Monetary Economics
Credit Cycles - The Kiyotaki Moore Model

Nicola Viegi

University of Pretoria

March 2010

Introduction

Crisis shows centrality of financial market

Objective of this lecture - introduce financial intermediaries in a macro model

The Microeconomics of Banking (to be done in reading groups)

- Diamond Dybvig Model - A Model of Bunk Runs
- Holstrom and Tirole Model - The Role of the State in Providing Liquidity

This lecture

- Stiglitz and Weiss Model - Imperfect Information and Financial Transactions
- Kiyotaki Moore Model - The Business Cycle Effects of Credit Market Imperfections

Credit Market Imperfection - the Stiglitz Weiss Model

Expected Value of Investment Project

$$p_i R_i^s + (1 - p_i) R^f = R$$

Banks lend $B = K - W$ and get $(1+r)B$ in case of success and R^f in case of failure.
Assume that $R_i^s > (1+r)B > R^f$ for all i.
Asymmetric info: entrepreneur knows his p_i the bank does not.
Profits

$$\begin{aligned} Firm &: \quad E(\pi_i) = p_i \left[R_i^s - (1+r)B \right] \\ Bank &: \quad E(\pi_b) = (1+r)B \int_0^p p_i g(p_i)\, dp_i + R^f \int_0^p (1-p_i) g(p_i)\, dp_i \end{aligned}$$

Credit Market Imperfections

Express the expected payoff π_i as :

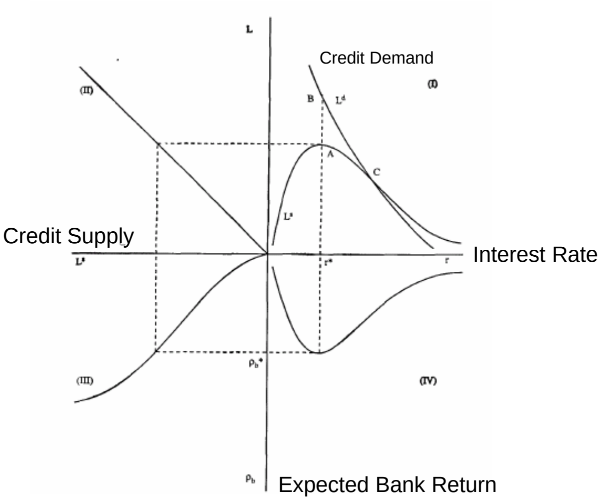
$$E(\pi_i) = R - R^f - p_i \left[(1+r)B - R^f\right]$$

which is decreasing in p_i :
high risk investors are willing to pay more for a loan, but then $dp/dr < 0$.
Impact on Banks

$$\begin{aligned} \frac{dE(\pi_b)}{dr} &= B \int_0^p p_i g(p_i)\, dp_i + \\ &\quad + \frac{dp}{dr}\left[(1+r)\, Bpg(p) + R^f (1-p_i)\, g(p)\right] \end{aligned}$$

Optimal Respone of the Bank - Collateral

Credit Market Imperfections



Interest rate signal of riskness

Credit Market Imperfection and the Business Cycle - the Kyotaki Moore model

- Credit Market Imperfections in a general equilibrium model - Kiyotaki and Moore
  - it produces comovement of amount of credit, asset prices and aggregate output,
  - it creates a propagation mechanism that produces persistence and amplification of a shock,
  - it produces procyclical productivity even if technology does not change,
  - it is able to explain cross-industry comovements.

Quite Complex - Need differentiated agents

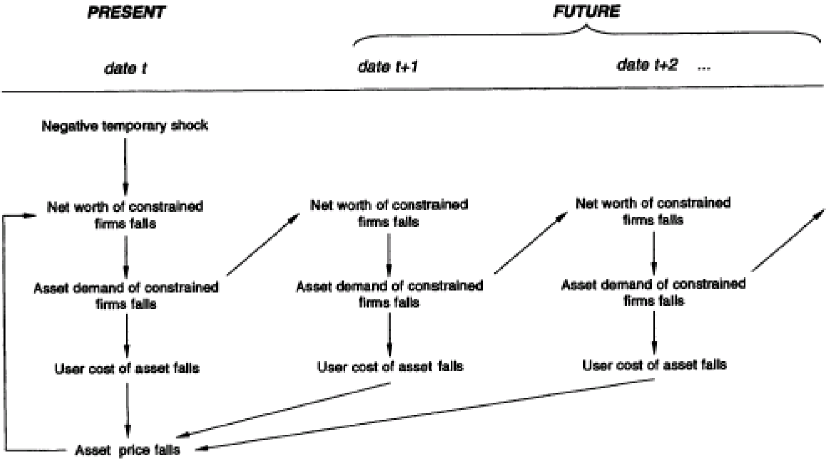

PRESENT
FUTURE
date t
date t+1
date t+2 ...
Negative temporary shock
Net worth of constrained firms falls
Asset demand of constrained firms falls
User cost of asset falls
Asset price falls
Net worth of constrained firms falls
Asset demand of constrained firms falls
User cost of asset falls
Net worth of constrained firms falls
Asset demand of constrained firms falls
User cost of asset falls

FIG. 1

The Model

- a constant interest rate (one less variable)
- no labor supply decision
- no capital accumulation
- only one asset that can be used for production, and is available in fixed supply in the aggregate.

