How Do Income and Bequest Taxes Affect Income Inequality? The Role of Parental Transfers

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Motivation

- Taxes affects parental transfers. Parental transfers include education, gifts and bequests.
- In the literature the analysis focus on the single types of transfers.
- We consider tax effects on parents’ joint decisions on the allocation of transfer.
  - Becker and Tomes (1986)
  - Brown et al. (2006); Laitner and Ohlsson (2001); Nordblom and Ohlsson (2010)
Questions

- How taxes (income and bequest) affect allocation and amount of transfers?
- How taxes affect income inequality?

Estimate the effects of income and bequest taxation on income inequality

- Income taxation is **positively** related to $Gini$; bequest is negatively related to $Gini$ while **insignificant**.

Develop a theoretical model to explain findings

- Calibrate the model based on U.S. data.
- By conducting numerical experiments, we find model predictions are consistent with the empirical findings.
• Taxes affect parents’ decisions on the educational expenditure and assets transfer.
• Education distribution is related to income inequality. (O’Neill (1995); Gregorio and Lee (2003))
Empirical Background

- Estimate the effects of each type of taxation on income distribution.
- Data: 20 OECD countries for the period 1980 to 2008.
- Follow the empirical strategy in Kneller and Bleaney (1999),

$$G_{it} = \alpha + \sum_{j=1}^{k} \beta_j Y_{jit} + \gamma_R R_{it} + \sum_{p=1}^{m} \gamma_p X_{pit} + u_{it}.$$  

- $G_{it}$ is the Gini coefficient.
- $X_{pit}$: revenue from each taxation (% of GDP).
- $R_{it}$: total tax revenue (% of GDP)
- $Y_j$ is the conditioning (non-fiscal) variables, found in Barro-type regression (Barro (2000)).
  ex: $g_{GDP}$, $g_{population}$, investment ratio, fertility rate ln $y$, $(\ln y)^2$, Human Capital
Empirical Findings

- Income taxation is positively related to *Gini*; bequest is negatively related to *Gini* while insignificant.
  - Model 1: Taxations.
  - Model 2: Taxations + {\(g_{GDP}\), \(g_{population}\), investment ratio, fertility rate}
  - Model 3: Variables in model 2 + {\(\ln y\), \((\ln y)^2\), Human Capital}, \(y\): GDP

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income taxation</td>
<td>0.994</td>
<td>0.873</td>
<td>0.923</td>
</tr>
<tr>
<td></td>
<td>(2.83)***</td>
<td>(2.40)**</td>
<td>(2.40)**</td>
</tr>
<tr>
<td>Bequest taxation</td>
<td>-0.047</td>
<td>-0.716</td>
<td>-1.714</td>
</tr>
<tr>
<td></td>
<td>(-0.01)</td>
<td>(-0.16)</td>
<td>(-0.36)</td>
</tr>
</tbody>
</table>
A three-period life cycle-overlapping generation model with heterogeneous agents. Each generation is altruistically linked towards their descendants.

Agents’ decision-making during life cycle:

- Worker: consumption $c_2$, education expenditure $e'$, saving $s$
- Retirees: consumption $c_3$, bequests (and gifts) $b'$
Model Assumptions

- Agents’s wealth $I$ comes from labor income $w^h$ and parents’ bequests transfer $b$.
- Individual faces idiosyncratic labor supply shocks $l$.
- Agents receive labor income $w^h$ by renting effective human capital $hl$ in the market.
  - Returns on human capital is risky:
- Agents human capital is linearly depends on parents’ educational expenses. $h = a^h e + h_0$.
- There exists an upper bound of human capital investments: tertiary education.
- Agents preference: CRRA utility function.
The Model - Workers’ Problem

Agents’ maximization problem in the working period:

$$V_2(I) = \max_{\{c_2, e', s\}} \left\{ u(c_2) + \beta E \left\{ u(c_3) + \beta_c B(I') \right\} \right\}, \quad (1)$$

s.t. $I \geq c_2 + s + e'$ \quad (2)

$s \geq 0$ \quad (3)

$e' \leq \bar{e}$ \quad (4)

- Agents wealth: $I = w^h + (1 - \tau_b)b + T$.
- Agents income $w^h \equiv (1 - \tau_w)whl$, $l$ is characterized as i.i.d. with bounded support $[\underline{l}, \bar{l}]$.
- Agents human capital $h = a^h e + h_0$. 
Agents’ maximization problem in the retired period:

\[
V_3(s, w^{h'}) = \max_{\{c_3, b\}} \left\{ u(c_3) + \beta_c B(I') \right\}, \tag{5}
\]

\[
s.t. (1 + r)s + T \geq c_3 + b', \tag{6}
\]

\[
I' = w^{h'} + (1 - \tau_b)b' + T \tag{7}
\]

\[
b \geq 0. \tag{8}
\]

- \( r \): world interest rates. (small open economy)
- \( b' \): bequests
A representative firm maximizes profit:

\[ K^\alpha H^{1-\alpha} - wH - rK. \]

Government budget constraint is balanced:

\[ \tau_w wH + \tau_b B = G + T. \]
Equilibrium

- Aggregates:

\[
\int_0^1 l^j \, dj = 1,
\]

\[
H = \int_0^1 h^j l^j \, dj,
\]

\[
B = \int_0^1 b^j \, dj,
\]

\[
K = \int_0^1 s^j \, dj + K^w.
\]

- A stationary competitive equilibrium exists.
  - invariant distributions of wealth, income and human capital.
Parents’ decisions on the allocations of transfers resemble portfolio choice problem between the risky and risk-free assets.

