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Chapter 9.3

Rehypothecation

Outline

- Problem and model assumptions
- Borrowing without rehypothecation
- Allowing rehypothecation
- Summary

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Outline

- Collateral is often assumed to be provided to banks as a means to reduce risks to the bank and gain more favourable loan conditions.
- In this view the bank passively holds the collateral and uses it if the loan is not repaid.
- In some instances, banks may use the collateral they have been given for their own purposes.
- While this is a practice not normally applied to private borrowers or smaller companies, it can be found in lending arrangements with larger borrowers.
- The re-use of collateral needs the explicit agreement of the provider of this collateral.
- We will see here how such a practice may be beneficial to banks and companies.

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Outline

- We will look at the process of re-using collateral by banks and will compare the implications this has on borrowers by comparing borrowing with and without this re-use of collateral.
- This will then allow us to determine who might benefits from such a practice.

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- We will start by defining closer the process of re-using collateral and how this is modelled here.

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Re-using collateral

- Companies pledge collateral to the bank to cover the bank against losses if the loan cannot be repaid
- The bank can use this collateral as their own collateral to obtain a loan
- This process is called rehypothecation

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Re-using collateral

→ Colletaral is commonly given to banks to reduce their risk, but can be used by banks in another way.

- The traditional view that banks obtain collateral and are only using these assets once the loans is not repaid to reduce their losses.
- However, having access to such an asset, the collateral, could allow the bank to use the collateral they have obtained as collateral in their own borrowing. Thus the banks uses as collateral for its borrowing an asset that is not belonging to them, but which has only been given to them as collateral.
- Such a re-use of the collateral by banks as collateral for their own borrowing is known as rehypothecation.

→ We will now assess how such rehypothecation affects borrowing and lending.

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Effort costs

- Companies use loans to make an investment that is successful with probability π_L
- If they exert effort, the success rate increases to π_H
- This effort imposes additional costs of E on companies
- Banks require this additional effort to make lending profitable

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Effort costs

→ Companies may exert additional effort to succeed with their investments

- As is common, we assume that a bank makes a loan to a company and this companies invests the proceeds and uses the returns generated form this investment to repay the loan. The investment might not be successful and the company might not be able to repay the loan.
- We assume here that companies can exert additional effort to increase the probability of their investment being successful.
- This additional effort is costly to the company.
- We assume that for banks lending is only profitable if this additional effort is exerted. Thus we have a potential moral hazard in that the bank requires additional effort, which the company might not be willing to provide.

→ We will now see how banks can provide incentives that this additional effort is exerted.

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- We first investigate the case where no rehypothecation is observed. This would be a standard loan contract with collateral.

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Uncollateralized borrowing

- Companies obtain their investment return, less the repayment of the loan, if successful
- If exerting effort, they also bear the effort costs
- $\Pi_C^H = \pi_H \left((1+R)\, L - (1+r_L)\, L \right) - E$
  $\Pi_C^L = \pi_L \left((1+R)\, L - (1+r_L)\, L \right)$
- Companies exert effort if $\Pi_C^H \geq \Pi_C^L$

$\Rightarrow$ $L \geq L^* = \frac{E}{(\pi_H - \pi_L)(R - r_L)}$

- Effort is only exerted if the loan is sufficiently large or effort costs sufficiently small

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Uncollateralized borrowing

→ We initial consider companies obtaining a loan without providing a collateral.

- Companies make their investment using the proceeds of the loan and this generates them a return.
  - They then use this return to repay the loan.
  - This is only possible if the investment is successful.
- If the company exerts additional effort, the probability of success increases, but the company also have to bear the additional costs.
- With additional effort the success rate is high, but the company faces higher costs.
- Without additional effort the success rate is low, but the company faces no costs.
- The additional effort is exerted if it is profitable to do so.

⇒ This condition can be solved for the minimum loan size required for such effort to be exerted.

- We instantly see that companies exert additional effort if loans are large.
  - Low effort costs will also make the exertion of effort more likely.

→ We can now compare this result with that of a company providing a collateral.

