Heterogeneous Returns and the Distribution of Wealth

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June 10, 2024

A two-way street between macro and inequality (Ahn et al. 2017) :

Empirically, fiscal policy (i.e. stimulus checks) and aggregate shocks can have differential effects across households.

- Macro matters for inequality

Representative agent models have a difficult time matching empirical estimates of macro variables (MPC and the wealth distribution).

- Inequality matters for macro

Incorporating *heterogeneity across households* can help focus on this second issue.

Macro with heterogeneous agents

- Uninsurable, idiosyncratic risk to income and movements in aggregate productivity (Krusell and Smith 1998)
- Ex-ante heterogeneity in the time preference of households (Carroll et al. 2017)
- Classifying models with ex-ante and ex-post heterogeneity (Kaplan and Violante 2022)
- Further surveys regarding heterogeneous agent macroeconomics (Guvenen 2011) and (Krueger, Mitman, and Perri 2016)

Related literature

1. Comprehensive, administrative tax data in Norway from 2004 to 2015 (Fagereng et al. 2020)
2. Documents heterogeneous returns in PSID and structural estimation of a model with skill endowments (Daminato and Pistaferri 2024)

Outline

1. Empirical evidence of heterogeneous returns
2. Model of saving with heterogeneous returns
3. Structural estimation of model to match wealth data

A closer look at Fagereng et al. 2020

Following optimal portfolio choice theory from Merton (1969) and Samuelson (1969)

- Optimal share in the risky asset is given by

$$\alpha_{it}^{m} = \frac{\mathbb{E}(r_t^m - r_t^s)}{\gamma_i \sigma_t^2}.$$

- Individual *realized* return to financial assets can be written as

$$r_{it}^{f} = r_t^s + \alpha_{it}^{m}(r_t^m - r_t^s).$$

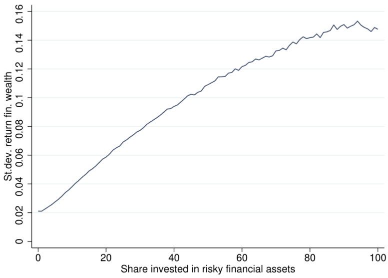


Figure: Heterogeneity in returns to financial wealth by share of risky assets from Fagereng et al. 2020.

- Step 1: *linear panel data regression model* for the return to net worth

$$r_{it}^{n} = X_{it}^{'}\beta + u_{it}.$$

- Step 2: Add fixed effects

$$u_{it} = f_i + e_{it}.$$

$\Longrightarrow$ R^2 goes from .33 to .5.

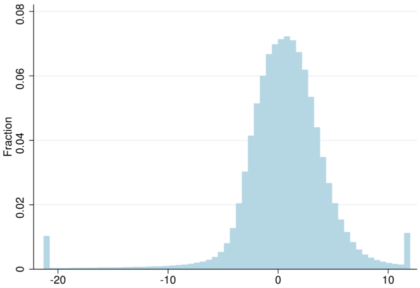


Figure: Distribution of fixed effects in the return to net worth from Fagereng et al. 2020.

Labor income process

- Household income:

$$y_t = p_t \xi_t W_t$$

- Permanent component:

$$p_t = p_{t-1} \psi_t$$

- Transitory component:

$$\xi_t = \begin{cases} \mu & \text{with probability } \mho \\ (1 - \tau_t)\ell\theta_t & \text{with probability } 1 - \mho \end{cases}$$

(Normalized) Optimization problem

Choose profiles $\{c_{t_n}\}_{n=0}^{\infty}$ that satisfy

$$
\begin{aligned}
v(m_t) &= \max_{c_t} u(c_t(m_t)) + \beta \cancel{D} \mathbb{E}_t[\psi_{t+1}^{1-\rho} v(m_{t+1})] \\
&\text{s.t.} \\
a_t &= m_t - c_t(m_t), \\
k_{t+1} &= \frac{a_t}{\cancel{D}\psi_{t+1}}, \\
m_{t+1} &= (\daleth + r_t)k_{t+1} + \xi_{t+1}, \\
a_t &\geq 0.
\end{aligned}
$$

Production function

$$
Y = ZK^{\alpha}(\ell L)^{1-\alpha}
$$

Calibration

Standard calibration scheme used to simulate the model.

Description	Parameter	Value	Source
Time discount factor	β	0.99^4	Den Haan, Judd, and Juillard 2010
CRRA	ρ	1	Den Haan, Judd, and Juillard 2010
Capital share	α	0.36	Den Haan, Judd, and Juillard 2010
Depreciation rate	δ	0.025	Den Haan, Judd, and Juillard 2010
Time worked per employee	ℓ	$1/.09$	Den Haan, Judd, and Juillard 2010
Effective interest rate	$r - \delta$	0.01	Den Haan, Judd, and Juillard 2010
Wage rate	W	2.37	Den Haan, Judd, and Juillard 2010
Unempl. insurance payment	μ	0.15	Den Haan, Judd, and Juillard 2010
Probability of survival	$\not D$	$(1 - 0.00625)^4$	Yields 40-year working life
Std. dev of $\log \theta_{t,i}$	σ_θ^2	$0.010 \text{ x } 4 \text{ x } \sqrt{4}$	Carroll 1992, Carroll, Slacalek, and Tokuoka 2015
Std. dev of $\log \psi_{t,i}$	σ_ψ^2	$0.010 \text{ x } 4/11 \text{ x } \sqrt{4}$	Carroll 1992, Debacker et al. 2013, Carroll, Slacalek, and Tokuoka 2015
Unemployment rate	$\mho$	0.07	Mean in Den Haan, Judd, and Juillard 2010

Table 1: Parameter values (annual frequency) for the perpetual youth model.

