The Effect of Aspirations, Habits, and Social Security on the Distribution of Wealth

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Introduction

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- Wealth is highly concentrated: in many industrial countries, the share of the richest 1% of households in net worth is estimated to be 20-30% (Davies and Shorrocks, 2000).
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- Many papers have tried to explain these large differences in asset holdings.
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Díaz et al. (2003) analyze a similar issue in an economy with infinitely lived agents (no distinction between habits and aspirations; no role for Social Security; no closed form expressions).
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- Analysis of intragenerational inequality and intergenerational mobility.
- An evaluation of the effects of PAYG Social Security.
The Model

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- Both the wage per efficiency unit of labor and the interest rate are constant.

- The wage \( w^i_t \) of each worker is i.i.d. with mean \( w \) and variance \( V \). The gross rate of return on savings is \( R = 1 + r \).
The Model

The problem faced by an individual $i$ belonging to generation $t$ is

$$\max_{\{c^i_t, x^i_{t+1}, b^i_{t+1}, s^i_t\}} \alpha \ln(c^i_t - \delta a^i_t) + \beta \ln(x^i_{t+1} - \gamma c^i_t) + \rho \ln(b^i_{t+1})$$

subject to

$$\begin{align*}
(1 - \tau) w^i_t + b^i_t &= c^i_t + s^i_t \\
R s^i_t + p^i_{t+1} &= x^i_{t+1} + n b^i_{t+1}
\end{align*}$$
The Model

The problem faced by an individual $i$ belonging to generation $t$ is

$$\max_{\{c_t^i, x_{t+1}^i, b_{t+1}^i, s_t^i\}} \alpha \ln(c_t^i - \delta a_t^i) + \beta \ln(x_{t+1}^i - \gamma c_t^i) + \rho \ln(b_{t+1}^i)$$

$$s.t \quad (1 - \tau) w_t^i + b_t^i = c_t^i + s_t^i$$

$$Rs_t^i + p_{t+1}^i = x_{t+1}^i + nb_{t+1}^i$$

Optimal Solutions

$$c_t^i = c(w_t^i, b_t^i, a_t^i, p_{t+1}^i; \tau, R), \quad x_{t+1}^i = x(w_t^i, b_t^i, a_t^i, p_{t+1}^i; \tau, R),$$

$$b_{t+1}^i = b(w_t^i, b_t^i, a_t^i, p_{t+1}^i; \tau, R), \quad s_t^i = s(w_t^i, b_t^i, a_t^i, p_{t+1}^i; \tau, R).$$
The Model

Aspirations:

\[ a_t^i = c_{t-1}^i. \]
Social Security: Benefits proportional to the contribution:

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The budget constraint of the PAYG social security system:
\[
\int_{[0,N_t]} p_{t+1}^i \, di = \int_{[0,N_t+1]} \tau w_t^j \, dj, \quad \text{for all } t,
\]
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\[ \pi \tau w = n \tau w \] so that \( \pi = n \).
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Applying the law of large numbers for a continuum of i.i.d random variables, the previous equation simplifies to \( \pi \tau w = n \tau w \) so that \( \pi = n \).

Thus, the balanced budget constraint of the social security system is

\[ p_{t+1}^i = n \tau w_t^i, \quad \text{for all } t. \]
The Model

\[ c_t^i = \left[ \frac{((1-\tau)R+n\tau)\alpha}{R+\gamma} \right] w_t^i + \left[ \frac{R\alpha}{R+\gamma} \right] b_t^i + \delta (\beta + \rho) c_{t-1}^i. \]

\[ x_{t+1}^i = \left[ \frac{((1-\tau)R+n\tau)(\gamma(1-\rho)+R\beta)}{R+\gamma} \right] w_t^i + \left[ \frac{R(\gamma(1-\rho)+R\beta)}{R+\gamma} \right] b_t^i - \delta (R\beta - \rho\gamma) c_{t-1}^i. \]

\[ b_{t+1}^i = \left[ \frac{((1-\tau)R+n\tau)\rho}{n} \right] w_t^i + \left[ \frac{\rho R}{n} \right] b_t^i - \left[ \frac{(R+\gamma)\delta\rho}{n} \right] c_{t-1}^i. \]

