INDUSTRIAL ORGANIZATION APPROACH TO BANKING FIRM

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Semester 1/2017

EE 431

UP TO THIS POINT

- Understand some stylized features of financial system.

- What shapes the pattern of (equilibrium) financial structure around the world. (what rationalize the data.)

- Why FIs, and Banks in particular, exist?

- Knowing basic behaviors of banking firm that gets reflected in terms of some key principles of bank managements.

WHAT'S NEXT?

- Discuss about banking industry as a whole.
- Begin with understanding the notation of the *industrial organization approach to banking firms.*
- Then, look into equilibrium analysis of banking industry and ask about some regulatory issues.
- Reading: Kent and Matthew "Chapter 6: Theory of banking firm"

WHAT IS THE INDUSTRIAL ORGANIZATION APPROACH TO (BANKING) FIRM?

What is the study on industrial organization?

- Study about behavior of firms under different market structures.
- Measuring performance (outcome) of firms and explain the pattern of observed data.
- Normatively, industrial organization asks about how to improve the market outcome, i.e. efficiency and desirability.

Industrial organization approach to banking firm

- Simply treating "bank" as a type of firm.

A QUICK REFRESH CONCEPT ON THEORY OF FIRM AND INDUSTRY EQUILIBRIUM

Firm v.s. industry

- Firm: a unit of production
- Industry: several firms

To understand the equilibrium of industry,

- We need to firstly understand about firms' behavior
- Next, how equilibrium outcome is determined; under what market structure and conditions?

A QUICK REFRESH CONCEPT ON THEORY OF FIRM AND INDUSTRY EQUILIBRIUM

Firm's behavior is usually modeled by profit-maximizing problem.

- Firm has a technology, and resulting cost function
- Produce output/goods/services that is demanded in the market (by consumers).
- Cost function, as expressed in terms of output, is typically derived.
- Then, we ask about the right amount of output, and price, that maximize the profit, loosely defined as revenue minus cost.

Firm's behavior differ across market structure.

- How to choose the right quantity of output depends on the market structure.
- Perfect competition: $p = mc$
- Monopoly: $p > mr = mc$

A QUICK REFRESH CONCEPT ON THEORY OF FIRM AND INDUSTRY EQUILIBRIUM

Equilibrium

- Short-run: for a fixed number of firm, price clears the market where aggregate demand (not modeled) is equal to aggregate supply (derived from individual supply).

- Long-run: If entry is allowed for, the number of firms might be changing. In the long-run, the number will respond to the level of existing profit that each incumbent has earned. Industry equilibrium arises when each firm earns 'zero' profit.

BANKING AS A FIRM IN THE INDUSTRIAL ORGANIZATION

To model bank's industry equilibrium using the approach, we need to begin with defining three things:

- What is the quantity of output for commercial banks?
- What is the cost of commercial banks?
- What is the price of commercial banks' output and cost?

BANKING AS A FIRM IN THE INDUSTRIAL ORGANIZATION

- What does a commercial bank do?

Asset	Liability
Reserve (R)	Deposit (D)
Tradable security (T)	
Create loan (L)	
	Bank equity (E)

- Accept Deposit (D) / borrow (B) → incurring financial cost: r_D and r_B.
- Creating loan (L) / Tradable security (T) → generating income: r and r_T.
- Reserve held on the balance sheet for the purpose of liquidity management and meeting regulatory requirement.

BANK'S PROFIT?

$$\pi = Total\ Revenue\ - Total\ cost$$

$$\pi = r_L L + r_T T - i_D D - C(D, L)$$

$$L + T + R = D + E$$

Suppose bank only holds reserve equal to the required reserve.

$$L + T = (1 - k)D + E$$

BANK'S PROFIT?

What does the $C(D, L)$ represent?

- Non-interest expenses on banking operation.
- Loan monitoring / loan enforcement / loan screening cost.
- Attracting/securing deposit.

Cost is increasing in both "D" and "L".

We have all everything we need. Let's proceed to all the analytical cases.

We begin with the perfect competition case.

