Quantitative Macro-Labor

Professor Griffy

UAlbany

Fall 2024

Welcome to Macro-Labor!

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- Office Hours: Tues 12:30-2:30pm.

Course Overview

- What is this course about?
  1. Quantitative macro-labor.
  2. Explore and develop "empirical regularities" about the labor market and labor market participants.
  3. Use theory to develop cogent explanations for these empirical regularities.
  4. Use a computer to solve and simulate models that would be impossible to solve by hand.
- Topics:
  1. Wage dispersion and income inequality.
  2. Income persistence and income risk.
  3. Consumption risk.

Course Requirements

- Materials:
  1. We won't explicitly require a textbook for this course.
  2. There are some suggested textbooks as well as free resources in the syllabus.
- Tools:
  1. One (or two, or three, or ...) programming language.
  2. My suggestion: Matlab, Julia, (Fortran or C++) for dynamic programming/numerical optimization. Maybe Python, but it's honestly not as good as Julia (though useful for other things).
  3. And Stata or R for statistics/empirical regularities.
  4. LaTeXfor homework and projects.
- Please note: best resource for class materials is my website: https://www.bengriffy.com

Grading

- Occasional homework: 30%. This will typically entail solving a model that I have discussed in class either by hand or on the computer.
- Introduction/Research Proposal (20%): Write a rough draft of an introduction that will serve as a research proposal. This will serve as an outline for your subsequent projects.
- Data Project (20%): Find an empirical regularity that relates to the topics in class using one of the publicly available datasets and then summarize related papers. Turn in short research paper along with code.
- Model Project (30%): Write down and solve a model that (you think/hope) can explain the regularities you found in the data project. Turn in short research paper that includes empirical work and new quantitative work.
- But basically, if you put effort into the class, you'll pass.

Some topics we will cover

- Exploring empirical regularities using panel data.
- Frictional models of the labor market.
- Incomplete markets models.
- Models that incorporate job search and incomplete markets.

Introduction/Research Proposal

- Idea: Write out the introduction to a paper on a question you are interested in.
- The goal is to give you "guideposts" for what you will do in subsequent projects.
- I have (or will have) a fairly general outline on my webpage.
- Must be a macro-labor related question.

Data Project

- Idea: We'll spend the first part of the course exploring "empirical regularities" about the labor market.
- These include:
  1. Income processes
  2. Labor market flows
  3. Labor market volatility
  4. Wage and income dispersion
  5. Lots of other topics as well
- You'll want to choose one of the datasets that I discuss and try to "discover" a feature of the data that might be possible to explore with a model.
- This doesn't have to be groundbreaking, so don't stress if you don't think can't find something huge.
- At the end, you'll give a short presentation about the findings and turn in a short research paper that will eventually (possibly) become the "empirical regularities" section of a quantitative paper.

Model Project

- Idea: The basic structure of a macro (or quantitative macro) paper is that you find some novel feature of the data and then write down a model to further explore it.
- That is what we'll do in the model project.
- Take the empirical regularity you explored in either previous project and develop a model that can (try) to explain it.
- You'll want to do a small extension to a previous model, solve it, and then simulate it to make predictions related to your data.
- The appropriate model will depend on the empirical regularity you find.
- If you end up interested in a different data topic, you aren't bound to what you did in either previous project.
- Like the data project, you'll present your work and turn in a working paper.

Scheduling

- I may miss a few classes, but I will let you know in advance.

Heterogeneity and the Macroeconomy

- Standard discrete time budget constraint:

$$c_t + a_{t+1} = (1 + r_t)a_t + w_t \tag{1}$$

- Standard macroeconomic models assume (among other things):
  1. Markets are frictionless: factors are paid their marginal product. $w_t = F_L, r_t = F_K$
  2. Markets are complete: agents can contract on any consumption path, subject to a resource constraint. i.e., there is no borrowing constraint.
- These assumptions are not always innocuous.

