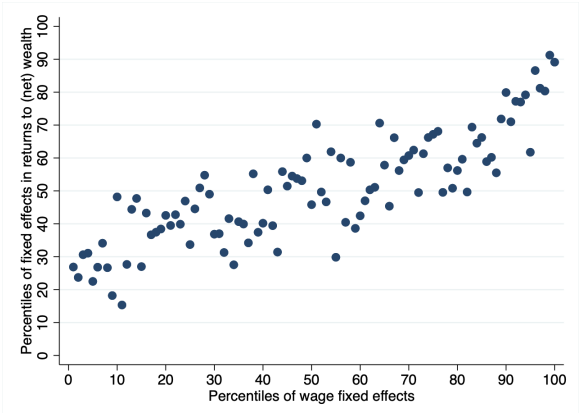
- Data from the PSID 1998-2018
- Sample selection:
  - Observations referring to the head and household-level data
  - Married couples where the head is between 25 and 65 years of age
- Wealth, returns and consumption definitions:
  - Gross wealth: sum of financial wealth, housing and private business wealth
  - Net worth: difference between gross wealth and outstanding debt
  - Returns to net worth and gross wealth as in Fagereng et al. (2020) ▸ Wealth returns
  - Consumption: comprehensive measure of total consumption (close to CEX)

Key fact I: evidence of type and scale dependence in returns



- Scale dependence in returns also in U.S. data (especially at the top)
- Fixed effects important in explaining variation in wealth returns ▸ FE in returns

Key fact II: rank correlation between wages and returns fixed effects



- Strong rank correlation ($\simeq 0.5$) between wages and returns fixed effects
- Rank correlation remains high after partialling out alternative explanations

▸ Residual rank-rank wages returns

Key fact III: persistent wealth returns, earnings, and consumption

- Wealth returns fixed effects strongly correlated with fixed effects in consumption

Model

Model overview

- Life-cycle model: yearly frequency between ages 25 and 90
- Rich economic environment:
  - **Assets**: riskless savings, risky assets (tail risk, participation cost κ)
  - **Heterogeneity by education**: two levels of education ($\leq$ high school, some college), education - specific labor income process
  - **Demography**: uncertain length of life, age-varying household composition z_t
  - **Medical expenses**: uncertainty with respect out-of-pocket medical expenses (permanent-transitory decomposition)
  - **Government**: carefully replicate social security rules, means-tested transfers (consumption floor à la HSZ), progressive labor income taxation

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- Parsimonious parametrization of preferences:
  - CRRA with homogeneous preference parameters (impatience δ, relative risk aversion γ)
  - Standard bequest function $b(A_t)$ (De Nardi, 2004)

The role of unobserved skills endowments

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- The stock of skills endowment affects:
  1. Returns to wealth. The individual excess return on the risky asset is:

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$$r^s_{i,t} - r^b = \mu_S + \delta^r \Phi_{i,0} + \xi^s_{i,t}$$

  2. Human capital formation. The log of real earnings is:

$$\log Y_{i,t} = X'_{i,t}\beta^y_j + P^y_i(\Phi_{i,0}) + u_{i,t} + \sum_{j=1}^{t} v_{i,j}$$

where $P^y_i(\Phi_{i,0}) = \exp(\omega^y_i + \delta^y \Phi_{i,0})$ and initial earnings have population variance $\sigma^2_{y_i}$.

Household's optimization problem

$$\max \mathbb{E}_t \left\{ \sum_{s=t}^{T} \beta^{s-t} \left[q_s u(C_s, R; z_s) + (1 - q_s) b(A_s) \right] \right\}$$

- 2 choice variables:
  - Consumption C
  - Portfolio share of risky assets ω_t
- 7 state variables:
  - Age in years t
  - Assets A
  - Skills endowment (Φ)
  - Initial labor income (ω^y)
  - History of permanent income shocks ($\sum_{j=1}^{t-1} v_j$)
  - Average lifetime earnings H
  - Permanent medical expense shock

