Entrepreneurs, Managers and Inequality

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CEPR ESSIM
Some Facts

In the U.S., income distribution has become more concentrated post 1980s

- In 1962, top income percentile earned 8.3% of aggregate income
- In 2000, top income percentile earned 20% of aggregate income

Closely connected with changes in labor income

- Top wage income percentile earnings increased from 6.2 to 15.5%
- Wage income share of top income percentile grew from 45.6 to 61.7%

Wealth is more concentrated than income

- In 1962, top wealth percentile held 32.2% of aggregate wealth
- In 2000, top wealth percentile held 32.2% of aggregate wealth
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- In 2000, top wealth percentile held 32.2% of aggregate wealth
Modeling Choices

Previous models cannot explain these facts

- Do not account for sources of income separately, nor link that to wealth
- High wealth concentration creating mechanisms lead to strong correlation between income and wealth concentrations

I use occupations to differentiate sources of income

- Entrepreneurs vs Managers
- Differing sources of income, savings motive
- Individual choices determined in general equilibrium

Change in tax code ⇒ Change in high income occupations
⇒ Change in distributions of income and wealth
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Related Facts

Sharp increase in executive compensation

- Associated with huge increase of corporate sector
- Executive compensation accounted for as wage income

Less progressive taxation

- But high income group share of total tax revenue has increased
- Implies income concentration is that much higher!
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Less progressive taxation
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- Implies income concentration is that much higher!

The graph illustrates the trends in top marginal tax rates and the top percentile share of tax revenue from 1970 to 2000. The data shows significant changes in tax policies over the decades, impacting the economic landscape for high-income earners. The top marginal tax rate has generally declined, while the top percentile share of tax revenue has risen, indicating shifts in tax burden distribution.

[Graph depicting changes in top marginal tax rate and top percentile share of tax revenue from 1970 to 2000.]

Key Findings

- Tax progressivity explains one third of increase in earnings and income concentration
- Wealth concentration is flat in progressivity
- More progressive taxation can increase welfare (1-2%)
Mechanism of the Model

- Entrepreneurs collateral constrained
- Creates strong wealth concentration

Entrepreneurs

Managers
Mechanism of the Model

Entrepreneurs collateral constrained
Creates strong wealth concentration

Managers earn superstar wages
Less wealth concentration

Larger income, save less
⇒ Income becomes more concentrated
⇒ But wealth does not
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1 Introduction

2 Model

3 Calibration

4 Results

5 Conclusion
Setup (stationary model without taxes)

- Discrete time, year $t = 0, 1, \ldots$
- Infinitely lived households with standard CRRA period utility
  \[ u(c) = \frac{c^{1-\gamma}}{1-\gamma} \]

- Agents enter period with state variable $(q, m, a)$
- $q \in \{0, q, \bar{q}\}$: Projects with Markov transition probability $\omega_q$
- $m \sim F[0, \bar{m}]$: Managerial ability, survives with probability $v_q$
- $a$: asset holdings, earns economy-wide interest rate $r$

All markets are competitive, subject to 2 financial frictions
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Financial Markets
Timeline

Financial Markets
Timeline

keep/sell project (if $q \neq 0$)

occupation decisions

produce (if $o \in \{2, 3\}$)

consume, save

$t$

$q, m$ realized

pay $p_q$

earn $R$

$q', m'$ realized

buy project

hire managers

rent out capital

pay $r, W(m)$

Financial Markets
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Timeline

- keep/sell project (if \( q \neq 0 \))
- occupation decisions
- produce (if \( o \in \{2, 3\} \))
- consume, save

\[
t \\
| q, m \text{ realized} |
\\
| pay \( p_q \) |
\\
| buy project |
\\
| hire managers |
\\
| earn \( R \) |
\\
| rent out capital |
\\
| pay \( r, W(m) \) |
\\
| \( q', m' \text{ realized} \) |
\\
| \( t + 1 \) |

Financial Markets
Timeline

- $q, m$ realized
- $t$
- $t + 1$

At time $t$:
- $q = 0$: Keep or sell project
- $q > 0$: Occupation decisions
- $q < 0$: Produce

At time $t + 1$:
- $q', m'$ realized
- Consume, save
- Pay $r, W(m)$
Timeline

- keep/sell project (if $q \neq 0$)
- occupation decisions
- produce (if $o \in \{2, 3\}$)
- consume, save

$t$

$\uparrow q, m$ realized

$\uparrow$ buy project

$\uparrow$ pay $p_q$

$\uparrow$ earn $R$

$\uparrow$ $q', m'$ realized

$\downarrow$ hire managers

$\downarrow$ rent out capital

$\downarrow$ pay $r, W(m)$

Financial Markets
Timeline

- **Financial Markets**

  - **keep/sell project (if \( q \neq 0 \))**
  - **occupation decisions**
  - **produce (if \( o \in \{2, 3\} \))**
  - **consume, save**

