FEDERAL RESERVE BANK of ST. LOUIS

CENTRAL TO AMERICA'S ECONOMY®

# Optimal Monetary Policy for the Masses

**James Bullard** (FRB of St. Louis)
**Riccardo DiCecio** (FRB of St. Louis)

University of Birmingham
Birmingham, United Kingdom
Aug. 9, 2018

# Introduction

# INEQUALITY AND MONETARY POLICY

- Interest in income, financial wealth, and consumption inequality has increased in the last decade.
- Can monetary policy be conducted in a way that benefits all households even in a world of substantial heterogeneity?
- The answer in this paper is "yes."
- Material has been posted online and previously presented at the Norges Bank, the St. Louis Fed, the Dallas Fed, the Texas Monetary Conference, and the Barcelona Workshop on Monetary Policy and Central Banking.

# SOME RECENT LITERATURE

- Kaplan, Moll, and Violante (*AER*, 2018):
  - NK macro with heterogeneous households ("HANK"); reasonable Gini coefficients.
  - The monetary policy transmission mechanism is substantially altered relative to standard model.
- Bhandari, Evans, Golosov, and Sargent (Working paper, NYU, 2018):
  - Incomplete markets, nominal friction, heterogeneous households ("HAIM"); reasonable Gini coefficients.
  - Optimal monetary-fiscal policy (Ramsey) substantially altered relative to standard model.
  - See A. Bhandari, D. Evans, M. Golosov, and T. Sargent, "Inequality, Business Cycles, and Monetary-Fiscal Policy," Working Paper, New York University, June 6, 2018, available at `http://www.tomsargent.com/research/begs2.pdf`.

# SOME RECENT LITERATURE

- Bullard and DiCecio (Working paper, St. Louis Fed, 2018):
  - Incomplete markets, nominal friction, heterogeneous households ("HAIM"); reasonable Gini coefficients.
  - Optimal monetary policy repairs the distortion caused by the friction for all households.
- See also the conference on "Monetary Policy and the Distribution of Income and Wealth," held at the St. Louis Fed on Sept. 11–12, 2015. Program available at `https://research.stlouisfed.org/conferences/monetary_policy_conf/program`.

# WEALTH, INCOME, AND CONSUMPTION INEQUALITY

- There is a lot of financial wealth, income, and consumption inequality in this stylized model.
- The role of credit markets, if they work correctly, is to reallocate uneven income across the life-cycle into perfectly equal consumption shares by cohort, appropriately scaled by life cycle productivity.
- The model equilibrium generates realistic Gini coefficients.

# OPTIMAL MONETARY POLICY

- The role of monetary policy in this model is to make sure credit markets are working correctly (i.e., complete).
- Practically speaking, this optimal monetary policy looks like "nominal GDP targeting."
- This result continues to hold even when there is "massive" heterogeneity—enough heterogeneity to approximate income, financial wealth, and consumption inequality in the U.S.
- Hence, *the main result is that NGDP targeting constitutes "optimal monetary policy for the masses" in this environment*.

# Environment

# LIFE-CYCLE MODELS

- General-equilibrium life-cycle economy.
  - Each period, a new cohort of households enters the economy, makes economic decisions over the next 241 periods, then exits the economy. The model is therefore "quarterly."
  - Households have log preferences defined over consumption and leisure.
  - Households are assigned a personal productivity profile when they enter the model.
  - The profile is symmetric—it begins low, rises and peaks exactly in the middle of life, then declines back to the low level. There will be many of these, as discussed below.
  - Productivity units determine the value of an hour worked in a competitive labor market.
  - There is no population growth in this version.

# HOUSEHOLD CREDIT

- The overlapping-generations structure creates a large private credit market essential to good macroeconomic performance.
- Relatively young households want to borrow to move consumption forward in the life cycle, while middle-aged households wish to save for retirement. So households in the middle of life lend to the relatively young.
- The key variable is therefore *privately issued* household debt. Household debt outstanding in the U.S. is on the order of GDP, around $20 trillion.
- As practical motivation, think of privately issued debt = "mortgage-backed securities."

# NON-STATE CONTINGENT NOMINAL CONTRACTING

- There is a friction in the credit market: Non-state contingent nominal contracting (NSCNC).
- *NSCNC: Loans are dispersed and repaid in the unit of account—that is, in nominal terms—and are not contingent on income realizations.*
- There are two aspects to this friction:
  - 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.

