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# Moral hazard in capital structure decisions

# Outline

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- We will now consider how the presence of moral hazard can affect the optimal capital structure.
- We will model moral hazard as the level of effort managers put into ensuring the investment they make is successful.
- We will also look at incentives to increase the risks of companies.

# Outline

- We will look at the optimal level of effort managers put into ensuring that the investment is successful.
- We will then look also look at incentives for companies to increase risks and how this will limit the amount of debt a company will be able to take on.

# Managerial decisions on investments

- Managers have a profound impact on the capital structure of a company
- Managers will choose the amount of debt and equity that are best for them
- This can lead to moral hazard as their decision might not be optimal for the company value

# Managerial decisions on investments

→ Managers are employed by company owners, equity holders, to make decisions on their behalf in the assumption that they do so in their interest.
- The way investments are funded is decided by managers.
- It are the managers' incentives that will determine the capital structure of the company.
- The optimal decision for managers might not be the optimal decision for equity holders, leading to a conflict of interest. As formally managers are agents of the equity holders and or supposed to act in their interest, this gives rise to a moral hazard problem.

→ We will now look at how effort levels chosen by managers to ensure investments succeed will cause a moral hazard problem.

# Effort and investment choice

- Managers can affect outcomes through their own actions, especially by through the effort they make to generate profits to shareholders
- As effort is costly, managers will balance these costs against the benefits that accrue to them
- Effort costs might include the working of long hours or working more intensely during the day
- Managers also decide which investments are pursued and these might not be in the best interest of shareholders or lenders
- The incentives of managers are affected by the capital structure and hence managers will make decisions that suit them

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- Managers are not only making decisions on investments and then let these investments run, but they can materially affect the outcome of the investments they have chosen.
- Most notably they can put in smaller or larger amounts of effort managing the investment; this amount of effort will affect the profits the investment generates for equity holders.

- However, exerting effort is costly and hence managers will exert effort only if this is beneficial for them in terms of the benefits exceeding these costs. This approach assumes that effort cannot be contract for in an employment contract as it is essentially not observable.

- The costs of effort might include putting in long hours at no extra pay,
- but can also imply working more intensely and more focussed than otherwise necessary.

- Of course, managers do not only decide how much effort they put in to generate profits from investments, but they decide which investments are pursued in the first place.
- The decision they take will maximize their own profits, taking into account effort costs, but might not be in the best interest of the equity holders or lenders.

- We will see that the profits of managers are affected by the capital structure of their investments,
- therefore, they will choose a capital structure that best suits their objectives.

→ We can now look at how managers choose effort levels optimally and how this affects the capital structure of companies.

- We can now see how the use of debt to finance investments affects the effort level of managers and thus the value of the company.
- From this result we can then make inferences about the capital structure the manager will choose.
- As a benchmark we will look at a company whose owners are also their managers, eliminating any moral hazard and then look at companies financing their investment with debt and outside equity, respectively.

# Manager-owned company

- A company's manager can affect their success through his effort, the higher the effort the higher the success rate of an investment
- Effort is costly and the marginal benefits are decreasing as the effort level increases
- The company generates a return on its investment if successful, which depends on the effort level
- If the company is fully financed by equity belonging to the manager, he will retain these profits and face the cost of effort
- $\Pi_M = \pi (1 + R) E - ce$
- The optimal effort level is given if $\frac{\partial \Pi_M}{\partial e} = 0$

$\Rightarrow \frac{\partial \pi}{\partial e} = \frac{c}{1+R} \frac{1}{E}$

# Manager-owned company

→ We can now derive the optimal effort level of a company that fully owned by its managers.