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Collateralized borrowing

- Companies providing collateral will lose this if the company does not succeed
- $\hat{\Pi}_C^H = \pi_H \left((1+R)\, L - (1+r_L)\, L \right) - (1-\pi_H)\, C - E$

  $\hat{\Pi}_C^L = \pi_L \left((1+R)\, L - (1+r_L)\, L \right) - (1-\pi_L)\, C$
- Companies exert effort if $\hat{\Pi}_C^H \geq \hat{\Pi}_C^L$

$\Rightarrow$ $L \geq L^{**} = \frac{E-(\pi_H-\pi_L)C}{(\pi_H-\pi_L)(R-r_L)}$

- This is less restrictive than without collateral as the loss of collateral provides additional incentives to exert effort

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Collateralized borrowing

→ We can now turn to the case in which a collateral is provided.

- If companies provide collateral, they might lose this in cases where the investment does not succeed.
-
  - The profits of the company are essentially the same with collateral as they are without.
  - The profits are reduced to the case of no collateral by the possible collateral loss.

  - The profits of the company are essentially the same with collateral as they are without.
  - The profits are reduced to the case of no collateral by the possible collateral loss.

- Again, the additional effort is exerted if it is profitable to do so.

⇒ This condition can be solved for the minimum loan size required for such effort to be exerted.

-
  - The minimum loan requirement to exert effort with collateral is reduced by the term $(\pi_H - \pi_L)\, C$ in the numerator.
  - This arises from the threat of losing the collateral, which gives additional incentives to companies to exert this additional effort.

→ After having determined the incentives in the case that no rehypotheetation is observed, we will now compare these results to the case when rehypothecation is used.

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- With rehypothecation being introduced, we can determine under which conditions banks and companies will agree to this practice.

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Bank incentives to rehypothecate

- The bank will invest the monies raised and be able to repay this loan only if their investment is successful
- They also obtain the repaid loan or collateral and repay depositors
- $\hat{\Pi}_B = \hat{\pi}\left(\left(1+\hat{R}\right)\hat{L} - \left(1+\hat{r}_L\right)\hat{L} + \pi_H\left(1+r_L\right)L + \left(1-\pi_H\right)C\right) - \left(1+r_D\right)L$
- Without rehypothecation the bank only receives repayment of the loan or collateral and repay depositors
- $\Pi_B = \pi_H\left(1+r_L\right)L + \left(1-\pi_H\right)C - \left(1+r_D\right)L$
- Rehypothecation is optimal if $\hat{\Pi}_B \geq \Pi_B$

$\Rightarrow \hat{\pi} \geq \hat{\pi}^* = \frac{\pi_H(1+r_L)L+(1-\pi_H)C}{\left(\hat{R}-\hat{r}_L\right)\hat{L}+\pi_H(1+r_L)L+(1-\pi_H)C}$

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Bank incentives to rehypothecate

→ We will look at how banks' profits are affected by rehypothecation.

- Banks will use the collateral to obtain a loan from another bank. They will then use the proceeds of this loan to invest, for example to provide more loans to other companies.
  - The loan they have raised can only be repaid if they have the necessary funds, which are obtained from the success of their investment.
  - Hence the repayment of the loan they have obtained will only be possible if their own investments, the loans, are successful.
- In addition to these additional loans and their repayment, they also obtain the repayment of original loan they have made.
  - If the original loan cannot be repaid, they obtain the collateral instead.
  - Banks have financed the original loan with deposits, which now have to be repaid.
- *Formula*
- If no rehypothecation occurs, the bank only obtains the repayment of the original loan if the company investment is successful.
  - If the company investment is not successful, the banks obtains the collateral
  - Banks have financed the original loan with deposits, which now have to be repaid.
- *Formula*
- banks will use rehypothecation if this gives them the higher profits.

⇒ This condition can be solved for the minimum requirements for the success rate of the additional investment the bank makes.

→ We can now provide a bit more analysis of this condition under which banks seek rehypothecation.