Heterogeneity and the Macroeconomy

- Basics of a macro model:

$$u'(c_t) = \beta E[(1 + r_{t+1})u'(c_{t+1})] \tag{2}$$

$$\text{s.t. } c_t + a_{t+1} = (1 + r_t)a_t + w_t \tag{3}$$

- Representative Agent:
  1. Single "average" agent that represents all workers in economy.
  2. Complete markets: contracts on risk that insulate from income and consumption shocks (assume r fixed):

$$E[u'(c_{t+1})] \approx u'(E[c_{t+1}]) \tag{4}$$

$$\rightarrow u'(c_t) = \beta(1 + r_{t+1})u'(E[c_{t+1}]) \tag{5}$$

$$\rightarrow c_t \approx c_{t+1} + \epsilon_{t+1} \tag{6}$$

  3. i.e., a permanent income hypothesis.

Heterogeneity and the Macroeconomy

- Basics of a macro model:

$$u'(c_t) = \beta E[(1 + r_{t+1})u'(c_{t+1})] \tag{7}$$
$$\text{s.t. } c_t + a_{t+1} = (1 + r_t)a_t + w_t \tag{8}$$
$$a_{t+1} \geq \underline{a} \tag{9}$$

- What about an agent who can't insure?

$$E[u'(c_{t+1})] > u'(E[c_{t+1}]) \tag{10}$$
$$\rightarrow u'(c_t) \not= \beta(1 + r_{t+1})u'(E[c_{t+1}]) \tag{11}$$
$$\rightarrow c_t \not= c_{t+1} + \epsilon_{t+1} \tag{12}$$

Heterogeneity and the Macroeconomy

- Basics of a macro model:

$$u'(c_t) = \beta E[(1 + r_{t+1})u'(c_{t+1})] \tag{13}$$

$$\text{s.t. } c_t + a_{t+1} = (1 + r_t)a_t + w_t \tag{14}$$

- What are the potential sources of heterogeneity?
  1. Consumption.
  2. Wealth.
  3. Labor income.
- We'll study models that explore breakdowns of perfect competition and complete markets and assess their impact on these quantities.

What We Want to Answer

- We want to take a structural approach to understanding
  1. Sources of heterogeneity.
  2. How individuals in the economy are different.
  3. Are these innate differences? Are they random?
  4. Are they temporary or permanent?
  5. What are the policy implications of these differences?
- Today: start by exploring the data.

Some Valuable Micro-Data Sources

- In class, we will typically discuss "micro-data":
  1. Panel Study of Income Dynamics (PSID): a panel of households from 1968-present, annually.
  2. National Longitudinal Survey of Youth (NLSY79, NLSY97): Two separate cohorts interviewed repeatedly at an annual frequency 1979-present and 1997-present.
  3. Survey of Income and Program Participation (SIPP): Series of panels that last 3-4 years. Each panel contains new participants.
  4. Current Population Survey (CPS): The main source of publicly available labor market information. A monthly survey that is representative. Some panel dimensions, but note that this lacks important panel components that the others retain.
  5. Current Expenditure Survey (CEX): Survey often used to connect expenditures in other panels to consumption.
  6. Survey of Consumer Finances (SCF): Cross-sectional survey with detailed information on household finances.
- You'll need to learn to work with at least one of these datasets.
- I'll provide code for most of them (not the CEX).

