Wealth Inequality and Intergenerational Links

Mariacristina De Nardi
## U.S. wealth and earnings distributions

<table>
<thead>
<tr>
<th>Percentage held by the top</th>
<th>1%</th>
<th>5%</th>
<th>20%</th>
<th>40%</th>
<th>80%</th>
<th>Percent with zero or negative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wealth</td>
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<td></td>
<td>28</td>
<td>49</td>
<td>75</td>
<td>89</td>
<td>99</td>
<td>6-15</td>
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<tr>
<td>Gross earnings</td>
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<td></td>
<td>6</td>
<td>19</td>
<td>48</td>
<td>72</td>
<td>98</td>
<td>7.7</td>
</tr>
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</table>
**Swedish wealth and earnings distributions**

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<td>37</td>
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<tr>
<td>Gross earnings</td>
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<tr>
<td>4</td>
<td>15</td>
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Some facts

• Earnings and wealth are unequally distributed and concentrated.
  Wealth is much more concentrated than earnings.

• Some of this inequality is due to life-cycle.

• In the aggregate, a large fraction of wealth is transmitted across generations rather than accumulated out of life-cycle savings.

• Rich people (with high lifetime income) keep lots of assets as they age.
Goals

• Are intergenerational links quantitatively important to explain household saving behavior and wealth concentration? If yes, which ones? Do voluntary or involuntary bequests matter?

• Is the same saving model valid for other countries? We will consider Sweden: country in which there is less inequality and the government redistributes more than in the U.S.?
Related Literature

Dynasty models

• Krusell and Smith (1997).
• Castañeda, Díaz–Giménez and Ríos–Rull (1998)
• Quadrini (1997).

OLG models

• Huggett (1996).
• Gokhale et al. (1998)
• Heer (1999)
Elements of the model

• OLG;
• lifetime and income uncertainty;
• parents are altruistic;
• children partially inherit parents’ productivity.

Why?

• Age structure generates inequality;
• Motives to save: precautionary, life cycle, bequests. poor people: life–cycle component of savings; rich: inheritance.
• Also differences due to different family backgrounds.
Summary of the main results

- Accidental bequests do not help explain the concentration in the upper tail of the wealth distribution. Voluntary bequests do.

- Transmission of productivity across generations increases concentration in the upper tail but voluntary bequests are quantitatively more important.

- Bequest motive \(\rightarrow\) life-cycle accumulation profile more consistent with the U.S. data.

- U.S.-Sweden cross-country comparison \(\rightarrow\) intergen. links important also in economies where redistribution programs are more prominent and there is less inequality. Disincentives to save.
Outline of the Talk

- The model
- The algorithm
- Calibration
- Results
The Model

Simplified model of the household: 1 parent and children.

- continuum of agents born each period (5 years)
- live up to 90 years of age. Cond. prob. of dying depends on age
- 20 year old people start consuming, working and paying taxes
- 25 year old people procreate
- exogenous number of children, total population grows at a constant rate over time.
- inherit once in a lifetime, at a random date
- exogenous income process
- after retirement the agent does not work and receives social security benefits
Preferences and Technology

\[ u(c_t) = \frac{c_t^{1-\sigma}}{1-\sigma} \]

"Warm glow altruism": \( \phi(b) \)

Children observe their parent’s productivity when the parent is 40.

Infer expected bequest distrib.

Workers experience productivity shocks \( y_t(s) \)

- After age 20 productivity evolves stochastically according to \( Q_y \)
- Initial productivity level at 20 is inherited from the parent’s productivity (at 40) according to \( Q_{yh} \)
- Exogenous age-efficiency profile, \( \epsilon_t \), during working years

The household can only invest in physical capital

The household faces a borrowing constraint
Government

The government taxes:
– labor, capital income and estates
to finance:
– exogenous public expenditure;
– pensions to the retired agents.

Social security system:
Retirees each period receive a lump sum transfer from the government.
Prices


Sweden: an “open economy”, the net interest rate is given by the U.S. one.
The Agent’s Recursive Problem

State variables:

- age $t$;
- assets from last period $a_t$;
- current productivity $y_t$;
- $y_p t$: parent’s prod. at 40 until child inherits and zero thereafter.

