



FEDERAL  
RESERVE  
BANK *of*  
ST. LOUIS

# CLASSIC POLICY BENCHMARKS FOR ECONOMIES WITH SUBSTANTIAL INEQUALITY

**James Bullard**, Federal Reserve Bank of St. Louis

**Riccardo DiCecio**, Federal Reserve Bank of St. Louis

XXV Annual Conference of the Central Bank of Chile  
“Heterogeneity in Macroeconomics: Implications for  
Monetary Policy”

Nov. 22, 2022  
Santiago, Chile

Any opinions expressed here are our own and do not necessarily reflect those of the FOMC.

# Introduction

## THIS TALK

- This is an academic talk that updates material that has been presented previously, most recently in Minneapolis, October 15, 2021; London, March 23, 2021; and the Dow Lecture, February 9, 2021.
- The present conference concerns the topic “Heterogeneity in Macroeconomics: Implications for Monetary Policy.”
- I want to use my opportunity for remarks to outline an argument that the contribution of the central bank to optimal macroeconomic policy may not be importantly altered by the presence of heterogeneous households.
  - In particular, the central bank should still strive to achieve the “correct” real interest rate for the economy, the “Wicksellian natural real rate of interest,” just as in the standard New Keynesian model.

## OUTLINE OF THE ARGUMENT

- We construct a heterogeneous-agent economy featuring:
  - Three aggregate shocks: (1) total factor productivity, (2) labor supply and (3) aggregate demand.
  - Both permanent and temporary idiosyncratic risk at the household level.
  - A simple and symmetric structure.
  - Income, wealth, and consumption inequality on the same scale as in observed economies.
- We include four policymaking authorities: (1) monetary, (2) fiscal, (3) labor market and (4) education.
- We describe a competitive equilibrium in which the four policymakers act in concert to attain a first-best allocation of resources.

## A CLASSIC VIEW

- What is interesting for this conference on “Heterogeneity in Macroeconomics” is that the policymaker roles are “classic.”
  - The monetary authority reacts to aggregate shocks each period in order to achieve the Wicksellian natural real rate of interest for the economy.
  - The fiscal authority raises revenue via a non-state contingent linear labor income tax on all households.
  - The labor market authority runs an unemployment insurance program.
  - The education authority minimizes the variance of beginning-of-life human capital endowments.
- *Hence, the main result is that classic policy prescriptions can achieve the first-best allocation of resources in this benchmark heterogeneous-agent economy.*
  - This result may be helpful in understanding somewhat more complicated economies that deviate from this benchmark including ones in the papers presented at this conference.

## SOME SURPRISING FINDINGS

- The proposed classic policy recommendations appear broadly similar to actual policies in place in many economies.
  - The monetary authority meets often and reacts to current developments.
  - Simple linear labor income taxes set for the long run can be used without distorting the labor supply.
- The best policy combination drives the consumption Gini toward zero but leaves income and financial wealth Ginis substantially positive—suggesting that some observed income and financial wealth inequality is due to life-cycle effects alone.
- There are asset-rich and asset-poor agents with high marginal propensities to consume (MPCs) as part of the optimal allocation of resources.
- The model has a paper-and-pencil solution despite the three aggregate shocks and the idiosyncratic risk.

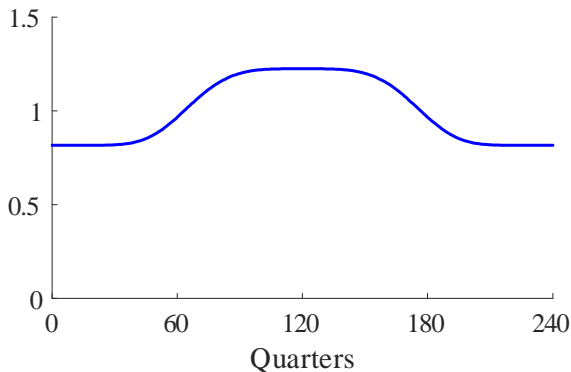
# Environment

## LIFE-CYCLE MODELS

- We construct a general-equilibrium life-cycle economy with “symmetry assumptions” which could be relaxed in a computational exercise.
- Each period, a new continuum of households enters the economy, makes economic decisions over the next  $T + 1 = 241$  periods (“quarterly”), then exits the economy.
- As each agent enters the economy they are randomly assigned a life cycle productivity profile that they will use for their whole life.
- We view this as a proxy for the human capital development that takes place before age 20 in actual economies.
- Related to Huggett, Ventura, and Yaron (2011, *AER*).

