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Chapter 16.1

Optimal remuneration

Outline

Bankers and traders

- Bankers assess securities and loans and monitor them, thereby adding value to the through increased value or higher likelihood of being repaid
- Traders assess the value of the securities and loans provided by other banks with an aim to benefit from trading these
- Remuneration of bankers and traders should be based on the value they add to the bank employing them
- Bankers add social value, while traders do not add social value, they only re-distribute value
- How is remuneration determined for these two types of employees?

Loan repayments

- Banks have given a loan L with interest r_L
- Probability that the loan is repaid is either π_H^i or $\pi_L^i = \delta\pi_H^i$
- State H occurs with probability p, but this probability for an individual loan is not known to other banks, only thr bank originating the loan
- The other banks receive a signal about the state and this is correct with probability ρ_i

Loans with low and high signals

- A bank does not know the probability with which the loans of another bank is repaid, but from expectations $E_i\left[\pi_s^j\right]$
- Bank i will assess a loan given by bank j if given a signal L as
- $P_L^{ij} = \rho_i E_i\left[\pi_L^j\right](1+r_L)\,L + (1-\rho_i)\,E_i\left[\pi_H^j\right](1+r_L)\,L$
- The signal L can be correct or incorrect, and gives the inference of the high or low probability of default
- For the high signal we get similarly
- $P_H^{ij} = \rho_i E_i\left[\pi_H^j\right](1+r_L)\,L + (1-\rho_i)\,E_i\left[\pi_L^j\right](1+r_L)\,L$

Seller accepting low offers

- If $\rho_i > \frac{1}{2}$, then $P_L^{ij} < P_H^{ij}$
- A bank can always offer to sell at P_L^{ij} and the loan will be purchased, if the banks wants to sell at P_H^{ij}, then the buyer needs to have the high signal
- We need $P_L^{ij} > pP_H^{ij}$ for the seller to accept the low offer
- This gives $\rho_i \leq \frac{1-p\delta}{(1-\delta)(1-p)}$
- Adverse selection must not be too high for the seller willing to accept low offers

Liquidity shock

- A bank faces a liquidity shortage with probability λ and has to sell loans
- A bank not facing a liquidity shortage has excess liquidity and would buy these loans
- Banks employ bankers, who can affect the probability of loans being repaid, π_j^i
- Banks employ traders, who obtain signals with precision ρ_i

Bank profits

- Banks facing a liquidity shortage, sell the loan for what the other bank thinks it is worth, P_L^{ji}
- Banks not facing a liquidity shortage, retain their loan
- and purchase at a price P_L^{ij} the loan of the other bank
- They pay depositors and their bankers and traders
- $$\Pi_B^i = \lambda P_L^{ji} + (1-\lambda)\left(p\pi_H^i\left(1+r_L\right)L + (1-p)\,\pi_L^i\left(1+r_L\right)L \right.$$
$$+ \left.\left(pE_i\left[\pi_H^j\right]\left(1+r_L\right)L + (1-p)\,E_i\left[\pi_L^j\right]\left(1+r_L\right)L - P_L^{ij}\right)\right)$$
$$- \left(1+r_D\right)D - w_T N_T^i - w_B N_B^i$$

Price of the loan the other bank pays

- The price paid will be determined by the inference the bank has on the quality of the signal by the other bank
- $P_L^{ji} = E_i\left[\rho_j\right]\pi_L^i\left(1+r_L\right)L + \left(1-E_i\left[\rho_j\right]\right)\pi_H^i\left(1+r_L\right)L$
- Probability of loans being repaid and the quality of the signal are not given but banks will optimize them

Hiring more bankers and traders

- Hiring more bankers increases the likelihood of loans being repaid: $\frac{\partial \pi_s^i}{\partial N_B^i} > 0$
- Hiring more traders increases the precision of the signal: $\frac{\partial \rho_i}{\partial N_T^i} > 0$
- The total number of bankers and traders is limited to N_k each
- If a bank hires N_k^i bankers or traders, the remaining banks share $N_k^j = \frac{N_k - N_k^i}{N-1}$