# LINEAR PRODUCTION TECHNOLOGY

- Output is produced using a technology that is linear in the labor input.
- In the equilibrium we study, the labor input (hours worked) will be constant.
- The level of technology (aka "aggregate productivity") grows at a stochastic rate.
  - The technology growth rate is bounded so that the ZLB is avoided.
- The real wage grows at the same stochastic rate as aggregate productivity.

# TIMING PROTOCOL

- At the beginning of every date, nature moves first and chooses the growth rate of aggregate productivity, which therefore implies a value for the real wage.
- The policymaker moves next and chooses a value for the price level.
- Households then decide how much to work, consume, and save.

# NOMINAL INTEREST RATE DETERMINATION

- Households meet in a competitive market for nominally denominated, non-state contingent loans.
- The non-state contingent nominal interest rate, "the contract rate," that clears this market is given by expected nominal GDP growth.
- In the equilibrium we study, this expectation is the same for all households, even those born at different dates or with different levels of personal productivity.

# THE EQUILIBRIUM MONETARY POLICY CREATES

- The monetary policymaker follows a nominal GDP targeting rule that delivers complete-markets consumption allocations.[1]
  - That is, low inflation in response to a high realization of the aggregate productivity growth rate, and vice versa.
- Given this policy rule, households consume equal amounts of available production, given their productivity, "*equity share contracting*," which is optimal under homothetic preferences.
- This means that any two households that share the same personal productivity profile will consume the same amount at each date.
- The nominal GDP targeting rule perfectly insures the household against future shocks to income.
- Income, consumption, and asset holdings fluctuate from period to period but in proportion to the value of the real wage.

[1] Similar to Sheedy (*BPEA*, 2014) and Koenig (*IJCB*, 2013).

# THE WICKSELLIAN NATURAL REAL RATE OF INTEREST

- The equilibrium we study has the following property:
  - *The real interest rate is exactly equal to the output growth rate at every date, even in the stochastic economy.*
- One could think of this as "the Wicksellian natural real rate of interest."
- This in turn creates a set of easy-to-understand baseline results for this stylized economy.

# Life-Cycle Productivity

# LIFE-CYCLE PRODUCTIVITY PROFILES

- Households entering the economy draw a scaling factor and receive a life-cycle productivity profile, which is a scaled version of the baseline profile.
- Life-cycle productivity profiles, once assigned, are deterministic.
- This process is a stand-in for the human capital development that takes place before age 20 in actual economies, including schooling, parenting, and any pre-age 20 job experience.
- Huggett, Ventura, and Yaron (*AER*, 2011) argue that differences in human capital initial conditions are more important than differences in shocks for life-cycle earnings.