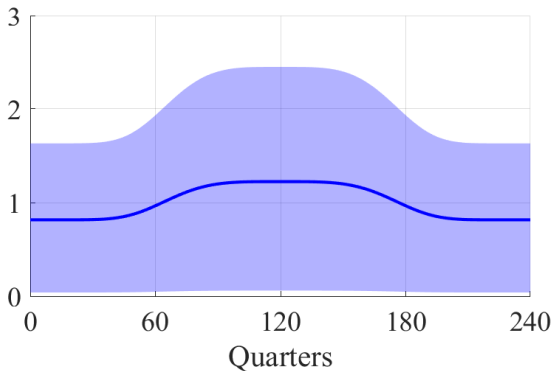


## BASELINE LIFE-CYCLE PRODUCTIVITY



**FIGURE:** A baseline personal productivity endowment profile. The profile is symmetric and peaks in the middle period of the life cycle at a level about 50% greater than at the beginning or end. A full model would include a set of symmetric profiles with differing shapes.

## THE MASS OF LIFE-CYCLE PRODUCTIVITY



**FIGURE:** The mass of endowment profiles with the scaling factor drawn from a uniform distribution  $U [0.05, 1.95]$ . Drawing from a lognormal distribution is harder to visualize, but such a distribution would include arbitrarily rich and arbitrarily poor households. The endowment Gini is about 35%.

## ADDITIONAL IDIOSYNCRATIC RISK

- Households can earn income in a competitive economywide labor market by supplying hours along with the productivity they have available at that date.
- At the beginning of each period, each household may be randomly unemployed.
- The household earns no income from work on dates of unemployment.
- The unemployment probability is *i.i.d.* and uncorrelated with the aggregate shock.

## NON-STATE CONTINGENT NOMINAL CONTRACTING

- There is a key friction in the credit market: non-state contingent nominal contracting.
- There are two aspects to this assumption.
  - The non-state contingent aspect means that real resources are misallocated via this friction.
  - The nominal aspect means that the monetary authority may be able to fix the distortion to the equilibrium through appropriate monetary policy.

# Four Policymakers

## FOUR POLICYMAKING ENTITIES

- There are four policymaking entities.
  - The monetary authority can observe the three aggregate shocks at the beginning of date  $t$  and then set the price level  $P(t)$ .
  - The fiscal authority can set taxes on labor or capital income to raise an exogenously specified fraction of available real output.
  - The labor market authority observes household-specific unemployment shocks, sets taxes and provides household-specific transfers.
  - The education authority can control the initial dispersion of life-cycle productivity profiles by controlling the standard deviation up to some limit  $\sigma_{\min} \geq 0$ .

## THE PROPOSED POLICY MIX

- The proposed policy mix is as follows:
  - The monetary policymaker follows an NGDP targeting rule.
  - The fiscal authority sets a linear tax on all labor income earned that is sufficient to meet its revenue requirement.
  - The labor market authority sets a linear tax on all labor income earned that is sufficient to provide appropriate transfers to unemployed households.
  - The education authority minimizes the dispersion of life-cycle productivity profiles by setting  $\sigma = \sigma_{\min}$ .

