Topic 10 : Bank Run, Systemic Risk and Deposit Insurance

EE431/438

Peter D. Spencer, Chapter 10
(available at the reserve section of the library, HG173 .S637)

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- Topic 8 Theory of Financial Intermediation : why financial intermediaries(FIs) exist.
- Topic 9 Convexity, Excessive Risk and Bank Regulation : the equilbrium in the financial market with asymmtric information and FIs.
- Topic 10 Bank Run, Systemic Risk and Deposit Insurance : bank's liquidity problem
- Depositors can withdraw their money at any time while the bank cannot recall its loans in a similar way.
- If the bank does not hold enough cash, it will suffer from liquidity problem.
- Liquidity problem can cause solvency problem.

- Normally, the bank has advantage over individual borrowers of managing liquidity risk

1. *Advantage in Scale of Managing*. The bank has a large scale of borrowing. Liquidity needs become more predictable (the same idea as the benefit of diversification in topic 8).

Figure 1: Direct Finance

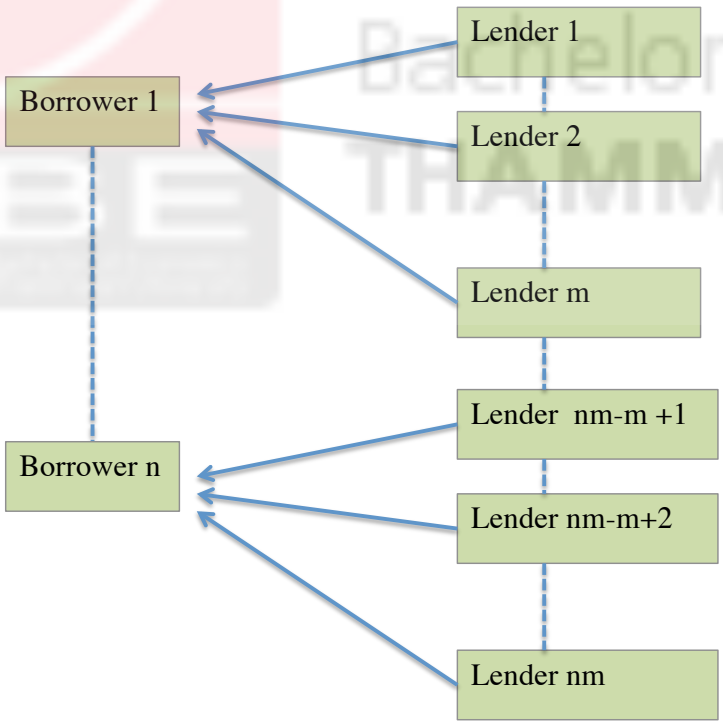
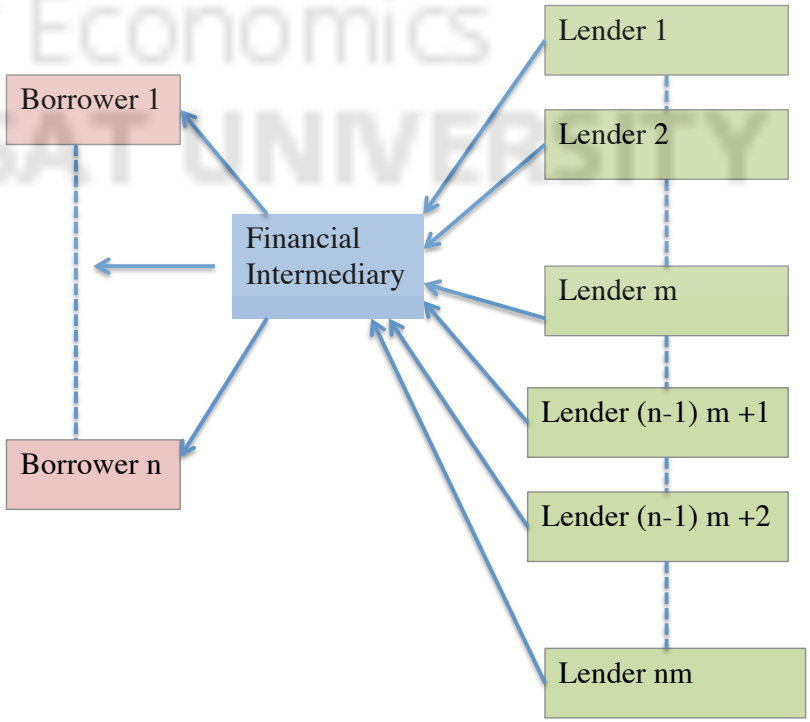


Figure 2. Intermediated Finance



2. Demand for cash of each depositors is unlikely to be perfectly correlated or coordinated. Most of the time it is likely to be inversely correlated. Why?
Therefore, interbank market can help. Overall, in normal time, banking system would have no liquidity problem.