Identification and estimation

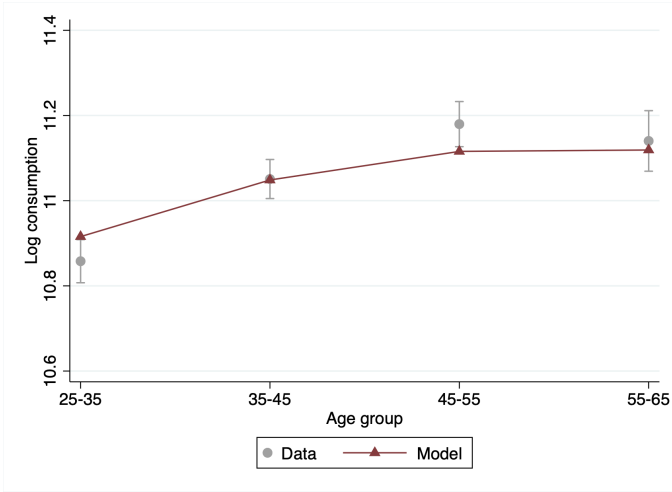
Two-steps approach:

1. Exogenous parameters estimated directly from the data (e.g., parameters earnings process, demographics, social security parameters)
2. 10 parameters are jointly estimated exploiting a minimum distance approach:
   - Three preference parameters: discount factor β, relative risk aversion γ, marginal propensity to bequeath $\widetilde{\theta}$
   - Fixed cost of risky assets participation κ
   - Parameters governing joint distribution of wealth returns and earnings fixed effects, by education group: $\sigma^2_{\Phi_i}, \sigma^2_{y_i}, \delta^y$

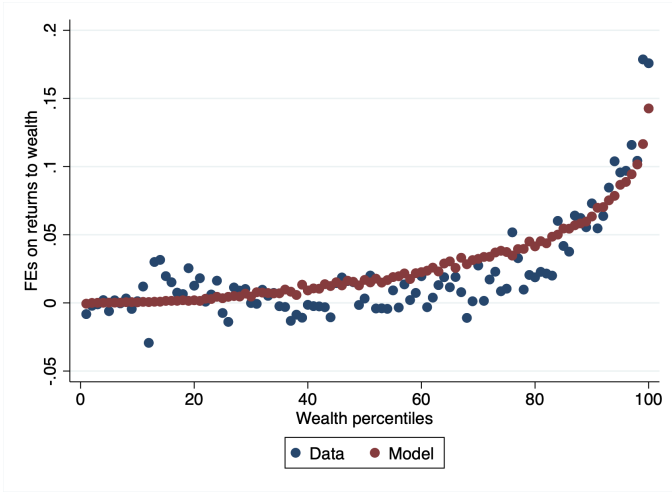
- Target 22 moments: median wealth and participation rates by age group, covariances fixed effects returns, earnings and consumption
- Inverse of the diagonal term of the bootstrapped variance matrix as weighting matrix

▸ Identification: ex. sensitivity ▸ Sedcond-step estimation results ▸ Model fit: wealth ▸ Model fit: covariances

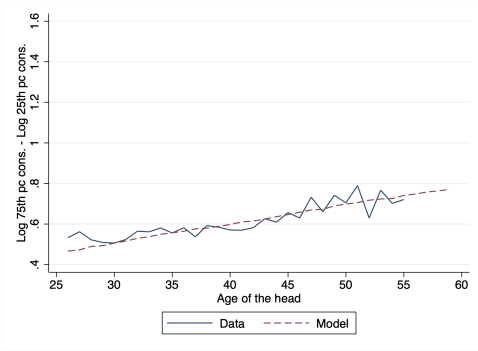
Model validation I: untargeted consumption over the life-cycle



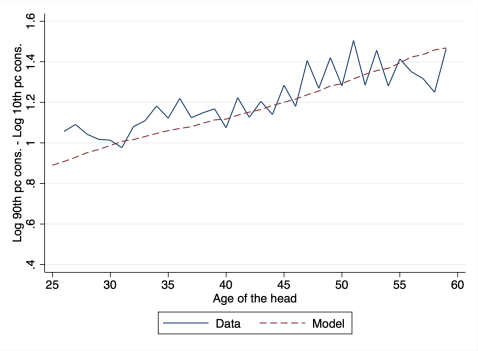
Model validation II: untargeted returns over wealth distribution