  - **\( t \)**
  - **\( t + 1 \)**

  - **\( q, m \) realized**
  - **pay \( p_q \)**
  - **earn \( R \)**
  - **\( q', m' \) realized**

  - **buy project**
  - **hire managers**
  - **rent out capital**
  - **pay \( r, W(m) \)**
Projects

- $q \neq 0$: access to economy-wide technology, i.e. “project”:
  \[ f(q\tilde{m}, k, l) = (q\tilde{m})^{1-\alpha-\nu}k^\alpha l^\nu \]

- DRS ($\alpha + \nu < 1$), otherwise there’s only one manager

- $\tilde{m}$: effective ability of the individual operating the project

- $[\pi^*(q\tilde{m}), k^*(q\tilde{m}), l^*(q\tilde{m})]$: unconstrained profits, factor choices
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Entrepreneurs

- If implemented - “entrepreneur” (self-run business owner)
- Face collateral constraint $k \leq \lambda a$
- Profits and factor choices are

$$\{ \pi(qm,a), k(qm,a), l(qm,a) \} = \begin{cases} 
\{ \pi_c, \lambda a, l_c \} & \text{if } \lambda a < k^*(qm) \\
\{ \pi^*, k^*, l^* \} & \text{if } \lambda a \geq k^*(qm) 
\end{cases}$$

- But opportunities also sellable at price $p_q$
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Financial Intermediaries (FI)

- FI’s take deposits from households and rent capital to firms...
- or buy projects at price $p_q$

- Once sold, FI’s hire managers to run the project
- Managers are unconstrained, but assignment is subject to friction $\kappa$
- FI and manager split total return: $\pi^*((1 - \kappa)qm) = d_q + W(m)$

- Zero profit condition implies

$$\frac{d_q}{p_q} = 1 + r \quad \Rightarrow \quad p_q = \frac{d_q}{1 + r}$$
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Managerial Compensation

- Perfect competition in the manager market
  ⇒ implies managers reap all additional returns to ability:

\[
W(m) = w + q(1 - \kappa) \left[ \pi^*(m) - \pi^*(\hat{m}) \right] \quad \text{if } m \leq \hat{m}
\]

\[
W(m) = W_q(\hat{m}) + \bar{q}(1 - \kappa) \left[ \pi^*(m) - \pi^*(\hat{m}) \right] \quad \text{otherwise}
\]

where \( \hat{m} \): manager market clearing cutoff; \( \hat{m} \): top manager cutoff

- FI earns

\[
d_q = (1 - \kappa) \pi^*(\hat{m}) - w
\]

\[
\Rightarrow \quad d_{\bar{q}} = d_q + (1 - \kappa)(\bar{q} - \underline{q})\pi^*(\hat{m})
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Managerial Compensation

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  otherwise

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  \[ \Rightarrow d_{\bar{q}} = d_{\bar{q}} + (1 - \kappa)(\bar{q} - \underline{q}) \pi^*(\hat{m}) \]
Entrepreneurs vs Managers

- **Entrepreneurs**: implement their own projects
- **Managers**: implement FI’s projects

- **Entrepreneurs**: subject to $k \leq \lambda a$ but retain all profits
- **Managers**: unconstrained but loses $\kappa$ of ability, splits profits with FI

- Competing mechanisms - high savings or high earnings?
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Occupation Choices and Incomes

Results in state-dependent income:

\[ \phi(q = 0, m, a) = \begin{cases} 
    w & \text{if } m \leq \hat{m} \\
    W(m) & \text{if } m > \hat{m}
\end{cases} \]

\[ \phi(q \neq 0, m, a) = \begin{cases} 
    w + p_q & \text{if } m \leq \hat{m} \text{ and } w + p_q > \pi(m, a) \\
    W(m) + p_q & \text{if } m > \hat{m} \text{ and } W(m) + p_q > \pi(m, a) \\
    \pi(m, a) & \text{if } \pi(m, a) > \max\{w, W(m)\} + p_q
\end{cases} \]
Agent’s Problem

Taking price vector $P = \{r, w, p_q, W(m)\}$ as given, agent solves

$$V(q, m, a) = \max_{c, a'} \left\{ u(c) + \beta \mathbb{E} \left[ V(q', m', a') | q, m \right] \right\}$$

subject to

$$c + a' = \phi(q, m, a) + (1 + r)a$$

- $(r, w)$: interest rate and wage
- $p_q$: price of projects
- $W(m)$: managerial compensation
- $\phi(q, m, a)$: income resulting from occupation choice
Stationary Equilibrium