# BASELINE LIFE-CYCLE PRODUCTIVITY

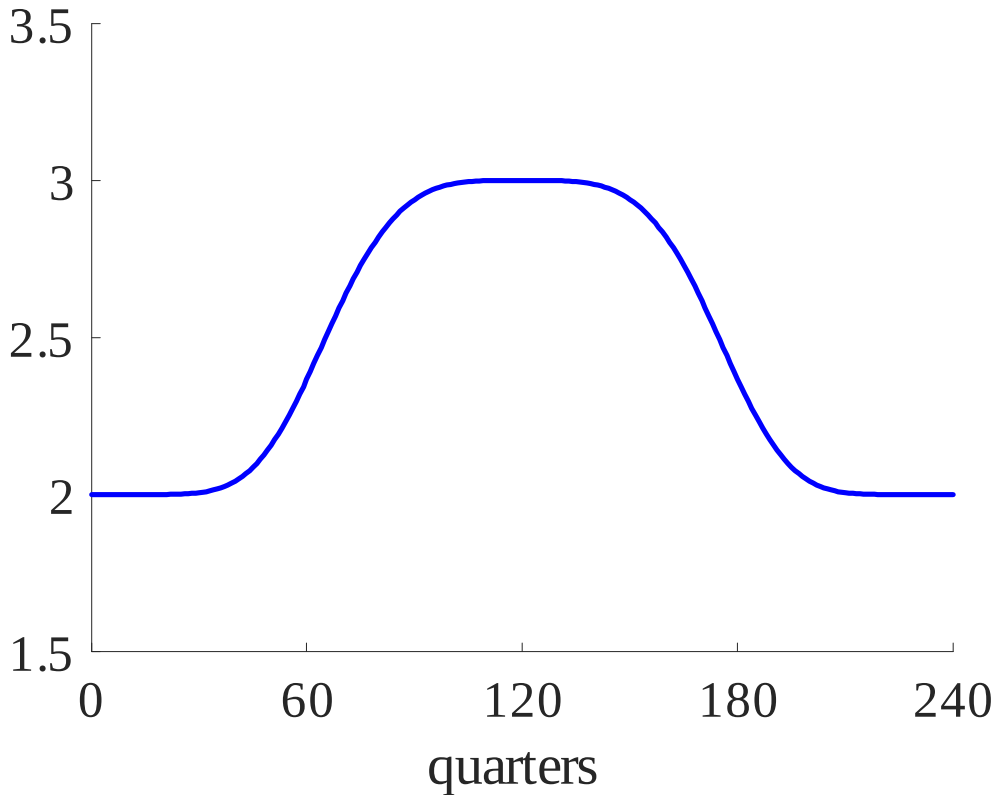


FIGURE: Baseline endowment profile. The profile is symmetric and peaks in the middle period of the life cycle.

# THE MASS OF LIFE-CYCLE PRODUCTIVITY

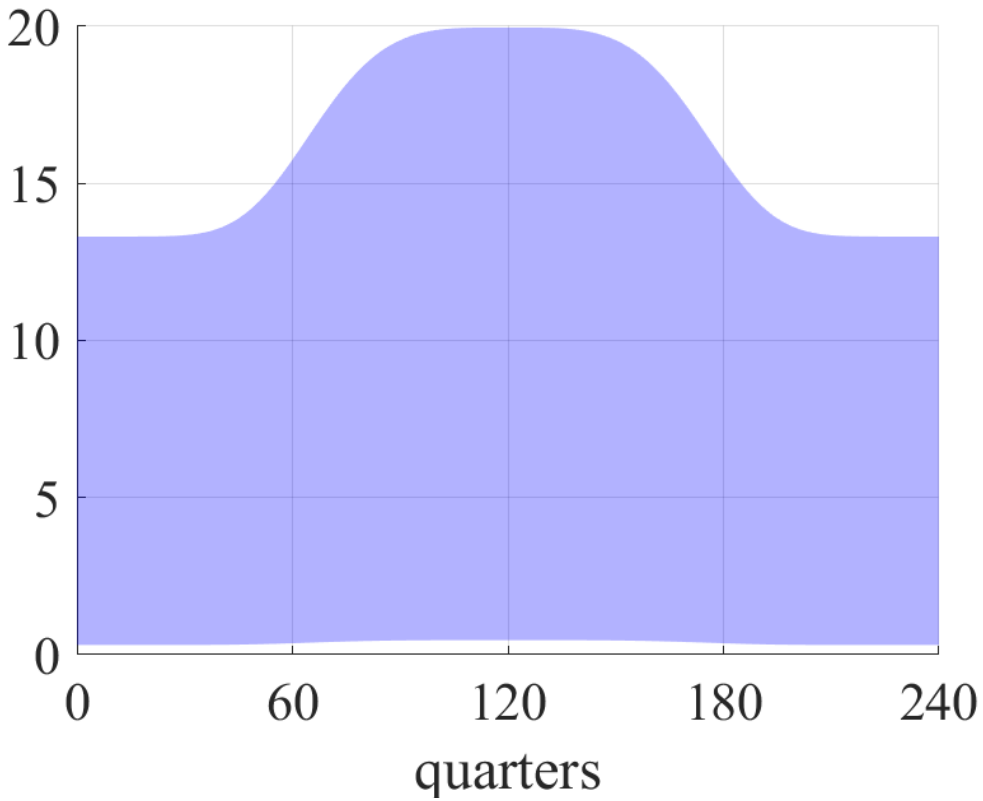


FIGURE: The mass of endowment profiles.

