Indian Institute of Management Calcutta

Working Paper Series

WPS No. 893/ April 2023

Monetary Policy and Inequality under Endogenous Financial Segmentation

Vipul Mathur *
Assistant Professor
Indian Institute of Management Calcutta
Email: vipul@iimcal.ac.in

Chetan Subramanian
Professor
Indian Institute of Management Bangalore
Email: chetan.s@iimb.ernet.in

* Corresponding author

Indian Institute of Management Calcutta, Joka, D.H. Road, Kolkata 700104

URL: https://www.iimcal.ac.in/faculty/publications/working-papers/

Monetary Policy and Inequality under Endogenous Financial Segmentation

Vipul Mathur   Chetan Subramanian[†]

Abstract

The empirical evidence on how monetary policy affects inequality is mixed. We propose a model with endogenously segmented financial markets which can reconcile this contrasting empirical evidence. In addition to the conventional income composition channel (intensive margin), monetary policy in our model also affects inequality through a *financial-inclusion margin* channel (extensive margin) by altering the extent of financial participation. We show analytically that the two channels impact inequality in opposite ways and that the net impact depends upon (a) the extent of financial market exclusion and (b) the density of households at the margin of

1 Introduction

The recent empirical evidence on how monetary policy affects inequality is mixed. While one strand of literature finds that contractionary monetary policy increases inequality (for instance, Coibion et al. (2017), Guerello (2018), Furceri et al. (2018)), another strand of empirical evidence suggests that it decreases income inequality (for instance, Cloyne et al. (2016), Inui et al. (2017), O'Farrell et al. (2016)).

We attempt to show that there is a way to reconcile these two contrasting empirical evidence asset holdings, the households trade shares, $S_0(!)$ and a complete set of one-period state contingent claims, $B(s^1, !)$ issued by the financial intermediary. The accounting constraint for the household's brokerage account at time t = 0 is, $\bar{B}(!) = j(s_0)S(s_0, !) + \overset{!}{}_{s_1} q(s^1)B(s^1, !)ds_1$ and for time t " 1 is

$$B(s^t, !) + P(s^t)\{j(s^t) + "_t\}S(s^{t-1}, !) = \overset{"}{\underset{s_{t+1}}{}} q(s^t, s_{t+1})B(s^t, s_{t+1}, !)ds_{t+1} + P(s^t)j(s^t)S(s^t, !)$$
$$+ P(s^t)[x(s^t, !) + !]z(s^t, !) \qquad (1)$$

where $P(s^t)$ denotes the aggregate price level, $B(s^t, s_{t+1}, !)$ denotes the amount of bonds purchased by a household at time t at a price $q(s^t, s_{t+1})$, which will pay o a dollar in time t + 1 if state s_{t+1} occurs;

$\{c(s^t,\omega), x(s^t,\omega), z(s^t,\omega), B(s^t,s_{t+1},\omega), S(s^t,\omega)\}_{t=1}^{\infty}$ to maximize

$$\max \sum_{t=1}^{\infty} \int_{s^t} \beta^t U(c(s^t,\omega))h(s^t)ds^t \tag{4}$$

subject to the constraints of equation (1), (2) and (3).

2.1.2 Monetary Policy

The government conducts open market operations to exchange money for one-period state-contingent bonds $B(s^t)$. At time $t = 0$, the budget constraint of the government is given by $B = \int_{s_1} q(s_1)B(s^1)ds_1$. For $t \geq 1$, the budget constraint is

$$B(s^t) + M_{t-1} = M_t + \int_{s_{t+1}} q(s^t,s_{t+1})B(s^t,s_{t+1})ds_{t+1} \tag{5}$$

with $M_0 > 0$ as given. Monetary policy is specified through the money growth rate in gross terms as $\mu_t = M_t/M_{t-1}$.

2.1.3 Financial Intermediary

The financial intermediary bundles the government bonds into state-contingent bonds while making zero profits such that for all $t \geq 0$

$$\int_{s_{t+1}} \int_{\omega} q(s^t,s_{t+1})B(s^t,s_{t+1},\omega)f(\omega)d\omega ds_t$$

s

The bonds market clear through equation (6). The money market clears when:

$$\int_{\omega} \{ M(s^{t-1}, \omega) + P(s^t) \left[x(s^t, \omega) + \omega z(s^t, \omega) \right] \} f(\omega) d\omega = M_t \tag{10}$$

It is easy to see the quantity equation for money holds such that $Y_t = \frac{M_t}{P(s^t)}$. Holding Y_t as fixed, the (gross) inflation rate, $\pi_t (\equiv \frac{P(s^{t+1})}{P(s^t)})$ is simply equal to (gross) rate of money growth $\mu_t (\equiv \frac{M_{t+1}}{M_t})$.

2.3 Segmentation Dynamics

Lemma 1. *At any time* t, *the financially included households identically consume* c_t^{FI} *and the financially excluded households identically consume* c_t^{FE}.

Proof.

3 Results & Discussion

3.1 Endogenous Inequality

The literature on inequality has, besides income, also focussed on heterogeneity in consumption as a measure of inequality (Krueger and Perri (2006)). Following this literature, we construct Figure 1 where the x-axis of the %ABC is the proportion of FI and FE households, and the y-axis is simply the respective aggregate consumption share relative to the total endowment available for consumption in the economy.