Influence of bankers and traders

- Influence of bankers on loan repayments of other banks:
  $$\frac{\partial \pi_H^j}{\partial N_B^i} = \frac{\partial \pi_H^j}{\partial N_B^j} \frac{\partial N_B^j}{\partial N_B^i} = -\frac{1}{N-1} \frac{\partial \pi_H^j}{\partial N_B^j} < 0$$
- Influence of traders on signal precision of other banks:
  $$\frac{\partial \rho_j}{\partial N_T^i} = \frac{\partial \rho_j}{\partial N_T^j} \frac{\partial N_T^j}{\partial N_T^i} = -\frac{1}{N-1} \frac{\partial \rho_j}{\partial N_T^j} < 0$$
- As the number of bankers and traders is limited, hiring more will reduce the number available to other banks and thus reduce their probability of loan repayment or signal precision

Number of bankers and traders

- Ignoring the effect hiring a banker has on the ability of other banks, the optimal number of bankers and traders to hire is given from $\frac{\partial \Pi_B^i}{\partial N_T^i} = \frac{\partial \Pi_B^i}{\partial N_B^i} = 0$
- All banks are alike, hence banks will infer that they behave like them: $E_i\left[\pi_H^j\right] = \pi_H^i$ and $E_i\left[\rho_j\right] = \rho_i$
- Traders: $w_T^* = (1-\lambda)(1-\delta)\pi_H^i(1+r_L)L\frac{\partial \rho_i}{\partial N_T^i}$
- Bankers: $w_B^* = (V + (1-\delta)\lambda(1-\rho_i-p)(1+r_L)L)\frac{\partial \pi_H^i}{\partial N_B^i}$

Equilibrium wages

- A Pareto optimal allocation of resources within banks requires that the marginal products of bankers and traders are identical
- The marginal product of a banker or trader is its wage
- This implies that $w_T^* = w_B^* = w^*$
- The wages are adjusted by hiring the requisite number of bankers and traders to adjust $\frac{\partial \rho_i}{\partial N_T^i}$ and $\frac{\partial \pi_H^i}{\partial N_B^i}$ accordingly

Optimal wages with impact on other banks

- The bank will now take into account the effect its hiring of a banker or trader has on the ability of the other bank to do likewise
- The optimal number of bankers and traders to hire is given from $\frac{\partial \Pi_B^i}{\partial N_T^i} = \frac{\partial \Pi_B^i}{\partial N_B^i} = 0$
- Traders: $w_T^{**} = (1-\delta)\left((1-\lambda) + \frac{\lambda}{N-1}\right)(1+r_L)\,L\,\frac{\partial \rho_i}{\partial N_T^i}$
- Bankers: $w_B^{**} = \frac{\partial \pi_H^i}{\partial N_B^i}\left(V + \left(\lambda + \frac{1-\lambda}{N-1}\right)(1-\delta)(1-\rho_i - p)(1+r_L)\,L\right)$

Traders are paid more than bankers

- Comparing with the efficient wage, we get $w_T^{**} > w^* > w_B^{**}$
- Traders are paid more than bankers
- Traders are paid more than their marginal product, they are overpaid
- Bankers are paid less than their marginal product, they are underpaid

Overpaid traders

- Traders contribute to bank profits by evaluating loans the bank buys
- Hiring traders contributes also to the bank achieving a higher sales price for their loans

$\Rightarrow$ Denying other banks a trader, reduces the precision of their signal

$\Rightarrow$ As $\frac{\partial P_L^{ij}}{\partial \rho_i} < 0$, the sale price of the loan increases

- Traders indirectly contribute more than their marginal product from signal precision to the profits of the bank

Underpaid bankers

- Bankers increase the value of the loan the bank holds through higher probabilities of repayment
- This also increases the value of the loan to any purchaser as loans are sold at a discount, increasing the loss to the selling bank
- This causes an externality and the banker contributes less than its marginal product from increasing the probability of repayment

Private benefits

- Traders create profits by buying loans at a higher discount and preventing other banks to purchasing loans at a high discount
- They benefit banks in two ways, making their remuneration high
- Bankers create value to the bank by reducing the default rate of loans, this also benefits the purchaser of a loan as it will be paid at a higher discount
- They create an externality that reduces bank profits, making their remuneration low

Social benefits

- Bankers produce social value by reducing defaults
- Traders produce no social surplus as they only redistribute value between banks
- The activity increasing welfare is paid less than the activity adding no welfare
- It is privately rational to reward traders more highly

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