Macroeconomics from the Ground up: Lecture 1

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The purpose of this lecture series

- Introduce some research areas in macroeconomics to graduate-level audiences.
- I will focus on the topics that I have been working on.
- But I will talk about more than my own papers.
- I titled "from the ground up," because
  - I want to start from the basic assumptions of macroeconomics.
  - I emphasize the "macroeconomic behavior is the sum of microeconomic behaviors" aspect.
- All lecture slides are available at my personal website:
  `https://sites.google.com/site/toshimukoyama/`

Outline

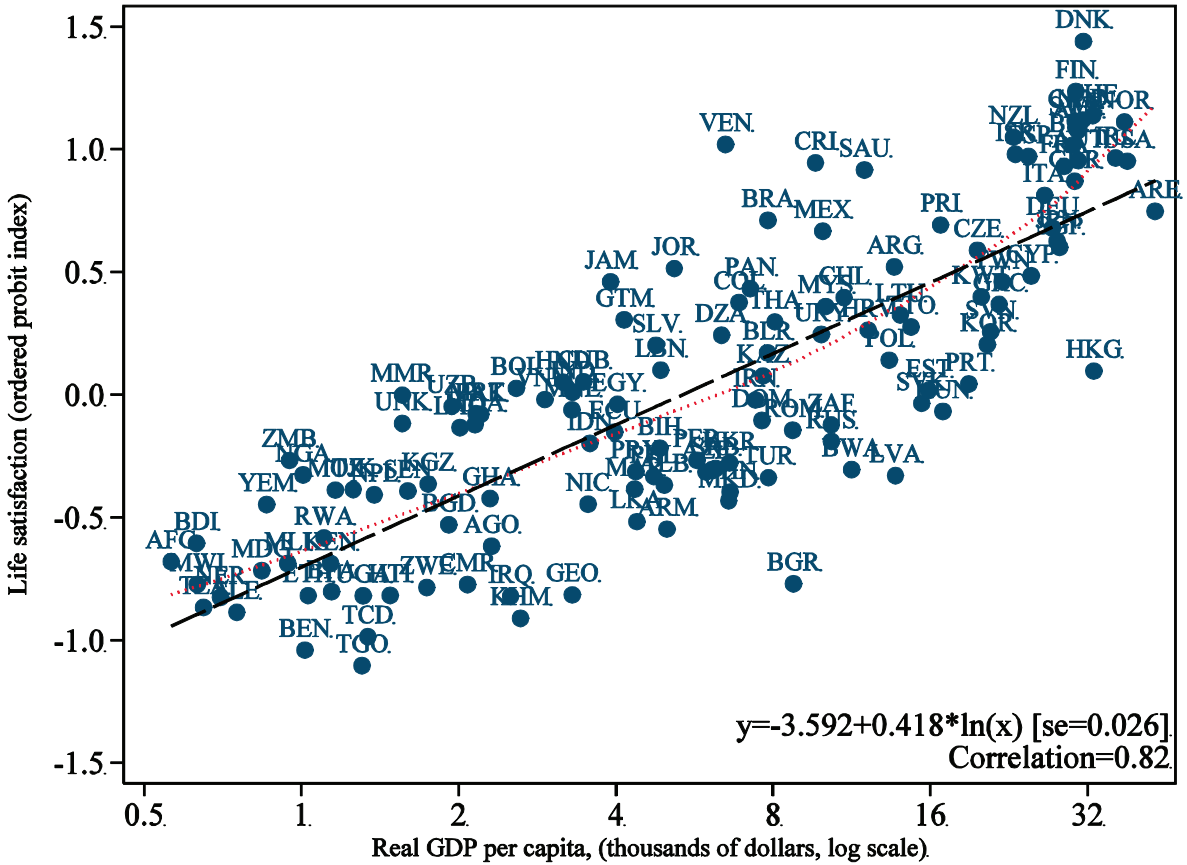
- Lecture 1: Some basics on macroeconomics, heterogeneity, inequality, and incomplete asset market
- Lecture 2: Labor market
- Lecture 3: Productivity and heterogenous firms: growth and business cycles

Macroeconomic fundamentals #1: GDP is important

- We always look at GDP as the primary object of macroeconomic study and macroeconomic policies.
  - Economic growth is measured by the growth of (per-capita) GDP.
  - Business cycles are defined by the fluctuations in GDP.
  - We tend to implicitly make the judgment that "high GDP is good."
- Why?

Macroeconomic fundamentals #1: GDP is important

Figure 4. Life Satisfaction and Real GDP per Capita: Gallup World Poll



Source: Stevenson and Wolfers (2008), from WP version.

- GDP is related to something we care about, for example, happiness.
- But why?