The Model

The model includes two kind of agents, productive (farmers) and unproductive (gatherers). The expected utilities of farmer and gatherers are respectevely

$$\begin{aligned} Farmers &: E\left(\sum_{s=0}^{\infty} \beta^{s} x_{t+s}\right) \\ Gatherers &: E\left(\sum_{s=0}^{\infty} \beta'^{s} x'_{t+s}\right) \end{aligned}$$

where $\beta' > \beta$.

The Model II

The productive agents use a linear production tecnology in capital only as,

$$y_t = (a + c)\, k_{t-1}$$

a fraction ck_{t-1} of the produced goods is untradable so that the "farmer" must consume it on his own.
The productive agent is subjected to a credit constraint like

$$Rb_t = q_{t+1} k_t$$

basic expression for the flow of funds

$$q_t\left(k_t - k_{t-1}\right) + \phi\left(k_t - \lambda k_{t-1}\right) + Rb_{t-1} + x_t - ck_{t-1} = ak_{t-1} + b_t$$

where $\phi\left(k_t - \lambda k_{t-1}\right)$ denotes an input for reproduction of capital.

The Model

Only a fraction π of the population can invest while a fraction $(1 - \pi)$ cannot.

For a farmer, investment is strictly better than consumption, so that it will use all the funds available to invest, so that $x_t \geqslant ck_{t-1}$ and $Rb_t = q_{t+1}k_t$ are binding.

Substituting these in the flow of funds and rearranging we have:

$$\left(q_t + \phi - \frac{q_{t+1}}{R}\right) k_t = (\alpha + \lambda\phi + q_t)\, k_{t-1} - Rb_{t-1}$$

On the other hand, non productive capital is just depreciating, so that $k'_t = \lambda k'_{t-1}$.

The Model

Combining these two law of motion, we get the aggregate capital law of motion

$$K_t = (1-\pi)\lambda K_{t-1} + \left(\frac{\pi}{q_t + \phi - \frac{q_{t+1}}{R}}\right)\left[(\alpha + \lambda\phi + q_t)\, k_{t-1} - Rb_{t-1}\right] \quad (1)$$

Aggregate debt follows

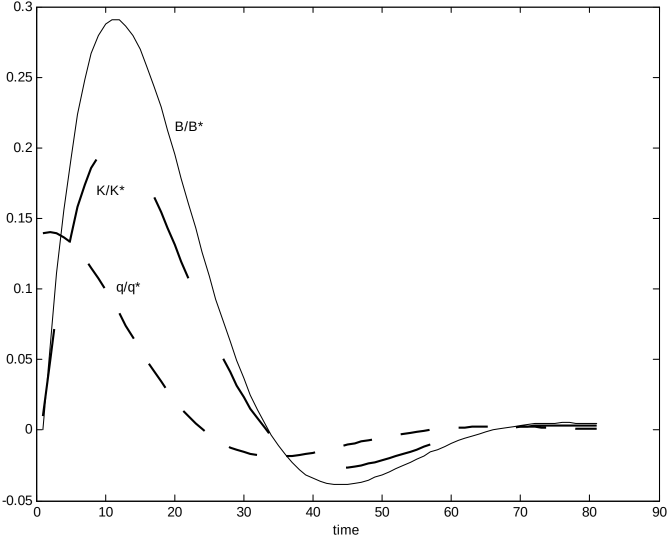
$$B_t = RB_{t-1} + q_t (K_t - K_{t-1}) + \phi (K_t - \lambda K_{t-1}) - aK_{t-1} \quad (2)$$

Finally, the Euler equation for consumption (a bit atypical), which determine the asset price

$$u(K_t) = q_t - \frac{q_{t+1}}{R}$$

where $u(K_t)$ is the user cost of capital $= G'(K - K_t)/R$ (explained in the paper). These equations are a first-order non-linear system. There is an unique steady state (q^*, K^*, B^*) with associated steady state user cost

Business Cycle Dynamics



Conclusions

- Real Business Cycle with large endogenous fluctuations
- Credit + Imperfect information = financial accelarator mechanism
- Next - Introducing financial frictions in a monetary model with sticky prices and monopolistic competition