# Characterizing the Equilibrium

# LABOR/LEISURE

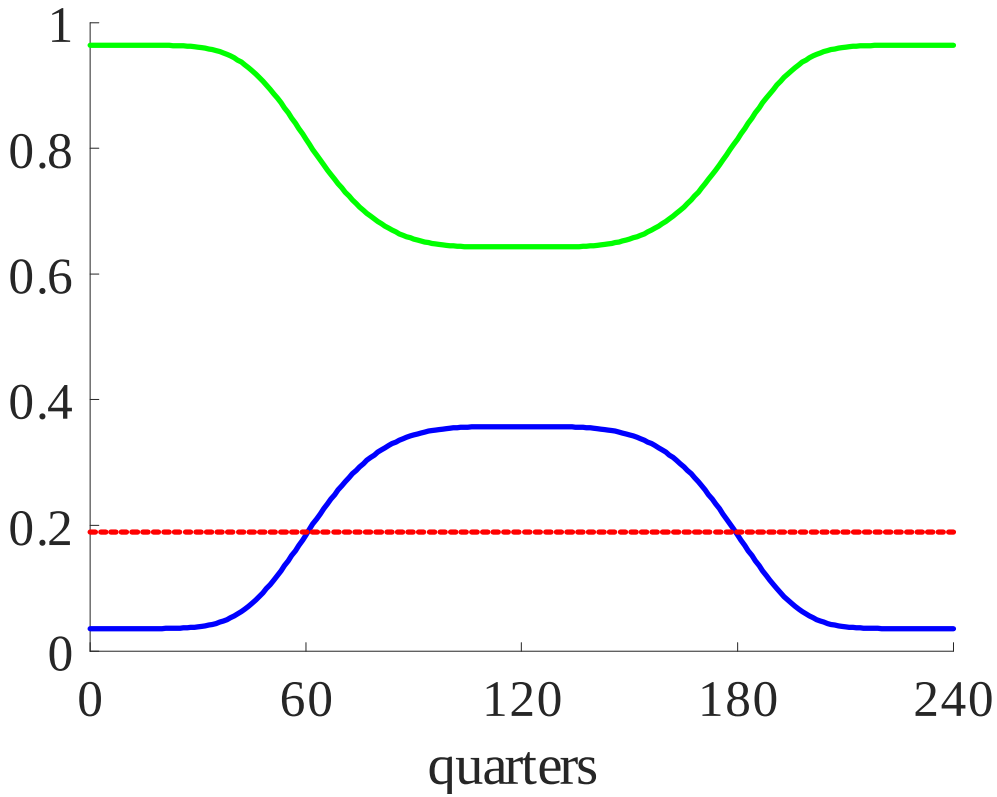


FIGURE: Cross section: Leisure decisions by age (green), labor supply by age (blue), and fraction of work time in U.S. data, 19% (red). The labor/leisure choices depend on age only. High-income households work the same hours as low-income households at each age.

# LABOR INCOME MASS

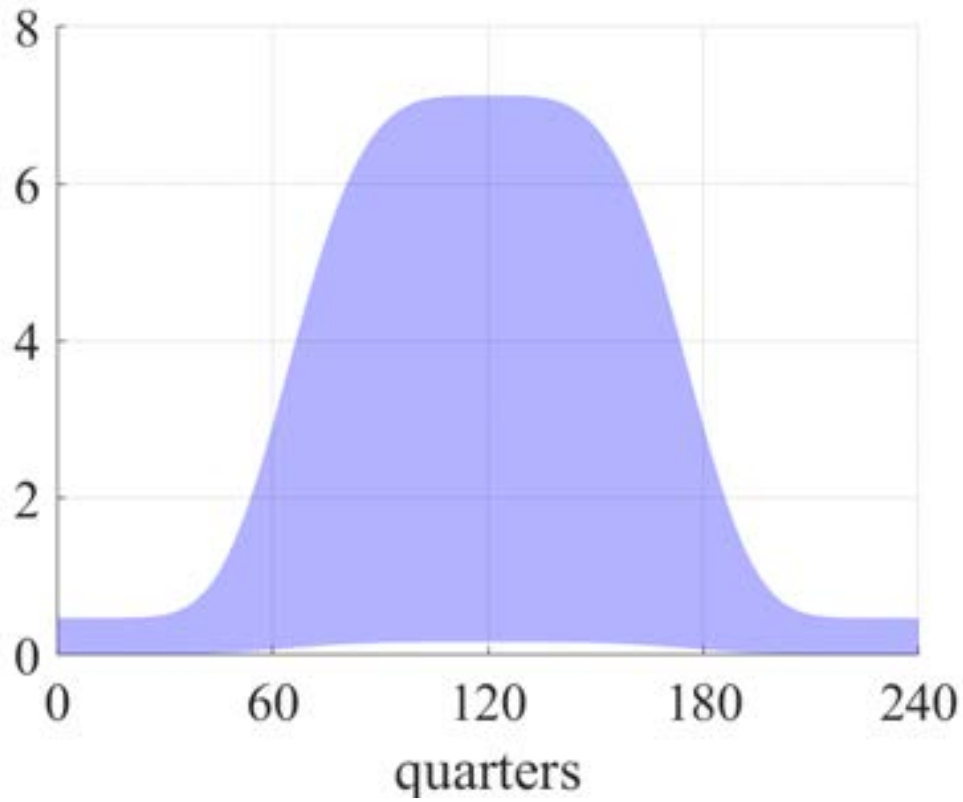


FIGURE: Cross section: Labor income profiles. Personal productivity peaks at the middle of the life cycle, and households work more at that time as well, making income even more concentrated in the peak earning years.