\[ s_t^i = \left[ \frac{(1-\tau)(R(\beta+\rho)+\gamma)-n\alpha\tau}{R+\gamma} \right] w_t^i + \left[ \frac{R(\beta+\rho)+\gamma}{R+\gamma} \right] b_t^i - \delta (\beta + \rho) c_{t-1}^i. \]
The dynamics of consumption, wealth, and bequests

\[ \bar{c}_t = c \left( \bar{b}_t, \bar{c}_{t-1}, w \right), \]
\[ \bar{b}_{t+1} = b \left( \bar{b}_t, \bar{c}_{t-1}, w \right), \]

and

\[ \text{Var} \left( c^i_t \right) = C \left( \text{Var} \left( b^i_t \right), \text{Var} \left( c^i_{t-1} \right), \text{Cov} \left( c^i_{t-1}, b^i_t \right), V \right), \]
\[ \text{Var} \left( b^i_{t+1} \right) = B \left( \text{Var} \left( b^i_t \right), \text{Var} \left( c^i_{t-1} \right), \text{Cov} \left( c^i_{t-1}, b^i_t \right), V \right), \]
\[ \text{Cov} \left( c^i_t, b^i_{t+1} \right) = H \left( \text{Var} \left( b^i_t \right), \text{Var} \left( c^i_{t-1} \right), \text{Cov} \left( c^i_{t-1}, b^i_t \right), V \right). \]
The Model

The steady state

\[ \bar{c} = \varphi_1 w, \]
\[ \bar{b} = \varphi_2 w, \]
\[ \bar{s} = \varphi_3 w, \]

and

\[ \text{Var} (c) = \psi_1 V, \]
\[ \text{Var} (b) = \psi_2 V, \]
\[ \text{Cov} (c, b') = \psi_3 V, \]
\[ \text{Var} (s) = s \left( \text{Var} (b), \text{Var} (c), \text{Cov} (c, b'), V \right) = \psi_4 (V). \]
The Model

- The stability of the dynamic system
The stability of the dynamic system

Lemma. If $\frac{\rho R}{n} < 1$ and the aspirations intensity $\delta$ is sufficiently small, then the dynamic system converges monotonically to the steady state for average young consumption and average bequest. Moreover, the system converges to the state steady state for the variance of young consumption, variance of bequest, and covariance between young consumption and the amount of bequest left to each descendant.
The Model

Intergenerational distribution of wealth

- Measured by the autocorrelation coefficient, $\text{Corr}(s_{t+1}^i, s_t^i)$. 
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Intergenerational distribution of wealth

- Measured by the autocorrelation coefficient, $Corr(s^{i}_{t+1}, s^{i}_{t})$.
- With no bequests and no aspirations $Corr(s^{i}_{t+1}, s^{i}_{t}) = 0$, so that there is perfect mobility as wages are i.i.d.
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- If we had perfect correlation of asset holdings, i.e., $\text{Corr}(s_{t+1}^i, s_t^i) = 1$, then intergenerational mobility would be null.
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- With no bequests and no aspirations \( \text{Corr}(s^i_{t+1}, s^i_t) = 0 \), so that there is perfect mobility as wages are i.i.d.
- If we had perfect correlation of asset holdings, i.e., \( \text{Corr}(s^i_{t+1}, s^i_t) = 1 \), then intergenerational mobility would be null.
- At a stationary distribution we have

\[
\text{Corr}(s^i_{t+1}, s^i_t) = \frac{\text{Cov}(s^i_{t+1}, s^i_t)}{(\text{Var}(s^i_{t+1}))^{1/2} \cdot (\text{Var}(s^i_t))^{1/2}} = \frac{\text{Cov}(s^i_{t+1}, s_t)}{\text{Var}(s^i_t)} = \text{Corr}(s^i, s).
\]
The Effects of Habits and Aspirations

The effect on aggregate variables.
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- \( \delta \) represents the intensity of aspirations.
- \( \gamma \) represents the intensity of habits.
The Effect of Aspirations, Habits, and Social Security on the Distribution of Wealth

- The effect on aggregate variables.

- $\delta$ represents the intensity of aspirations.