Estimation procedure

Simulated method of moments (SMM) estimation for R.

1. No ex-ante heterogeneity: *R-point* model
   Estimate a common rate of return across households by finding the $\grave{R}$ which matches the capital-to-output ($\frac{K}{Y}$) ratio from data.

2. Ex-ante heterogeneity: *R-dist* model
   Estimate a **Uniform distribution** of returns across households by finding the $\grave{R}, \nabla$ which matches empirical Lorenz targets, given $\frac{K}{Y}$.

Estimation procedure with heterogeneity

Empirical targets using 2004 SCF data

Net worth percentile	Cumulative net worth
20th	-.18%
40th	.95%
60th	5.3%
80th	17.09%

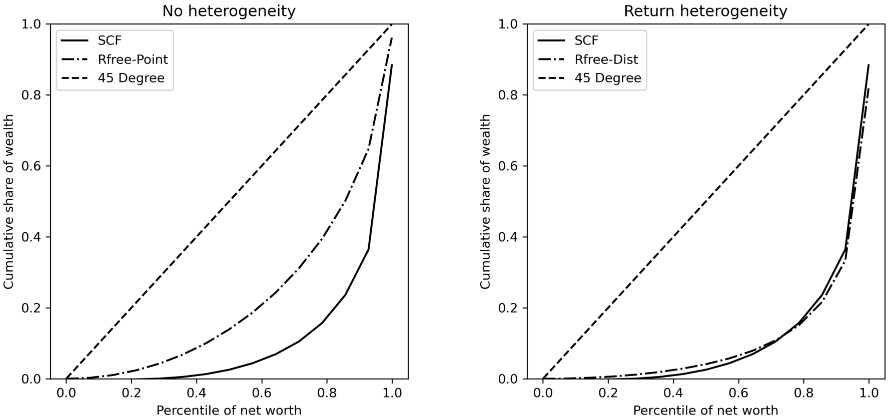
Optimization problem for the *R-dist* model

$$\{\grave{R}, \nabla\} = \arg\min_{R,\nabla} \left(\sum_{i=20,40,60,80} (w_i(R,\nabla) - \omega_i)^2 \right)^{\frac{1}{2}}$$

s.t.

$$\frac{K}{Y} = 7.47.$$

How good is the fit?



Lifecycle version of the model

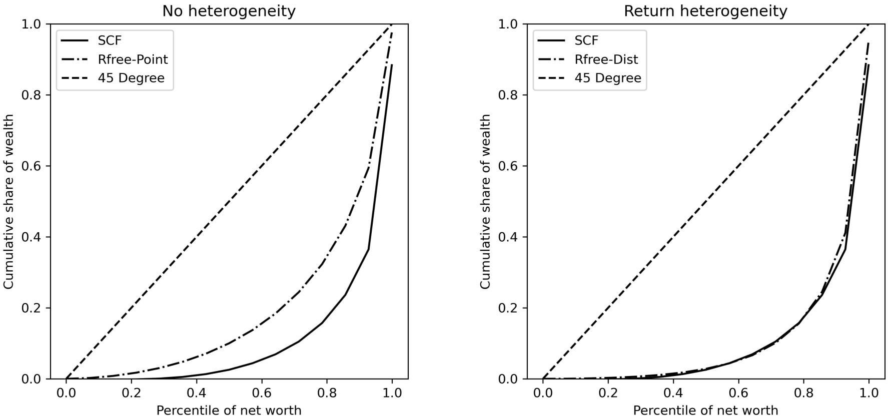
- Education cohort $e \in \{D, HS, C\}$
- Initial wealth-to-income k_0 and income p_0 levels
- Education-age dependent mortality rates (Brown, Liebman, and Pollet 2007)
- Modified labor income uncertainty $y_t = \xi_t \psi_t \overline{\psi}_{es} p_{t-1}$ (Cagetti 2003)
    - Education-age dependent shock variances (Sabelhaus and Song 2010)

Calibration

Description	Parameter	Value
Population growth rate	N	0.0025
Technological growth rate	Γ	0.0037
Rate of high school dropouts	θ_D	0.11
Rate of high school graduates	θ_{HS}	0.55
Rate of college graduates	θ_C	0.34
Labor income tax rate	τ	0.0942

Table 2: Parameter values (annual frequency) for the lifecycle model.

How good is the fit?



Assessing the performance of the model

Empirical values from Fagereng et al. 2020

	Mean	St. Dev
Net worth (after tax)	0.0365	0.0781

Values from the structural estimation (uniform distribution for R)

	Mean	St. Dev
PY-Point	0.071	0.0
PY-Dist	0.055	0.006
LC-Point	0.063	0.0
LC-Dist	0.039	0.012

Work to be done

1. Modify structural estimation to include bequest parameter
2. Incorporate choice of risky asset
3. Robustness checks
    - Wealth data from other waves of the SCF
    - Different measures of wealth (liquid and/or financial)

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