Sources of U.S. Wealth Inequality: Past, Present, and Future

Joachim Hubmer, Per Krusell, Tony Smith
Penn, IIES, Yale

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Evolution of top wealth inequality in the U.S.

Overview

- examine a quantitative macro model with sharp implications for the distribution of wealth: can it match the data?
  - its average shape
  - its evolution over time

- in particular, study the role of a number of wealth inequality determinants: tax rates, labor income, and portfolio returns—all varying across households and over time

- we discipline the model by tying all parameters to micro data
  - does the benchmark framework do an adequate job?
Quantitative model

Extended Aiyagari 1994 framework:

- exogenous labor supply with idiosyncratic risk: persistent and transitory component, plus Pareto tail

- heterogeneous returns: increasing in wealth, i.i.d. idiosyncratic component

- progressive taxation
Return heterogeneity

- overall return given asset holdings $a_t$ equals
  \[ r_t + r^X_t(a_t) + \sigma^X_t(a_t)\eta_t \]

- $r_t$ is endogenous

- $r^X_t(\cdot)$ and $\sigma^X(\cdot)$ are exogenous excess return schedules (mean and st.dev.), taken from the data

- $\eta_t$ is an i.i.d. standard normal shock

- reduced form portfolio choice
### Schedule of excess returns

<table>
<thead>
<tr>
<th>Percentile Range</th>
<th>Mean Excess Return</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>P0-P40</td>
<td>0</td>
<td>0.05</td>
</tr>
<tr>
<td>P40-P50</td>
<td>0.1</td>
<td>0.15</td>
</tr>
<tr>
<td>P50-P60</td>
<td>0.2</td>
<td>0.25</td>
</tr>
<tr>
<td>P60-P70</td>
<td>0.3</td>
<td>0.3</td>
</tr>
<tr>
<td>P70-P80</td>
<td></td>
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<tr>
<td>P80-P90</td>
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<td>P90-P95</td>
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<tr>
<td>P95-P97.5</td>
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<tr>
<td>P97.5-P99</td>
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<tr>
<td>P99-P99.5</td>
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<tr>
<td>P99.5-P99.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P99.9-P99.99</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 0.01%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Data sources: Bach, Calvet, Sodini (2019); Kartashova (2014); Jorda, Knoll, Kuvshinov, Schularick, Taylor (2019); Case-Shiller.
Results, I: steady state (1967)

<table>
<thead>
<tr>
<th></th>
<th>Top 10%</th>
<th>Top 1%</th>
<th>Top 0.1%</th>
<th>Top 0.01%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data</td>
<td>70.8%</td>
<td>27.8%</td>
<td>9.4%</td>
<td>3.1%</td>
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<tr>
<td>Model</td>
<td>66.6%</td>
<td>23.7%</td>
<td>11.2%</td>
<td>7.2%</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Bottom 50%</th>
<th>Fraction $a &lt; 0$</th>
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</thead>
<tbody>
<tr>
<td>Data</td>
<td>4.0%</td>
<td>8.0%</td>
</tr>
<tr>
<td>Model</td>
<td>3.5%</td>
<td>7.3%</td>
</tr>
</tbody>
</table>

- model matches wealth distribution well on its entire domain
  - return heterogeneity is key ingredient
  - wealth concentration is mitigated by progressive taxation and labor income risk
Observed change 1: decrease in tax progressivity

- federal effective tax rates (Piketty & Saez 2007): income, payroll, corporate and estate taxes
Observed change 2: increase in labor income risk

Observed change 3: increase in top labor income shares

- adjust standard AR(1) in idiosyncratic productivity by imposing a Pareto tail for the top 10% earners: calibrated tail coefficient decreases from 2.8 to 1.9 (updated Piketty & Saez 2003 series)
Observed change 4: return premia

- feed in (smoothed) time series of aggregate U.S. asset premia (Kartashova 2014, Case-Shiller index)
Observed change 4: return premia

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- feed in (smoothed) time series of aggregate U.S. asset premia (Kartashova 2014, Case-Shiller index)
Results, II: historical evolution

**top 10% wealth share**

- **model**
- **data (SZ)**
- **data (SZZ)**

**top 1% wealth share**

**top 0.1% wealth share**

**top 0.01% wealth share**
Summary of transitional dynamics

- model captures the salient features of the evolution of the U.S. wealth distribution

- these results are robust
  - perfect foresight not critical
  - robust to CES production function with elasticity > 1 and more generally falling labor share

- shortcomings:
  - explosion of wealth concentration at the extreme top (0.01%) not fully captured quantitatively
Decomposition of transitional dynamics

- overall increase in wealth inequality (more than) fully explained by declining tax progressivity
  - primarily due to direct effect on resource distribution and not due to changing savings behavior

- time-varying return premia account for U-shape in wealth inequality

- subtle role of increasing earnings dispersion
  - thickening Pareto tail in labor income contributes slightly positively to wealth inequality
  - increase in overall earnings risk decreases wealth inequality
Capital in the 21st century?