- $\gamma$ represents the intensity of habits.

\[
\begin{align*}
\frac{\partial \bar{s}}{\partial \delta} & < 0, & \frac{\partial \bar{s}}{\partial \gamma} & > 0, \\
\frac{\partial \bar{b}}{\partial \delta} & < 0, & \frac{\partial \bar{b}}{\partial \gamma} & = 0.
\end{align*}
\]
We use the Coefficient of Variation of savings $CV(s)$ as a measure of intragenerational inequality in wealth.
The Effects of Habits and Aspirations

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Effect on the intragenerational distribution of wealth of Aspirations

\[
\frac{\partial CV(s)}{\partial \delta} \bigg|_{\delta=\gamma=\tau=0} > 0.
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- **Effect on the intragenerational distribution of wealth of Aspirations**

\[
\frac{\partial CV(s)}{\partial \delta} \bigg|_{\delta=\gamma=\tau=0} > 0.
\]

- Intergenerational propagation of shocks through inherited tastes.
The Effects of Habits and Aspirations

Effect on the intragenerational distribution of wealth of aspirations

\[ \frac{\partial CV(s)}{\partial \delta} \bigg|_{\delta=\gamma=\tau=0} > 0. \]

\[ \gamma = 0, \tau = 0 \]

\[ \gamma = \frac{1}{4}, \tau = 0 \]
Effect on the intragenerational distribution of wealth of Aspirations

\[
\frac{\partial CV(s)}{\partial \delta} \bigg|_{\delta=\gamma=\tau=0} > 0.
\]

\(\gamma=0, \tau=\frac{1}{3}\)

\(\gamma=\frac{1}{4}, \tau=\frac{1}{3}\)
The Effects of Habits and Aspirations

Effect on the intragenerational distribution of wealth of Habits

\[
\frac{\partial CV(s)}{\partial \gamma} \bigg|_{\delta=0} = 0.
\]

\[
\frac{\partial CV(s)}{\partial \gamma} \bigg|_{\gamma=\tau=0} < 0.
\]

- Habits smooth consumption along the life cycle: a worker’s consumption is less sensitive to wage shocks and this induces in turn less volatility in the consumption and saving of her descendants.
The Effects of Habits and Aspirations

Effect on the intragenerational distribution of wealth of Habits

\[ \frac{\partial CV(s)}{\partial \gamma} \bigg|_{\gamma=\tau=0} < 0. \]

\(\delta = \frac{1}{5}, \tau = 0\)

\(\delta = \frac{1}{5}, \tau = \frac{1}{3}\)
The Effects of Habits and Aspirations

Effect on the intergenerational mobility of Aspirations

\[
\left. \frac{\partial \text{Corr}(s', s)}{\partial \delta} \right|_{\delta=\gamma=\tau=0} < 0.
\]

- Aspirations reduce bequests and, thus, mobility rises.
The Effects of Habits and Aspirations

Effect on the intergenerational mobility of Aspirations

\[ \frac{\partial \text{Corr}(s', s)}{\partial \delta} \bigg|_{\delta=\gamma=\tau=0} < 0. \]

\[ \gamma=0, \ \tau=0 \quad \text{and} \quad \gamma=\frac{1}{4}, \ \tau=0 \]
The Effects of Habits and Aspirations

Effect on the intergenerational mobility of Aspirations.

\[
\frac{\partial \text{Corr}(s', s)}{\partial \delta} \bigg|_{\delta=\gamma=\tau=0} < 0.
\]

\[\begin{array}{c}
\gamma=0, \tau=\frac{1}{3} \\
\gamma=\frac{1}{4}, \tau=\frac{1}{3}
\end{array}\]
The Effects of Habits and Aspirations

Effect on the intergenerational mobility of Habits

\[
\frac{\partial \text{Corr}(s', s)}{\partial \gamma} \bigg|_{\rho=\gamma=\tau=0} > 0.
\]

The effects of shocks on saving are magnified by habits and, in the presence of aspirations, this translates into more autocorrelation of asset holdings, i.e., into less mobility.
Effect on the intergenerational mobility of Habits

\[
\mu \left( \frac{\partial \text{Corr}(s', s)}{\partial \gamma} \right) \bigg|_{\rho=\gamma=\tau=0} > 0.
\]

- The effects of shocks on saving are magnified by habits and, in the presence of aspirations, this translates into more autocorrelation of asset holdings, i.e., into less mobility.

