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Chapter 18.2.1

The optimality of deposit insurance limits

Outline

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- 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 what limit regarding the cover by 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 and depositors have for these different types of deposit insurance covers.

- 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.

Choosing a bank

- Depositors staying with bank j are repaid deposits if the loans are repaid to the bank and face costs from not obtaining optimal banking services
- $\Pi_D^i = \pi\left(1 + r_D^i\right)\hat{D} - \hat{D} - cd_i\hat{D}$
- Depositors choose bank i if this is more profitable than choosing bank j, $\Pi_D^i \geq \Pi_D^j$

$\Rightarrow\ d_i \leq d_i^* = \frac{1}{2} + \pi\frac{\left(1+r_D^i\right)-\left(1+r_D^j\right)}{2c}$

Choosing a bank

→ We consider under which conditions a depositor will choose bank i.

- As there is no deposit insurance, banks can only repay deposits if they have the means to do so, which will be if the loans they have provided are repaid.
- Depositors are located at a distance d_i from the bank and this represents costs as they do not obtain banking services as they prefer.

- Without deposit insurance there is no difference between large and small depositors in the incentives.

- Depositors will choose the bank that gives them highest utility
- A depositor chooses a bank if the utility is highest.

⇒ 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.
→ We can now determine the total deposits for a bank and then its profits as well as that of depositors.

Bank and depositor profits

- Deposits a bank holds will consist of large deposits and small deposits.
- $D_i = 2\lambda d_i^* D + (1-\lambda)\, d_i^* D$
- 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 $\frac{\partial \Pi_B^i}{\partial\left(1+r_D^i\right)} = 0$

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

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

$\Pi_D^* = (\pi\,(1+r_L) - c - 1 - c d_i)\, \hat{D}$

Bank and depositor profits

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

- We assume that the market consists of a fraction of large depositors, each having deposits of $2D$
  - and the remainder being small depositors with deposit size D.
- 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 at this bank.
- *Formula*
- The bank will now 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 only consider symmetric equilibria where both banks offer the same deposit rate.

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

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

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

Choosing a bank

- Deposits are always repaid
- $\Pi_D^i = \left(1 + r_D^i\right) \hat{D} - \hat{D} - c d_i \hat{D}$
- Depositors choose bank i if this is profitable: $\Pi_D^i \geq \Pi_D^j$

$\Rightarrow \; d_i \leq d_i^{**} = \frac{1}{2} + \frac{\left(1+r_D^i\right) - \left(1+r_D^j\right)}{2c}$

Choosing a bank

→ 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.

- For depositors, they have repaid their deposits with certainty and will never lose their deposits.
- With full deposit insurance there is no difference between large and small depositors in the incentives.
- Depositors choose the bank that gives them the higher utility.

⇒ 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.

→ We can now determine the total deposits for a bank and then its profits as well as that of depositors.

Bank and depositor profits

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

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

- 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

$\Rightarrow \Pi_D^{**} = (1 + r_L - c - 1 - c d_i)\,\hat{D} = \Pi_D^* + (1-\pi)\,(1+r_L)\,\hat{D}$

- Despite the lower deposit rate, depositors are better off than without deposit insurance as their deposits are risk-free

Bank and depositor 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.

⇒ As above, we can also determine the profits accruing to depositors.
- Despite being offered a lower deposit rate with deposit insurance, depositors are better off than without desposit insurance as this lower deposit rate is more than compensated for by the deposits becoming risk-free.

→ 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.

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

Large deposits

- Large depositors will only be covered for their deposits up to D
- They can use only bank i and have D repaid for sure and D only repaid if the loan is repaid to the bank, and bear costs for receiving banking services not fully meeting their needs
- $\Pi_D^i = \left(1 + r_D^i\right) D - D + \pi \left(1 + r_D^i\right) D - D - 2cd_iD$
- They can split the deposits between the two banks and have the full deposits insured, bearing costs for receiving banking services not fully meeting their needs
- $\Pi_D^{ij} = \left(1 + r_D^i\right) D - D + \left(1 + r_D^j\right) D - D - cd_iD - cd_jD$

Large deposits

→ 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 use a single 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.
  - Depositors would also have to bear the costs for receiving suboptimal banking services on their full deposit amount.
- *Formula*
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  - If large depositors deposit half of their deposits to one bank and retain the other half at another bank, they would be repaid their deposits with certainty, but the deposit rate applied might be different.
  - In addition they would face costs from suboptimal banking services at each of the banks.
- *Formula*

→ We can now analyse this more complex decision to allocating deposits.

Deposit allocation

- Large depositors split their deposits if $\Pi_D^{ij} \geq \Pi_D^j$

$\Rightarrow$ $d_i \leq d_i^{***} = \frac{1}{2} + \frac{\pi\left(1+r_D^i\right)-\left(1+r_D^j\right)}{2c}$

- Large depositors prefer to keep their deposits only at bank i over bank j if $\Pi_D^i \geq \Pi_D^j$

$\Rightarrow$ $d_i \leq \hat{d}_i^{***} = \frac{1}{2} + (1+\pi)\frac{\left(1+r_D^i\right)-\left(1+r_D^j\right)}{2c}$

$\Rightarrow$ If $0 \leq d_i \leq d_i^{***}$, all deposits are held at bank i

If $d_i^{***} < d_i \leq \hat{d}_i^{***}$, deposits are split between banks

- Bank i obtains deposits from those that do not split them, those close to them that move some deposits to the other bank, and from those further away that move some deposits to them

$\Rightarrow$ $D_i^L = 2\lambda d_i^{***} D + \lambda\left(\hat{d}_i^{***} - d_i^{***}\right) D + \lambda\left(\hat{d}_j^{***} - d_j^{***}\right) D = 2\lambda \hat{d}_i^{***} D$

Deposit allocation

→ We now establish under which conditions depositors split their deposits or retain them at a single bank.