## THE WICKSELLIAN NATURAL REAL RATE OF INTEREST

### THEOREM

*Under the proposed policy mix, the real interest rate is exactly equal to the stochastic aggregate output growth rate at every date and an equal-treatment social planner that discounts at this rate will conclude that this is a social optimum.*

### COROLLARY (EQUITY SHARE CONTRACTING)

*Any two households that share the same productivity profile consume the same amount at each date, and consumption growth is equalized for all households.*

### COROLLARY

*Desired labor supply over the life cycle depends on the shape of the productivity profile alone.*



# Characterizing the Policies

## POLICY CHARACTERIZATION

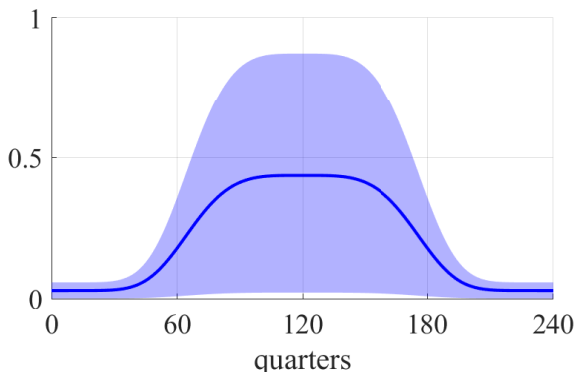
- Monetary policy, fiscal policy, and labor market policy are relatively standard.
- “Education policy” influences the productivity profile dispersion parameter  $\sigma$ .
- One could interpret this as an idealized insurance market that operates before households enter the economy at age 20.
- Limiting case:  $\sigma_{\min} = 0$ , all households receive the same profile.
- This would be a “perfectly equal” economy in that the talent/human capital distribution would collapse to just one life-cycle pattern.
  - This would drive the consumption Gini all the way to zero.
  - However, the income and wealth Gini coefficients would remain close to observed values—these are driven mostly by the life-cycle structure.

# Characterizing the Equilibrium

## LABOR INCOME

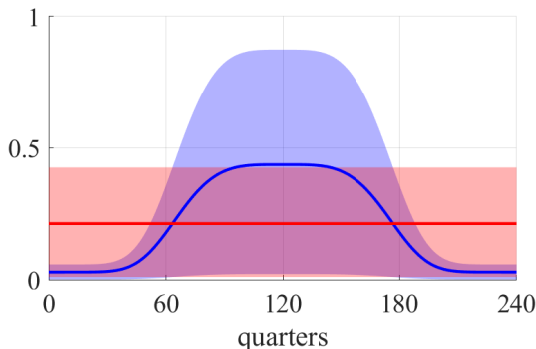
- Households want to work more when they are in their peak earning years in the middle of the life cycle.
- This creates substantial labor income inequality.

## LABOR INCOME MASS



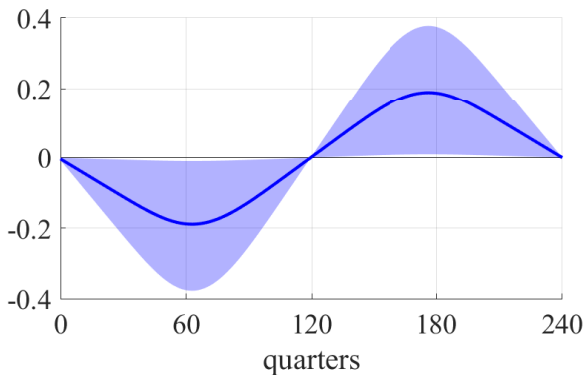
**FIGURE:** Cross section: Labor income profiles with unemployment insurance. Personal productivity peaks at the middle of the life cycle, and households work more at that time as well, making income even more concentrated in the peak earning years. The blue line depicts the limiting case  $\sigma_{\min} = 0$ .

## CONSUMPTION MASS



**FIGURE:** Cross section: Schematic consumption mass (red) and labor income mass (blue). Under optimal monetary policy, the private credit market reallocates uneven labor income into perfectly equal consumption along each productivity profile. The consumption Gini is 31.7%, similar to values calculated from U.S. data. The solid lines depicts the limiting case with  $\sigma_{\min} = 0$ .

## NET ASSET HOLDING MASS



**FIGURE:** Cross section: Schematic net asset holding mass relative to GDP by cohort. Borrowing, the negative values to the left, peaks at stage 60 of the life cycle (age ~35), while positive assets peak at stage 180 of life (age ~65). The financial wealth Gini is 72.7%, similar to values calculated in U.S. data. The blue line depicts the limiting case with  $\sigma_{\min} = 0$ .