BANK'S BEHAVIOR UNDER *PERFECT COMPETITIVE MARKET*

- Bank takes all the interest rates (loan, treasury, deposit) as given.
- Suppose for now that bank uses no equity financing, i.e. E = 0.
- The problem can be stated as

$$\max_{L,T,D} r_L L + r_T T - r_D D - C(D, L)$$

$$L + T = (1 - k)D$$

$$\max_{L,D} r_L L + r_T[(1 - k)D - L] - r_D D - C(D, L)$$

BANK'S OPTIMAL CONDITIONS

- [D]: $(1-k)r_T = r_D + C_D(D,L)$

- [L]: $r_L = r_T + C_L(D,L)$

BANK'S *INTEREST RATE SPREAD*: SHORT-RUN

- Suppose that each bank has the same non-interest cost. The two conditions can be interpreted as equilibrium conditions.

- Combining the two yields us an interpretation to the equilibrium bank spread ($r_L - r_D$):

$$r_L = r_D + kr_T + C_L(D, L) + C_D(D, L)$$

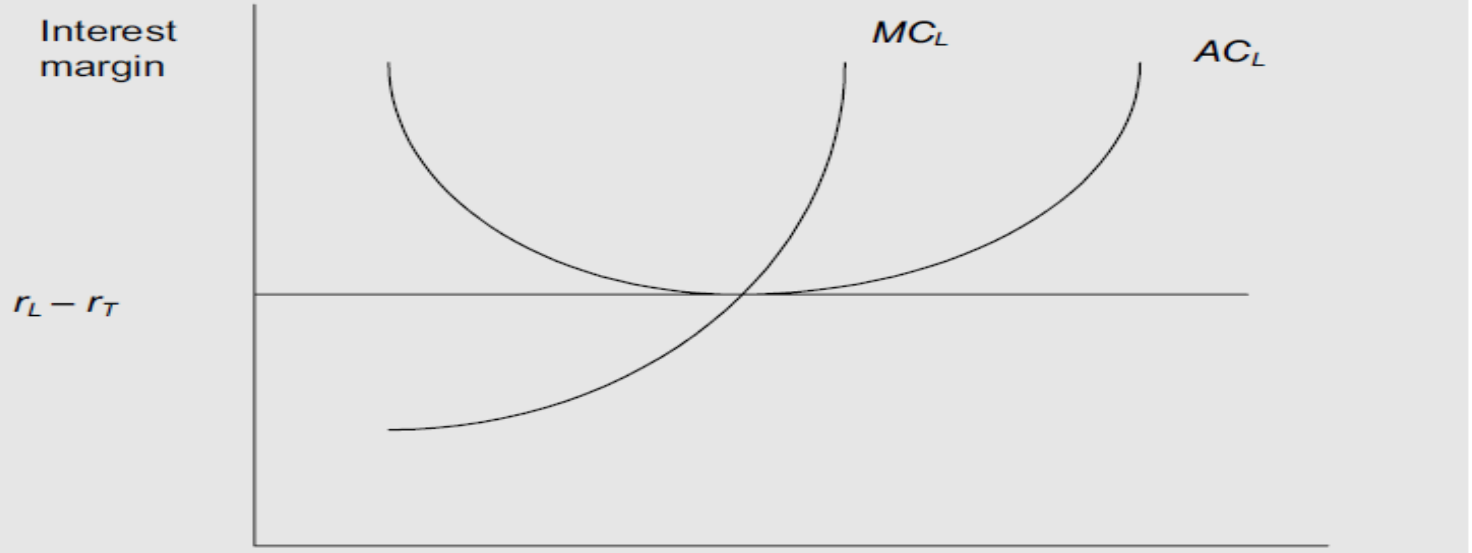
$$r_L - r_D = kr_T + C_L(D, L) + C_D(D, L)$$

BANK'S INTEREST RATE SPREAD: LONG-RUN

Long-run equilibrium suggests that each bank earns "zero" profit. (number of bank is endogenously determined.)

FIGURE 6.1

The competitive model



MONOPOLY BANK: MONOPOLY IN LOAN AND MONOPSONY IN DEPOSIT

- Now we extend to the analysis of monopoly bank.

- Assuming double monopoly.