Education spending (as a proportion of wealth $\phi_h$) is independent of wealth, but depends on agents’ **degree of risk aversion**, **asset riskiness** and the **risk premium**.

Taxes effects:

- Income tax rate ($\tau_w$) ↑, transfer allocation on education ↓, bequest ↑.
- Bequest tax rate ($\tau_b$) ↑, transfer allocation on education ↑, bequest ↓.

Distribution of income is mainly affected by the distribution of human capital.
Distributions and parents’ decisions

- Distribution of income, wealth, and human capital.
- Income (human capital) inequality is affected by
  - Proportion of people obtaining college education, related to the wealth threshold $I_h$.
  - Human capital distribution, determined by wealth distribution.
**Allocation of Transfers and Income Gini**

- If parents decrease the allocation of transfers on human capital investment (when $\tau_b \downarrow$ or $\tau_w \uparrow$)
  - The fraction of workers obtain college degree decrease.
  - Income Gini increases.
If parents decrease the amount of assets transfers. (when tax rates increase)

- The wealth distribution shift leftward.
- Income Gini increase.
Tax effects on the quantity of transfers depend on parents’ wealth level.

- The change of wealth distribution is not simply rightward/leftward shifting.

Another effects: change the spread of wealth distribution.

- If agents’ wealth incorporate higher proportion of risky assets ⇒ wealth dispersion increases.
- Income Gini increases.
Tax effects on the spread of wealth distribution

- \( \tau_b \) increases, parents tend to invest more on human capital.
  - the risk of next generations’ wealth increases.
  - The spread of wealth distribution increases.
- \( \tau_w \) creates the opposite effects.
**Tax effects on parents transfer allocation**

- $I_h$: wealth threshold
- $\phi_h$: proportion of wealth spending on education
- $EI'$: offspring’s expected wealth

**Table**: Tax effects

<table>
<thead>
<tr>
<th></th>
<th>Portfolio choice</th>
<th>Wealth distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\phi_h$</td>
<td>$I_h$</td>
</tr>
<tr>
<td>$\tau_b$ Effects on $Gini_i$</td>
<td>+</td>
<td>−</td>
</tr>
<tr>
<td>$\tau_w$ Effects on $Gini_i$</td>
<td>−</td>
<td>+</td>
</tr>
</tbody>
</table>


Baseline case parameters are pinned down by targeting U.S. data.

One period as 25 years.

Parameters of technology, preference: follow the standard value in the literature.

Risks of human capital: from the estimates of Palacios-Huerta (2003); yearly return follows log-normal distribution.

\[
\log r_i^{1,h} \sim N(0.09, 0.076).
\]

Policy parameters: income and bequest tax rates \((\tau_w, \tau_b)\) are pinned down by the ratio of labor income to gdp and the ratio of bequest and gift to gdp
**Parameters and Data Targets**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Value</th>
<th>Source and Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capital share</td>
<td>$\alpha$</td>
<td>0.33 standard value in the literature</td>
</tr>
<tr>
<td>Discount factor (period)</td>
<td>$\beta$</td>
<td>0.96 standard value in the literature</td>
</tr>
<tr>
<td>World interest rate (annually)</td>
<td>$\bar{\pi}$</td>
<td>1/0.96 standard value in the literature</td>
</tr>
<tr>
<td>RRA of utility function</td>
<td>$\gamma_c$</td>
<td>2 standard value in the literature</td>
</tr>
<tr>
<td>RRA of child value function</td>
<td>$\gamma_B$</td>
<td>2 assume curvature is the same as utility function</td>
</tr>
<tr>
<td>Maximum human capital</td>
<td>$\bar{c}$</td>
<td>0.3145 the wage ratio between workers with college degree and high school is 2.578</td>
</tr>
<tr>
<td>Bequest tax</td>
<td>$\tau_b$</td>
<td>0.176 Proportion of inheritance and gift taxation to GDP is 0.25% (U.S. 2008)</td>
</tr>
<tr>
<td>Wage tax</td>
<td>$\tau_w$</td>
<td>0.032 Proportion of income taxation to total GDP is 11.8% (U.S. 2008)</td>
</tr>
<tr>
<td>Initial human capital</td>
<td>$h_0$</td>
<td>1</td>
</tr>
<tr>
<td>Child value discount variable</td>
<td>$\beta_c$</td>
<td>3.058 target: fraction of workers with education above college degree (9.27% 2010)</td>
</tr>
</tbody>
</table>
In the empirical strategy, to examine a particular tax effects, we control for the aggregate tax expenditure and the size of other taxation.