# CONSUMPTION MASS

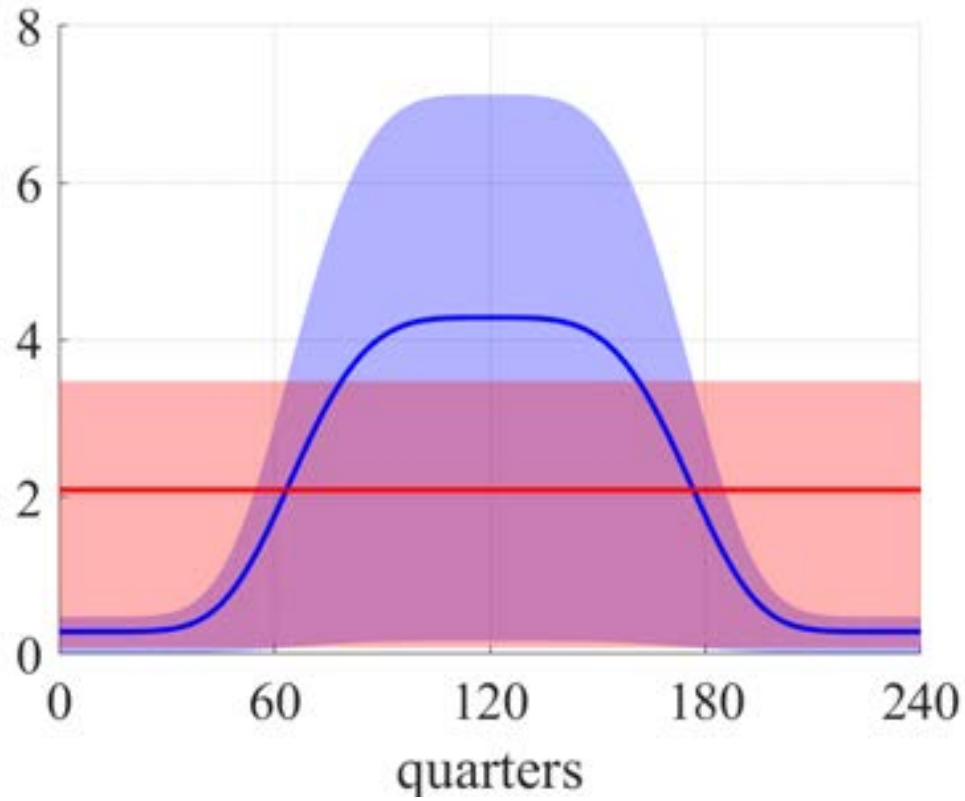


FIGURE: Cross section: Consumption mass (red) and labor income mass (blue) along the complete-markets balanced growth path. Under optimal monetary policy, the private credit market reallocates uneven labor income into perfectly equal consumption for each productivity profile. The consumption Gini is 31.8%, similar to values calculated from U.S. data.

