Wealth Inequality and Intergenerational Links

By Mariacristina De Nardi
Review of Economic Studies, 2004
# 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>
<td>28</td>
<td>49</td>
<td>75</td>
<td>89</td>
<td>99</td>
<td>6-15</td>
</tr>
<tr>
<td>Gross Earnings</td>
<td>6</td>
<td>19</td>
<td>48</td>
<td>72</td>
<td>98</td>
<td>7.7</td>
</tr>
</tbody>
</table>
Swedish wealth and earnings distributions

<table>
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<tr>
<td>Wealth</td>
<td>17</td>
<td>37</td>
<td>75</td>
<td>99</td>
<td>100</td>
<td>30</td>
</tr>
<tr>
<td>Gross Earnings</td>
<td>4</td>
<td>15</td>
<td>42</td>
<td>68</td>
<td>98</td>
<td>7.6</td>
</tr>
</tbody>
</table>
Some more 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.
Questions

• 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?
• 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).
- Quadrini (1997).

OLG models
- 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;
- Also differences due to different family backgrounds.
Key elements of 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. Prob. of dying depends on age
- 20 year old people consume, work and pay 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

- Period utility from consumption:

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

- Bequest motive: "Warm glow altruism"

\[ \phi(b) \]
Technology

- Observe parental productivity when one’s parent is 40 and use it to infer expected bequest distribution.
- Workers experience productivity shocks $y_t(s)$.
  - After age 20 it evolves stochastically according to $Q_y$.
  - Initial level at 20 is inherited from parent’s productivity (at 40) according to $Q_{yh}$.
  - Exogenous age-efficiency profile, $\epsilon_t$, during working years.
- One asset: capital.
- The household faces a borrowing constraint.
The government taxes:

- Labor, capital income and estates

To finance:

- Exogenous public expenditure;
- Social security transfers to the retired agents. 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 $y_t$;
- $yp_t$: parent’s prod. at 40 until child inherits and zero thereafter.
  - $yp_t > 0 \Rightarrow$ make inference on bequests;
  - $yp_t = 0 \Rightarrow$ distinguish orphans.
Life cycle structure

Four subperiods in the agent’s life:

• from 20 to 30 years of age;
• from 35 to 55 years old;
• 60 years old;
• 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 \((\Rightarrow y_p' = y_p)\).

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

subject to:

\[
c \leq \left[ 1 + r (1 - \tau_a) \right] a + (1 - \tau_l) \epsilon_t y
\]

\[
a' = \left[ 1 + r (1 - \tau_a) \right] a - c + (1 - \tau_l) \epsilon_t y
\]
(ii) 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:

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

\[ l_{yp > 0} \text{ indicator fn: 1 if } yp > 0. \]

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

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

\[ b(a') \equiv a' - \tau_b \cdot \max(0, a' - ex_b). \]

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

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

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

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

subject to (5) and:

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

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

\(p\): pension payment from the government. \(V(T + 1, a) = \phi(b(a))\).
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 (part I) is:

- an interest rate $r$,
- allocations $c(x), a(x)$,
- government policy, $(\tau_a, \tau_I, \tau_b, e_x b, p)$,
- family of prob. distr. for bequests $\mu_b(x; \cdot)$,
- const. distr. of people over $x$: $m^*(x)$,

such that, given $r$, and government policy:
A stationary equilibrium (part II) is:

- \( c(x) \) and \( a(x) \) solve individual max. problem given bequest distr.
- the gvt b.c. balances at each period

\[
\begin{align*}
g &= \int \left[ \tau_a r a + \tau_l \epsilon_t y \mathbb{I}_{t\leq t_r} - p \mathbb{I}_{t\geq t_r} \\
&\quad + \tau_b (1 - \alpha_{t-1}) \cdot \max(0, a' - e_b) \right] \, dm^*(x)
\end{align*}
\] (12)

- \( m^* \) is an invariant distribution for this economy
- U.S.: \( \frac{(r+\delta)K}{(r+\delta)K+wL} = \alpha. \)
  Normalizations: \( w = 1, \) \( L \) is fraction of working age people.
  Sweden: small open economy, so \( r \) is taken as exogenous.
- family of expected beq. distr. \( \mu_b(\cdot; t, y_p) \) is consistent with the bequests left by parents
The Algorithm

- Solve backward the agents’ value functions, starting from $T$: next period the agent is dead for sure hence derives utility only from bequests
- compute the invariant distribution
- iterate on the government budget
- iterate on bequests
### The model economy for the U.S.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>US Economy, 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>
<tr>
<td>Parameter</td>
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</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>$\tau_b$</td>
<td>10%</td>
<td>see text</td>
</tr>
<tr>
<td>$e x_b$</td>
<td>$40 \times$ 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>
</tbody>
</table>
The model economy for Sweden

Sweden has:

- less income inequality
  \[\Rightarrow\] less idiosyncratic earnings uncertainty
- more generous social security system
- higher average tax rates on earnings, capital income and estates.
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<tr>
<td>$\alpha_t$</td>
<td>*</td>
<td>Stat. Yearbook Sweden (1997)</td>
</tr>
<tr>
<td>$\epsilon_t$</td>
<td>*</td>
<td>as U.S.</td>
</tr>
<tr>
<td>$\beta$</td>
<td>.95–.97</td>
<td>as U.S.</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>1.5</td>
<td>as U.S.</td>
</tr>
<tr>
<td>$\phi_1$</td>
<td>-9.5</td>
<td>as U.S.</td>
</tr>
<tr>
<td>$n$</td>
<td>.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>
</tr>
<tr>
<td>$\tau_a$</td>
<td>30%</td>
<td>OECD Ec. Surveys, Sweden (1998)</td>
</tr>
<tr>
<td>$r$</td>
<td>6.86%</td>
<td>see text</td>
</tr>
<tr>
<td>$Q_y$</td>
<td>+</td>
<td>see text</td>
</tr>
<tr>
<td>$Q_{yh}$</td>
<td>+</td>
<td>Zimmerman (1992)</td>
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<tr>
<td>-----------</td>
<td>---------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>$\tau_b$</td>
<td>15%</td>
<td>see text</td>
</tr>
<tr>
<td>$e x_b$</td>
<td>10 * avg earn.</td>
<td>see text</td>
</tr>
<tr>
<td>$\phi_2$</td>
<td>3.3</td>
<td>“altruism”, see text</td>
</tr>
</tbody>
</table>
Experiments

Add sequentially key elements to model economies:

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

• Add bequest motive:
  OLG + bequest motive

• Add productivity link:
  OLG + bequest motive + productivity inheritance
<table>
<thead>
<tr>
<th>Beq/Wealth Ratio</th>
<th>Wealth Gini</th>
<th>Percentage wealth in the top 1%</th>
<th>Percentage wealth in the top 5%</th>
<th>Percentage wealth in the top 20%</th>
<th>Percentage wealth in the top 40%</th>
<th>Percentage wealth in the top 60%</th>
<th>% ≤ 0 Wealth</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. data</td>
<td>.60</td>
<td>.78</td>
<td>29</td>
<td>53</td>
<td>80</td>
<td>93</td>
<td>98</td>
</tr>
<tr>
<td>No intergenerational links, equal bequests to all</td>
<td>.67</td>
<td>.67</td>
<td>7</td>
<td>27</td>
<td>69</td>
<td>90</td>
<td>98</td>
</tr>
<tr>
<td>No intergenerational links, unequal bequests to children</td>
<td>.38</td>
<td>.68</td>
<td>7</td>
<td>27</td>
<td>69</td>
<td>91</td>
<td>99</td>
</tr>
<tr>
<td>One link: productivity inheritance</td>
<td>.38</td>
<td>.69</td>
<td>8</td>
<td>29</td>
<td>70</td>
<td>92</td>
<td>99</td>
</tr>
<tr>
<td>One link: parent’s bequest motive</td>
<td>.55</td>
<td>.74</td>
<td>14</td>
<td>37</td>
<td>76</td>
<td>95</td>
<td>100</td>
</tr>
<tr>
<td>Both links: parent’s bequest motive and productivity inheritance</td>
<td>.60</td>
<td>.76</td>
<td>18</td>
<td>42</td>
<td>79</td>
<td>95</td>
<td>100</td>
</tr>
</tbody>
</table>
U.S. wealth .1, .3, .5, .7, .9, .95 quantiles, by age

No links, equal bequests to all.
U.S. wealth .1, .3, .5, .7, .9, .95 quantiles, by age.

Bequest motive only.
Cumulative distribution of estates

Solid=model, dash-dot=AHEAD data.
Expected bequest distribution at 40, model

Figure: U.S.  Figure: Sweden
Saving rate conditional on inheritance expectation

U.S. calibration. Bequest motive only.
Wealth quantiles: .1, .25, .5, .75, .85, .95, US calib.

**Figure:** Conditional on not having inherited.

**Figure:** Conditional on having inherited.
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt; .51</td>
<td>.73</td>
<td>17</td>
<td>37</td>
</tr>
<tr>
<td>No intergenerational links, equal bequests to all</td>
<td>.73</td>
<td>.64</td>
<td>5</td>
</tr>
<tr>
<td>No intergenerational links, unequal bequests to children</td>
<td>.38</td>
<td>.67</td>
<td>6</td>
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<td>8</td>
</tr>
<tr>
<td>Both links: bequest motive and productivity inheritance</td>
<td>.77</td>
<td>.73</td>
<td>9</td>
</tr>
</tbody>
</table>
Conclusions

- Accidental bequests do not help explain wealth concentration. Voluntary bequests do.
- Transmission of productivity across generations increases some more the concentration.
- Bequest motive $\rightarrow$ life-cycle accumulation profile more consistent with the U.S. data.
- U.S.-Sweden comparison $\rightarrow$ intergenerational links important also in economies where redistribution programs are more prominent and there is less inequality. Disincentives to save.