Discussion of "A Model of Intermediation, Money, Interest and Prices" by Saki Bigio & Yuliy Sannikov

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### Overview

- model of money as a store of value in incomplete markets
- nice feature: risk choice about endowment
- Discussion:
  - study effects in an environment where financial structure is real

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connect to literature on fiscal policy

### Environment

• utility function over consumption

$$E\int_{0}^{\infty}e^{-\rho t}\frac{\left(c_{i,t}^{1-\gamma}-1\right)}{1-\gamma}dt$$

nontradable exogenous income

$$dw_{i,t} = y(u_{i,t}) dt + \sigma(u_{i,t}) dZ_{i,t}$$

- *dZ<sub>i,t</sub>* idiosyncratic shock
- risk choice u<sub>i,t</sub>: high mean y<sub>H</sub> and volatility σ<sub>H</sub> or low mean y<sub>L</sub> and volatility σ<sub>L</sub> = 0
- in every instant, choose consumption  $c_{i,t}$  and  $u_{i,t}$
- resource constraint: aggregate consumption = aggregate output, output endogenous!

### First best allocation

- all households choose high risk: u<sub>i,t</sub> = H mean y<sub>H</sub> is high for everyone!
- perfect risk sharing:  $\sigma_H$  does not matter

- high output  $Y_t = y_H$
- high consumption  $C_t = y_H$

### Incomplete markets

 financial structure as in Aiyagari: real noncontingent bonds save and borrow at real interest rate r up to a debt limit s̄

$$E\int_{0}^{\infty}e^{-\rho t}\frac{\left(c_{i,t}^{1-\gamma}-1\right)}{1-\gamma}dt$$

$$dw_{i,t} = y(u_{i,t}) dt + \sigma(u_{i,t}) dZ_{i,t}$$
  
$$ds_{i,t} = (r \ s_{i,t} - c_{i,t}) dt + dw_{i,t}$$
  
$$s_{i,t} \ge \bar{s}$$

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• close to debt limit  $\bar{s}$ , precautionary motive is strong:

- households choose low risk  $u_{i,t} = L$  with low mean  $y_L$
- output and consumption are inefficiently low:  $Y_t < y_H$
- equilibrium interest rate r is low

# Comparison with other incomplete markets models

- Models with imperfect risk sharing without aggregate shocks
  - $\blacktriangleright$  strong precautionary motive  $\rightarrow$  welfare loss
  - output may be distorted relative to first best
- Aiyagari 1994 endowment model
  - idiosyncratic shocks to endowment, real bonds have low rate
  - no aggregate output loss
- Aiyagari model with production
  - idiosyncratic skill shocks, capital and bonds are perfect substitutes
  - overaccumulation of capital, aggregate output inefficiently high
- Angeletos 2007 with sufficiently high EIS
  - capital and bonds are not perfect substitutes, low real interest rate
  - underaccumulation of capital, aggregate output inefficiently low
- Bigio & Sannikov model
  - ► risk choice makes aggregate output inefficiently low

## Fiscal policy in incomplete markets

• Aiyagari & McGrattan 1998: debt in model with production

- capital and government debt are perfect substitutes for savers
- government debt  $B_t$  crowds out private capital  $K_t$ , reduces output
- equilibrium real rate depends on debt and taxes
- Bigio & Sannikov with government debt
  - household and government debt are perfect substitutes for savers

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- government debt allows precautionary savings
- equilibrium real rate depends on debt and taxes
- Fiscal policy can improve risk sharing and output distortion

## Intermediation and spreads

- So far, banks are a veil
- Without government debt: competitive banks take household savings  $A_t$  and pay interest  $r^A$ , lend to households  $L_t$  and collect interest  $r^L$ , maximize

$$L_t\left(1+r^L\right)-A_t\left(1+r^A\right)$$

banks' FOCs equalize rates of return:  $r^L = r^A$ 

• What if government forces banks to hold some government debt?

$$egin{split} \mathcal{L}_t \left(1+r^{\mathcal{L}}
ight)+\mathcal{B}_t \left(1+r^{\mathcal{B}}
ight)-\mathcal{A}_t \left(1+r^{\mathcal{A}}
ight)\ \mathcal{B}_t \geq 
ho \mathcal{A}_t \end{split}$$

If constraint binds,  $r^L > r^A > r^B$ 

- If ho=1, narrow banking, no loans to households  $L_t=0$
- $\rightarrow\,$  Fiscal policy not only changes real rate but also spreads

## Fiscal policy vs monetary policy

- So far, theory of fiscal policy, how do we think about monetary policy?
- recast model with nominal assets and nominal interest rates
- definition of equilibrium
  - given initial price level P<sub>0</sub>, nominal interest rate path i<sup>B</sup><sub>t</sub>, nominal supply of government debt M<sub>t</sub>
  - ▶ find path of prices  $P_t$  so that real interest rate  $r_t^B = i_t^B \dot{P}_t / P_t$  clears market for path of real debt  $M_t / P_t$
- changing nominal rate has real effects holding fixed  $M_t$
- interpretation of government debt as reserves
  - bank constraint from before = reserve requirement
  - government forces banks to also hold some reserves  $\rho P_t A_t$
  - if constraint does not bind:  $i^L = i^A = i^M$  floor system
  - if constraint binds:  $i^L > i^A > i^M$  corridor system

### Money as store of value

• reinterpretation of the model works if there are no other assets that dominate money in rate of return

- tradition of Bewley 1980, Samuelson 1968 money is the only asset, useful as store of value
- in data, rate of return dominance is important
  - floor system: spread between deposit rates, T-bill rates

## T-bill rate and deposit rate in Floor System



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  - floor system: spread between deposit rates, T-bill rates
- can explain spread with money as medium of exchange
- Bewley/Samuelson not typically used for monetary policy but Aiyagari/OLG workhorse models for fiscal policy
- Bigio-Sannikov: very interesting insights about fiscal policy, risk choice, output and welfare