(Labor) Income and Wage Inequality

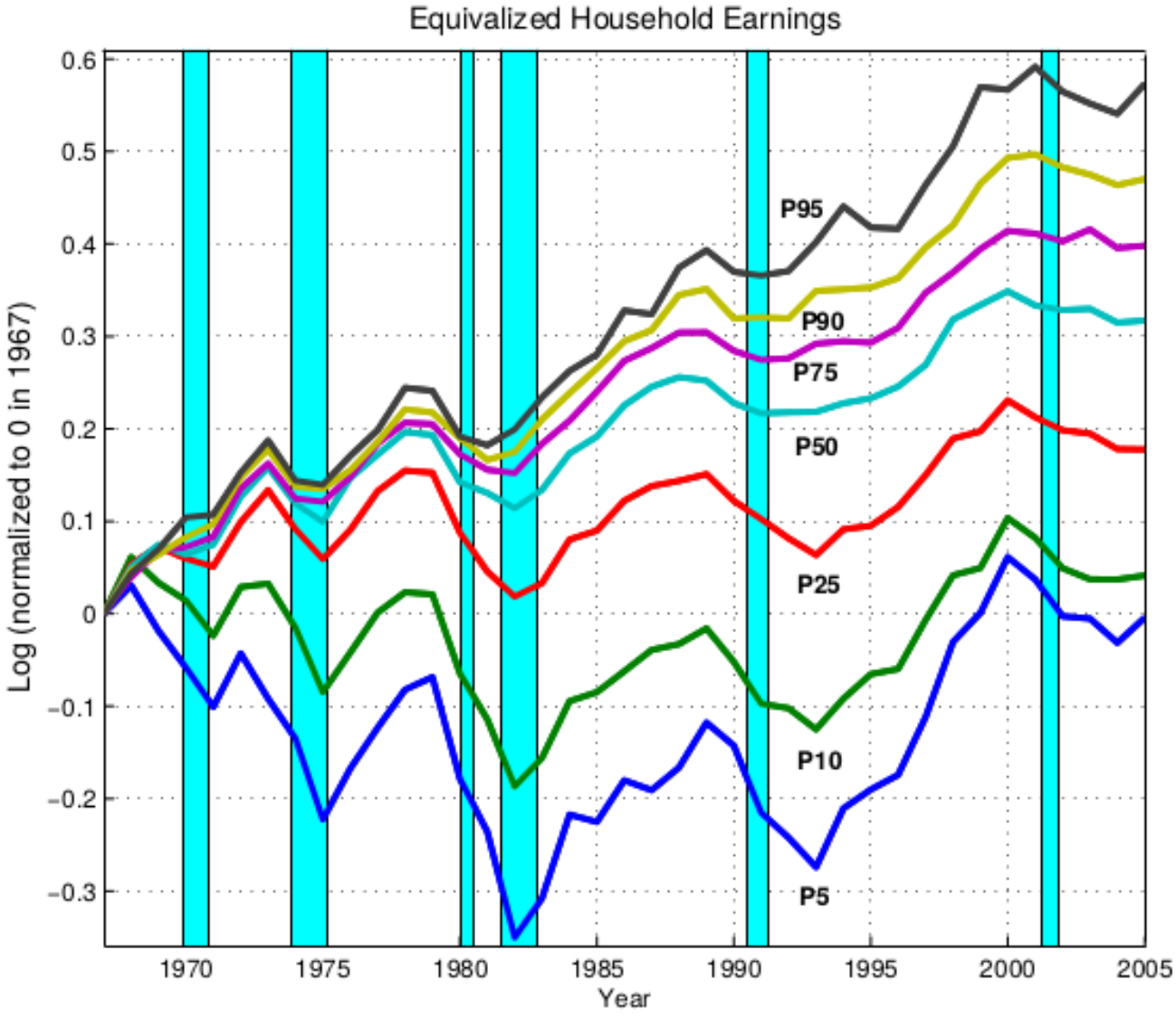
- Important distinction: $y_t = w_t \times h_t$.
- Note: income/earnings vs. labor income/earnings:
  total inc. $= w_t \times h_t + r_t \times a_t$.

$$ln(y_t) = ln(w_t) + ln(h_t) \tag{15}$$

$$\rightarrow Var(ln(y_t)) = Var(ln(w_t)) + Var(ln(h_t)) + Cov(ln(w_t), ln(h_t)) \tag{16}$$

- Income inequality will almost always exceed wage inequality (in the absence of very strong income effects).