Macroeconomic fundamentals #1: GDP is important

- GDP equals income. Income equals consumption and saving. High income enables high level of consumption. Saving is future consumption. If happiness comes from consumption, GDP is linked to welfare. (There is a theoretical foundation for this—see Weitzman 2003).
- High income (probably) means you don't have to work very hard and enjoy leisure. Consumption and leisure are the usual ingredients of utility function (Jones and Klenow 2011).
- GDP measures the value added traded in the market. What is special about trading in the market, as opposed to household production or gift exchanges with neighbors? Perhaps because in the market a higher degree of division of labor can be achieved?

Macroeconomic fundamentals #1: GDP is important

- Other possible reasons why GDP is correlated with happiness.
  - Low unemployment during the period of high GDP may itself be valuable—the joy of "self-realization" by having a job.
  - Wealthier is healthier and live longer (Pritchett and Summers 1996).
  - Higher education may itself be valuable.
  - Democracy, freedom, etc. may themselves be valuable.
  - These things are a bit difficult to quantify (but still worthwhile thinking).
- The basis for our implicit judgment lies in how GDP is translated into happiness at the individual level.

Macroeconomic fundamentals #2: Aggregation

- Macroeconomy is a collection of individuals consumers and individual firms.
- Consumers are different, and firms are different.
- We frequently use the "representative consumer" and "representative firm" assumptions to avoid the complication coming from aggregating heterogeneous consumers and firms.
- What do we miss by assuming the representative consumer and the representative firm?
- Two key words: reallocation and disagreement.
  1. Scarce resources have to be allocated properly.
  2. Different people have different opinions about future, policy, etc.
- Today I will talk about the second. The first will be the main subject for tomorrow and the day after.

Heterogeneity and aggregation

- In reality, consumers are heterogeneous in many respects.
- I will not talk about:
  - Heterogeneity in preferences (Krusell and Smith 1998, Schulhofer-Wohl 2008).
  - Heterogeneity in beliefs (Harrison and Kreps 1978).
- I will talk about:
  - Heterogeneity in productivity (and income). (Related to tomorrow)
  - Heterogeneity in wealth. (Today).

Wealth inequality

- There are three types of inequalities that people talk about:
  - Wealth inequality,
  - Income inequality,
  - Earnings inequality.
  - (There is also wage inequality, which is a big topic too, but I will skip.)
- These inequalities are somewhat different:
  - In 2007, the Gini coefficient of was 0.82 for wealth, 0.58 for income, and 0.64 for earnings (Díaz-Giménez et al. 2011).
  - They are not perfectly correlated. For example, old people tend to have a lot of wealth but not much earnings.
- We have to be careful about which one matters, depending on the context. In many macro models, what matters the most is the wealth (lifetime wealth).

Does wealth inequality matter?

- The answer is "no" in many macro models—a model with large inequality behaves exactly the same as a model with small inequality (and has the same policy recommendations).
- This is because of the Gorman Aggregation Theorem.
- If the indirect utility function is in the Gorman form

$$v_i(\mathbf{p}, W_i) = a_i(\mathbf{p}) + b(\mathbf{p})W_i,$$

where $\mathbf{p}$ is the price vector and W_i is the wealth. From Roy's identity, the Walrasian demand function is

$$c_i(\mathbf{p}, W_i) = g_i(\mathbf{p}) + h(\mathbf{p})W_i,$$

and thus the aggregate demand

$$C(\mathbf{p}, W_i) = \sum_i g_i(\mathbf{p}) + h(\mathbf{p}) \sum_i W_i,$$

so this depend only on the prices and the sum of wealth, so the wealth distribution doesn't matter for macroeconomic outcome.

Does wealth inequality matter?

- Indeed, in the CRRA utility function that is commonly used in macroeconomic studies

$$\mathbf{U} = E_t \left[\sum_{t=0}^{\infty} \beta^t \frac{c(s^t)^{1-\nu} - 1}{1-\nu} \right]$$

where $c(s^t)$ is the consumption at state s^t, $\beta \in (0,1)$ and $\nu \leq 1$, if the asset market is complete (i.e. there is an Arrow-Debreu security for every possible state),

$$c_i(\mathbf{p}, W_i) = h(\mathbf{p}) W_i$$

holds and therefore

$$C(\mathbf{p}, W_i) = h(\mathbf{p}) \sum_i W_i.$$

In other words,

$$\frac{c_i}{C} = \frac{W_i}{\sum_i W_i} = \text{const.}$$

for every possible state (see Mukoyama 2010).

Does wealth inequality matter?

- Thus in a model with complete asset market, everyone behaves "proportionally" to each other. Unless there are wealth transfers, people feel the same about the change in environment or macroeconomic policy.
- This is one of the justifications of the use of representative agent (and the use of GDP as the welfare criterion).
- A corollary is that the stochastic discount factor

$$\beta^t \left(\frac{c_i(s^t)}{c_i(s^0)} \right)^{-\nu}$$

is common across i, thus everyone agrees on the asset valuation, and all shareholders agree on the objective of the firms that they own.

Does wealth inequality matter?