**top 1% wealth share**

- Model
- Data (SZ)

Year timeline: 1980, 2000, 2020, 2040, 2060, 2080, 2100

Wealth share progression from 1980 to 2100.
Conclusion: (surprising) success, challenging new questions

- the model does a very good job at accounting for the level of wealth inequality
  - (realistic) return heterogeneity is key
Conclusion: (surprising) success, challenging new questions

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  - (realistic) return heterogeneity is key

- the model also does a very good job at explaining its evolution over time
  - declining tax progressivity most powerful force for generating increases in wealth inequality
  - asset-price movements account well for medium-run dynamics
Conclusion: (surprising) success, challenging new questions

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- cautious prediction: unless stronger tax progressivity restored, wealth concentration will continue to rise
Conclusion: (surprising) success, challenging new questions

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- cautious prediction: unless stronger tax progressivity restored, wealth concentration will continue to rise

- remaining questions from perspective of this paper:
  - why are portfolios heterogeneous (both across and within wealth levels), what drives returns?
Appendix
Consumer problem

\[ V_t(x_t, p_t) = \max_{a_{t+1} \geq a_t} \{ u(x_t - a_{t+1}) + \beta \mathbb{E} [V_{t+1}(x_{t+1}, p_{t+1}) | p_t] \} \]

subject to

\[ x_{t+1} = a_{t+1} + y_{t+1} - \tau_{t+1}(y_{t+1}) + (1 - \tilde{\tau}_{t+1})\tilde{y}_{t+1} + T_{t+1} \]

\[ y_{t+1} = (r_{t+1} + r^X_{t+1}(a_{t+1})) a_{t+1} + w_{t+1} l_{t+1}(p_{t+1}, \nu_{t+1}) \]

\[ \tilde{y}_{t+1} = \sigma^X(a_{t+1}) \eta_{t+1} a_{t+1} \]

- cash-on-hand \( x_t \)
- persistent component of labor income process \( p_t \)
- transitory shocks to labor income \( \nu_t \) and capital income \( \eta_t \)
- progressive tax on ordinary income \( \tau_t(\cdot) \); flat on cap. gains \( \tilde{\tau}_t \)
- Lumpsum transfer \( T_t \)
Equilibrium: capital market clearing

need to find two equilibrium objects \((K_t, r_t)\) for capital market clearing:

1. aggregate capital (as usual)

\[
K_t = \int a_t d\Gamma(a_t)
\]

2. aggregate capital income (redundant if \(r_t X(\cdot) = 0\))

\[
(MPK(K_t) - \delta)K_t = \int \left(r_t + r_t X(a_t)\right) a_t d\Gamma(a_t)
\]
Multiplicative shocks and Pareto tails

- Linear savings rules as wealth grows large (Bewley 1977; Carroll 2012; Benhabib et al. 2015): \( \lim_{x \to \infty} s(x, \beta) = \bar{s}_\beta x \).

- Asset accumulation for large \( x \):

\[
\begin{align*}
a_{t+1} & = s(x_t, \beta) \\
& = s(a_t + y_t - T(y_t), \beta) \\
& \approx \bar{s}_\beta a_t (1 + (1 - \tau_{\text{max}})r) + \bar{s}_\beta (1 - \tau_{\text{max}})e_t \\
& \equiv \hat{s}a_t + z_t,
\end{align*}
\]

where \( e_t \) is earnings.

- \( \beta \) and/or \( r \) random \( \rightarrow \hat{s} \) is random.

- With reflecting barrier (borrowing constraint) and/or random earnings, the invariant distribution for wealth has a Pareto tail with coefficient \( \zeta \) solving: \( \mathbb{E}[\hat{s}^\zeta] = 1 \).
Stochastic-$\beta$ yields stochastic, linear savings decisions

<table>
<thead>
<tr>
<th>log(k)</th>
<th>0.84</th>
<th>0.86</th>
<th>0.88</th>
<th>0.90</th>
<th>0.92</th>
<th>0.94</th>
<th>0.96</th>
<th>0.98</th>
<th>1.00</th>
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<tbody>
<tr>
<td>marginal propensity to save</td>
<td>high beta, high earnings</td>
<td>high beta, low earnings</td>
<td>low beta, high earnings</td>
<td>low beta, low earnings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Graph showing the marginal propensity to save across different beta and earnings scenarios.](image-url)
Gives rise to a Pareto tail in the wealth distribution
Excess return schedule details