- We assume that a manager can affect the success rate of the investment through the effort he exerts,
  - the higher effort, the more likely an investment is to succeed.
- We assume that effort is costly
  - and the marginal benefits of effort are reducing. This implies that the increase in the probability of sucess is reducing the higher the effort is.
- We assume the company generates some return on its investment, which here is its equity.
  - This return is only realised if the investment is successful; if the investment is not successful, then the company does not obtain any funds.
  - The rate of success will depend on the level of effort the manager exerts.
- With the company only using equity, the owner-manager will retain all profits,
  - but will also face the cost of exerting effort.
- *Formula*
- The managers will choose the effort level that is optimal for them by maximizing their profits.
- [⇒] Solving the first order condition gives us the expression for the marginal impact of effort on the success rate as in the *formula*.

→ We can now use this result as a benchmark and compare the outcome with a company financed using debt.

# Financing with debt

- Assume that managers do not hold sufficient equity to finance the company and use loans for the remainder: $E = \hat{E} + L$
- Any profits accrue to the manager again, but from these he has to repay the loan with interest
- $\hat{\Pi}_M = \pi (1 + R) \left( \hat{E} + L \right) - (1 + r_L) L - ce$
- The optimal effort level is given if $\frac{\partial \hat{\Pi}_M}{\partial e} = 0$

$\Rightarrow \frac{\partial \pi}{\partial e} = \frac{c}{1+R} \frac{1}{\hat{E}+L}$

- As $E = \hat{E} + L$ the effort level is identical to the case where the manager finances the company fully
- Increasing the amount of debt increases effort levels if not increasing the manager's investment into the company

# Financing with debt

→ We now consider the case where the managers use loans to increase the amount of investment they can make.

- We assume that managers have investment opportunities that require more funds than they have available in the company.
  - The missing funds are obtained through a loan.
  - This gives a total investment funded by the existing equity and the loan. Note that the total investment is the same as in the previous case, the manager has only less equity available and supplements this by a loan.
- As the manager is the only equity holder, all profits accrue to him.
  - But now he the profits are reduced by the repayment of the loan, in addition to managers bearing the effort costs.
- *Formula*
- The managers will choose the effort level that is optimal for them by maximizing their profits.
- [⇒] Solving the first order condition gives us the expression for the marginal impact of effort on the success rate as in the *formula*.
- As the total investment is identical to the case where the manager was using only equity, the optimal effort level is the same.
- We can now make a different conclusion. If the company were to increase the investment by using debt, the marginal success rate should decrease; having assumed that the marginal success rate is decreasing the higher the effort is, will imply that the optimal effort level is higher, the higher the amount of debt is.

→ We can now investigate a company which uses equity provided by a non-manager instead of debt.

# Financing with outside equity

- Assume that managers do not hold sufficient equity to finance the company and use outside equity for the remainder: $E = \hat{E} + E^*$
- Any profits accrue to the manager again, but he can only obtain a fraction in proportion to his ownership of the company
- $\Pi_M^* = \pi (1 + R) \left( \hat{E} + E^* \right) \frac{\hat{E}}{\hat{E} + E^*} - ce = \pi (1 + R) \hat{E} - ce$
- The optimal effort level is given if $\frac{\partial \hat{\Pi}_M}{\partial e} = 0$

$\Rightarrow \frac{\partial \pi}{\partial e} = \frac{c}{1+R} \frac{1}{\hat{E}}$

- As $\hat{E} < E$ the effort level is lower to the case where the manager finances the investment through debt
- This arises from the decreasing marginal success rate as the effort increases

# Financing with outside equity

→ Outside equity here means that the company seeks equity from an investor who is not a manager.

- We assume that managers have investment opportunities that require more funds than they have available in the company.
  - The missing funds are obtained through raising additional equity.
  - This gives a total investment funded by the existing equity and the newly raised equity. Note that the total investment is the same as in the previous cases, the manager has only less equity available and supplements this by rasing additional equity.
- All profits from the investment accrue to the equity holders.
  - The manager now only holds a proportion of the total equity and will therefore only obtain a fraction of the total profits. However, he will bear the cost of efforts fully.
- *Formula*
  - We can simplify the expression.
- The managers will choose the effort level that is optimal for them by maximizing their profits.
- [⇒] Solving the first order condition gives us the expression for the marginal impact of effort on the success rate as in the *formula*.
- We now see that the marginal success rate needs to be higher than before with debt financing.
- As the marginal success rate was assumed to be decreasing in the effort level, the optimal effort level will be lower.