Model validation III: untargeted consumption inequality



(a) 75th-25th percentile



(b) 90th-10th percentile

▸ Untargeted moments: wealth inequality

Implications

Implications I: Risk taking or skills in scale dependence

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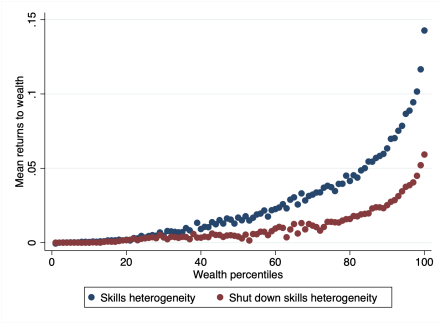

Skills and returns heterogeneity

Shutting down persistent returns to wealth heterogeneity ($\sigma^2_{\Phi_i} = 0$):

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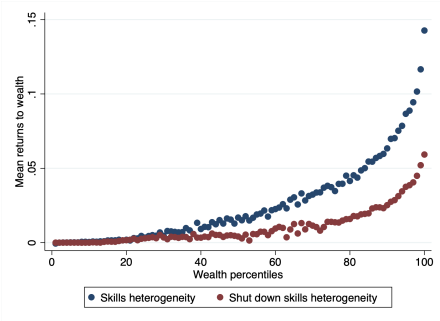

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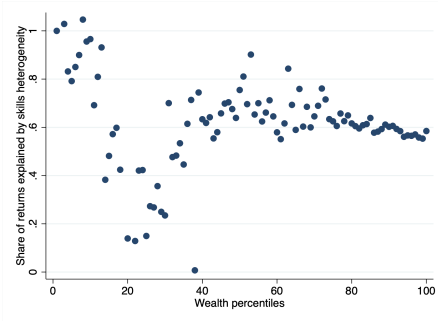

Explained share of wealth returns

Shutting down persistent returns to wealth heterogeneity ($\sigma^2_{\Phi_i} = 0$):

- Skills explain large share of scale dependence in returns ($\simeq 60\%$ at the top)

Implications II: Wealth returns and consumption inequality

Q2: What is the quantitative importance of wealth returns heterogeneity on wealth and consumption inequality?

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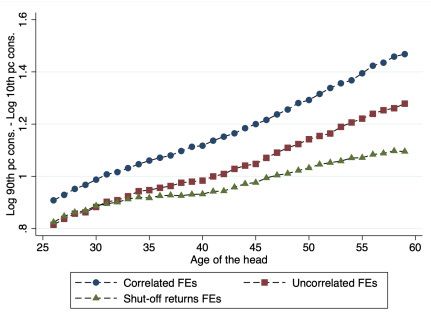

Consumption inequality

Shutting down the correlation between wages and returns ($\delta^y = 0$) OR persistent returns to wealth heterogeneity ($\sigma^2_{\Phi_i} = 0$):

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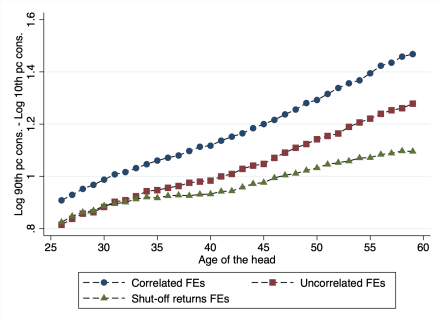

Consumption inequality

Explained share of consumption inequality

Shutting down the correlation between wages and returns ($\delta^y = 0$) OR persistent returns to wealth heterogeneity ($\sigma^2_{\Phi_i} = 0$):

- Correlation between wages and returns explains around 12% of consumption inequality
- Skills heterogeneity explains between 10 and 25% of consumption inequality over the life-cycle

Conclusions

- We document new facts about persistent household heterogeneity:
  - Rank correlation between persistent returns to wealth and the permanent component of wages
  - Rank correlation between returns to wealth and consumption
- We build and estimate a quantitative model of savings and portfolio choice that incorporates individual skills heterogeneity generating correlated labor earnings and persistent wealth returns
- The model replicates untargeted wealth and consumption inequality measures over the life-cycle
- Implications:
  - Unobserved skills explain about half of the degree of scale dependence in returns to wealth
  - Correlated wealth returns and earnings explain around 25% of consumption inequality and 40% of wealth inequality at the end of the working life