- It is still possible that the banking system will have liquidity problem.
- It occurs when all the depositors want to withdraw the money not because they need it to spend but because they are panicking.
- The effect may be contagious.
- In this case, no bank can hold enough reserve and interbank market cannot help.
- What the bank will do when they do not have enough cash to pay their depositors? (Topic 7)
- Liquidation of the bank's assets before maturity causes a loss.
- Then liquidity problem causes solvency problem.

Dybvig and Diamond (1983) model

- There are 3 period: numbered 0, 1, and 2.
- Primary nvestments cost 1 in period 0, and yield 1 if cshed in period 1, $R > 1$ if cashed in period 2
- Individual are identical
  - Each has wealth of 1 unit in period 0
  - Each will realize their type in period 1. Each can be either type 1 or type 2.
    - Type 1s (early die) die and consome C_1 in period 1 with utility level $U(C_1)$
    - Type 2s (late die) die in period 2 with utility level $U(C_1 + C_2)$. Since $R > 1$, type 2 optimally set $C_1 = 0$.
    - Each individual's type is his own private information.

- Utility function $U(C)$ is defined over consumption C with $U' = \frac{\partial U}{\partial C} > 0, \frac{\partial^2 U}{\partial C^2} < 0$. It satisfies the Inada conditions: $U'(0) = \infty, U'(\infty) = 0$
  - Currrent consumption is a normal good in the sense that it falls in response to an increase in its relative cost (R). In other words, high degree of intertemporal substitution : $-\frac{\frac{C\partial^2 U}{\partial C^2}}{\frac{\partial U}{\partial C}} > 1$
  - compare $U(C)$ with $U(C) = lnC$
- Individuals know that there will be p percent type 1s and $(1-p)$ percent type 2s.

Autarchy

- Type 1s will have to liquidate their investment early and hence get lower utility.
- At period 0, no one knows their type, so $EU =$
- utility function is concave. Autarchic is inefficient.

Optimal Social Insurance

- Let $p = \frac{1}{2}$.
- Continuum of agents. Total population is nomalised to 2.
- Therefore, population of type 1 = population of type 2 = 1
- S1 = bad state =early die, S2= good state = late die
- C_1 = consumption in period 1
- C_2= consumption in period 2
- Autaky solution?
- Opimization function

$$\begin{aligned} & \text{Max } U = U(C_1) + U(C_2) \\ \text{subject to} \quad & C_1 \leq ..... \\ & C_2 = ... \end{aligned}$$

- Optimal value = C_1^*, C_2^*
- Draw the solution on (C_1, C_2) space.
- Slope of the budget line = ...

- How does C_1^* compare to C_2^* ? Should they be equal?
- How does (C_1^*, C_2^*) compare to $(1,\ R)$, the consumption point for autarky case?
- Recall assumption that $-\frac{C\partial^2 U}{\partial C^2}{\partial U} > 1$. This assumption implies the indifferent curve is steeper than logarithmic utility function case.
- Consider logarithmic utility function case.