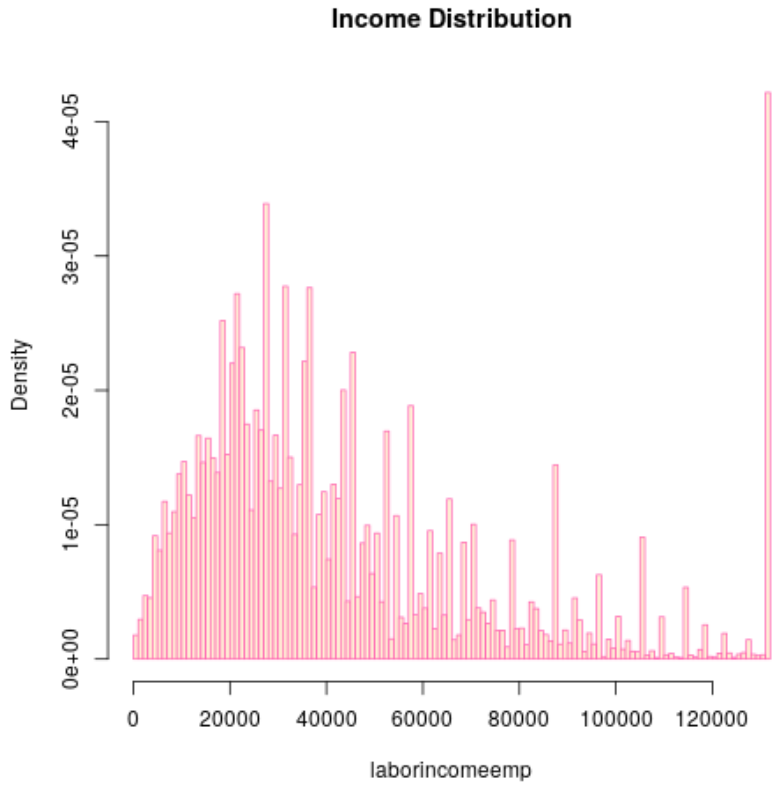
Income Inequality over Time

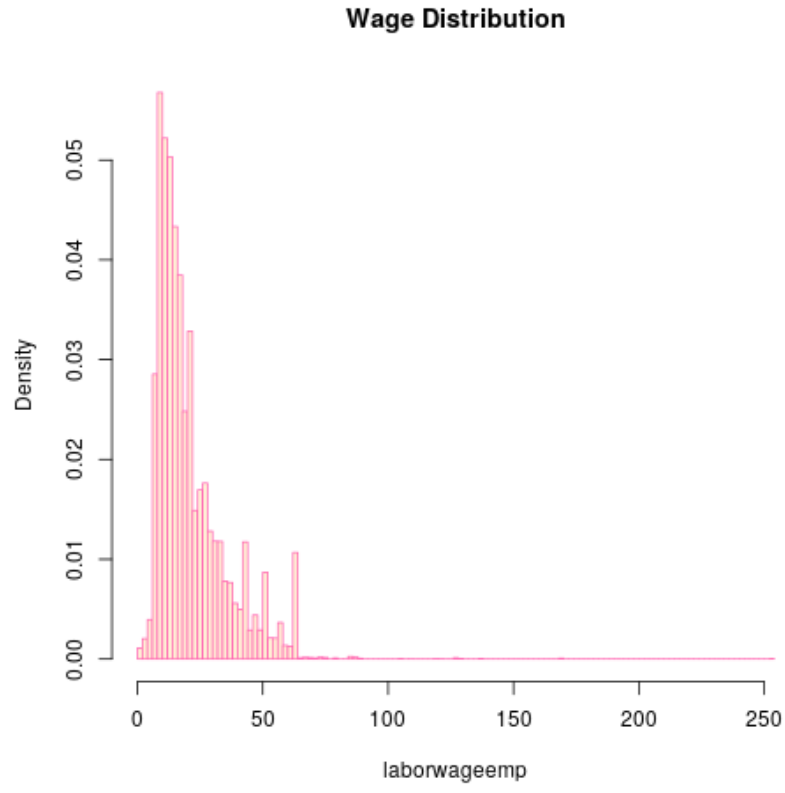


Source: Heathcote, Perri, Violante 2010

- What do you notice?