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Risk of bank investment

- If the bank investment is not too risky, rehypothecation is optimal
- If the loan is very safe, $\pi_H \approx 1$, the investment can be riskier
- If the loan is more risky, $\pi_H \ll 1$, the investment needs to be less risky

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Risk of bank investment

→ We can now compare the risks of the original loan with the risk of the investment the bank makes with the funds raised from the loans using rehypthecation.

- Banks will want to rehypothecate if the investments they make with the additional funds are not too risky. If we assume that banks use the funds to make additional loans, these loans must be sufficiently safe.
- If the original loan is sufficiently safe, the threshold is such that the new loans can be more risky.
- In contrast, if the original loan is quite risky, the new loans have to be safer.

→ Having looked at the incentives for banks to seek rehypothecation, we now need to evaluate the company's incentives to allow such rehypothecation.

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Company incentives

- Companies only obtain their investment return and have to repay their loan if they are successful
- If the bank is not successful, it will lose the collateral and the company does not have to repay its loan
- The company loses the collateral if it itself is not successful or the bank is not successful, and has to pay effort costs
- $\hat{\hat{\Pi}}_C^H = \pi_H \left((1+R)\, L - \hat{\pi}(1+r_L)\, L \right) - (1 - \pi_H \hat{\pi})\, C - E$

  $\hat{\hat{\Pi}}_C^L = \pi_L \left((1+R)\, L - \hat{\pi}(1+r_L)\, L \right) - (1 - \pi_L \hat{\pi})\, C$
- Companies exert effort if $\hat{\hat{\Pi}}_C^H \geq \hat{\hat{\Pi}}_C^L$

$\Rightarrow L \geq L^{***} = \frac{E - \hat{\pi}(\pi_H - \pi_L) C}{(\pi_H - \pi_L)((1+R) - \hat{\pi}(1+r_L))}$

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Company incentives

→ We first look at how rehypothecation affects the incentives of companies to exert effort.

- In the normal course of business, banks obtain the return on their investment.
  - They then use these proceeds to repay their loan and retain the differences.
  - This will only be the case if the investment is successful.
- The bank may not be able to repay its loan and will have to forfeit the collateral, which implies that the company will lose its collateral. In this case we assume that the company will not have to repay its loan. We can interpret this as the company providing a collateral for the collateral in form of the loan repayment.
  - The company also loses its collateral if itself is not able to repay the loan; this is in addition to the bank not being able to repay its loan and having to forfeit the collateral.
  - If they exert effort, they will obtain the higher success rate but also have to bear these costs.
- With additional effort the success rate is high, but the company faces higher costs.
- Without additional effort the success rate is low, but the company does not face additional costs.
- The additional effort is exerted if it is profitable to do so.

⇒ This condition can be solved for the minimum loan size required for such effort to be exerted.

→ We can now analyse this minimum loan size for the exertion of effort.

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Minimum loan size to exert effort

- Minimum loan size with rehypothecation is smaller if $L^{***} \leq L^{**}$

$\Rightarrow$ $E \geq E^* = (\pi_H - \pi_L)(1 + r_L)C$

- If effort costs are sufficiently high, smaller loans are sustainable
- The possibility that the loan does not need to be repaid provides additional incentives to exert effort, unless effort costs are too high
- This is not fully compensated for by losing the collateral more frequently

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Minimum loan size to exert effort

→ The loan size required to exert effort maybe larger or smaller than in the case not allowing rehypothecation.

- We can look at the condition under which the minimum loan size for the exertion of effort is smaller, meaning that effort is more likely to be forthcoming.

⇒ Solving this condition we see that with rehypothecation the minimum loan size is smaller if effort costs are sufficiently high.

- Smaller loans can be given and effort is still exerted if effort costs are high.
-
  - The fact that if the bank forfeits the collateral the company can retain the investment proceeds without having to repay the loan, gives an incentive to exert effort. The higher profits in this case, give an incentive to increase efforts.
  - This works as long as the costs of this effort are not too high.
- The collateral is more likely to be lost, but as there is the possibility of both the company investment failing and the bank forfeiting the collateral, which makes not difference to the company, the effect of the increased likelihood of losing the collateral through the bank does not counter these benefits fully.