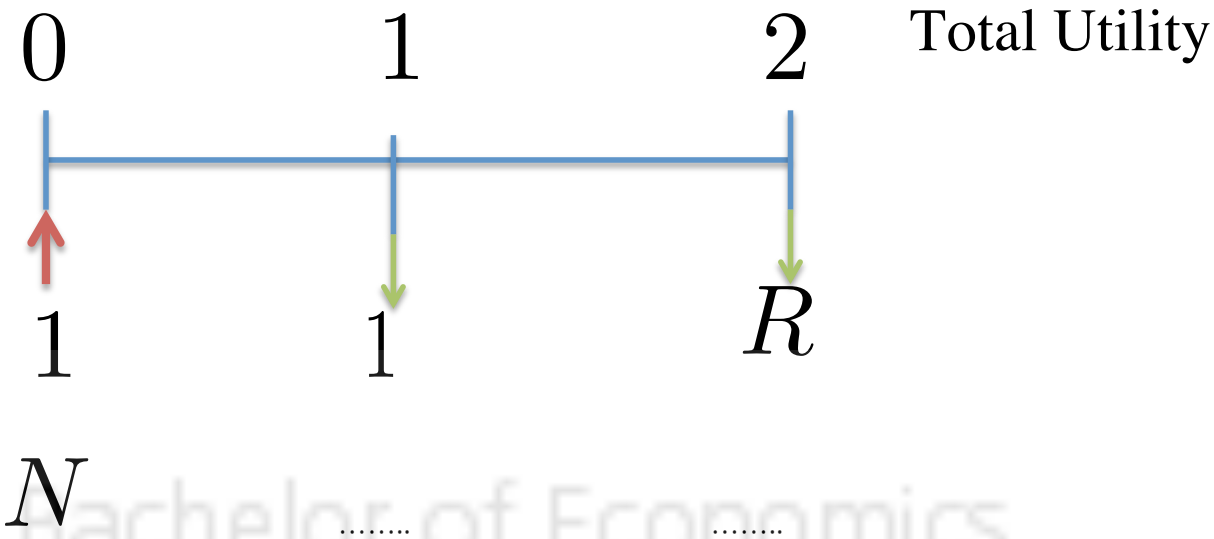
$$\frac{U'(C_1)}{U'(C_2)} = ...$$

- Therefore, for logarithimic utility function, (C_1^*, C_2^*) is $(1,\ R)$.
- Here, the indifferent curve is steeper.
- Go back the the graph. Hence, $1 < C_1^* < C_2^* < R$.

- If there is no trade, the economy will never achieve (C_1^*, C_2^*).
- (C_1^*, C_2^*) can be achieved by an insurance contract.
- i.e. agents agree beforehand that type 2 will pay type 1 a nominal amount π^* at period 1 : $C_1^* = 1 + \pi^*$,
  $C_2^* = R(.....) = R(.....)$
- Dybvig and Diamond show that (C_1^*, C_2^*) can be achieved by a non-tradable deposit contract.
- The bank as a financial intermediary pools all the resources from all the agents in the economy and operate the investment projects. When the types of agents are realised, the bank allocates the returns from investment to both types of agents.
- The depositors who withdraw early (early die) will get the lower interest rate on deposit. $C_1^* < C_2^*$

Bank Solution

- Since $C_1^* < C_2^*$, type 2 individuals keep their money in the bank unless they fear of a bank run.
- There is no fundamental basis for such fears in this model
- If only $p = \frac{1}{2}$ of population withdraw early there will be always enough cash to pay those who withdraw late
- Suppose the population is now equal to N.



Technology

Autarky

Bank
Solution
(No run)

- Bank solution (bank run)?
- In period 1, people fear that the bank will become insolvent.
- Type 1s have to withdraw in period 1 since they need to consume.
- Type 2 s can choose to withdraw either in period 1 or period 2.
- If both types withdraw early, total amount of deposit claims is equal to .....
- However, the bank has just only ..... which is less than NC_1^*
- First come, first serve.
- Only $f = ?$ depositors will get C_1^*
- The rest $1 - f =$ ..... will have nothing to consume
- Total welfare is then equal to .....

	Welfare
Autarchy	
Bank Solution (No bank run)	
Bank Solution (Bank run)	

- Bank solution (bank run) is ..... (better or worse) than autarky case.
  - Distribution Effect
  - Premature liquidation Effect
- Will there be a bank run? $\Rightarrow$Payoff of type1s and type 2s
- type 1s has no choice, they have to withdraw early
- bank will run if type 2 decide to withdraw early

- payoff matrix

		Type 2 #1: Withdraw late	Type 2 #1: Withdraw early
Type 2 #2	Withdraw late		
	Withdraw early		

- Find Nash Equilibrium.
- How to prevent bank runs?

1. Suspension of converibility
   - bank shut the door once it is clear that the panic is developing
   - it will close the door as soon as $p = \frac{1}{2}$ people withdraw C_1^*.
   - disadvantages? advantages?
2. Deposit Insurance
   - government backed deposit insurance
   - the first $\frac{N}{C_1^*}$ people who withdraw get C_1^*. The rest $1 - \frac{N}{C_1^*}$ get nothing.
   - the government collect tax from those $\frac{N}{C_1^*}$ people, each is taxed $C_1^* - 1$.
   - each of those $\frac{N}{C_1^*}$ will have ..... left for their consumption.
   - The government will give their tax income to $1 - \frac{N}{C_1^*}$ people who get nothing. Each get ?

- payoff matrix

Type 2 #1

Type 2 #2		Withdraw late	Withdraw early
	Withdraw late		
	Withdraw early		

- However, now type 2 individuals have nothing to gain by withdrawing early even if there is a bank run
- There is always some chance tat there will not be a panic and they will get $C_2^* > 1$
- Good Nash Equilibrium is unique.
- tax system has to be used appropriately
  - "income distribution after tax"
  - the model suggests that the government should guarantee only the principal.