  - Loan market: $\mathrm{L} = L(r_L)$; $L'(r_L) < 0$

  - Deposit market: $\mathrm{D} = D(r_D)$; $D'(r_D) > 0$

MONOPOLY BANK

$$\max_{L,D} r_L(L)L + r_T[(1-k)D - L] - r_D(D)D - C(L,D)$$

Bank's optimal condition:

$$r_L'(L)L + r_L - \{r_T + C_L(L,D)\} = 0$$

$$r_T(1-k) - \{r_D'(D)D + r_D + C_D(L,D)\} = 0$$

SUPPOSE THAT $C(L, D) = constant$

FIGURE 6.2

Equilibrium for loans $r_L'(L)L + r_L - r_T = 0$

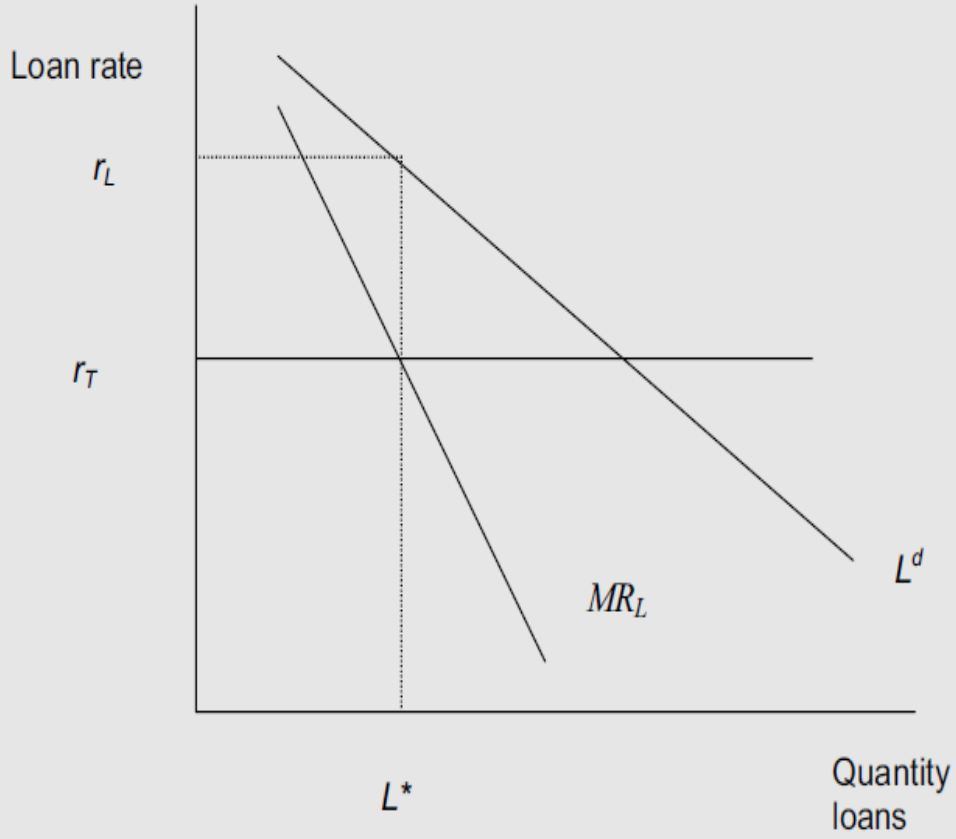
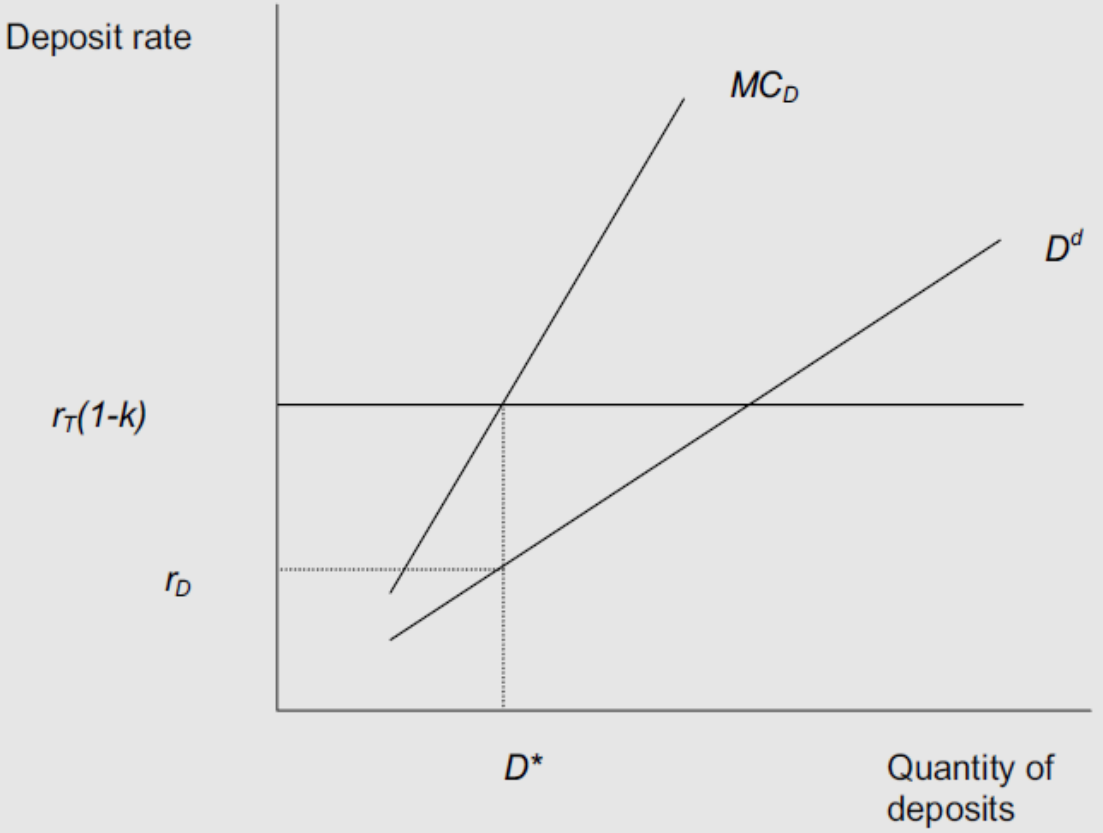


