Economics of Banking
Lecture 11

March 2023

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BitCoin

First electronic means of payments **without intermediation**

Introduced by Nakamoto 2008, now other cryptocurrencies have been developed

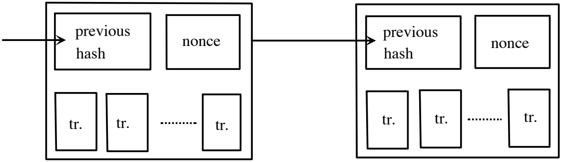
Fundamental problem for means of payment:

How can it be guaranteed that the money is used only once?

BitCoin: Internet community check that money is used correctly

Blockchain

Transactions are recorded in special data structure:



A new block of transactions can be checked by any individual (a "miner"), showing that it is ok

To perform this, the miner must solve a complicated (time and energy consuming) problem (find the inverse of a specific cryptographic function)

Blockchain technology is interesting also for banks (and central banks)

Pros and Cons of BitCoin

No (or almost no) cost of money transfers

Decentralized system (not subject to monetary policy)

But:

BicCoin has limited capacity

Transfer is slow (up to 10 minutes before a transfer is confirmed)

The mining process is energy-intensive

Negative interest rates

Interest rates have been moving downwards for decades

Currently many interest rates are negative

Combined with small annual growth rates

What are the implications for:

- Macroeconomic stability (to be dealt with in Macro)
- Monetary policy (to be considered in Monetary Economics)
- Financial intermediation?

Islamic Banks

Banking without interest payments:

Basic principles:

(1) *risk-sharing:* symmetric distribution of risk and return,
(2) *materiality:* linkage to real activity,
(3) *no exploitation*
(4) *no financing of prohibited activities*

Main forms of financing:

- Participatory form: Bank is business partner (more or less active)
- Non-participatory form (trade-based): Bank initiates investment and allows the investor buys it back

Islamic banks quite succesful (70% of financial assets in selected countries)

Perfect competition

Given: loan (interest) rate r_L, the deposit rate r_D, interbank rate r

Bank chooses loans L and deposits D to maximize profits

$$\pi(D, L) = r_L L + rC - r_D D - c(D, L),$$

(with C net position in the interbank market, $c(D, L)$ managing cost)

If $0 < \alpha < 1$ of deposits are kept as reserve, then $C = (1-\alpha)D - L$, and

$$\pi(D, L) = (r_L - r)L + ((1-\alpha)r - r_D)D - c(D, L),$$

First order conditions are

$$\frac{\partial \pi}{\partial L} = r_L - r - c'_L = 0, \quad \frac{\partial \pi}{\partial D} = (1-\alpha)r - r_D - c'_D = 0$$

Market equilibrium

How is r determined?

There are n banks, demand for loans comes from investment function $I(r_L)$, so that

$$I(r_L) = \sum_{j=1}^{n} L_j(r_L, r_D, r).$$

Household saving depends on r_D, so

$$S(r_D) = B + \sum_{j=1}^{n} D_j(r_L, r_D, r).$$

where B is bond issue (by government).
Finally, the interbank marketmust be balanced:

$$\sum_{j=1}^{n} L_j(r_L, r_D, r) = (1 - \alpha) \sum_{j=1}^{n} D_j(r_L, r_D, r).$$

A Digression: The money multiplier

Simple version: Bond changed by $\triangle B$, then deposits change by the same amount.
Then banks can expand credits by $(1-\alpha)\triangle B$, again changing deposits, and summing all:

$$\triangle D = \triangle B(1 + (1-\alpha) + (1-\alpha)^2 + \cdots) = \frac{1}{\alpha}\triangle B.$$

More sophisticated version, using our model:
Inserting the first two equations in the last one:

$$S(r(1-\alpha) - c_D') - \frac{I(r + c_L')}{1-\alpha} - B = 0$$

Determines r as an implicit function of B.

Open market policies

Use implicit function theorem:

$$\frac{dr}{dB} = \frac{1}{(1-\alpha)S' - \dfrac{I'}{1-\alpha}}.$$

Then

$$\frac{\partial D}{\partial B} = (1-\alpha)S'\frac{dr}{dB} - 1 = \frac{(1-\alpha)S'}{(1-\alpha)S' - \dfrac{I'}{1-\alpha}} - 1 = \frac{1}{\dfrac{(1-\alpha)^2 S'}{I'} - 1}.$$

If $S' > 0$, $I' < 0$, then

$$\frac{\partial D}{\partial B} < 0$$

as expected, but

$$\left|\frac{\partial D}{\partial B}\right| < 1$$

Money multiplier is small!

The Monti-Klein model

Bank maximizes profits

$$\pi(D, L) = (r_L(L) - r)L + ((1-\alpha)r - r_D(D))D - c(D, L).$$

First order conditions are

$$\frac{\partial \pi}{\partial L} = r_L' L + r_L - r - c_L' = 0,$$
$$\frac{\partial \pi}{\partial D} = -r_D' D + (1-\alpha)r - r_D - c_D' = 0,$$

Can be reformulated in several ways:

Lerner index

(1.) 1st order conditions using *Lerner indices:*

$$\frac{r_L - (r + c_L')}{r_L} = -\frac{r_L' L}{r_L} = \frac{1}{-\frac{r_L}{r_L' L}} = \frac{1}{\varepsilon_L},$$

where

$$\varepsilon_L = -\frac{L'}{\frac{L}{r_L}}$$

Similarly for the deposit rate

$$\frac{r(1-\alpha) - r_D - c_D'}{r_D} = \frac{1}{\varepsilon_D}, \quad (1)$$

with $\varepsilon_D = r_D D'/D$.

Amoroso-Robinson

(2.). 1st order condition expressed using the Amoroso-Robinson formula:
For the loan rate:

$$r_L = \frac{r + c_L'}{1 - \dfrac{1}{\varepsilon_L}}.$$

and for the deposit rate:

$$r_D = \frac{(1-\alpha)r - c_D'}{1 + \dfrac{1}{\varepsilon_D}}.$$

Application: Taxing banks

Proposed as a way of making banks more secure (after the crisis 2007-8)
Suppose that a tax is collected as a fixed percentage t of the loans L.
Then profits are

$$\pi(D, L) = (r_L(L) - (r + t))L + ((1 - \alpha)r - r_D(D))D - c(D, L),$$

and 1st order condition wrt L become

$$\frac{r_L - (r + t + c'_L)}{r_L} = \frac{1}{\varepsilon_L},$$

1st order condition wrt r_D is as before.

The Lerner index is unchanged if ε_L is constant: The tax is shifted to the borrowers.

Depositors are unaffected if c'_D is independent of L ($c(D; L)$ separable in D and L)

Oligopoly

Suppose that there are not one but a few (namely N) banks.
Banks choose *quantities* (Cournot oligopoly) to maximize

$$\pi_i(D, L) = (r_L(L) - r)L_i + ((1-\alpha)r - r_D(D))D_i - c(D_i, L_i),$$

with $L = \sum_{i=1}^{N} L_i,\ D = \sum_{i=1}^{N} D_i$.
First order conditions:

$$\frac{\partial \pi}{\partial L} = r_L' L_i + r_L - r - c_L' = 0,$$
$$\frac{\partial \pi}{\partial D} = -r_D' D_i + (1-\alpha)r - r_D - c_D' = 0.$$

Symmetric case: Lerner indexes are

$$\frac{r_L - (r + c_L')}{r_L} = \frac{1}{N\varepsilon_L}, \quad \frac{r(1-\alpha) - r_D - c_D'}{r_D} = \frac{1}{N\varepsilon_D}$$