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Chapter 18.2.1

The optimality of deposit insurance limits

Outline

- Problem and model assumptions
- No deposit insurance
- Full deposit coverage
- Partial deposit coverage
- Summary

Outline

- Deposit insurance can reduce or even eliminate the risk of bank runs.
- It is, however, common to find that deposit insurance is limited to small deposits only; larger deposits, those above a certain limit in size, will not be covered.
- We will investigate why such a limit on the cover deposit insurance provides is optimal.

Outline

- We will compare the three scenarios of no deposit insurance being offered, all deposits being covered by deposit insurance, and only small deposits being covered by deposit insurance.
- We can then compare the preferences banks have for these different types of deposit insurance covers. This assumes that decisions on deposit insurance cover are made under the influence of banks and their ability to successfully lobby politicians and regulators.

- Problem and model assumptions
- No deposit insurance
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- We will first develop the basic ideas of the model we will subsequently analyse.

Dividing deposits

- The amount of deposits covered by deposit insurance is usually limited
- Depositors may divide their deposits between banks to increase their coverage
- Banks compete with deposit rates and might retain larger deposits if these are sufficiently attractive
- Banks might find it optimal to limit deposit insurance to attract parts of larger deposits

Dividing deposits

→ Deposit insurance has limits to its coverage, and this limit is typically applied to deposits in each bank for each individual.

- In most cases deposits are only covered by deposit insurance up to a certain limit per person; any deposits exceeding this limit will only be covered up this limit and the amount above the limit is then uncovered.
- Typically deposit coverage is for deposits ar each bank, so depositors can spread their deposits across different banks to increase the amount they have covered by deposit insurance.
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  - Depositors react sensitively to the deposit rate banks offer, this is particularly true for larger deposits.
  - If a bank offers attractive deposit rates, large depositors might be willing to accept that for their deposits the deposit insurance coverage is incomplete; the higher deposit rate would compensate them for this risk.
- We will see that banks might find it optimal to limit deposit coverage such that they can attract larger deposits.

→ We can now use a stylised version of this scenario to build a simple model containing these core elements.

Differentiated accounts

- Depositors have deposits D or $2D$ and deposit insurance might be limited to D
- Banks offer differentiated accounts and moving deposits to another bank involves costs depending on these differences
- Banks are one unit apart and depositors are uniformly distributed on this line with distance d_i

Differentiated accounts

→ We will develop a model based on the Hotelling model of differentiated products.

- - We assume that depositors are of two type they are either small depositors or large depositors.
  - We will assume that if we limit the coverage of the deposit insurance, the cover limit will be the size of the small depositor.
- - We assume that banks offer differentiated accounts in that they are offering different features, such as access to online services, different fee structures, different additional benefits derived from the account.
  - Each depositor will have its preferences for these features and moving from one of their banks to another bank will involve costs that are increasing in the differences to their preferences.
- - We assume that preferences for these account features are expressed as a position on a line at which end the banks are located; there are only two banks in this model. The distance between banks is normalised to 1.
  - We finally assume that depositors are uniformly distributed on this line, representing a uniform distribution of preferences for the account offered by each bank. The distance to each bank is denoted d_i.

→ We can now use this basic model to assess the impact deposit insurance has on bank profits.

- As our first case we assume that no deposit insurance exists at all.

Switching banks

- Depositors staying with bank j are repaid deposits if the loans are repaid to the bank and lose their deposits otherwise
- $\Pi_D^{jj} = \pi\left(1 + r_D^j\right)\hat{D} - \hat{D} - (1-\pi)\hat{D}$
- Depositors switching banks to bank i are repaid deposits if the loans are repaid to the bank and lose their deposits otherwise, and they face switching costs
- $\Pi_D^{ji} = \pi(1 + r_D^i)\hat{D} - \hat{D} - (1-\pi)\hat{D} - cd_i$
- Depositors switch if this is profitable: $\Pi_D^{ij} \geq \Pi_D^{ii}$

$\Rightarrow$ $d_i \leq d_i^* = \pi \frac{(1+r_D^i)-(1+r_D^j)}{c}\hat{D}$

Switching banks

→ We assume that initially depositors are with a bank who meets their preferences and they can either stay with this banks or they can switch to another banks at some costs.