# NET ASSET HOLDING MASS

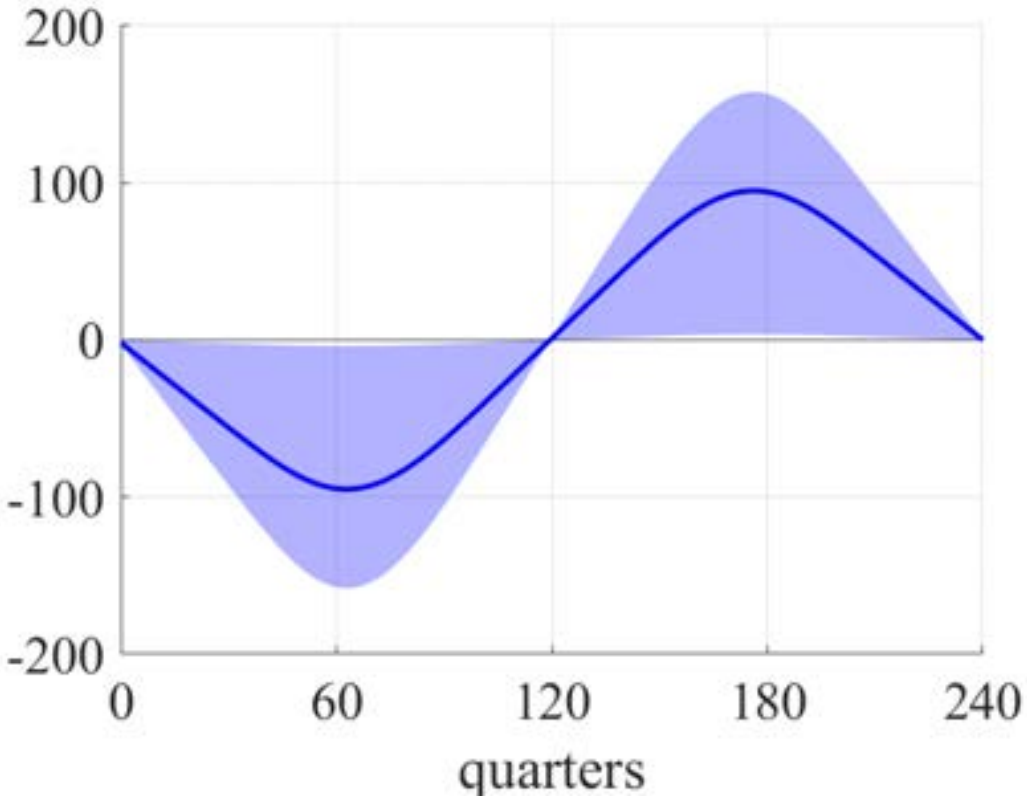


FIGURE: Cross section: Net asset holding mass. Borrowing, the negative values to the left, peaks at stage 60 of the life cycle (age ~35), while positive assets peak at stage 180 of life (age ~65). The financial wealth Gini is 72.7%, similar to values calculated in U.S. data.

# THREE NOTIONS OF INCOME

- Three notions of income:
  1. Labor income $(Y_1)$.
  2. Labor income plus non-negative capital income $(Y_2)$.
  3. The non-negative component of total income $(Y_3)$.
- Gini coefficients of the various income distributions: $G_{Y_1} = 56.2\%$, $G_{Y_2} = 51.6\%$, $G_{Y_3} = 59.6\%$.

# LABOR INCOME + NON-NEGATIVE CAPITAL INCOME

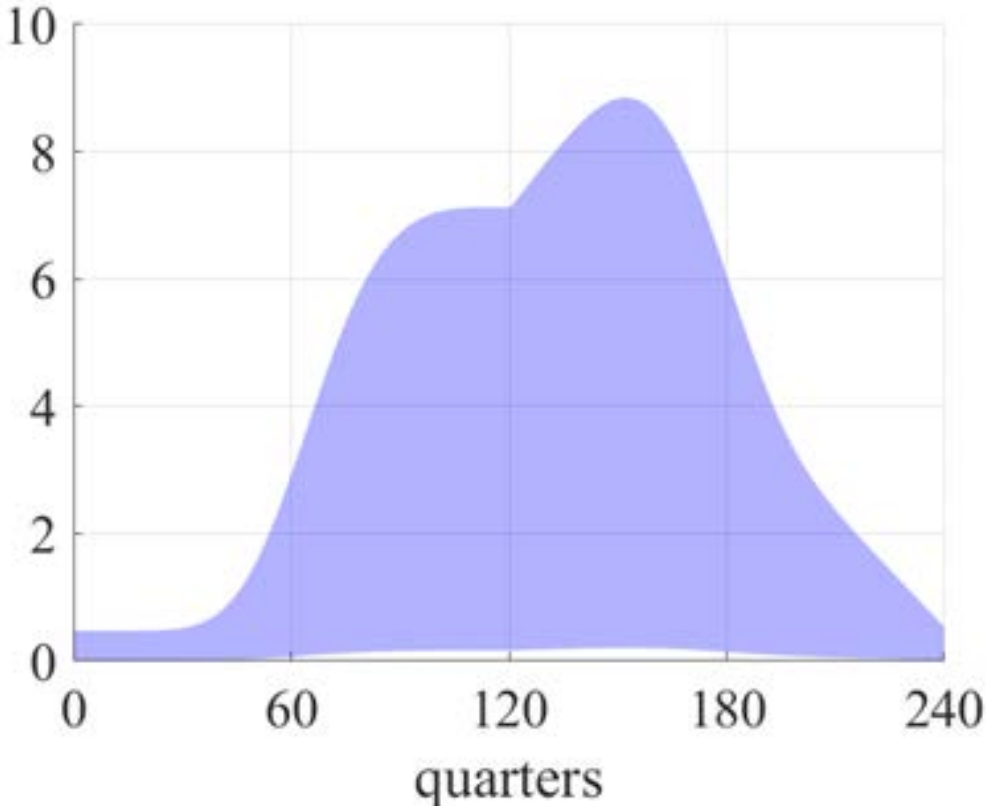


FIGURE: Cross section: Profiles of labor income and non-negative capital income.

