Inequality, Household Behavior and the Macroeconomy
(Wealth inequality and the life-cycle)

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Not to forget

Welcome to Ohlin lecture!

- Daron Acemoglu
- Tuesday May 7 at 15.30 in the aula
- "Artificial Intelligence and the Future of Economy and Society"

Last time

- Learnt (one way) how to capture realistic income risk in a model
- Found that a simple life-cycle model can fit the relation of income risk and consumption variance
- Haven't looked at wealth

Today

- Some theory/discussion: Incomplete markets
- Wealth inequality in life-cycle models
- Decide on topics covered next

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The role of financial markets

- We have seen that income risk matters
- How much do they matter? Partly depends on your ability to insure against them!

Consider two polar cases:

1. Autarky, where no insurance mechanism (not even savings...) is available
2. Complete markets, where households can buy state-contingent claims (Arrow securities)

We are usually somewhere in between

The role of financial markets—Autarky

Under autarky, individuals are forced to consume their income in each period

This means that $c_{i,t} = y_{i,t}$ for each household i at each age t

As a consequence, consumption inequality will track income inequality **exactly**

The role of financial markets—Complete markets

- Under a complete markets scenario, income uncertainty does not matter!
- Households can buy Arrow securities that insure them against all the possible states of the economy
- Arrow security: pays one unit of consumption in a particular history

  E.g. if I get fired, but you don't, you pay me.

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- In GE, risk-averse agents optimally insure away all **idiosyncratic** shocks, by trading Arrow securities with each other
- Aggregate shocks cannot be insured away
- This implies that consumption does not react to idiosyncratic income shocks

  Consequently, consumption inequality would stay constant over time!

Interpreting STY

- Why did they care about consumption variance? (apart from being a measure of welfare inequality)

  $\Rightarrow$ Tells us how big share of income risk people can insure!

- Good match means

  $\Rightarrow$ A simple life-cycle model can/might get right the amount of insurance available to households.

- Terminology:
  our model is
  - an **incomplete markets** model
  - where there is **partial insurance** against uncertainty.

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Wealth Inequality in life-cycle models

So far we did not say much about the distribution of wealth

We studied how savings motives (e.g. precautionary savings) are important to jointly account for income and consumption inequality

Can the models we studied so far match the amount of wealth inequality in the data?

- Huggett (1996) looks at this and investigates the effects of income uncertainty + uncertain lifetimes + borrowing limits
- De Nardi (2004) looks at bequest motives, inheritances and ability transfer, in addition

Problem - (Bellman equation form)

$$V(\alpha, t, z_t, x_t) = \max_{a_t \geq 0} \frac{(x_t - a_t)^{1-\gamma}}{1-\gamma} + \xi_t \beta E_t V(\alpha, t+1, z_{t+1}, x_{t+1}) + (1-\xi_t) E_t \Phi(x_{t+1}(1-\tau_b))$$

$$s.t. \quad x_{t+1} = (1 + r(1-\tau_c))a_t + y_{t+1}(1-\tau_l)$$

$$y_t = \begin{cases} \exp\left(\alpha + gt + k_t + z_t + \epsilon_t\right) & \text{if } t \leq 65 \\ B \cdot \bar{Y} & \text{if } t > 65 \end{cases}$$

$$\text{where } z_t = \rho z_{t-1} + \eta_t$$

$$\eta \sim \mathcal{N}(\sigma_\eta^2) \quad \epsilon \sim \mathcal{N}(0, \sigma_\epsilon^2)$$

ξ_t is conditional probability of survival, g is growth rate, k is age fixed-effect, B is replacament ratio, $\bar{Y}$ is average income of working age population.