- ▶
  - As there is no deposit insurance, banks can only repay deposits if they have the means to do so,k which will be if the loans they have provided are repaid.
  - If the loans they have provided are not repaid, depositors will not receive any repayments and lose their deposits.
- Without deposit insurance there is no difference between large and small depositors in the incentives.
- ▶
  - Depositors currently at a bank can switch their banks and are treated the same at this banks by having their deposits repaid if the banks is repaid its loans
  - and it will lose its deposits if the loans are not repaid.
  - In addition, the depositor would face switching costs, which are increasing in the distance to the bank they are switching to.
- *Formula*
- If it is more profitable to switch than to stay with their current bank, the depositor will do so.

⇒ All depositors that are sufficiently close to the new bank will switch. This distance will depend on the deposit rates offered and the switching costs, in addition to the size of the deposit.

→ We can now determine the total deposits for a bank and then its profits.

Bank profits

- Deposits a bank holds will consist of existing large and small deposits, plus those it attracts from the other bank
- $D_i = \lambda \left(1 + 2\pi \frac{(1+r_D^j)-(1+r_D^i)}{c}\right) 2D + (1-\lambda) \left(1 + \pi \frac{(1+r_D^j)-(1+r_D^i)}{c} D\right) D$
- Banks profits are generated if loans are repaid, consisting of these repaid loans after deposits are repaid
- $\Pi_B^i = \pi \left((1+r_L) - \left(1+r_D^i\right)\right) D_i$
- The optimal deposit rate is obtained if $\frac{\partial \Pi_B^i}{\partial\left(1+r_D^i\right)} = 0$

$\Rightarrow$ $1 + r_D^* = (1+r_L) - \frac{1-\lambda}{\pi(1+3\lambda)} \frac{c}{D}$

$\Rightarrow$ $\Pi_B^* = \frac{(1+\lambda)^2}{1+3\lambda} D$

Bank profits

→ We can now determine the total deposits a bank holds and from this derive their profits.

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  - We assume that the market consists of a fraction of large depositors and the remainder being small depositors. A bank will obtain deposits from those it retains.
  - In addition it will attract from the other bank all those depositors that are located closer than d_i^*; a negative value would imply the bank losing depositors to the other bank.
- *Formula*
- We assume that banks can repay deposits only if the loans they have granted are repaid. The total profits are then given by the difference between the interest they receive on loans and the interest they pay on deposits, provided the loans are repaid, and this is multiplied by the size of the deposits.
- *Formula*
- The bank will not set the deposit rate optimally to maximize its profits, assuming the loan rate to be given.

⇒ The first order condition solves for this optimal deposit rate; we can obtain that the deposit rates bath banks offer are identical.

⇒ Inserting this deposit rate into the profits of the bank, we can obtain their profits.

→ We have now determined the profits of the banks without deposit insurance.

- Problem and model assumptions
- No deposit insurance
- Full deposit coverage
- Partial deposit coverage
- Summary

- We continue our analysis by now assuming that all deposits are covered by deposit insurance.

Switching banks

- Deposits are always repaid and if switching, the switching costs are to be paid
- $\Pi_D^{jj} = \left(1 + r_D^j\right) \hat{D} - \hat{D}$
- $\Pi_D^{ji} = \left(1 + r_D^i\right) \hat{D} - \hat{D} - cd_i$
- Depositors switch if this is profitable: $\Pi_D^{ij} \geq \Pi_D^{ii}$

$\Rightarrow$ $d_i \leq d_i^{**} = \frac{\left(1+r_D^i\right)-\left(1+r_D^j\right)}{c} \hat{D}$

Switching banks

→ We now follow the same steps as in the previous case, only taking into account that deposits are always repaid to the depositor due to the deposit insurance.

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  - For depositors, they have repaid their deposits with certainty and will never lose their deposits.
  - If they decide to switch banks, they again face switching costs.
- *Formula*
- *Formula*
- If it is more profitable to switch than to stay with their current bank, the depositor will do so.

⇒ All depositors that are sufficiently close to the new bank will switch. This distance will depend on the deposit rates offered and the switching costs, in addition to the size of the deposit.

→ We can now again determine the total deposits for a bank and then its profits.

Bank profits

- Deposits at the bank are $D_i = (1+\lambda)\, D + \frac{\left(1+r_D^i\right) - \left(1+r_D^j\right)}{c} (1+3\lambda)\, D^2$
- Maximizing bank profits gives $1 + r_D^{**} = (1 + r_L) - \frac{1+\lambda}{3+\lambda} \frac{c}{D}$

$\Rightarrow$ $\Pi_B^{**} = \pi \frac{(1+\lambda)^2}{1+3\lambda} D = \pi \Pi_B^*$

- Full deposit coverage gives banks less profits than no deposit insurance
- Competition for deposits has increased as the profits of depositors have increased and more can switch
- The lower deposit rate due to the absence of risk does not compensate for this sufficiently