→ Thus we see that financing with equity reduces the effort level and the more equity is raised, the lower the effort level; when raising debt, the opposite was the case.

# Sharing benefits of efforts with outside equity

- Financing the company through outside equity lowers effort levels as the manager has to share the benefits of his effort with outside equity holders
- With debt financing, any surplus arising from increasing effort is retained by the manager as debt repayments are fixed
- The higher benefits arising from increased effort will be balanced against its costs

# Sharing benefits of efforts with outside equity

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- We have seen that raising outside equity reduces the effort levels of the manager.
- The reason for this lower effort is that the manager has to share the profits with other equity holders, thus receives only a fraction of the profits, but still faces the full costs of their effort.

- If the manager were to raise debt, he as the only equity holder would retain all surplus, less the given repayment of the loan, giving a clearer relationship between profits and effort.
- Higher debt, thus higher leverage, will increase the profits to the manager and thus induce him to exert more effort to increase these profits even further.

→ We thus see that it is optimal to use debt to increase the effort of managers and there is no moral hazard as the effort level is the same as if the manager held the entire investment as equity.

# Attracting funding

- Outside equity needs to be attracted at the optimal effort level of the managers and return at least its costs
- $\pi^* (1+R) E^* \geq (1+r_E) E^*$

$\Rightarrow \pi^* (1+R) \geq 1+r_E$

- Loans will only be given if they can be repaid at the optimal effort level of the manager
- $\pi (1+R) \left(\hat{E}+L\right) - (1+r_L) L \geq 0$

$\Rightarrow \pi^{**} (1+R) \geq (1+r_L) \frac{L}{\hat{E}+L}$

- The effort when raising debt is higher, $\pi^{**} > \pi^*$, and as loan costs are lower than equity costs, it is easier to attract debt than equity

# Attracting funding

→ Of course, the choice between debt and equity is only a true choice if outside equity is provided by such investors and loans are offered. We will derive conditions under which this is the case and compare the two financing choices.

- We know the effort level that managers will choose and hence we need to be able to attract outside equity
- and this must receive at least its cost, the require return.

- The expected return with the optimal effort level on the investment must exceed the minimum return.
- [⇒] We can simply restate this condition by eliminating the amount of equity.
- Loans on the other hand are only given if they can be repaid, given the (higher) effort level chosen by the manager.
- The loan can be repaid if the expected return from the investment is exceeding the loan repayment.
- [⇒] This condition can be solved for this *formula*.
- We know that the effort levels when choosing debt is higher than when choosing outside equity.
- *Formula*
- As furthermore the loan rate will be lower than the cost of equity and the final term is less than one, the condition for raising debt is more easily fulfilled. It is thus more likely that the manager can raise debt than equity.

→ We have seen that when raising debt moral hazard in the effort by managers is eliminated and debt is more easily raised than outside equity. It is thus that using debt to finance investments is preferable.

- The use of debt does not only affect the efforts managers might exert, but also the risks they are taking with their investments.
- This is incentive to take higher risk is a oral hazard from the perspective of the lender, the bank.
- We will see how the capital structure is affected if banks seek to ensure companies do not take on too risky investments.

# Investment opportunities

- Suppose a company can choose between two investments
- One investment has a low risk and a low return if successful, while the other has a high risk and a high return if successful
- The company uses debt and equity to finance the investment
- $\Pi_C^i = \pi_i \left( (1 + R_i) (E + L) - (1 + r_L) L \right)$

# Investment opportunities

→ We are now looking at a different kind of moral hazard, namely the choice by the company between different investments.

- Consider a company which has the choice between two investments, given the funds it has obtained. It will partially be using equity and partially debt to finance this investment.
- 
  - One investment has a high probability of success, thus is low risk, but will also have a low return if the investment is successful, going with the low risk.
  - The other investment has a low probability of success, thus is high risk, but will have a high return if the investment is successful, going with the high risk.
- The investment consists of debt and equity and the loan can only be repaid if the investment is successful as otherwise the company has no funds to repay the loan.
- *Formula*

→ The company can now decide between these two investments. We assume that it is not feasible to enter an enforceable contract that will bind the company to choose one investment over the other.