# NON-NEGATIVE TOTAL INCOME

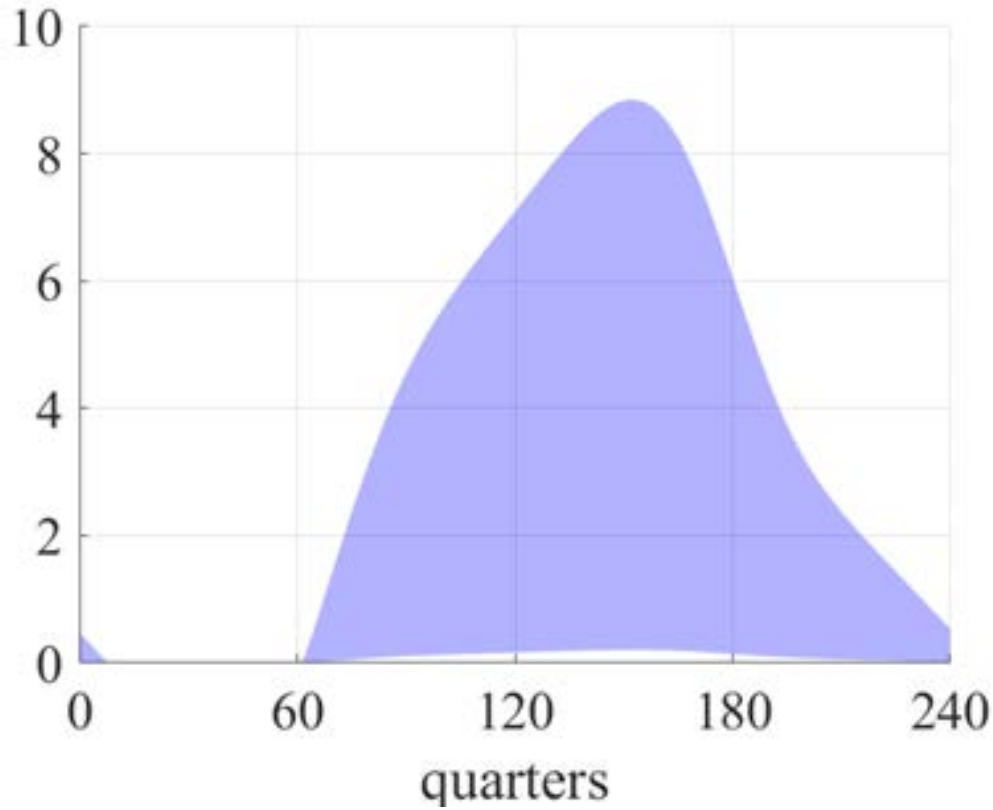


FIGURE: Cross section: Profiles of non-negative total income.

# Inequality

# DATA ON INEQUALITY IN THE U.S.

- Consumption (Heathcote, Perri, and Violante, *RED*, 2010): $G_{C,\text{U.S.}} = 32\%$.
- Income (CBO, 2016): pre-taxes/transfers $G_{Y,\text{U.S.}} = 51\%$; post-taxes/transfers $G_{Y,\text{U.S.}} = 43\%$.
- Financial wealth (Davies, Sandström, Shorrocks, and Wolff, *EJ*, 2011): $G_{W,\text{U.S.}} = 80\%$.

# INEQUALITY IN THE MODEL

- Financial wealth is defined as the non-negative part of net assets.
- Model

$$G_W = 72.7\% > G_{Y_2} = 51.6\% > G_C = 31.8\%,$$

versus U.S. data

$$G_{W,\text{U.S.}} = 80\% > G_{Y,\text{U.S.}} = 51\% > G_{C,\text{U.S.}} = 32\%.$$

# Policy

# INTERPRETING MONETARY POLICY

- The nominal GDP targeting rule characterizes policy by "counter-cyclical price level" movements.
- But the policy can also be interpreted more conventionally in interest rate terms.
- Nominal interest rates are determined in a private market, understanding policy ...
- And policy is made understanding nominal interest rate determination ...
- Nominal interest rate policy is a fixed point of this process.

