FEDERAL RESERVE BANK of ST. LOUIS

Optimal Monetary Policy for the Masses

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Introduction

Inequality and monetary policy

- Interest in income, financial wealth, and consumption inequality has increased in the last decade.
- Some of the discussion has a focus on the role of monetary policy in promoting or reducing inequality.
- Key issues include:
  - Has global low interest rate policy over the last decade necessarily exacerbated inequality?
  - Does low interest rate policy necessarily redistribute toward borrowers?
  - Can monetary policy conducted in a way that benefits all households in a world of substantial heterogeneity?
  - The answers in this paper are "no," "no," and "yes."

Some recent literature

- Conference on "Monetary Policy and the Distribution of Income and Wealth," held at the St. Louis Fed on September 11 and 12, 2015. Program available online.
- Kaplan, Moll, and Violante (*AER*, 2018 forthcoming): new Keynesian macro with uninsurable idiosyncratic risk and multiple assets ("HANK"). Produces reasonable Gini coefficients. The monetary transmission mechanism is altered relative to the representative agent case. Also provides a good discussion of the literature.
- This paper also produces reasonable Gini coefficients, and features incomplete markets due to a friction, with strictly limited idiosyncratic risk. The policymaker is able to repair the distortion caused by the friction for all households.

Household credit in a DSGE model

- We study an economy with a large private credit market essential to good macroeconomic performance.
- This market has an important friction: Non-state contingent nominal contracting (NSCNC).
- The role of monetary policy will be to keep this large credit market functioning properly (i.e., complete).
- I ignore ZLB issues in this talk. See the companion paper by Azariadis, Bullard, Singh and Suda (2015), available on my web page.

Wealth, income and consumption inequality

- There is a lot of wealth, income and consumption inequality in this stylized model.
- The role of credit markets, if they work correctly, will be to re-allocate uneven income profiles across the life cycle into perfectly equal consumption shares by cohort.
- The model equilibrium will naturally rank:
    - the wealth Gini coefficient $>$ the income Gini coefficient $>$ the consumption Gini coefficient..

HOW LARGE ARE THESE MARKETS?

- According to Mian and Sufi (*AER*, 2011), the ratio of household debt to GDP was about 1.15 before the increase during the 2000s when it ballooned to 1.65.
- In today's dollars, that would be about $19.5 trillion to about $28 trillion, comprised mostly of mortgage debt.
- Disrupting these markets might be quite costly for the economy, so this friction could be quite important.

The monetary policy implications

- Optimal monetary policy in this model looks like "nominal GDP targeting"—countercyclical price level movements.
- 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 = many-period overlapping generations.
- Key variables are *privately-issued* debt, real interest rates and inflation.
- Think of privately-issued debt = "mortgage-backed securities."
- This talk has inelastic labor supply. Elastic labor supply can be added—for more on this, see the companion paper by Bullard and Singh (2017), available on my web page.

Symmetry assumptions

- We make a set of important "symmetry assumptions" so that we can better understand the equilibrium of the model even with substantial heterogeneity.
- These assumptions involve the symmetry of the life cycle productivity endowment pattern of the households (detailed below), along with log preferences, no discounting, and no population growth.
- These assumptions help deliver the result that in the equilibria we study:
  - *The real interest rate is exactly equal to the output growth rate at every date, even in the stochastic economy.*
- This in turn creates a set of easy to understand baseline results for this economy.

Environment details

- Standard $T + 1$-periods (quarterly) DSGE life-cycle endowment economy.
- Each period, a new cohort of households enters the economy at age 20, makes economic decisions over the next 241 periods, then exits the economy.
- There is one asset in the model, *privately-issued* debt (consumption loans).
- The monetary authority controls the nominal price level $P(t)$ directly. For a money demand version, see Azariadis et al. (2015).
- All households have log preferences with no discounting.
    - Other assumptions: No population growth, inelastic labor supply, no capital, no default, flexible prices, no borrowing constraints.

Key friction: 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 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.

STOCHASTIC STRUCTURE

- We model a growing economy in which a linear technology is improving over time.
- The real wage $w(t)$ is then exogenously given by

$$w(t+1) = \lambda(t, t+1)\, w(t), \tag{1}$$

where $w(0) > 0$, and $\lambda(t, t+1)$ is the gross rate of aggregate productivity growth between date t and date $t+1$, and where

$$\lambda(t, t+1) = (1-\rho)\,\lambda + \rho\lambda(t-1, t) + \sigma\eta(t+1), \tag{2}$$

where $\lambda > 1$ represents the average gross growth rate, $\rho \in (0,1)$, $\sigma > 0$, and $\eta(t+1) \sim N(0,1)$.

- For sufficiently large, negative draws of η, the ZLB may threaten. We ignore this issue in this paper and refer readers to Azariadis et al. (2015).