Definition

- Price vector $P = \{r, w, p_q, W(m)\}$ and cutoffs $\{\hat{m}, \hat{\hat{m}}\}$
- Policies $\{c(q,m,a), a'(q,m,a), o(q,m,a), k(m,a), l(m,a)\}$
- Distribution $\mu(q,m,a)$ and law of motion $\mathcal{H}$ such that
  1. given $P$, policies solve the agent’s problem
  2. FI makes zero profit ($R = r + \delta$), project returns = capital returns
  3. capital, labor, manager and goods markets clear
  4. $\mu$ is a fixed point of $\mathcal{H}$:

\[
\mu = \mathcal{H}(\mu)
\]

where $\mathcal{H}$ is derived from the policy functions
Equilibrium

\[ \frac{k^*(qm)}{\lambda} \]

\[ q \neq 0 \]

\[ q = 0 \]
Equilibrium

entrepreneur

$\frac{k^*(qm)}{\lambda}$

$q \neq 0$

$q = 0$
Equilibrium

\[
\frac{k^*(qm)}{\lambda} \quad q \neq 0
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Equilibrium

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Taxation

- **Capital income**: \( ra \) taxed at flat rate
- **Wage and business income**: taxed progressively according to parametrized average tax rate (ATR) function
Taxation

- **Capital income**: $ra$ taxed at flat rate
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Comparative Statics

\[ \hat{m} \]

\[ \hat{m} \]

entrepreneur

worker

manager

\[ q \neq 0 \]

\[ q = 0 \]
Comparative Statics

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q ≠ 0

q = 0
Calibration: Exogenous Processes

- “Shifted” Pareto distribution with shape parameter $s$:
  \[
  F(m) = \frac{1 - (1 + m)^{-s}}{1 - (1 + \bar{m})^{-s}}
  \]

- Finite state Markov chain for idiosyncratic labor productivity shocks:
  \[
  \log \epsilon_{t+1} = (1 - \rho)\mu_\epsilon + \rho \log \epsilon_t + \epsilon_{t+1},
  \]
  where
  \[
  \epsilon_{t+1} \sim \mathcal{N}(0, \sigma_\epsilon^2)
  \]
  \[
  \mu_\epsilon = -\frac{\sigma_\epsilon^2}{2(1 - \rho^2)}
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Calibration: Taxation

- **Capital income tax**
  - flat rate METRs from Gravelle (2007)
  - average over 1970 to 2000: 35%

- **Wage income tax**: simple polynomial function calibrated to match average tax rate / top income percentile tax share

\[ ATR(y) = b_0 + b_1 y^{b_2} \]

where:

\begin{align*}
  y & : \text{pretax wage income} \\
  y_{min} & : \text{smallest possible wage income (} w_{e_{min}} \text{)} \\
  b_0 & : \text{lowest bracket tax rate (1970: 14%, 2000: 15%)} \\
  b_1, b_2 & : \text{calibrated}
\end{align*}
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- \( b_0 \): lowest bracket tax rate (1970: 14%, 2000: 15%)
- \( b_1, b_2 \): calibrated
Calibration

Unfortunately, current version is \( q = \bar{q} \) Steady State Comparisons

- Calibrate model to 2000 U.S.
- Change **tax parameters only** to 1970 U.S.
- Flat wage income tax
- Welfare computations

Counterfactuals if time...

- No managers: \( \kappa = 1 \)
- No entrepreneurs: \( \lambda = 0 \)

Transitions running...
Calibration

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Transitions running...
Parameters and Moments

Fixed Parameters (7)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Target Data Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\gamma$</td>
<td>2.06</td>
<td></td>
</tr>
<tr>
<td>$\delta$</td>
<td>.3</td>
<td></td>
</tr>
<tr>
<td>$\alpha$</td>
<td>.95</td>
<td></td>
</tr>
<tr>
<td>$\rho$</td>
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<td></td>
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<tr>
<td>$s$</td>
<td>.88</td>
<td></td>
</tr>
<tr>
<td>$v$</td>
<td>.177</td>
<td></td>
</tr>
<tr>
<td>$\frac{1-\omega_0}{2-\omega_0-\omega_1}$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calibrated Parameters (7)