Supplementary material

Return to wealth definition

- Returns to net worth:

$$r_t = \frac{(y_t^c + cg_t - y_t^d)}{(A_{t-1} + 0.5F_t)}$$

  - y_t^c: interest income and dividends from financial wealth, real estate (no own housing) and business
  - cg_t: "capital gains/losses" from business, rents, stocks, real estate, pension/IRA
  - y_t^d: payments on debt
  - F_t: Dietz's correction (net investment flow)
  - A_{t-1}: total household's net wealth at the beginning of the previous period

- Returns to gross wealth:

$$r_t^G = \frac{(y_t^c + cg_t)}{(A_{t-1}^G + 0.5F_t)}$$

  - $A_{t-1}^G = A_{t-1} + D_{t-1}$: gross household wealth, with D indicating household debt

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Table: Fixed effects in returns to wealth

	Whole sample		*Non-missing risk avs and transfers*			
	(1)	(2)	(3)	(4)	(5)	(6)
Baseline controls	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Shares*Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Risk aversion	No	No	No	Yes	Yes	No
Intergenerational transfers	No	No	No	No	Yes	No
Individual FE	No	Yes	No	No	No	Yes
Adj R squared	0.209	0.272	0.247	0.247	0.248	0.299
N	8274	8274	2566	2566	2566	2566

Note: Dependent variable is net returns to wealth. Regressions control for age, education, employment, year and state dummies, share of wealth allocated to different asset classes, leverage of mortgage and other debt, and wealth percentiles.

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Key fact II: correlation between wages and returns fixed effects

Table: Residual rank correlation after partialling out alternative explanations

	No controls	cohort effects	cohort effects and risk avs	cohort effects and transfers	cohort effects risk avs and transfers
	(1)	(2)	(3)	(4)	(5)
$\rho(\eta^P, \eta^\psi)$	0.498	0.479	0.481	0.412	0.438
Explained share by observ.		0.018	0.096	0.164	0.187
N	1,002	1,002	406	908	355

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Identification: sensitivity

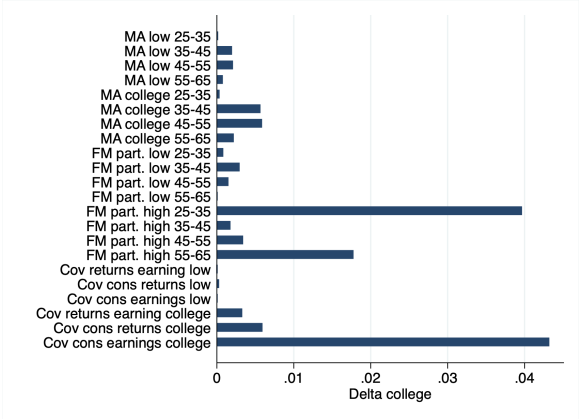

Figure: Absolute value of the scaled sensitivity matrix as defined in Andrews et al. (2017). The sensitivity measure has been rescaled to indicate the effect of a 1% increase in the moments on the parameters.

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Second-step estimation results

Parameter		Value	Std. error
Time discount factor	β	0.9800	0.0007
Coefficient of relative risk aversion	γ	2.6823	0.0178
Financial markets participation cost	κ	1129.16	169.54
Marginal propensity to bequeath	$\widetilde{\theta}$	0.8759	0.0271
Upper secondary education			
Variance skills FEs	$\sigma^2_{\Phi_i}$	0.0028	0.0007
Variance initial earnings	$\sigma^2_{y_i}$	0.0485	0.0134
Effect FEs skills on earnings	δ^y	2.7997	0.4614
Some college degree			
Variance skills FEs	$\sigma^2_{\Phi_i}$	0.0034	0.0004
Variance initial earnings	$\sigma^2_{y_i}$	0.0955	0.0164
Effect FEs skills on earnings	δ^y	3.0215	0.1916