- **Aggregate Excess Returns in 1967 steady state:**
  - public equity 0.067 (U.S., Kartashova 2014)
  - private equity 0.129 (U.S., Kartashova 2014)
  - housing 0.037 (incl. imputed rent; Jorda, Knoll, Kuvshinov, Schularick, Tayler 2017)

- Cross-sectional data from Bach, Calvet, Sodini (2019)

<table>
<thead>
<tr>
<th>Fixed Portfolio Weights</th>
<th>P0-P40</th>
<th>P40-P50</th>
<th>P50-P60</th>
<th>P60-P70</th>
<th>P70-P80</th>
<th>P80-P90</th>
<th>P90-P95</th>
<th>P95-P97.5</th>
<th>P97.5-P99</th>
<th>P99-P99.5</th>
<th>P99.5-P99.9</th>
<th>P99.9-P99.99</th>
<th>Top 0.01%</th>
</tr>
</thead>
<tbody>
<tr>
<td>risk-free</td>
<td>0.722</td>
<td>0.412</td>
<td>0.248</td>
<td>0.182</td>
<td>0.156</td>
<td>0.134</td>
<td>0.115</td>
<td>0.102</td>
<td>0.090</td>
<td>0.079</td>
<td>0.071</td>
<td>0.051</td>
<td>0.029</td>
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<tr>
<td>housing</td>
<td>0.162</td>
<td>0.394</td>
<td>0.580</td>
<td>0.662</td>
<td>0.678</td>
<td>0.674</td>
<td>0.658</td>
<td>0.626</td>
<td>0.572</td>
<td>0.482</td>
<td>0.363</td>
<td>0.253</td>
<td>0.155</td>
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<tr>
<td>public equity</td>
<td>0.113</td>
<td>0.189</td>
<td>0.165</td>
<td>0.147</td>
<td>0.153</td>
<td>0.170</td>
<td>0.189</td>
<td>0.207</td>
<td>0.219</td>
<td>0.232</td>
<td>0.230</td>
<td>0.185</td>
<td>0.179</td>
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<tr>
<td>private equity</td>
<td>0.002</td>
<td>0.005</td>
<td>0.007</td>
<td>0.009</td>
<td>0.013</td>
<td>0.021</td>
<td>0.038</td>
<td>0.065</td>
<td>0.118</td>
<td>0.207</td>
<td>0.336</td>
<td>0.511</td>
<td>0.637</td>
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<table>
<thead>
<tr>
<th>Difference from Aggregate Return on Asset Class</th>
<th>P0-P40</th>
<th>P40-P50</th>
<th>P50-P60</th>
<th>P60-P70</th>
<th>P70-P80</th>
<th>P80-P90</th>
<th>P90-P95</th>
<th>P95-P97.5</th>
<th>P97.5-P99</th>
<th>P99-P99.5</th>
<th>P99.5-P99.9</th>
<th>P99.9-P99.99</th>
<th>Top 0.01%</th>
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</thead>
<tbody>
<tr>
<td>risk-free</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
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<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>housing</td>
<td>0.000</td>
<td>0.000</td>
<td>0.002</td>
<td>0.004</td>
<td>0.005</td>
<td>0.007</td>
<td>0.009</td>
<td>0.010</td>
<td>0.010</td>
<td>0.011</td>
<td>0.011</td>
<td>0.010</td>
<td>0.011</td>
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<tr>
<td>public equity</td>
<td>0.000</td>
<td>0.000</td>
<td>0.001</td>
<td>0.002</td>
<td>0.003</td>
<td>0.005</td>
<td>0.008</td>
<td>0.012</td>
<td>0.014</td>
<td>0.015</td>
<td>0.016</td>
<td>0.016</td>
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<tr>
<td>private equity</td>
<td>0.000</td>
<td>0.000</td>
<td>-0.019</td>
<td>-0.030</td>
<td>-0.054</td>
<td>-0.055</td>
<td>-0.049</td>
<td>-0.066</td>
<td>-0.064</td>
<td>-0.063</td>
<td>-0.063</td>
<td>-0.059</td>
<td>-0.060</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Standard Deviation of Return on Asset Class</th>
<th>P0-P40</th>
<th>P40-P50</th>
<th>P50-P60</th>
<th>P60-P70</th>
<th>P70-P80</th>
<th>P80-P90</th>
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</thead>
<tbody>
<tr>
<td>risk-free</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
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<td>0.000</td>
<td>0.000</td>
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</tr>
<tr>
<td>housing</td>
<td>0.140</td>
<td>0.140</td>
<td>0.140</td>
<td>0.140</td>
<td>0.140</td>
<td>0.140</td>
<td>0.140</td>
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<tr>
<td>public equity</td>
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<td>0.035</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.031</td>
<td>0.032</td>
<td>0.033</td>
<td>0.035</td>
<td>0.038</td>
<td>0.042</td>
<td>0.046</td>
<td>0.053</td>
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<tr>
<td>private equity</td>
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<td>0.664</td>
<td>0.621</td>
<td>0.595</td>
<td>0.544</td>
<td>0.525</td>
<td>0.518</td>
<td>0.480</td>
<td>0.474</td>
<td>0.470</td>
<td>0.474</td>
<td>0.492</td>
<td>0.443</td>
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<tr>
<td>private equity (re-scaled)</td>
<td>0.345</td>
<td>0.345</td>
<td>0.323</td>
<td>0.309</td>
<td>0.283</td>
<td>0.273</td>
<td>0.269</td>
<td>0.249</td>
<td>0.246</td>
<td>0.246</td>
<td>0.246</td>
<td>0.256</td>
<td>0.230</td>
</tr>
</tbody>
</table>