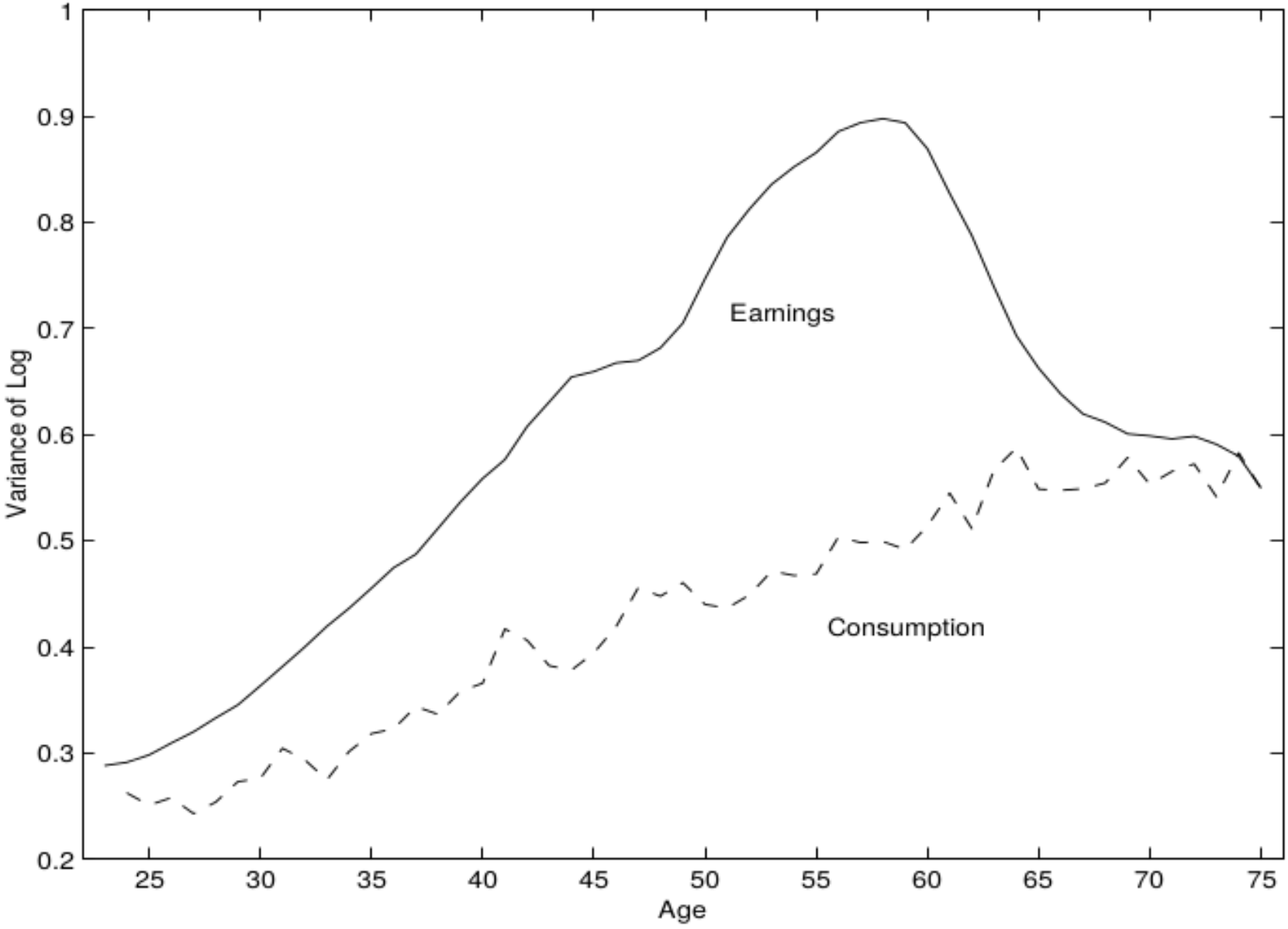
Income and Wage Inequality Today





Source: CPS Dec.-2017

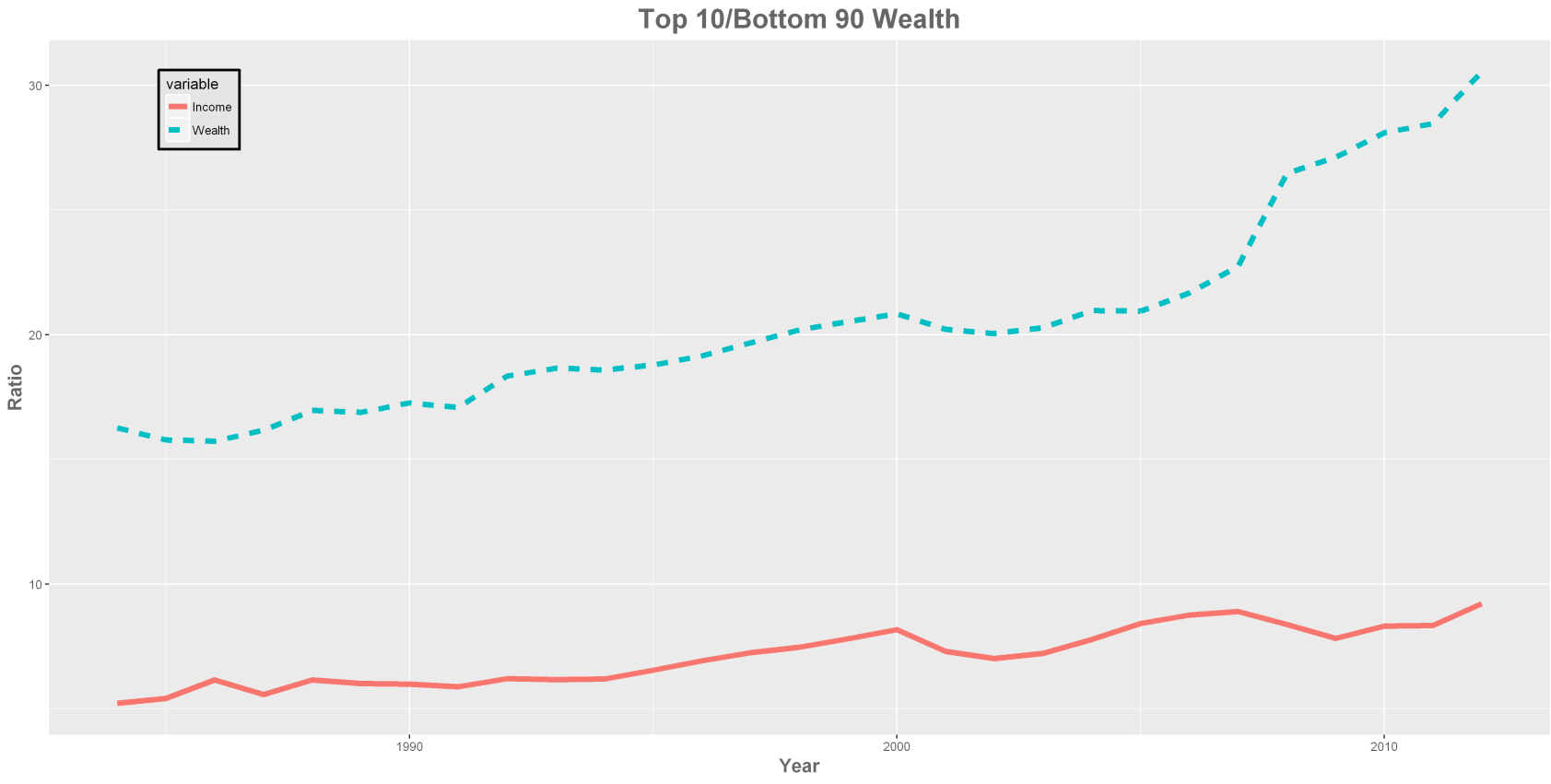
Income and Consumption Inequality



Source: Storesletten, Telmer, and Yaron 2004

Wealth and Total Income Inequality

- Wealth inequality dwarfs income inequality.



Source: Saez and Zucman/Piketty and Saez

- Why is that?

But Who Cares? Poor People are Just Less Productive!

- This is one possible explanation, and is the explanation we would arrive at in the absence of frictions.
- But that need not be true if workers face frictions in the income process or their ability to income smooth.
- Allows us to address
  1. How much inequality is predetermined? How much is due to shocks over the life-cycle?
  2. What are the sources of income and wage dispersion?
  3. Are they efficient?
  4. Are there policies that can decrease income or wealth dispersion efficiently?

Income Processes

- In conducting our quantitative exercises, we want an accurate model of income and wages for calibration & evaluation.
- Basic approach:
  1. Condition on observables in data and estimate residual earnings.
  2. Use model to understand the contributions to residual earnings.
- Some considerations:
  1. Make your data look as much like the model as possible.
  2. Does your model have an hours choice, i.e., an *intensive margin*? Then you want to match hourly wages.
- Good sources (where much of this comes from):
  - Chris Tonetti's Write-up on income processes
  - Gianluca Violante's slides on income processes

Residual Earnings

- Estimate the following:

$$Y_{i,j,t} = w_{i,j,t} \exp(f(X_{i,j,t}) + \epsilon_{i,j,t}) h_{i,j,t} \tag{17}$$