Bank profits

- → We can now determine the total deposits a bank holds and from this derive their profits.
- ▶ The deposits of a bank are obtained in the same way as in the previous case and collecting terms, we obtain the expression in the *formula*.
- ▶ Using the same profit function of banks, assuming that deposit insurance is provided free by the government through guarantees, the first order condition solves for the optimal deposit rate.
- ⇒ Inserting this deposit rate back into the bank profits, we obtain the expression in the *formula*.
- ▶ We see that the expected profits of the bank is smaller with full deposit insurance than without deposit insurance, due to the factor π.
- ▶ The reason is that the lack of risk for depositors whether they are repaid their deposits increases competition between banks as it increases the value of deposits relative to switching costs, making switching more attractive.
- ▶ The lack of risk will reduce the deposit that is offered, increasing the profits of banks; but this doe snot fully compensate for the increase in competition between banks. The deposit rate does not fall far enough due to the competition for depositors and bank profits are reduced.
- → We have thus seen that banks will always prefer that no deposit insurance os provided, rather than that all deposits are covered by deposit insurance.

- Problem and model assumptions
- No deposit insurance
- Full deposit coverage
- **Partial deposit coverage**
- Summary

- Having established that banks would never prefer full deposit insurance coverage, we can now investigate thew case where only small deposits are covered.

Switching opportunities

- Large depositors will only be covered for their deposits up to D
- They can stay with bank j and have D repaid for sure and D only repaid if the loan is repaid to the bank
- $\Pi_D^{jj} = \left(1 + r_D^j\right) D - D + \pi \left(1 + r_D^j\right) D - D - (1 - \pi) D$
- They can stay switch entirely to bank i and have D repaid for sure and D only repaid if the loan is repaid to the bank, and bear switching costs
- $\Pi_D^{ji} = \left(1 + r_D^i\right) D - D + \pi \left(1 + r_d^i\right) D - D - (1 - \pi) D - cd_j$
- They can switch D to bank i and have the full deposits insured, bearing switching costs
- $\Pi_D^{jij} = \left(1 + r_D^j\right) D - D + \left(1 + r_D^i\right) D - D - cd_j$

Switching opportunities

→ With partial deposit insurance coverage, the possibilities of large depositors are increased. As before they can stay with their current bank, or they can switch their entire deposits to another bank. In both cases their deposits would be covered up the limit of deposit insurance. Alternatively, now, they can move one part of their deposit to the other banks nd retain the other part with their original bank; in this strategy their deposits are fully covered as they are split between two banks and fall within the coverage limit.

- We know that large depositors at a single bank will only have half their deposits insured.
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  - If large depositors stay with their current bank, they would be repaid the first half of their deposits with certainty.
  - The second half of their deposits would only be repaid if the bank can do so, thus is the loan they have granted is repaid; otherwise they would lose this part of their deposit.
- *Formula*
-
  - If large depositors switch their entire deposits to the other bank, they would be repaid the first half of their deposits with certainty.
  - The second half of their deposits would only be repaid if the bank can do so, thus is the loan they have granted is repaid; otherwise they would lose this part of their deposit.
  - In addition they would face switching costs.
- *Formula*
-
  - If large depositors switch half of their deposits to the other bank and retain the other half at their current bank, they would be repaid their deposits with certainty, but the deposit rate applied might be different.
  - In addition they would face switching costs.
- *Formula*

→ We can now analyse this more complex decision to switch banks.

Switching decision

- Large depositors switch parts of their deposits if $\Pi_D^{jij} \geq \Pi_D^{jj}$

$\Rightarrow d_i \leq d_i^{***} = \frac{\left(1+r_D^j\right)-\pi\left(1+r_D^i\right)+(1-\pi)}{c} D$

- Large depositors are attracted from other banks seeking to increase their deposit insurance coverage
- Large depositors are lost to other banks seeking to increase their deposit insurance coverage
- Small depositors will be fully insured and behave as indicated above
- $$D_i = \lambda\left(2D - \frac{\left(1+r_D^j\right)-\pi\left(1+r_D^i\right)+(1-\pi)}{c} D^2 + \frac{\left(1+r_D^i\right)-\pi\left(1+r_D^j\right)+(1-\pi)}{c} D^2\right) + (1-\lambda)\left(D + \frac{\left(1+r_D^i\right)-\left(1+r_D^j\right)}{c} D^2\right)$$

Switching decision

→
- Large depositors would switch half of their deposits if it is more profitable to do so.