Closing the economy

- Capital income and labor income taxes finance pensions
- Bequest taxes are redistributed evenly over all survivors
- Rest of bequests goes to child! (assumed to be 25 years younger)
- Abilities are correlated across generations: αs of parent are child are correlated

Differences from De Nardi (2004)

- Nobody expects receiving bequests
- Capital markets are not closed (she has a representative firm)
- Our model is yearly

Utility from bequests

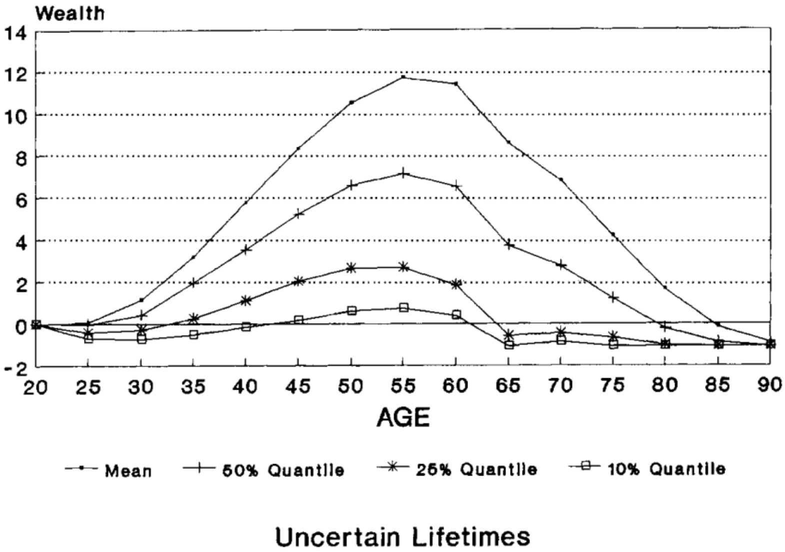
$$\Phi(a) = \Phi_1 \left(1 + \frac{a[1 + r(1 - \tau_c)](1 - \tau_b)}{\Phi_2}\right)^{1-\gamma}$$

- Determines utility from leaving wealth behind
- Luxury bequests: Only rich enough households care about this.

Solving the model

- Eating everything is not the optimal policy anymore in the last period $\rightarrow$ replace with pencil&paper solution
- Solve for τ_l to balance the government budget (as in Assignment 2)
- Simulate many generations. Individual i in generation m is the child of individual i in generation $m-1$
- Once the mth generation looks similar to the $m-1$th generation, you can think that generation m represents the whole economy.

Wealth Profiles with Uncertain Lifetimes - Huggett (1996)



Results - Huggett (1996)

Wealth distribution (risk aversion coefficient $\sigma = 1.5$)

Credit limit $\underline{a}$	Earnings shock σ_ε^2	K/Y	Transfer wealth ratio	Wealth Gini	Percentage wealth in the top 1%	5%	20%	Zero or negative wealth (%)
US economy		3.0	0.78–1.32	0.72	28	49	75	5.8–15.0
Certain lifetimes								
0.0	0.00	2.9	0.0	0.47	2.4	11.6	42.8	14.0
$-w$	0.00	2.8	0.0	0.54	2.7	12.7	46.6	25.0
0.0	0.045	3.2	0.0	0.70	10.8	32.4	68.9	19.0
$-w$	0.045	3.1	0.0	0.74	11.1	33.8	72.3	24.0
Uncertain lifetimes								
0.0	0.00	3.1	1.03	0.46	2.5	11.7	42.8	11.0
$-w$	0.00	3.0	1.07	0.49	2.6	12.1	44.3	12.0
0.0	0.045	3.4	0.84	0.69	10.9	32.9	70.0	17.0
$-w$	0.045	3.2	0.89	0.76	11.8	35.6	75.5	24.0

Conclusion

Life Cycle models can generate a more realistic wealth distribution through adding earnings uncertainty and the incentive to save for retirement / bequests

However, they have to rely on a very large number of agents at the borrowing constraint..

... and they cannot match the top 1% of wealth distribution

What are we missing?