## MARGINAL PROPENSITY TO CONSUME

- Consumption is linear in the real wage

$$c_{t,i}(t+s) = \eta \bar{\xi} \bar{e} w(t+s).$$

- Labor income is linear in the real wage

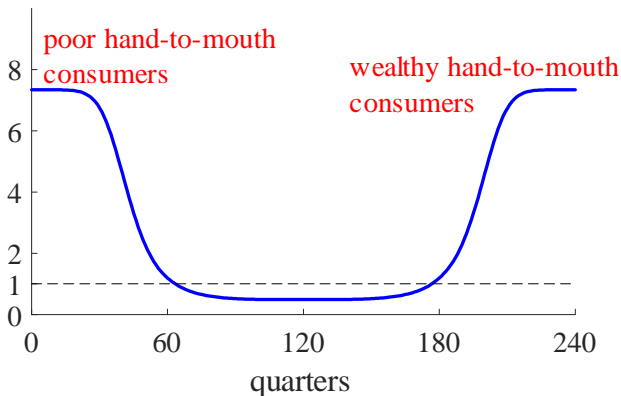
$$Y_{1;t,i}(t+s) = \xi e_s [1 - \ell_t(t+s)] w(t+s).$$

- Hence, the MPC can be calculated as follows:

$$MPC = \frac{dc/dw}{dY_1/dw} = \frac{\eta \bar{e} \bar{\xi}}{e_s \bar{\xi} \left[ 1 - (1 - \eta) \frac{\bar{e}}{e_s} \right]} = \frac{\eta \bar{e}}{e_s - (1 - \eta) \bar{e}}$$



## YOUNG AND OLD AGENTS HAVE HIGH MPC



**FIGURE:** Cross section: Marginal propensity to consume out of labor income by cohort. Notice that the MPC does not depend on the endowment scaling factor,  $\zeta$ .

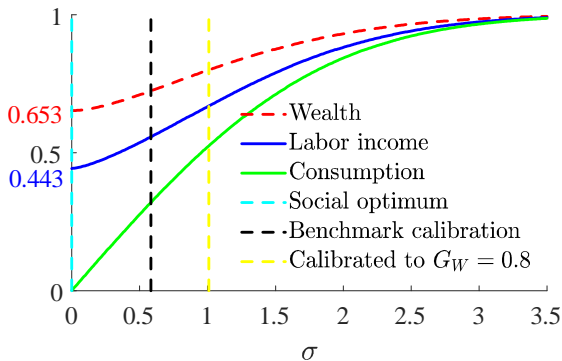
# Inequality

## GINI COEFFICIENTS

	<b>Wealth</b> W	$Y_1$	<b>Income</b> $Y_2$	$Y_3$	<b>Consumption</b> C
U.S. data	80%		51%		32%
Uniform	72.7%	56.1%	51.5%	59.5%	31.7%
Lognormal	72.4%	55.7%	51.1%	59.0%	32%

**TABLE:** Gini coefficients in the U.S. data and in the model with uniform and lognormal productivity.

## PRODUCTIVITY DISPERSION AND GINI COEFFICIENTS



**FIGURE:** As the dispersion of productivity profiles,  $\sigma$ , increases, the Gini coefficients increase. The ordering  $G_W > G_Y > G_C$  is preserved. The case where  $\sigma_{\min} = 0$  has  $G_C = 0$ , but  $G_W = 65.3\%$  and  $G_Y = 44.3\%$ . The model can match any single Gini with a sufficiently large choice of  $\sigma$ .

# Conclusions

## CONCLUSIONS

- A classic combination of policies can deliver a first-best allocation of resources in this environment even with substantial inequality in income, wealth, and consumption.
  - A monetary policymaker provides period-by-period insurance against aggregate shocks by conducting policy to achieve the Wicksellian natural real rate of interest—the same as in a baseline New Keynesian model.
  - This enables non-distortionary linear labor income taxes to fund government expenditures as well as an unemployment insurance program.
  - A perfectly executed “education policy” can drive the consumption Gini toward zero but would leave income and wealth Ginis at positive levels.
- Bottom line: The nature of modern conceptions of optimal monetary policy—“achieve the Wicksellian natural real rate of interest”—would be unchanged even in this economy with substantial income and wealth inequality.