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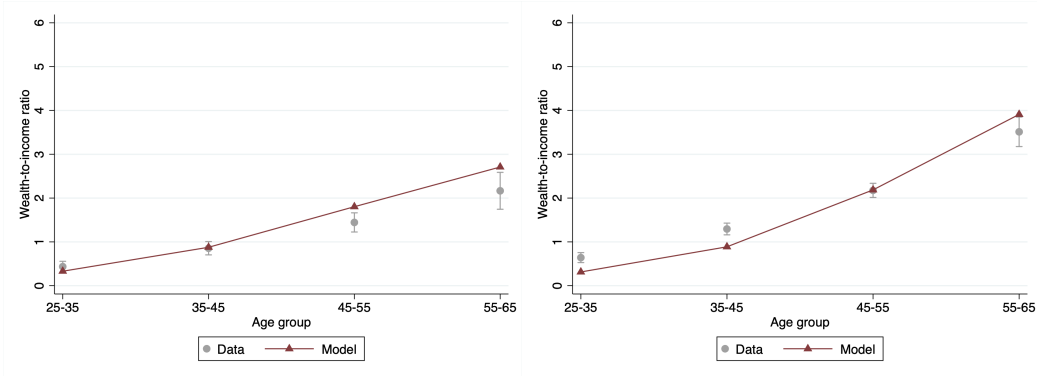
Goodness of fit: median wealth



(a) Upper secondary or lower

(b) Some college education

Figure: Model fit of assets

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Table: Goodness of fit - FE covariances

Target moments	Education level	Model	Data	[95% CI	Diff.]
$Cov(\psi_i, P_i^y)$	Upper secondary	0.5481*	0.4226	-0.298	0.047
	Some college	0.4957*	0.5216	-0.065	0.117
$Cov(\widetilde{c}_i, \psi_i)$	Upper secondary	0.6322	0.4755	-0.307	-0.006
	Some college	0.5953	0.4973	-0.194	-0.001
$Cov(\widetilde{c}_i, P_i^y)$	Upper secondary	0.7945*	0.7515	-0.115	0.029
	Some college	0.7806*	0.7893	-0.038	0.055

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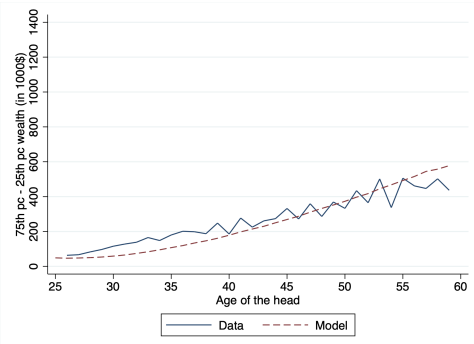

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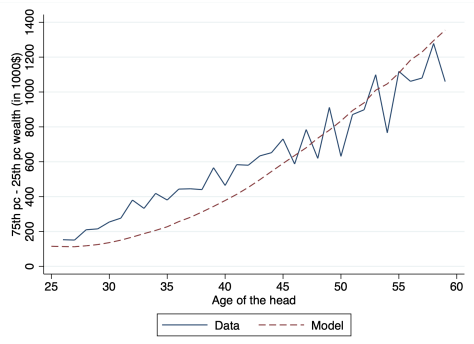

(b) 90th-10th percentile

Figure: Untargeted moments: Wealth inequality.

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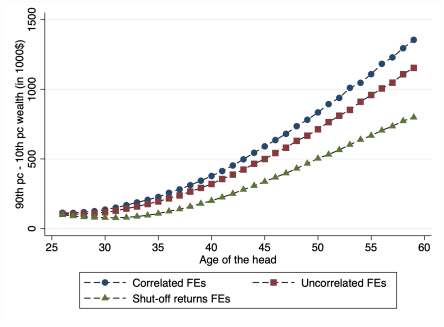
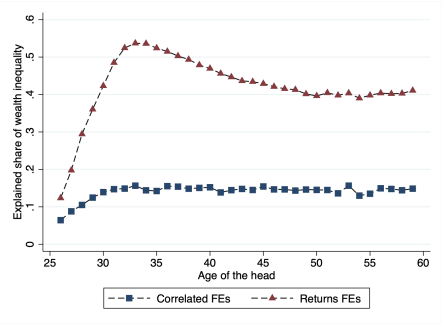
Implications II: Wealth returns and wealth inequality

Q2.a: What is the quantitative importance of wealth returns heterogeneity on wealth and consumption inequality?



Wealth inequality



Explained share of wealth inequality

Shutting down the correlation between wages and returns ($\delta^y = 0$) OR persistent returns to wealth heterogeneity ($\sigma^2_{\Phi_i} = 0$):

- Correlation between wages and returns explains around 15% of wealth inequality
- Skills heterogeneity explains between 15 and 55% of wealth inequality over the life-cycle

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