▶ 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 bank will split deposits. This distance will depend on the deposit rates offered and the switching costs.

▶ Large depositors would keep all of their deposits at bank i if it is more profitable to do so.

⇒ All large depositors that are sufficiently close to the bank will keep deposits with bank i. This distance will depend on the deposit rates offered and the switching costs.

⇒ Depositors very close to the bank will keep all their deposits at this bank. The costs of using the more distant second bank outweighs the risk of losing the deposits.

· Depositors in an intermediate range will split their deposits.

▶
- The large depositors at a bank are given by those that retain all their deposits at that bank
- and the deposits of those that move parts of their deposits to the other bank
- and the deposits of those depositors close to the other bank that move parts of their deposits to this bank.

▶ *formula*

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

Bank profits

- Small depositors are fully insured and hence behave as above: $D_i^S = (1-\lambda)\, d_i^{**} D$
- Total demand of deposits for bank i is then $D_i = D_i^L + D_i^S$
- Maximizing bank profits gives $1 + r_D^{***} = (1 + r_L) - c\frac{1+\lambda}{1+\pi\lambda}$

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

- We can get that $\Pi_B^{**} < \Pi_B^{***} < \Pi_B^{*}$

$\Rightarrow$ Banks prefer the lowest possible amount of deposit insurance

Bank profits

→ We can determine the bank profits and the optimal level of deposit insurance coverage.

- Small depositors are fully covered by deposit insurance, they are not affected by the limit on deposit insurance and will therefore have the same demand as with full deposit insurance coverage
- The total deposits of the bank consist then of the deposits by large and small depositors.
- 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.

- Inserting these expressions and comparing them this relationship can be obtained.

⇒ With partial deposit insurance coverage, competition increases, as in the case of full deposit insurance cover though to a lesser degree, but this effect is not so strong as to fully compensate for the positive effect of the lower deposit rate on bank's profits, making banks prefer a lower deposit insurance coverage.

→ Having established that banks prefer the lowest possible amount of deposit insurance, we can now establish the preferences for depositors.

Depositor preferences

- Small depositors: $\Pi_D^{**} > \Pi_D^{S,***} > \Pi_D^*$
- Large depositors splitting deposits: $\Pi_D^{**} > \Pi_D^{L,***} > \Pi_D^*$
- Large depositors not splitting deposits: $\Pi_D^{**} > \hat{\Pi}_D^{L,***} > \Pi_D^*$

$\Rightarrow$ depositors prefer the highest possible amount of deposit insurance

Depositor preferences

→ We can determine the depositor profits and the optimal level of deposit insurance coverage.

- If we insert the deposit rate into the profits of small depositors, then the profits that are generated show that they prefer the highest possible deposit insurance coverage.
- If we insert the deposit rate into the profits of large depositors splitting deposits, then the profits that are generated show that they prefer the highest possible deposit insurance coverage.
- If we insert the deposit rate into the profits of large depositors not splitting deposits, then the profits that are generated show that they prefer the highest possible deposit insurance coverage.

⇒ The benefits of safe deposits (small depositors and large depositors splitting deposits) outweigh the lower deposit rate that banks will offer, making deposit insurance attractive to depositors. Even if deposits are not split, depositors benefit from partial coverage of their deposits.

→ We can summarise the key results from this model.

- We can now assess the optimal level of deposit insurance cover from the perspective of banks and depositors.

Increased competition with deposit insurance

- Banks prefer deposit insurance to be limited to smaller deposits
- Depositors prefer deposit insurance to be covering all deposits
- Deposit insurance increases competition for deposits , but also reduces deposit rates due to the elimination of risk

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 due to the increased competition, banks would prefer that no deposit insurance is provided, even if it is free.
- Depositors have the opposite view, they want the highest possible coverage from deposit insurance.
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  - The reason for no deposit insurance being preferred by banks is that deposit insurance increases competition, reducing profits. This is because the safety of deposits makes them more valuable relative to the costs of imperfect banking services, thus relatively the costs c are reduced, increasing competition between banks, which increases deposit rates.
  - but deposit insurance also allows to offer lower deposit rates as deposits are risk-free, increasing profits to banks. This reduction due to the lower risk is more than offset by the increased competition. For depositors the reduced deposit rate without risk is more attractive than the higher deposit rate with risk.

→ We thus observe that due to the impact on competition, banks prefer no deposit insurance coverage, while depositors would want to deposit insurance.

Conflict of interest

- Banks and depositors have opposite views on the provision of deposit insurance
- If deposit insurance is charged to banks, this will entrench their view even more
- Limited coverage for deposits can be the result of a compromise between the interests of banks and depositors

Conflict of interest

→ The incentives of banks and depositors on the provision of deposit insurance are not aligned.

- Banks want no deposit insurance, while depositors want the maximal possible coverage. This is true for banks even though the deposit insurance is free; the effect on competition between banks drives this result.
- We here assumed that deposit insurance was free to banks and they preferred not to take it up, a charge to banks for deposit insurance will make this view even stronger. If deposit insurance was charged to depositors, it might soften their preferences for deposit insurance.
- The commonly observed limit on the amount of deposits that are covered by deposit insurance can be interepreted as a compromise between the desire for depositors to have full deposit insurance and banks preferring no deposit insurance.

→ Deposit insurance can prevent bank runs and as such would be beneficial to banks, a benefit that has not been included in the model and might also contribute to the existence of partial deposit insurance coverage.

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