- where

$Y_{i,j,t}$: Total income of ind. i at age j, at time t

$w_{i,j,t}$: Hourly wages

$X_{i,j,t}$: Predictable component

$\epsilon_{i,j,t}$: Stochastic component

$h_{i,j,t}$: Hours worked

- Note: if your model has an *intensive margin*, i.e., choice of hours, estimate

$$y_{i,j,t} = \frac{Y_{i,j,t}}{h_{i,j,t}} = w_{i,j,t} \exp(f(X_{i,j,t}) + \epsilon_{i,j,t}) \tag{18}$$

Residual Earnings

- Estimate the following:

$$ln(Y_{i,j,t}) = ln(w_{i,j,t}) + ln(h_{i,j,t}) + f(X_{i,j,t}) + \epsilon_{i,j,t} \qquad (19)$$

- $X_{i,j,t}$ includes covariates (heterogeneity) that is observable and not central to the research question.
- Some examples:
  - Race, gender (usually just use males), marital status
  - Year, state, age
- You might try to explain the effect of a covariate, i.e., race on labor earnings.
- Usually, write down a model to understand the residual.

Statistical Model of Income

- We can think about residual earnings as being partially transitory:
  - Temporary layoff
  - Temporary hours cut
- And persistent:
  - College degree
  - Innate ability
  - Job-specific skills
- A statistical model (i.e., one with no explicit structural interpretation) will estimate the size of these two components over the life-cycle.

Statistical Model of Income

- If you are not micro-founding the income process (i.e., writing down a search model), need alternate model of income.
- Basic approach: specify two equation transitory and persistent model of income.
- Let $\tilde{Y}_{i,j}$ be residual log earnings of individual i at age j (remember, we controlled for time in the first stage).

$$\tilde{Y}_{i,j} = z_{i,j} + \psi_{i,j} \tag{20}$$

$$z_{i,j} = \rho z_{i,j-1} + \nu_{i,j} \tag{21}$$

$$\psi_{i,a} \sim iid(0, \sigma_\psi) \tag{22}$$

$$\nu_{i,a} \sim iid(0, \sigma_\nu) \tag{23}$$

$$z_{i,0} \sim iid(0, \sigma_z) \tag{24}$$

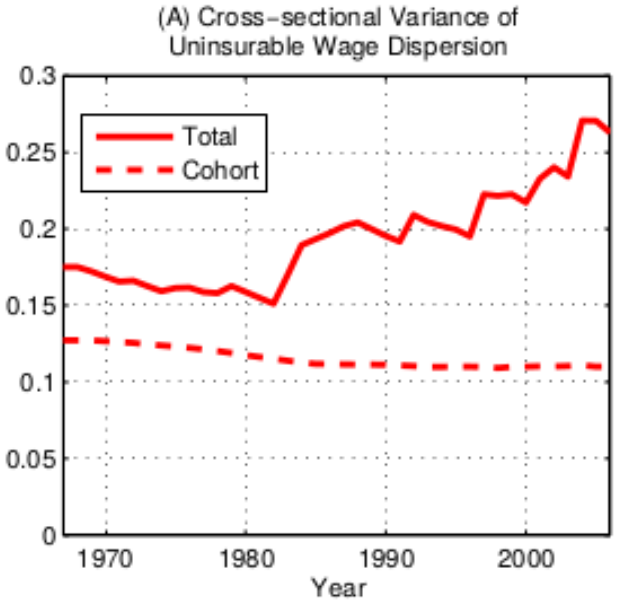
Statistical Model of Income

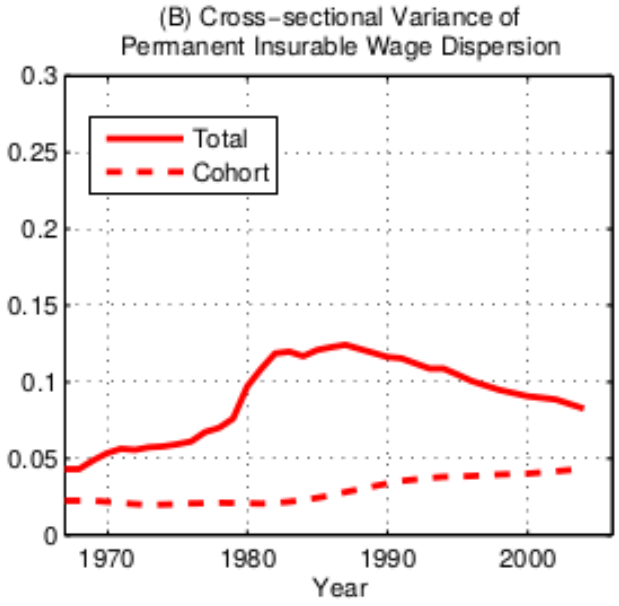
- Once we have ways of identifying each parameter (next time... probably), we can estimate it.