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<tr>
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<th>Value</th>
<th>Target Data Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\lambda$</td>
<td>4.89</td>
<td>mass of entrepreneurs (%) 7.6 5.5</td>
</tr>
<tr>
<td>$\kappa$</td>
<td>.81</td>
<td>business income share of top income percentile (%) 24.7 42.1</td>
</tr>
<tr>
<td>$\bar{m}$</td>
<td>466.73</td>
<td>wage income share of top income percentile (%) 61.7 45.7</td>
</tr>
<tr>
<td>$\omega_1$</td>
<td>.92</td>
<td>top wealth percentile share of aggregate wealth (%) 32.2 29.1</td>
</tr>
<tr>
<td>$\nu$</td>
<td>.43</td>
<td>top earnings percentile share of aggregate earnings (%) 15.5 13.6</td>
</tr>
<tr>
<td>$\sigma_\varepsilon$</td>
<td>.28</td>
<td>Gini coefficient of wage income .61 .52</td>
</tr>
<tr>
<td>$\beta$</td>
<td>.99</td>
<td>annual interest rate (%) 4.0 4.0</td>
</tr>
</tbody>
</table>
## Income and Wealth Concentration

<table>
<thead>
<tr>
<th>Regime</th>
<th>Gini</th>
<th>top percentile share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Wealth</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data (1970)</td>
<td>0.77</td>
<td>32.2</td>
</tr>
<tr>
<td>Model (1970)</td>
<td>0.77</td>
<td>31.1</td>
</tr>
<tr>
<td>Data (2000)</td>
<td>0.81</td>
<td>32.2</td>
</tr>
<tr>
<td>Model (2000)</td>
<td>0.78</td>
<td>29.1</td>
</tr>
<tr>
<td>Flat labor tax</td>
<td>0.79</td>
<td>29.6</td>
</tr>
<tr>
<td>$\kappa/2$</td>
<td>0.65</td>
<td>12.2</td>
</tr>
<tr>
<td><strong>Wage Income</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data (1970)</td>
<td>0.52</td>
<td>6.2</td>
</tr>
<tr>
<td>Model (1970)</td>
<td>0.50</td>
<td>10.3</td>
</tr>
<tr>
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<td>15.5</td>
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<tr>
<td>$\kappa/2$</td>
<td>0.54</td>
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<tr>
<td><strong>Total Income</strong></td>
<td></td>
<td></td>
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<tr>
<td>Data (1970)</td>
<td>0.58</td>
<td>8.3</td>
</tr>
<tr>
<td>Model (1970)</td>
<td>0.57</td>
<td>17.7</td>
</tr>
<tr>
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</tr>
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<td>Model (2000)</td>
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<td>18.3</td>
</tr>
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## Income and Wealth Concentration

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#### Top income percentile composition of income

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Max managerial compensation over average wage:

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<tr>
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<tbody>
<tr>
<td>1970</td>
<td>29.7</td>
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</tr>
<tr>
<td>2000</td>
<td>342.2</td>
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<tr>
<td>Flat labor tax</td>
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<tr>
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</table>
**No Entrepreneurs \((\lambda = 0)\)**

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## No Managers ($\kappa = 1$)

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### Steady State Welfare Analysis

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<th>(consumption equivalent value)</th>
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<tr>
<td>W</td>
<td>(aggregate capital supply)</td>
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<td>AKS</td>
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- Decrease in equilibrium capital stock (-)
- Increased efficiency in production (+)...$\kappa$ has larger effect
- Decreased variation in equilibrium consumption plan (+)

- Transitions running...but loss must be lower given that capital will be eaten along the transition path
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Conclusion

- Explained changes in wealth, total income and wage income concentration
- Differing sources of income and savings motive by occupation
- Differentiates entrepreneurs vis-à-vis managers
- Less progressive taxation causes shifts in occupations, leading to empirically observed changes
- Contrary to (some) popular beliefs, progressive taxation may not result in much welfare loss
- Can be extended to international and development context
Thank You!!
Computing the Stationary RCE

1. Discretize state space for \((m, a)\)
2. Solve for stationary equilibrium with manager markets
   - Guess \((r, w)\).
   - Guess \(\hat{m}\), solve for policy functions, generate stationary distribution
   - Check manager market clearing
   - Check capital and labor market clearing
   - Iterate to convergence
Transition between RCEs

Extend Ríos-Rull (1997):

1. Compute the initial and terminal stationary distributions \((F_0 \text{ and } F_\infty)\)
2. Pick \(T\) large, assuming that \(F_T \simeq F_\infty\). Then \(V_T \simeq V_\infty\).
3. Guess a path for prices \(\{r, w, \hat{m}\}_{T=1}^T\). Solve out for \(\{V_t\}_{t=1}^{T-1}\) using backward induction.
4. Starting from \(F_0\), simulate the economy for \(T\) periods. Check market clearing for each period, and update sequence of guesses. Use bisection for each period to update the guesses.
5. Repeat from 3 until markets clear in all periods.
6. Check whether \(F_T \simeq F_\infty\). If not, repeat from 2 with larger \(T\).
Business/Capital income METRs