TIMING PROTOCOL

- At the beginning of date t, nature moves first and chooses $\lambda(t-1,t)$, which implies a value for $w(t)$.
- The policymaker moves next and chooses a value for $P(t)$.
- Households then decide how much to consume and save.

NOMINAL INTEREST RATE

- Households contract by fixing the nominal interest rate one period in advance.
- The non-state contingent nominal interest rate, "the contract rate," is given by

$$R^n(t, t+1)^{-1} = E_t\left[\frac{c_t(t)}{c_t(t+1)}\frac{P(t)}{P(t+1)}\right]. \tag{3}$$

- This rate depends on the expected rate of consumption growth and the expected rate of inflation.
- In the equilibria we study, this expectation is the same for all households, even those born at different dates or with different levels of productivity.

What monetary policy does

- The countercyclical price level rule delivers complete markets allocations:

$$P\left(t\right)=\frac{R^{n}\left(t-1,t\right)}{\lambda^{r}\left(t-1,t\right)}P\left(t-1\right), \tag{4}$$

  where λ^{r} indicates a realization of the shock and R^{n} is the expectation given in the previous slide.
- This is a similar result to Sheedy (*BPEA*, 2014) and Koenig (*IJCB*, 2013).
- Given this policy rule, households consume equal amounts of available production, given their productivity, "*equity share contracting*," which is optimal under homothetic preferences.
- This price level rule renders the households' date-t decision problem deterministic because it perfectly insures the household against future shocks to income.
- Consumption and asset holdings fluctuate from period to period, but in proportion to the value of $w\left(t\right)$.

Life-Cycle Productivity

Life-cycle productivity profiles

- Households entering the economy draw one of $N+1$ life-cycle productivity profiles

$$e_s = \begin{cases} \frac{\tilde{e}_s}{\xi} & \text{w.p. } 1/\left(N+1\right) \\ \vdots & \vdots \\ \left(1 - \frac{1}{\xi}\frac{\xi-1}{N/2}\right)\tilde{e}_s & \text{w.p. } 1/\left(N+1\right) \\ \tilde{e}_s & \text{w.p. } 1/\left(N+1\right) \\ \left(1 + \frac{\xi-1}{N/2}\right)\tilde{e}_s & \text{w.p. } 1/\left(N+1\right) \\ \vdots & \vdots \\ \xi\tilde{e}_s & \text{w.p. } 1/\left(N+1\right) \end{cases},$$

where $\xi \geq 1$ determines the within-cohort dispersion.

- Productivity profiles are deterministic.
- Huggett, Ventura and Yaron (*AER*, 2011) argue that differences in initial conditions are more imporant than differences in shocks.

Average life-cycle productivity

- The average profile, $\tilde{e}_s$, is given by:

$$\tilde{e}_s = f(s) = \exp\left\{-\left[\frac{(s-120)}{80}\right]^4\right\},$$

  such that $f(0) = f(240) > 0$ and $f(120) = 1$.
- Profiles begin at a low value, rise to a peak in the middle period of life, and then decline to the low value.
- The productivity profiles are symmetric.
- Agents can sell productivity units available in a particular period in the labor market at the competitive wage.

The range of life-cycle productivity

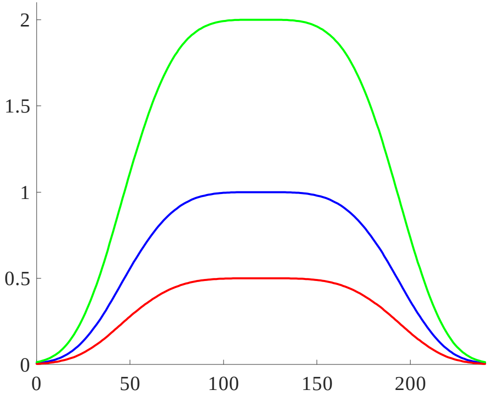

Figure: The range of productivity endowment profiles for credit market participant households ($N = 2$). Profiles are symmetric and peak in the middle period of the life cycle.

Stationary equilibria

- We let $t \in (-\infty, +\infty)$.
- We only consider stationary equilibria under perfectly credible policy rules governing $P(t)$.
- We let $R(t)$ be the gross real rate of return in the credit market.
- Stationary equilibrium is a sequence $\{R(t), P(t)\}_{t=-\infty}^{+\infty}$ such that markets clear, households solve their optimization problems, and the policymaker credibly adheres to the stated policy rule.
- Key condition is that aggregate asset holding $A(t) = 0 \; \forall t$.

STATIONARY EQUILIBRIA

THEOREM

Assume symmetry as defined above. Assume the monetary authority credibly uses the price level rule $\forall t$. *Then the general equilibrium gross real interest rate,* $R(t-1,t)$, *is equal to the gross rate of aggregate productivity growth, and hence the real growth rate of the economy,* $\lambda(t-1,t)$, $\forall t$.