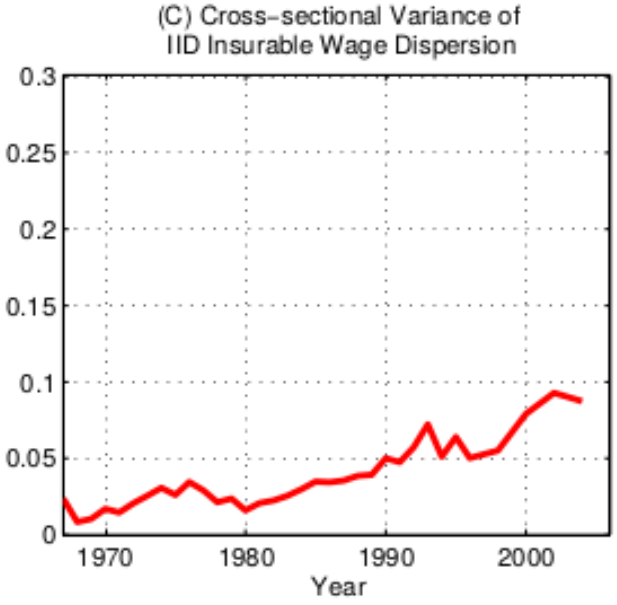
$$\tilde{Y}_{i,j} = z_{i,j} + \psi_{i,j} \tag{25}$$
$$z_{i,j} = \rho z_{i,j-1} + \nu_{i,j} \tag{26}$$
$$\psi_{i,a} \sim iid(0, \sigma_\psi) \tag{27}$$
$$\nu_{i,a} \sim iid(0, \sigma_\nu) \tag{28}$$
$$z_{i,0} \sim iid(0, \sigma_z) \tag{29}$$

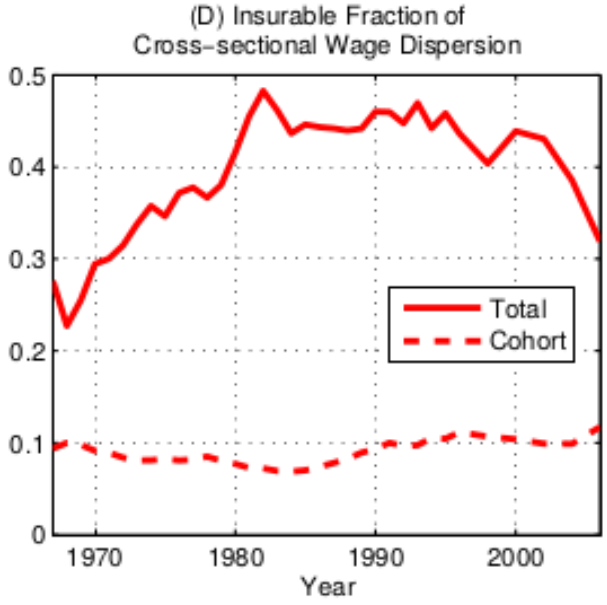
- What can we use it for?
  1. Calibration targets for a structural model.
  2. External validation of structural model.
  3. Better understanding of data.
- This also tells us roughly what fraction of income shocks are insurable (transitory) and what are not (permanent).

Statistical Model of Income









Key Assumptions

- We've assumed that earnings profiles are identical across individuals, conditional on the covariates we specified in the first-stage.
- But of course, there is heterogeneity in life-cycle income growth.
- How do we rationalize this? We allow for heterogeneity in income profiles.
- Next time.

Next Time

- Continue to study statistical models of income.
- Heterogeneous and restricted income profiles.
- Install the appropriate programming languages.
- Read Guvenen (2009).