$y_p t > 0 \Rightarrow$ make inference on bequests;

$y_p t = 0 \Rightarrow$ distinguish orphans.
Four subperiods in the agent’s life:

(i) from 20 to 30 years of age;

(ii) from 35 to 55 years old;

(iii) 60 years old;

(iv) from 65 to 85;
(i) 20 to 30 years old: person works, survives for certain until next period and does not expect to inherit soon ($\Rightarrow y_{p'} = y_p$).

$$V(t, a, y, y_p) = \max_{c,a'} \{ u(c) + \beta E_t V(t+1, a', y', y_p) \}$$  \hspace{1cm} (1)

subject to:

$$c \leq \left[ 1 + r (1 - \tau_a) \right] a + (1 - \tau_l) \varepsilon_t y$$  \hspace{1cm} (2)

$$a' = \left[ 1 + r (1 - \tau_a) \right] a - c + (1 - \tau_l) \varepsilon_t y$$  \hspace{1cm} (3)
(ii) from 35 to 55: worker survives into next period, parent may die and leave a bequest.

\[ V(t, a, y, yp) = \max_{c, a'} \left\{ u(c) + \beta E_t V(t + 1, a', y', yp') \right\} \]  \hspace{1cm} (4)

subject to (2) and:

\[ a' = \left[ 1 + r \left( 1 - \tau_a \right) \right] a - c + (1 - \tau_l) \epsilon_t y + b' I_{yp > 0} I_{yp' = 0} \]  \hspace{1cm} (5)

\( I_{yp > 0} \) indicator fn: 1 if \( yp > 0 \).

\[ yp' = \begin{cases} 
yp & \text{with probability } \alpha_{t+5} \\
0 & \text{with probability } (1 - \alpha_{t+5})
\end{cases} \]  \hspace{1cm} (6)

\( \mu_b(t, yp) \): cond. distr. of \( b' \), bequest net of taxes a person expects if parent dies.
(iii) age 60: next period the agent retires. He faces a positive prob. of dying. Define

\[ b(a') \equiv a' - \tau_b \cdot \max(0, a' - e_{x_b}). \]

\[
V(t, a, y, y_p) = \max_{c, a'} \left\{ u(c) + \alpha_t \beta E_t V(t + 1, a') \right. \\
+ (1 - \alpha_t) \phi(b(a')) \right\} 
\]

(7)

\[
\phi(b) = \phi_1 \left( 1 + \frac{b}{\phi_2} \right)^{1-\sigma}
\]

(8)

subject to (2, 5 and 6).
(iv) age 65 to 85: the agent is retired and does not expect to inherit.

\[
V(t, a) = \max_{c, a'} \left\{ u(c) + \alpha_t \beta V(t + 1, a') + (1 - \alpha_t) \phi(b(a')) \right\}
\tag{9}
\]

subject to (5) and:

\[
c \leq \left[ 1 + r (1 - \tau_a) \right] a + p \tag{10}
\]

\[
a' = \left[ 1 + r (1 - \tau_a) \right] a - c + p \tag{11}
\]

\(p\) is the pension payment from the government.

The terminal period value function \(V(T + 1, a)\) is set to be equal to \(\phi(b(a))\).
Transition Function

Use agents’ policy fns and exogenous Markov processes to get a transition function that maps the time $s$ distribution of the state variables in the population, $m(\cdot; s)$, into the distribution for next period $m(\cdot; s + 1)$.

Focus on stationary equilibria (constant transition function $M^*$ and its invariant distribution $m^*$).
A stationary equilibrium is:

\[
\begin{align*}
\text{interest rate } r, \\
\text{allocations } c(x), a(x), \\
\text{government policy, } (\tau_a, \tau_t, \tau_b, ex_b, p), \\
\text{family of prob. distr. for bequests } \mu_b(x; \cdot), \\
\text{const. distr. of people over } x: m^*(x)
\end{align*}
\]

such that, given \( r \) and the government policy:

(i) \( c(x) \) and \( a(x) \) solve the individual's maximization problem, given \( x, r, \text{gvt policy} \) and the expected bequest distr.

(ii) the gvt b.c. balances at each period

\[
g = \int \left[ \tau_a r a + \tau_t e x I_{t < t_r} - p I_{t \geq t_r} + \tau_b (1 - \alpha_{t-1}) \cdot \max(0, a' - ex_b) \right] dm^*(x)
\]  

(iii) \( m^* \) is an invariant distribution for this economy

(iv) U.S.: \( \frac{(r+\delta)K}{(r+\delta)K+wL} = \alpha \).

Normalization: \( w = 1 \), \( L \) is fraction of working age people.

Sweden: small open economy, so \( r \) is taken as exogenous.