To make the experiments results can be comparable with the coefficient in the regression results, the ratios of

- total tax revenue to total output
- alternative tax revenue to total output

have to keep in the *baseline* level.
Numerical exercise

To see the effects of each taxation, numerical exercises are designed as follows:

- Income taxation: increase $\tau_w$, and let $\tau_b$, $T$ to be adjusted.
- Bequest taxation: increase $\tau_b$, and transfers back the excess tax revenue.

We design the government transfers in two ways.

- $T_a$, workers and retirees all receive the transfer,
- $T_r$, only retirees receive the transfer.

This is used to examine how strong the effects from wealth transfer.
## Results

**Table:** Experiment Results

<table>
<thead>
<tr>
<th>Experiment</th>
<th>Details</th>
<th>$\Delta Gini_i/\Delta\text{tax}$</th>
<th>$\Delta h/h$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tau_w$</td>
<td>$\tau_w \uparrow 5%$</td>
<td>Model 0.824 Data 0.994 (1)</td>
<td>$-3.2%$</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\tau_w \uparrow 10%$</td>
<td>Model 0.763 Data 0.923 (3)</td>
<td>$-6.5%$</td>
</tr>
<tr>
<td>$\tau_b$</td>
<td>$\tau_b = 1.5 \times \tau_b^*, T_a$</td>
<td>Model 0.051 Data -0.047 (1)</td>
<td>$0.05%$</td>
</tr>
<tr>
<td></td>
<td>$\tau_b = 1.5 \times \tau_b^*, T_r$</td>
<td>Model 0.013 Data -0.716 (2)</td>
<td>$0.07%$</td>
</tr>
<tr>
<td></td>
<td>$\tau_b = 2 \times \tau_b^*, T_a$</td>
<td>Model -0.006 Data -1.714 (3)</td>
<td>$0.13%$</td>
</tr>
<tr>
<td></td>
<td>$\tau_b = 2 \times \tau_b^*, T_r$</td>
<td>Model -0.042 Data 0.16%</td>
<td></td>
</tr>
</tbody>
</table>
**Results**

- Model predictions on income taxation effects are consistent with empirical evidence.
- The effects of bequest taxes depends on the level of tax rate change and transfer mechanism.
  - If $\Delta \tau_b$ is large, equality effects $> \text{dispersion effect}$
  - If the transfer $T$ apply to retirees only, equality effects $> \text{dispersion effect}$
- Income tax harms human capital accumulation, bequests tax promote human capital accumulation. (Grossmann and Poutvaara (2009))
**Conclusion**

- Data shows that income taxation is positively associated with income inequality, while the effects from bequest taxation is not significant.
- We provided theoretical model to explain our empirical findings through the mechanism of intergenerational transfer.
- Future work:
  - progressive taxation
## Data

<table>
<thead>
<tr>
<th>Variable</th>
<th>Functional Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income taxation</td>
<td>Individual taxation on income, profit and capital gains</td>
</tr>
<tr>
<td>Bequest taxation</td>
<td>Estate, inheritance and gift taxation</td>
</tr>
<tr>
<td>Social security taxation</td>
<td>Social security contribution from employees, employers, self-employed, and non-employed</td>
</tr>
<tr>
<td>Consumption taxation</td>
<td>Taxation on goods and services</td>
</tr>
<tr>
<td>Other tax revenues</td>
<td>Corporate taxation on income, profit and capital gains; Property taxation excluding bequest</td>
</tr>
</tbody>
</table>

Note: Functional classifications refer to the classifications given in their OECD data source.
### Table A1: Definition of Conditioning Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Definition or Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income inequality</td>
<td>Gini coefficient</td>
</tr>
<tr>
<td>GDP per capita</td>
<td>US dollars, current prices and PPPs</td>
</tr>
<tr>
<td>Real GDP growth rate</td>
<td>Annual growth rate (%)</td>
</tr>
<tr>
<td>Investment ratio</td>
<td>Gross fixed capital formation (as % of GDP)</td>
</tr>
<tr>
<td>Population growth rate</td>
<td>Annual growth rate of total population (%)</td>
</tr>
<tr>
<td>Fertility rate</td>
<td>Number of children per women</td>
</tr>
<tr>
<td>Human Capital</td>
<td>Average years of school attainment for the population aged 25 and over</td>
</tr>
</tbody>
</table>

Note: GDP per capita and average years of school attainment are measured at the beginning of each period.
Tax effects on the spread of human capital distribution
Tax effects on the wealth evolution

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### Graph 1
- X-axis: Wealth
- Y-axis: Percentage change in \( I' \)
- Legend:
  - Red: average
  - Purple: low
  - Black: high

### Graph 2
- X-axis: Wealth
- Y-axis: Percentage change in \( I' \)
- Legend:
  - Red: average
  - Purple: low
  - Black: high