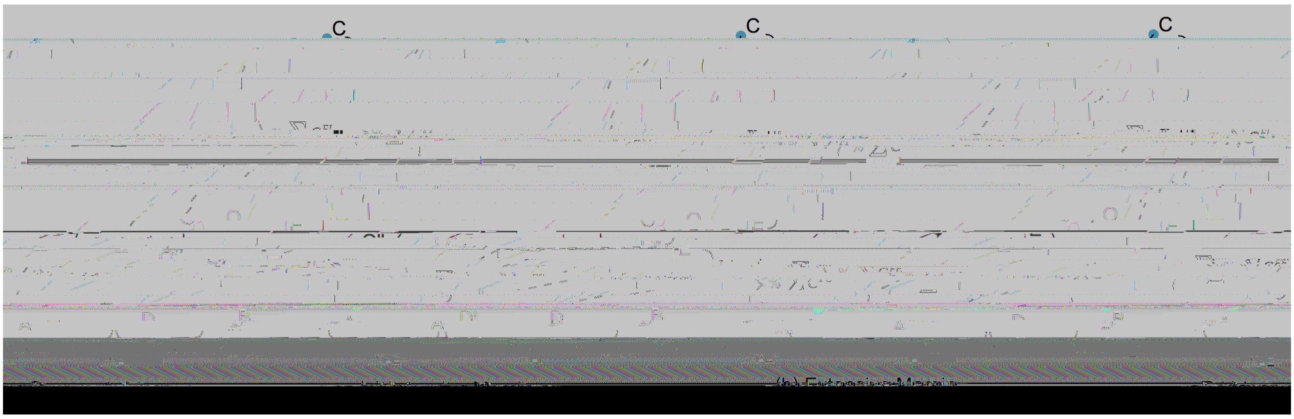

Figure 1: Endogenous Inequality and Monetary Policy

We define the consumption gini as the ratio of areas of %AOC/%ABC in Figure 1:

$$gini_t = area(\%AOC)$$

The RHS of (12) has two effects:

- (a) Intensive margin effect: $[1 - \int_0^{\tilde{\omega}_t} f(\omega)d\omega]\frac{1}{\mu_t^2}$. The term in brackets is the proportion of financially excluded households who are simply consuming their real balances. Expansionary monetary policy increases inflation tax, thereby reducing the consumption share of non-participants and hence increasing inequality. In Figure 1 we denote this as the area of ' AOCO , which gets added to the initial area of %AOC.

- (b) Extensive margin effect: $(1 - \frac{1}{\mu_t})f(\tilde{\omega}_t)\frac{d\tilde{\omega}_t}{d\mu_t}$. The term $f(\tilde{\omega}_t)\frac{d\tilde{\omega}_t}{d\mu_t}$ is the proportion of households at the margin of inclusion, $(1 - \frac{1}{\mu_t})$ is the increment in the consumption share of such marginal households when they become financially included, and this increment reduces inequality. Figure 1 we denote this as the area of ' AOCO , which gets subtracted from the initial area of %AOC.

Proposition 1. *Monetary policy has two contrasting impacts on inequality: intensive effect and extensive effect. An expansionary monetary policy, for instance, increases inequality through intensive margin effect but decreases inequality through extensive margin effect.*

Proof. The first term in the RHS of (12) is the proportion of FE households, which being a non-negative number, increases inequality. The second term, is also positive because From Lemma 3 we know that $\frac{d\tilde{\omega}_t}{d\mu_t} > 0$. But since the second term enters the RHS of (12) with a negative sign, it decreases inequality. □

Proposition 2. *The net effect of monetary policy on inequality depends upon the extent of financial*

Proof.

3.2 Counterfactual: Exogenous Participation

Suppose that our participation margin channel was absent (as in Areosa and Areosa (2016)). Then inequality would simply have been

$$\text{gini}_t^{eogenous} = (1 \# \&) \# (1 \# \&)(1/\mu_t)$$

Consequently,

$$\frac{\%\text{gini}_t^{eogenous}}{\%\mu} = (1 \# \&)(1/\mu_t^2) > 0$$

Monetary policy in the case of exogenous participation has a uni-directional impact on inequality. For instance, expansionary monetary policy would always increase inequality through the traditional income composition channel where only the financial market participants who hold financial assets will earn capital income on monetary injection. In our case, however, expansionary monetary policy also increases the proportion of financial market participants, thereby allowing some of the previously financially excluded households to augment their income through capital gains, and this

References

[1] Alvarez, F., Atkeson, A. and Kehoe, P.J., 2009. Time-varying risk, interest rates, and exchange rates in general equilibrium. *The Review of Economic Studies*

A Appendix

A.1 Market Equilibrium

Aggregate equation (1) over ! , substitute equation (6) and rearrange to:

$$B(s^t) \# \overset{"}{\underset{s_{t+1}}{}} q(s^t, s_{t+1})B(s^t, s_{t+1})ds_{t+1} = \overset{"}{\underset{!}{}} [P(s^t)j(s^t)S(s^t, !) + P(s^t)[x(s^t, !) + !]z(s^t, !)$$
$$\# P(s^t)\{j(s^t) + "_t\}S(s^{t-1}, !)]f(!)d!$$

Substitute from equation (5) & (9) to get

$$M_t \# M_{t+1} = \overset{"}{\underset{!}{}} P(s^t)[x(s^t, !) + !]z(s^t, !)f(!)d! \# P(s^t)"_t \tag{13}$$

Add !z $(s^t, !$

$0; \lim_{t->\infty} !_{s^t} Q(s^t)S(s^t,!)ds^t = 0$

Since the households are ex-ante identical, the Lagrangian multiplier $\Lambda(!) = \Lambda$. FOCs:

$$c(s^t,!) : \#^t U \; \$ c(s^t,!) \% h(s^t) = \Theta(s^t,!)$$

$$x(s^t,!) : \Theta(s^t,!) z(s^t,!) = \Lambda Q(s^t) P(s^t)$$