(v) family of expected beq. distr. \( \mu_b(\cdot; t, y_p) \) is consistent with the bequests left by parents.
The Algorithm

(i) Solve backward the agents’ value functions, starting from $T$: next period the agent is dead for sure hence derives utility only from bequests

(ii) compute the invariant distribution

(iii) iterate on the government budget

(iv) iterate on bequests
Experiments

Add sequentially key elements to model economies:

- Age structure and income uncertainty
  OLG, no intergenerational links.
  Accidental bequests:
  (i) redistributed equally to people alive
  (ii) given to the deceased’s children

- Add bequest motive:
  OLG + bequest motive

- Add productivity link:
  OLG + bequest motive + productivity inheritance
## Numerical Simulations for the U.S. Economy

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Source(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha_t$</td>
<td>*</td>
<td>Bell Wade Goss (1992)</td>
</tr>
<tr>
<td>$\epsilon_t$</td>
<td>*</td>
<td>Hansen (1993)</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>1.5</td>
<td>Attanasio et al (1995)</td>
</tr>
<tr>
<td>$\tau_a$</td>
<td>20%</td>
<td>Kotlikoff et Al. (1997)</td>
</tr>
<tr>
<td>$r$</td>
<td>6%</td>
<td>see text</td>
</tr>
<tr>
<td>$Q_y$</td>
<td>+</td>
<td>Huggett (1996), Lillard et al. (1978)</td>
</tr>
<tr>
<td>$Q_{yh}$</td>
<td>+</td>
<td>Zimmerman (1992)</td>
</tr>
</tbody>
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<tr>
<td>$\tau_b$</td>
<td>10%</td>
<td>see text</td>
</tr>
<tr>
<td>$ex_b$</td>
<td>40 * median earn.</td>
<td>see text</td>
</tr>
<tr>
<td>$\beta$</td>
<td>.95–.97</td>
<td>capital-output ratio</td>
</tr>
<tr>
<td>$\phi_1$</td>
<td>-9.5</td>
<td>interg. transfers share</td>
</tr>
<tr>
<td>$\phi_2$</td>
<td>11.6</td>
<td>match 1 moment of bequest distr.</td>
</tr>
<tr>
<td>Transfer wealth ratio</td>
<td>Wealth Gini</td>
<td>Percentage wealth in the top 1%</td>
</tr>
<tr>
<td>-----------------------</td>
<td>------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>U.S. data</td>
<td>.63</td>
<td>.78</td>
</tr>
<tr>
<td>No intergenerational links, equal bequests to all</td>
<td>.67</td>
<td>.67</td>
</tr>
<tr>
<td>No intergenerational links, unequal bequests to children</td>
<td>.38</td>
<td>.68</td>
</tr>
<tr>
<td>One link: productivity inheritance</td>
<td>.38</td>
<td>.69</td>
</tr>
<tr>
<td>One link: parent’s bequest motive</td>
<td>.55</td>
<td>.74</td>
</tr>
<tr>
<td>Both links: parent’s bequest motive and productivity inheritance</td>
<td>.60</td>
<td>.76</td>
</tr>
</tbody>
</table>
The model economy for Sweden

Sweden has:

• less income inequality
  \[ \Rightarrow \text{less idiosyncratic earnings uncertainty} \]

• more generous social security system

• higher average tax rates on earnings, capital income and estates.
**Numerical Simulations for the Swedish Economy**

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<tr>
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<td>Stat. Yearbook Sweden (1997)</td>
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<tr>
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<td>as U.S.</td>
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</tr>
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<td>1.5</td>
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<tr>
<td>$\phi_1$</td>
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<td>as U.S.</td>
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<tr>
<td>$n$</td>
<td>0.8%</td>
<td>OECD Ec. Surveys, Sweden (1998)</td>
</tr>
<tr>
<td>$g$</td>
<td>25% GDP</td>
<td>OECD Ec. Surveys, Sweden (1998)</td>
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<tr>
<td>$\tau_a$</td>
<td>30%</td>
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<tr>
<td>$r$</td>
<td>6.86%</td>
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<td>$Q_y$</td>
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<td>$+$</td>
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</table>

Parameter | Value | Chosen to Match |
---|---|---|
<p>| $\tau_b$ | 15% | see text |
| $ex_b$ | 10 * avg earn. | see text |
| $\phi_2$ | 3.3 | “altruism”, see text |</p>
<table>
<thead>
<tr>
<th>Capital output ratio</th>
<th>Transfer wealth ratio</th>
<th>Wealth Gini</th>
<th>Percentage wealth in the top 1%</th>
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<th>Percentage wealth in the top 40%</th>
<th>Percentage wealth in the top 80%</th>
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Conclusions

• Accidental bequests do not help explain wealth concentration. Voluntary bequests do.

• Transmission of productivity across generations increases some more the concentration.

• Bequest motive → life-cycle accumulation profile more consistent with the U.S. data.

• U.S.-Sweden comparison → intergen. links important also in economies where redistribution programs are more prominent and there is less inequality. Disincentives to save.

Future research

• Effects of changing estate taxation

• Study demand for annuities