- So, in this world, the wealth inequality doesn't matter, and everyone behaves essentially the same way, no matter what happens.
- This is a useful benchmark and convenient to analyze, but not too interesting/realistic.
- For example,
  - Everyone agrees on policy (except for the transfers)—no role for politics.
  - Everyone is fully insured—losing a job, for example, is not a big pain.
- In reality, not all states are covered by Arrow-Debreu securities.
  - People may not keep the promise (enforcement friction).
  - People may lie about what they do/did (information friction).

Does wealth inequality matter?

When asset markets are incomplete, inequality matters.

- There has been a lot of analysis in the context of economic growth.
  - The majority of the studies considers how the inequality translates into growth through human capital accumulation. Sometimes entrepreneurship and "trickle-down" mechanism is emphasized.
  - A less emphasized channel, which I think is perhaps more important, is through politics. If wealth inequality is related to the inequality of political power, the politics $\leftrightarrow$ economics feedback may generate a serious stagnation. Mukoyama and Popov (2012) is not about the wealth heterogeneity, but an example of how to model this feedback.
- In the business cycle context, my impression is that
  - Many studies (starting Krusell and Smith 1998) show that the aggregate business cycle dynamics is not much affected by the market incompleteness.
  - But it matters for normative evaluation of policies (see, for example, Krusell, Mukoyama, Şahin, and Smith 2009).

Analyzing models with market incompleteness

- The models with representative agent are relatively easy to analyze:
  - Often the second welfare theorem applies, and we can compute the social planner's problem instead;
  - Even when there are some distortions, one can still use techniques like policy function iteration. ("Big K, small k")
- With incomplete market and idiosyncratic shocks, each person faces different problem (different value of individual state variable).
- When aggregate shocks are present, there is an additional complication.
  - In order to know what tomorrow's prices can be, one has to know what others are doing.
  - Thus the distribution of individual state variables matter for the individual decision problem.
  - Many new methods are being proposed—the most popular one is by Krusell and Smith (1998). (See special issue of *JEDC* in 2010.)

Analyzing models with market incompleteness

- Krusell and Smith (1998) method has many textbook treatments (see, for example, Heer and Maussner 2009), so I won't talk much about it (unless I have time ▸ KS method). The basic idea is to guess the future aggregate state as a function of the current aggregate state and check if the guess was correct using the simulated data.
- Additional difficulties of incomplete market models: because $\beta^t(c_i(s^t)/c_i(s^0))^{-\nu}$ is different across people,
  - How do we price assets?
  - How do firms make dynamic decisions (if they have to)?

A useful setting

- Suppose that there are "aggregate Arrow securities" that gives one unit of consumption good if the aggregate state is Z.
- The consumer's problem is to maximize

$$E\left[\sum_{t=0}^{\infty}\beta^t\frac{{c_t}^{1-\nu}}{1-\nu}\right]$$

subject to

$$c+\sum_{Z'}Q_{Z'}a'_{Z'}=a_Z+\epsilon_{z,Z}$$

and

$$a'_{Z'}\geq\underline{a}\text{ for all }Z'.$$

- This is still an incomplete market model, since z is not spanned by the aggregate Arrow securities.
- With $Q_{Z'}$, any asset whose return depends only on aggregate state can be priced (Krusell, Mukoyama, and Smith 2011).
- $Q_{Z'}$ can be used to discount firm's future profit (Krusell, Mukoyama, and Şahin 2010).

Main takeaways

- With complete asset market, standard macroeconomic models with wealth heterogeneity can be aggregated into a representative agent model.
- When the asset market is incomplete, inequality matters, and people may have different opinions about policy.
- Recent development in computational method has made the computation of this class of model easier.

Krusell and Smith (1998)

- The consumer's Bellman equation:

$$v(a, \epsilon, Z, \Gamma) = \max_{c, a'} \quad \log(c) + E[v(a', \epsilon', Z', \Gamma')|\epsilon, Z]$$

subject to

$$a' = (1 + r(K, z) - \delta)a + w(K, z)\epsilon - c,$$

$$a' \geq \underline{a}$$

and

$$\Gamma' = H(\Gamma, Z, Z'),$$

where H is the (endogenous) law of motion for the distribution Γ.

Krusell and Smith (1998)

1. Assume that the consumres only use a part of Γ as the information for making a decision.
2. In particular, use K and assume that

$$\log(K') = \begin{cases} a_0 + b_0 \log(K) & \text{if } Z = g, \\ a_1 + b_1 \log(K) & \text{if } Z = b. \end{cases}$$

   Guess a_0, a_1, b_0, and b_1.
3. Solve

$$v(a, \epsilon, Z, K) = \max_{c, a'} \quad \log(c) + E[v(a', \epsilon', Z', K')|\epsilon, Z]$$

   subject to

$$a' = (1 + r(K, z) - \delta)a + w(K, z)\epsilon - c,$$
$$a' \geq \underline{a},$$

   and the above.
4. Simulate the economy.
5. Compare the simulated outcome of K with the law of motion. If the time series matches the guess, we found the REE. If not, modify the guess and repeat.

back

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