

Topic 9 : Convexity, Excessive Risk and Bank Regulation # 2

EE431/438

Peter D. Spencer, Chapter 9
(available at the reserve section of the library, HG173 .S637)

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Bank Loan Markets and Convexity

- Adverse selection problem $\rightarrow$ credit rationing
- Banks borrow the money from depositors. Their debt to equity ratio is very high.
- Low equity, high debt, limited liability $\Rightarrow$ convexity $\Rightarrow$ excessive risk, asset substitution $\rightarrow$ negative effect to the depositors $\Rightarrow$? appropriate bank regulations
- Credit Rationing : unsatisfied demand by borrowers at existing loan rate. Credit rationing can occur for many reasons.

A simple model of credit rationing

- Off-Equilibrium Credit Rationing

- Restriction on availability : Post-War period: the U.K government rationed mortgage and consumer lending while keeping interest rates relatively low to encourage industrial borrowing and investment.
- Interest rates are too slow to adjust. How can this phenomenon be sustained in equilibrium? Why don't banks simply raise their interest rate to choke off the surplus borrower?

- Equilibrium Credit Rationing : Stiglitz and Weiss (1981) “twin effect” (adverse selection and moral hazard) “expected return can fall when interest rate charges rise”

- Basic Assumptions:

- 1 Borrowers invest in project with the same mean return, but different degree of risk: represented by the spread θ
- 2 The Bank cannot distinguish between borrowers with high-and low risk projects, so all borrowers pay the same interest rate (pooling equilibrium)

- Two types of borrowers, A and B.
- Half of the total population of the borrower are type A. The other half are type B.
- Borrower A(B) can invest in project A(B).

	Project A	Project B
Return on Project		
Return to Equity		
Return to Debt		

- Asymmetric information : the bank cannot distinguish type A borrower from Type B borrower.

- Each borrower has to borrow I to invest in his investment project and pay loan rate r_L .
- Therefore, the amount of loan payment promised to the bank, $L =$
.....
- Break-even loan rate

Type A borrower, r_L^*	Type B borrower, r_L^{**}
	
if $r_L < r_L^*$, if $r_L = r_L^*$, if $r_L > r_L^*$,	if $r_L < r_L^{**}$, if $r_L = r_L^{**}$, if $r_L > r_L^{**}$,
$r_L^* \dots\dots r_L^{**}$	

- Deposit market is perfectly competitive. The bank takes the deposit rate, r_D as given.
- Bank profits?
 - Income =.....
 - Cost =.....
 - Profit = Income - Cost
- consider two cases :
 - $0 < r_L \leq r_L^*$
 - $r_L^* < r_L \leq r_L^{**}$
 $\Rightarrow$ What types of borrower will borrow from the bank? What is the bank's expected profit?
- $0 < r_L \leq r_L^* : \pi = \frac{3}{4}(r_L - r_D)I + \frac{1}{4}(Y_1 - (1 + r_D)I) \Rightarrow (\text{Equation 1})$
- $r_L^* < r_L \leq r_L^{**} : \pi = \frac{1}{2}(r_L - r_D)I + \frac{1}{2}(Y_1 - (1 + r_D)I) \Rightarrow (\text{Equation 2})$
- Monopoly bank will charge r_L^* or r_L^{**} .

Competitive Equilibrium

- Perfect competition in bank loan market is assumed
- Bank's economic profit is then equal to zero
- First case : $0 < r_L \leq r_L^*$, $r_L = r_D + \frac{1}{3} \left[1 - \frac{Y_1}{I} + r_D \right]$
 - r_L is mark-up on r_D : $r_D \uparrow$, r_L
 - $r_L < r_L^* = \dots\dots\dots$
 - $r_D < r_D^* = \frac{3}{4} \frac{\bar{Y}}{I} - 1 + \frac{1}{4} \frac{Y_1}{I}$