# Companies increasing risks

- Companies will choose the low-risk investment if $\Pi_C^H \geq \Pi_C^L$

$\Rightarrow \frac{L}{E} \leq \frac{\pi_H(1+R_H)-\pi_L(1+R_L)}{\pi_L(R_L-r_L)-\pi_H(R_H-r_L)}$

- If the leverage is sufficiently low, companies will seek the low-risk investment
- Higher leverage will induce companies to take the more risky investment
- This is known as the risk shifting property of debt
- Lenders may seek to limit the amount of lending such that the company does not choose the high-risk investment

# Companies increasing risks

→ Companies can now choose the investment they prefer. We assume here that the lender, such as a bank would prefer the company to choose the low-risk investment as the high-risk invest would give them lower profits or losses due to the higher default rate on the loan.

- The company will choose the low-risk investment if this is more profitable to do.
- [⇒] This condition can be solved for the leverage ratio having to be below the expression in the *formula*
- We see that if the leverage (the ration of loans over equity) is sufficiently low, the company will choose the safe (low-risk) investment.
- A higher leverage will induce companies to select the high-risk investment. The reason is because of the low amount of equity, the losses to the company are small if the investment does not succeed, but the large return gives them high profits if the investment succeeds; the company will choose returns over risk. If the leverage ratio is smaller, the relatively large losses in not-successful investments will dominate the decision and the company chooses risk over return.
- This observation that a higher level of debt induces companies to choose higher-risk investments is now in the literature as risk-shifting. The term risk-shifting has been coined because the company shifts the risk of losses from itself (equity) to the lender (loans).
- We thus see that lenders (banks) might not provide large loan to companies if this would induce them to choose high-risk investments.

→ The amount of leverage a company can achieve is limited by the desire of the lender to ensure the company chooses the low-risk investment. The possible choice of the high-risk investment by the company represents a moral hazard, as the company makes a choice that is not in the interest of the lender.

- We can now summarize our results on the effect moral hazard has on the capital structure of companies.

# Debt increases efforts and risks

- Using debt to finance investment increases effort levels, making companies more valuable
- Debt is easier to attract than outside equity
- Higher debt levels also provide managers with incentives to increase risks
- This might make debt unattractive to lenders and the company has to finance itself through outside equity

# Debt increases efforts and risks

→ We have seen that the debt level affects the effort managers make to ensure investments succeed, and it affects the amount of risk the company is taking.

- Using debt increases the effort management puts into making the investment successful.
  - This will increase the value of the company.
- We also found that debt was easier to attract than outside equity.
- However, we have also seen that higher debt levels makes it optimal for companies to increase the risks they are taking.
- This higher risk makes it unattractive for lenders to provide large loans to companies.
  - If companies want to finance such high-risk investments, it has to rely on outside equity.

→ We can now have a look it the implications for the capital structure of companies.

# Optimal capital structure

- The optimal capital structure would balance the increased risks arising from debt with the increased effort
- The optimal leverage would be where the overall value of the company to the manager is highest
- As the manager bears the costs of effort, this leverage will not necessarily be maximizing company value

# Optimal capital structure

→ The optimal financing choice and thus the optimal capital structure will be a trade-ff between more efforts by managers and higher risks taken by the company.

- The capital structure would have to balance the increased risk that a higher debt level entails against the higher effort and thus reduced risk.
- The overall optimal level of debt would be such that the company value is maximized, provided the lenders are willing to provide the loan.
- However, the manager is bearing the costs of his efforts to reduce risks, so the actually chosen capital structure might not be the one that maximizes the company value, but the one that maximizes the profits to the manager.

→ Thus moral hazard makes it optimal for companies to use debt, but the level of debt will be limited.



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