Excess return schedule in 1967

<table>
<thead>
<tr>
<th>Mean Excess Return</th>
<th>P0-P40</th>
<th>P40-P50</th>
<th>P50-P60</th>
<th>P60-P70</th>
<th>P70-P80</th>
<th>P80-P90</th>
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<th>P95-P97.5</th>
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<th>P99.9-P99.99</th>
<th>Top 0.01%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.000</td>
<td>0.011</td>
<td>0.017</td>
<td>0.020</td>
<td>0.022</td>
<td>0.026</td>
<td>0.031</td>
<td>0.035</td>
<td>0.041</td>
<td>0.050</td>
<td>0.062</td>
<td>0.079</td>
<td>0.091</td>
<td>0.091</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>0.023</td>
<td>0.056</td>
<td>0.081</td>
<td>0.093</td>
<td>0.095</td>
<td>0.095</td>
<td>0.094</td>
<td>0.093</td>
<td>0.098</td>
<td>0.119</td>
<td>0.167</td>
<td>0.254</td>
<td>0.283</td>
</tr>
<tr>
<td>St. Dev. (priv_equ. re-scaled)</td>
<td>0.023</td>
<td>0.056</td>
<td>0.081</td>
<td>0.093</td>
<td>0.095</td>
<td>0.095</td>
<td>0.093</td>
<td>0.089</td>
<td>0.086</td>
<td>0.085</td>
<td>0.098</td>
<td>0.136</td>
<td>0.149</td>
</tr>
</tbody>
</table>
Housing details

- financial return on housing as sum of capital gains term and rental income
- we set capital gains term to zero in steady states (in long run 0-0.5% real price growth)
- over transition, use growth in aggregate house price index (Case-Shiller)
- rental income set to 5.33% (average for U.S. from Jorda, Knoll, Kuvshinov, Schularick, Tayler "Rate of Return on Everything")
Public and private equity

Public Equity
- U.S. stock market return

Private Equity
- Kartashova (AER, 2014) documents private equity premium over stock market
- Aggregate time series for U.S. starting in 1960
Results: Capital-output ratio and bottom 50 %
Results: Risk-free rate

- return premia are matched in model by construction
- risk-free rate is endogenous: comparable level and decline
Decomposition of transitional dynamics

- **Top 10% Wealth Share**
  - Full model
  - Taxes
  - Earnings risk
  - Top earnings
  - Excess returns

- **Top 1% Wealth Share**

- **Top 0.1% Wealth Share**

- **Top 0.01% Wealth Share**
Perfect foresight vs. myopic transition; CES

- Top 10% wealth share
- Top 1% wealth share
- Top 0.1% wealth share
- Top 0.01% wealth share
Perfect foresight vs. myopic transition; CES

capital - net output ratio

bottom 50% share
Tax changes: changes in savings behavior vs. resources

- Top 10% wealth share
- Top 1% wealth share
- Top 0.1% wealth share
- Top 0.01% wealth share

Graphs show the trend of wealth shares from 1970 to 2010 under different tax scenarios.
Dynamics in multiple-\(\beta\) model I
Dynamics in multiple-\(\beta\) model II

**capital - net output ratio**
- **Model (capital)**
- **Data (national wealth)**
- **Data (private wealth)**

**bottom 50% share**
- **Model**
- **Data (SCF)**