⇒ All large depositors that are sufficiently close to the new bank will switch. This distance will depend on the deposit rates offered and the switching costs.
- Those depositors switching part of their deposits seek to benefit from the full deposit insurance coverage this move entails, this allows the other bank to attract additional deposits.
- Similarly, the bank will lose deposits for the same reason.
- Small depositors are not affected by this limit on the deposit insurance cover and will behave in the same way as in the previous case
- *Formula*
- [] *Formula*

→ We can now determine the profits banks make in this scenario using the deposits each bank attracts.

Bank profits

- Maximizing bank profits gives $1 + r_D^{***} = (1 + r_L) - \frac{1+\lambda}{1+\pi\lambda}\frac{c}{D}$

$\Rightarrow$ $\Pi_B^{***} = \pi\frac{(1+\lambda)^2}{1+\pi\lambda}D$

- These profits are higher than no deposit insurance if $\pi > \frac{1}{1+2\lambda}$
- In this case competition for large deposits is not too strong to negate the effect of the lower deposit rate due to them not being exposed to risk

Bank profits

→

- The profit function of the bank is unaffected and using the deposits they attract, the first order condition solves for the deposit rate given here in the *formula*.

⇒ Inserting this expression back into the profit function of banks, the term in this *formula* emerges.

- We had ruled out that banks would want full deposit insurance coverage, so compare these profits to the case that no deposit coverage is provided. We see that partial deposit insurance cover is preferred by banks that are sufficiently safe, those whose loans are repaid frequently.
- With partial deposit insurance coverage, competition increases, as in the case of full deposit insurance cover, but this effect is not so strong as to fully compensate for the positive effect of the lower deposit rate on bank's profits.

→ In this intermediate case, competition for large deposits is limited as the increased cover when switching banks for parts of their deposits cannot be prevented. This limits the need to increase deposit rates as the attraction of additional deposit insurance cover will induce large depositors to switch banks.

- Problem and model assumptions
- No deposit insurance
- Full deposit coverage
- Partial deposit coverage
- Summary

- We can now assess the optimal level of deposit insurance cover.

Increased competition with deposit insurance

- If banks are not too risky they prefer deposit insurance to be limited to smaller deposits
- More risky banks would prefer no deposit insurance at all
- Deposit insurance increases competition for deposits but also reduces deposit rates due to the elimination of risk
- Higher-risk banks see a stronger competition effect and will therefore prefer not to have any deposit insurance

Increased competition with deposit insurance

→ We have seen that deposit insurance increases competition between banks, but also allows for lower deposit rates.

- We have obtained that provided banks are not too risky, they would find a partial deposit insurance cover for small deposits only most beneficial.
- However, more risky banks would prefer to not have any deposit insurance.
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    - The reason for deposit insurance being preferred by safe banks is that deposit insurance increases competition, reducing profits,
    - but also allows to offer lower deposit rates as deposits are risk-free, increasing profits. With partial deposit insurance, this trade-off is optimal for banks.
- Higher risk banks see competition increase more than lower risk banks as their offering are worth less due to the higher risks when compared to the switching costs. Taking away this lower value of deposits, will increase competition as switching costs become less important; this effect is stronger than the reduced deposit rates.

→ We thus observe that low-risk banks prefer partial deposit insurance coverage, while high-risk banks would want to deposit insurance.

Optimal limited coverage

- Deposit insurance is not provided to large deposits unless banks are highly risky
- If deposit insurance is not provided free, this will make the benefits of partial insurance coverage over full coverage more pronounced
- Banks are content with limits on deposit insurance as this limits competition for large deposit

Optimal limited coverage

→ Thus in most cases, assuming banks are not too risky, deposit insurance should be limited to small deposits at each bank only.

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  - Large deposits are found to be optimally not covered by deposit insurance, a situation observed in many deposit insurance scheme globally.
  - This result holds unless the banks are very risky, in which case deposit insurance should not be offered.
- We here assumed that deposit insurance was free to banks. Partial coverage of deposits will naturally be less costs if a premium were to be charged than a full coverage; this should re-enforce the dominance of partial deposit insurance coverage as a cheaper alternative to full deposit insurance. Of course, if the insurance premia are high, the benefits of partial deposit insurance might over having no deposit insurance might be eliminated and providing any deposit insurance might never be optimal.
- The reason banks prefer partial deposit insurance coverage is that it limits competition between banks, while still reducing reposit rates due to lower risks. The net effect is that banks' profits are increasing.

→ Deposit insurance can prevent bank runs and as such would be beneficial, but banks might also prefer some level of deposit insurance to reduce their costs, while not increasing competition between banks too much.

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