# POLICY CHARACTERIZATION

- The nominal rate is determined one period in advance as the expected rate of nominal GDP growth.
- Wicksellian natural real rate = aggregate productivity growth rate.
- The nominal rate is always ratified ex post by the policymaker.
- This makes the real rate = aggregate productivity growth rate = Wicksellian natural real rate of interest.
- "Just like the simple NK model."

# NOMINAL GDP TARGETING

- How can we interpret these results as NGDP targeting?
  - No persistence in productivity growth: The expected rate of NGDP growth never changes, and the economy never deviates from the NGDP path. "Perfect NGDP targeting."
  - Persistence in productivity growth: The expected rate of NGDP growth fluctuates persistently with the shock, and it takes longer to return to the balanced growth NGDP path.
  - Nominal and real rates fall in a recession.

# EFFECTS OF A SHOCK

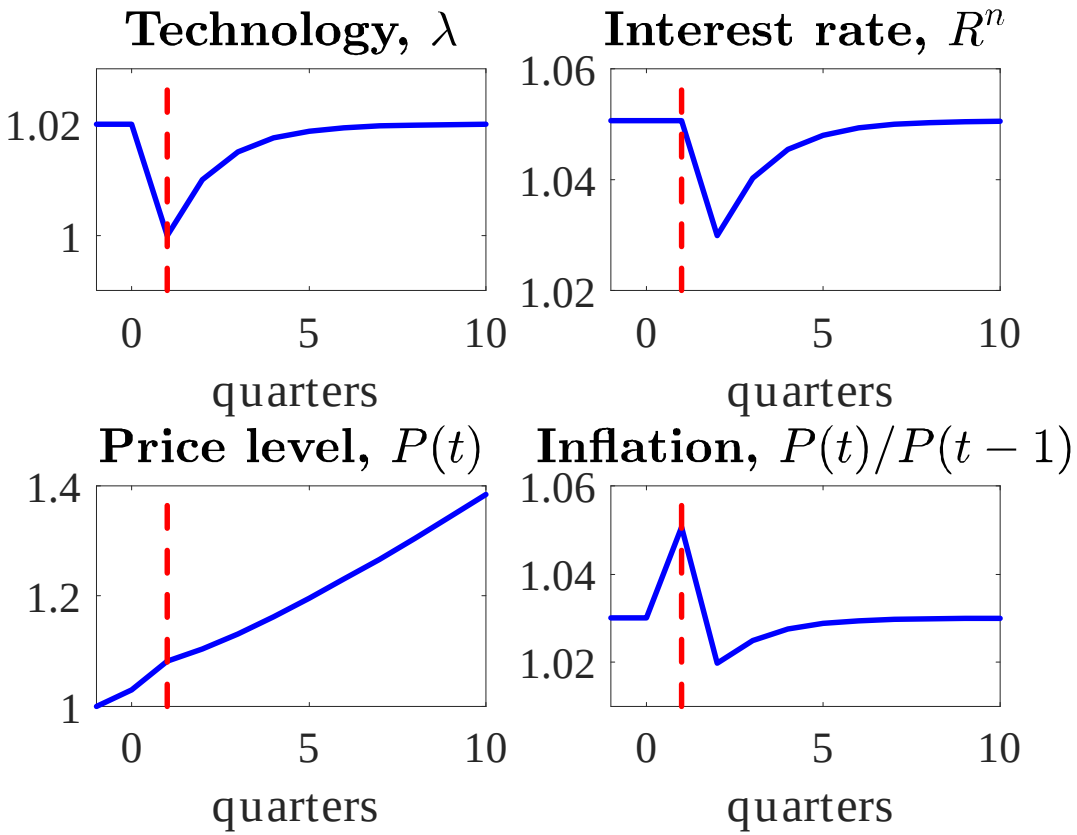


FIGURE: Monetary policy responds to a decrease in aggregate productivity growth by increasing the inflation rate in the period of the shock. Subsequently, inflation converges to its BGP value from below. The nominal interest rate drops in the period after the shock.

# Conclusions

# SUMMARY

- This paper attributes observed levels of U.S. inequality to life-cycle effects in conjunction with heterogeneous life-cycle productivity profiles.
- All households in this model, regardless of their assigned life-cycle productivity profile, face a problem of smoothing life-cycle consumption in a world with a credit market friction, "non-state contingent nominal contracting."
- The monetary authority can remove this impediment to life-cycle consumption smoothing for all households: "optimal monetary policy for the masses."
- Does monetary policy affect inequality? Yes, it improves consumption allocations.