FIGURE 6.3

Equilibrium for deposits $r_T(1-k) - (r_D'(D)D + r_D) = 0$



MONOPOLY BANK AND *THE LEARNER INDEX*

Define $e_L = -\frac{r_L}{r_L'(L)L} > 0$ (inverse elasticity of loan demand) and

$e_D = \frac{r_D}{r_D'(D)D} > 0$ (inverse elasticity of loan supply)

$$\frac{r_L - \{r_T + C_L(L, D)\}}{r_L} = \frac{1}{e_L}$$

$$\frac{r_T(1-k) - \{r_D + C_D(L, D)\}}{r_D} = \frac{1}{e_D}$$

PERFECT COMPETITION V.S. MONOPOLY

Two extreme cases are simple, but don't provide any much insight about how banking industry actually evolves.

More realistic cases are is the oligopolistic banking structure.

- Oligopoly in loan market
- Oligopsony in deposit market.

OLIGOPOLISTIC BANKING STRUCTURE

Competition under *Cournot* fashion.

Suppose we have "N" banks in the industry.

- (inverse) loan demand : $r_L(L) = r_L\left(\sum_{i=1}^{N} L_i\right)$
- (inverse) deposit supply: $r_D(D) = r_D\left(\sum_{i=1}^{N} D_i\right)$

OLIGOPOLISTIC BANK'S PROBLEM

$$\max_{L_j, D_j} r_L\left(\sum_{i=1}^{N} L_i\right) L_j + r_T\left[(1-k)D_j - L_j\right] - r_D\left(\sum_{i=1}^{N} D_i\right) D_j - C^j(L_j, D_j)$$

Each bank chooses for L_j, D_j that maximizes the profit.

- Taking as given what other banks choose.

BANK'S OPTIMAL CONDITION

Suppose that $C^j\left(L_j, D_j\right) = \gamma_L^j L_j + \gamma_D^j D_j$

$[L_j]$:

$[D_j]$:

SYMMETRIC EQUILIBRIUM

Since $L_j^* = \frac{L}{n}$ and $L_j^* = \frac{D}{n}$, we can show that

$$\frac{r_L - (r_T + \gamma_L)}{r_L} = \frac{1}{ne_L}$$

$$\frac{r_T(1-k) - (\gamma_D + r_D)}{r_D} = \frac{1}{ne_D}$$

$$r_L - r_D = \frac{r_T}{1 - \frac{1}{ne_L}} - \frac{r_T(1-k)}{1 + \frac{1}{ne_D}}$$

HOW LOAN RATE/DEPOSIT RATE ADJUSTS TO MARKET INTEREST RATE?

We can show that

$$\frac{\partial r_L}{\partial r_T} = \frac{1}{1 - 1/ne_L}$$

$$\frac{\partial r_D}{\partial r_T} = \frac{1 - k}{1 + 1/ne_D}$$

Economically, this is called the *"interest rate pass-through"*.

CONCLUSIONS

- By treating bank as a regular firm, one can understand some key principles of pricing decisions.
- Interest-rate spread can be generated in the equilibrium, and varied with market structure.
- Change in the market interest rate affects loan rates differently across market structures.