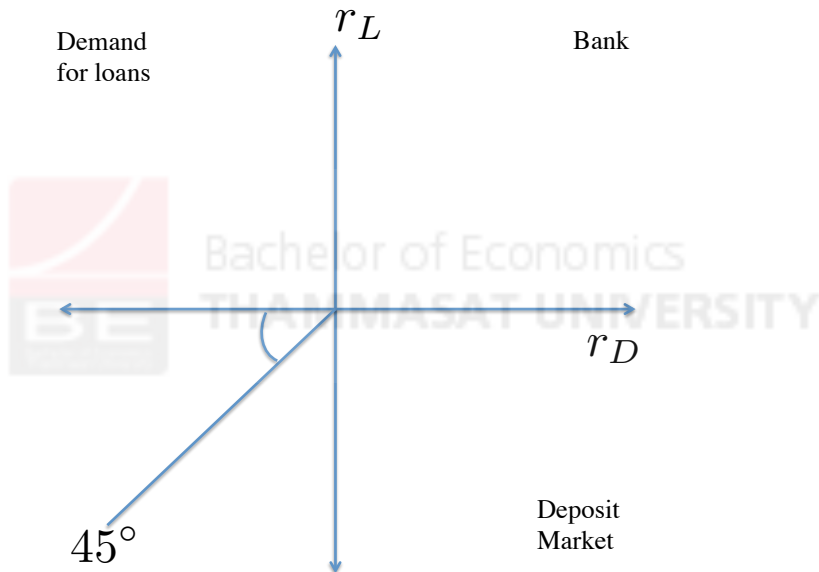
- First case : draw equilibrium in (r_L, r_D) plane



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- If $r_D > r_D^* = \frac{3}{4} \frac{\bar{Y}}{I} + \frac{1}{4} \frac{Y_1}{I} - 1$, the bank has to charge $r_L > r_L^*$. Only type B borrowers are able to borrow.
- Second case : $r_L^* < r_L \leq r_L^{**}$
 - $\pi = \dots$
 - Competition forces bank's economic profit to zero
 - $r_L = 2r_D - \frac{Y_1}{I} + 1$
 - $r_D > r_D^* = \frac{3}{4} \frac{\bar{Y}}{I} + \frac{1}{4} \frac{Y_1}{I} - 1, r_L > r_L' = \frac{\bar{Y}}{I} + \frac{1}{4} \frac{(Y_2 - Y_1)}{I} - 1$
 - $r_L' \dots r_L^*$
- Second case : draw equilibrium in (r_L, r_D) plane

Competitive Pooling Equilibrium



- Equilibrium depends on the deposit supply

- 1 There are enough deposits forthcoming at rate at or below r_D^* : deposit supply is enough to finance both type A and type B borrowers $\Rightarrow r_D = r_D^*$ and $r_L = r_L^*$
 - 2 If the deposit supply at a rate between r_D^* and r_D^{**} is enough to finance only type B borrower $\Rightarrow r_D = r_D^{**}$ and $r_L = r_L^{**}$
 - 3 If the deposit supply at r_D^* is enough to accommodate type B but not sufficient to accommodate type A and type B together
 - at $r_L = r_L^*$ and $0 < r_L < r_L^*$, there is an excess for loans
 - at $r_L > r_L^*$, there is an excess for loans
 - there is no market clearing equilibrium
- 1 $r_D = r_D^*$, $r_L = r_L^*$: the bank lends to both type A and type B subject to the availability of credit. Not all borrowers get finance.
 - 2 $r_D = r_D^*$, $r_L = r_L'$: all type B borrowers will get finance.
- In this model, only (a) will happen. Type B finds it more profitable to mix with low-risk type and take their chances to get funds at r_L^* rather than getting funds at r_L' for sure.

Implications for the prudential regulation of banks

- there are so many possible sources of credit rationing → appropriate ways to solve the problem depends on what causes credit rationing
- off-equilibrium credit rationing
 - government intervention : benefit vs cost
 - deposit supply is too slow to adjust to changing market : find the other source of funds
- equilibrium credit rationing
 - asymmetric information problem → credit rationing
 - the government should not force the bank to increase credit (why?)
 - the bank also has an incentive to take excessive risk
 - banks which offer high deposit rates are usually risky banks
 - regulation : deposit ceiling (regulation Q in the US in 1933), cons = ?