→ We can now finally determine under which conditions companies would agree to rehypothecation by banks.

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Company preferences

- Companies prefer rehypothecation if $\hat{\hat{\Pi}}_C^H \geq \hat{\Pi}_C^H$

$\Rightarrow$ $(1 + r_L)\, L \geq C$

- If loans are not under-collateralised, companies would agree to rehypothecation
- The loss of collateral weighs less than the possibility of not having to repay the loan

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Company preferences

→ We can now derive that companies will in many cases allow rehypothecation.

- Companies will agree to rehypothecation if their profits from doing so are higher than when not allowing it. We here only consider the case where high effort is exerted as this is the requirements for banks to provide loans profitably.

⇒ This condition implies that the collateral must not exceed the loan repayments.

- Whenever the collateral is worth less than the loan repayment, companies would find it profitable to allow rehypothecation.
- The company weighs the loss of the collateral due to the bank forfeiting it against the benefits of not having to repay the loan in this case. As the value of the collateral is below the repayment of the loan, the company would benefit from the bank forfeiting the collateral and readily agree to it.

→ Companies allow rehypothecation whenever a loan is not fully collaterised, but bank would only conduct reg=hypothecation if they have sufficiently safe investment opportunities..

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Summary

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- This allows us now to summarize the findings and provide some analysis of the issues arising.

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The optimality of rehypothecation

- Rehypothecation is optimal if banks have a not-too-risky investment opportunity and loans are not over-collateralised
- Rehypothecation provides stronger incentives for companies to exert effort
- Banks can increase their profits from additional investments
- If competition erodes loan rates, the benefits to companies would be even stronger

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The optimality of rehypothecation

→ We have found that in a wide range of cases rehypothecation is optimal for banks and companies.

- Rehypothecation is optimal if banks can extend additional loans from the proceeds they obtain that are sufficiently safe; such a situation might arise at the start of a an economic upswing.
  - At the same time, companies will only agree to rehypothecation if the loans is not fully collaterised; the practice to overcollaterise loans due to the costs and difficulties for banks in selling the collateral would make rehypothecation unsustainable.
- The prospect of not having to repay the loan and make larger profits, due to under-collaterisation increases the incentives for companies to exert effort and secure those additional profits.
- The additional investments, such as the provision of additional loans, allows banks to increase their profits, provided these loans are not too risky.
- We assumed loans rates to be fixed, but with rehypothecation banks can provide more loans, which should reduce loans rates, making the benefits of rehypothecation even stronger for companies.

→ While there are clear benefits from rehypothecation, it is not a widespread practice amongst banks. We will therefore look at aspects that will restrict its extent.

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Limits to rehypothecation

- Collateral is difficult to value, handing on collateral removed the lender further from the originator of the collateral and increases this difficulty
- In principle the collateral can be continued to be handed to ever more remote lenders in a collateral chain
- This is most likely only to happen if the collateral consists of securities or real estate

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Limits to rehypothecation

→ While rehypothecation could be commonly observed, there are some problems with the valuation of the collateral which could limit the attractiveness of this process.

- The value of collateral is difficult to assess, especially if it is not based on real estate. Collateral might include future income streams of companies and the value of such assets require significant information.
  - Rehypothecation requires another lender to assess the value of this collateral, which might not have any connection to the company originating the collateral.
  - This would make an assessment of the value of the collateral even more difficult. Using discount to account for these uncertainties can quickly lead to an over-collaterisation of loans, which would lead companies refusing to allow rehypothecation.
- In principle the rehypothecation chain can be extended by the banks receiving the collateral from the first bank, it self rehypothecating this collateral, this can give rise to an ever longer collateral chain.
- Unless the collateral is easily valued, such as marketable securities, such collateral chains are not sustainable due to the problems in valuing the collateral.

→ The problem of valuing the collateral puts limits on which assets can be used in rehypothecation in the first place and the limits to extend the collateral chain, will limit the extent to which we observe rehypothecation.

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