COROLLARY

For any two households that share the same productivity profile, consumption is equalized at each date t.

Characterizing the Equilibrium

CONSUMPTION

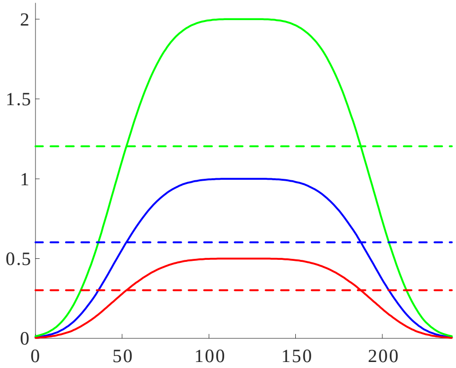

FIGURE: Consumption (flat lines) versus income (bell shaped curves) profiles, by cohort along the complete markets balanced growth path with $w(t) = 1$. Under optimal monetary policy, the private credit market reallocates uneven income into perfectly equal consumption for each productivity profile. The consumption Gini is 35.9%, similar to values calculated from U.S. data.

Net asset holding

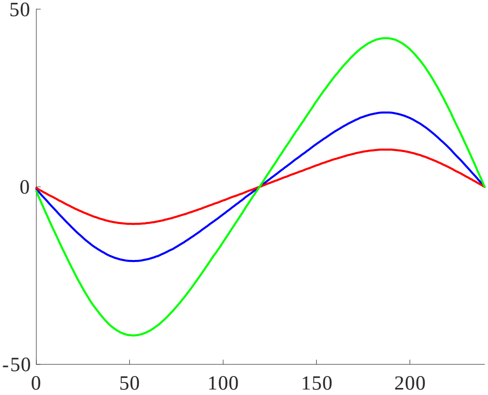

Figure: Net asset holding profiles by cohort along the complete markets balanced growth path. Borrowing, the negative values to the left, peaks at stage 60 of the life cycle (age ~35), while positive assets peak at stage of life 180 (age ~65). The financial wealth Gini is 74.4%, similar to values calculated in U.S. data.

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*, 2010): $g^{W,\text{U.S.}} = 80\%$.

Inequality in the model

- Large amount of heterogeneity which depends in part on how many productivity profiles N we include.
- There are $N \times 121$ income (wealth) levels, and N consumption levels.
- We measure inequality by the Gini coefficient, g.
- Financial wealth is defined as the non-negative part of net assets.
- Denote by g^W (g^Y, g^C) the wealth (income, consumption) Gini coefficient.
- For $\xi = 2.5$ and nine possible income profiles (i.e., $N = 8$)

$$g^W = 72\% > g^Y = 50\% > g^C = 31\%,$$

versus U.S. data

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

PRODUCTIVITY DISPERSION AND GINI COEFFICIENTS

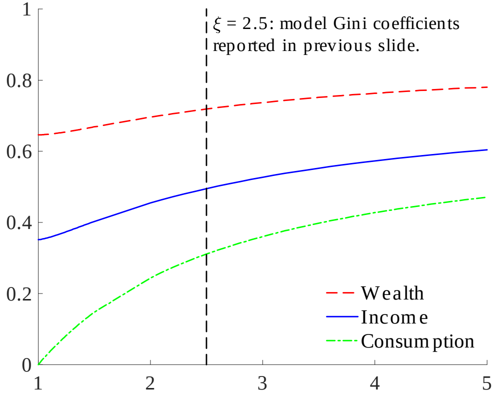

FIGURE: As the dispersion of productivity profiles, ξ, increases, the Gini coefficients increase. The ordering $g^W > g^Y > g^C$ is preserved.

Conclusions

All households face a consumption smoothing problem

- The relationship between monetary policy and inequality has been a topic of increased research interest.
- This paper attributes observed levels of inequality to life-cycle effects in conjunction with heterogeneous life-cycle productivity profiles.
- The productivity profiles are exogenous to the model, but they could be interpreted as representing the output of an unmodelled human capital accumulation process.
- All households in this model face a problem of smoothing life-cycle consumption in a world with non-state contingent nominal contracting (the NSCNC friction).

CONCLUSIONS

- Monetary policy can eliminate the distortion coming from the NSCNC friction for all households, even when there is substantial heterogeneity.
- All households benefit from eliminating this distortion.
- The monetary policymaker is not operating by helping financial wealth holders or borrowers, but by repairing the distortion caused by the NSCNC friction.
- To the extent optimal monetary policy affects inequality in this model, it is mostly through helping households smooth lifetime consumption, and therefore the largest effects are likely on the consumption Gini as opposed to those associated with income or financial wealth.