- If only aspiration is present, then \( \text{Corr}(s', s) < 0 \).
The Effects of Habits and Aspirations

Effect on the intergenerational mobility of Habits

\[ \left. \frac{\partial \text{Corr}(s', s)}{\partial \gamma} \right|_{\rho=\gamma=\tau=0} > 0. \]

\[ \delta = \frac{1}{5}, \, \tau = 0, \, \rho = 0 \]

\[ \delta = \frac{1}{5}, \, \tau = \frac{1}{3}, \, \rho = 0 \]
The Effects of Habits and Aspirations

Effect on the intergenerational mobility of Habits

\[ \frac{\partial \text{Corr}(s',s)}{\partial \gamma} \bigg|_{\rho=\gamma=\tau=0} > 0. \]

\[ \delta=\frac{1}{5}, \ \tau=0, \ \rho=\frac{1}{4} \]

- When bequests are introduced under habits, the equilibrium amount of bequests goes down and this increases the degree of mobility.
The effect of Social Security on aggregate variables:

\[ \frac{\partial \bar{s}}{\partial \tau} < 0, \quad \frac{\partial \bar{b}}{\partial \tau} \geq 0 \iff n \geq R \]
Social Security

The effect of Social Security on the intragenerational distribution of wealth

\[ \frac{\partial CV(s)}{\partial \tau} \bigg|_{\delta=\gamma=\tau=0} < 0. \]
Social Security

The effect of Social Security on the intragenerational distribution of wealth

\[
\frac{\partial CV(s)}{\partial \tau} \bigg|_{\delta=\gamma=\tau=0} < 0.
\]

- For high values of the social security tax \( \tau \), saving becomes negative.
Social Security

The effect of Social Security on the intragenerational distribution of wealth

\[
\frac{\partial CV(s)}{\partial \tau} \bigg|_{\delta=\gamma=\tau=0} < 0.
\]

\[\delta = \frac{1}{5}, \quad \gamma = 0 \quad \text{and} \quad \delta = \frac{1}{5}, \quad \gamma = \frac{1}{4}\]
Social Security

The effect of Social Security on intergenerational mobility

\[ \frac{\partial \text{Corr}(s', s)}{\partial \tau} \bigg|_{\delta=\gamma=\tau=0} > 0. \]

- Larger wages \rightarrow Larger pension benefits \rightarrow Larger amount of bequests.
The effect of Social Security on intergenerational mobility

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\frac{\partial \text{Corr}(s',s)}{\partial \tau} \bigg|_{\delta=\gamma=\tau=0} > 0.
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The effect of Social Security on intergenerational mobility

\[ \frac{\partial \text{Corr}(s', s)}{\partial \tau} \Bigg|_{\delta=\gamma=\tau=0} > 0. \]

\[ \delta = \frac{1}{5}, \; \gamma = 0 \]

\[ \delta = \frac{1}{5}, \; \gamma = \frac{1}{4} \]

- Here aspirations make the amount of savings negative.
Social Security

The interaction between Social Security and Aspirations and Habits

\[
\frac{\partial \bar{s}}{\partial \tau \partial \delta} \geq 0 \iff R \geq n \quad \frac{\partial \bar{s}}{\partial \tau \partial \gamma} \geq 0 \iff n \geq R
\]
The interaction between Social Security and Aspirations and Habits

\[ \frac{\partial \bar{s}}{\partial \tau \partial \delta} \geq 0 \iff R \geq n \]

\[ \frac{\partial \bar{s}}{\partial \tau \partial \gamma} \geq 0 \iff n \geq R \]

\[ \left. \frac{\partial CV(s)}{\partial \tau \partial \delta} \right|_{\delta=\gamma=\tau=\rho=0} > 0 \]

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\]

\[
\left. \frac{\partial CV(s)}{\partial \tau \partial \gamma} \right|_{\delta=\gamma=\tau=0} > 0
\]

\[
\left. \frac{\partial^2 Corr(s', s)}{\partial \tau \partial \delta} \right|_{\delta=\gamma=\tau=\rho=0} < 0
\]

\[
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Conclusion

We have analyzed the effect of the introduction of habits and aspirations on the distribution of wealth and the interaction with the redistributive features of a SS system.
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- Our results show that:

  - Aspirations increase both the intragenerational inequality of wealth and the intergenerational mobility.
  - Habits decrease both the intragenerational inequality of wealth and the intergenerational mobility.
  - While Social Security has an equalizing intragenerational effect, this effect becomes smaller in the presence of aspirations or habits.
  - While Social Security decreases mobility, this reduction becomes smaller in the presence of aspirations or habits.
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