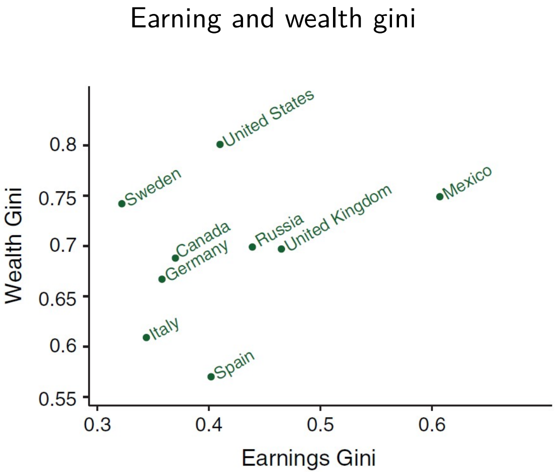
Income is uncertain: does it matter to distinguish between labor earnings and other sources of income (e.g., business income)?

Earnings and wealth inequality across countries

The slope coefficient from a linear regression of wealth Gini on earnings Gini is 0.258 and not statistically significant!

This suggests a significant role for other factors to drive the distribution of wealth!

Caveat: very few observations...



Earnings and wealth inequality

Consider a linear individual wealth (w) accumulation equation,

$$w_{t+1} = r_t w_t + y_t - c_t. \tag{1}$$

Consider also a linear consumption function,

$$c_t = \psi w_t + \chi_t. \tag{2}$$

We can then write the wealth accumulation equation as

$$w_{t+1} = (r_t - \psi)\, w_t + (y_t - \chi_t) \tag{3}$$

Suppose that r_t and $y_t > 0$ are both random variables, independent and i.i.d. over time and independent of w_t. Suppose also that $\chi_t \geq 0$, $0 < E(r_t) - \psi < 1$, and $\Pr(r_t - \psi > 1) > 0$ for any $t \geq 0$.

Earnings and wealth inequality

Benhabib, Bisin and Luo (2017) [BBL] prove the following:

The right tail index of the wealth distribution induced by the accumulation equation (3) is EITHER

1. γ, which depends on the stochastic properties of returns r_t
2. β, the right tail of $y_t - \chi_t$

In other words, it is either stochastic returns via the accumulation process or skewed earnings which determine the thickness of the right tail of the wealth distribution..

.. **not both!**

Earnings and wealth inequality

BBL result makes strict assumptions, but their theorem has important implications

Because of the theorem, the distribution of earnings cannot even partially contribute to explain the thickness of the tail of the wealth distribution

Why? Because of two reasons:

- If the distribution of earnings can explain some of the tick tail of the wealth distribution, then it **must** explain it all!
- The distribution of wealth has a thicker tail than the distribution of earnings

Earnings and wealth inequality

The theorem also explains why studies postulating extraordinarily high earnings states do in fact match the wealth distribution by relying solely on earnings and precautionary savings as a determinant of wealth accumulation.

Models (e.g., Castañeda et al., 2003) in which earnings and precautionary savings are the main determinants of wealth accumulation, a much thicker distribution of earnings than the observed distribution is required to fit wealth data.

Indeed, these studies assume an *awesome state* for earnings to explain the wealth distribution

Problem: the awesome state in Castañeda et al. (2003) requires the top 0.039% earners to have about 1, 000 times the average labor endowment of the bottom 61%

The ratio between the top 0.01% and the median is at most 200 in the World Wealth and Income Database

Earnings and wealth inequality

The conclusion is that the distribution of earnings cannot explain the tail of the wealth distribution

Other factors should drive the tail of the wealth distribution

- The theorem of BBL suggests a role for stochastic idiosyncratic returns to wealth.
- But first we look at entrepreneurship in the next class.

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Two ways to finish this course:

- Focus on optimal taxation, economic policy
  - Some theory of optimal taxation
  - Connection to inequality
  - How do incomplete markets affect fiscal policy interventions? (what do people do if you throw money at them?)
- Focus on causes of wealth inequality
  - Portfolio choice: risky or safe assets?
  - How does portfolio composition affect wealth inequality?