



# SEPARATING EQUILIBRIUM

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## The role of collateral



# SEPARATING EQUILIBRIUM

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- Key concepts
- The role of collateral in an adverse selection framework
- The incentive effect of collateral and other variables



# 1-KEY CONCEPTS

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- Stiglitz/Weiss (1981)
  - The bank is passive and doesn't search any information about the borrowers
  - The bank offers the same contract (rate) to different borrowers
- In contrast, Bester (1985)
  - The bank tries to screen the loan applicants
  - The bank offers a whole menu of different contracts to different borrowers



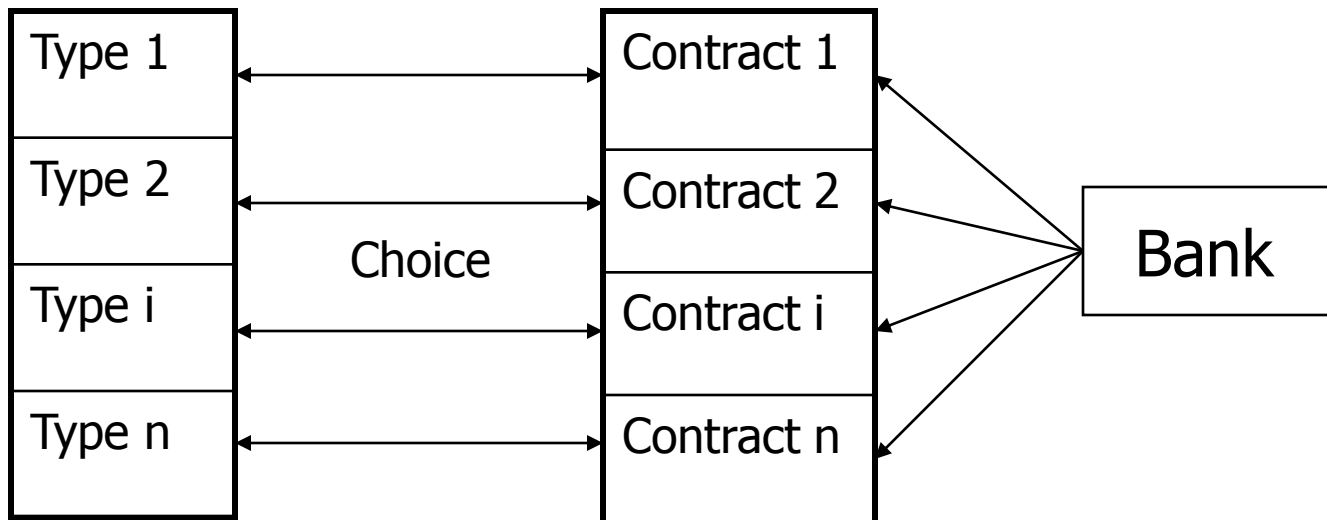
# 1-KEY CONCEPTS

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- Separating contracts
  - A set of various credit contracts, each one being a couple {interest rate, collateral required}
  - The set of contracts is structured so as to separate the loan applicants
  - 2 different loan applicants choose 2 different contracts
  - When observing the chosen contract, the bank can induce the risk-type of the borrower

# 1-KEY CONCEPTS

- The principle





# 1-KEY CONCEPTS

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- Examples of separating contracts
  - In the insurance market
  - In the credit market
    - {interest rate; collateral}, (Bester, 1985)
    - {interest rate; size loan}, (Freixas-Laffont, 1989)
    - {interest rate; rationing probability}, (Gillet-Lobez, 1992), (Lobez-Statnik, 2001)



# 2-THE ROLE OF COLLATERAL

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- Assumptions

- Bank offers a set of contracts

- $\{(C_k, R_k), k=L, H\}$
    - $C_k$ =collateral required
    - $R_k=1$ +interest rate (repayment if success)
    - L for low risk borrower, H for high risk



## 2-THE ROLE OF COLLATERAL

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- Borrowers manage investment projects
  - $1 \longrightarrow y$  with prob  $(1-\theta_k)$   
0 otherwise
  - $\theta_k$  is private information of the borrower
  - If the project fails, the bank can liquidate the collateral and gets  $\delta C_k$  while the borrower loses  $C_k$  ;  $\delta < 1$ .
  - If the project succeeds, the bank gets  $R_k$  and the borrower obtains  $(y-R_k)$
  - Borrowers have reservation utilities  $U_k$  and the bank maximizes its profit



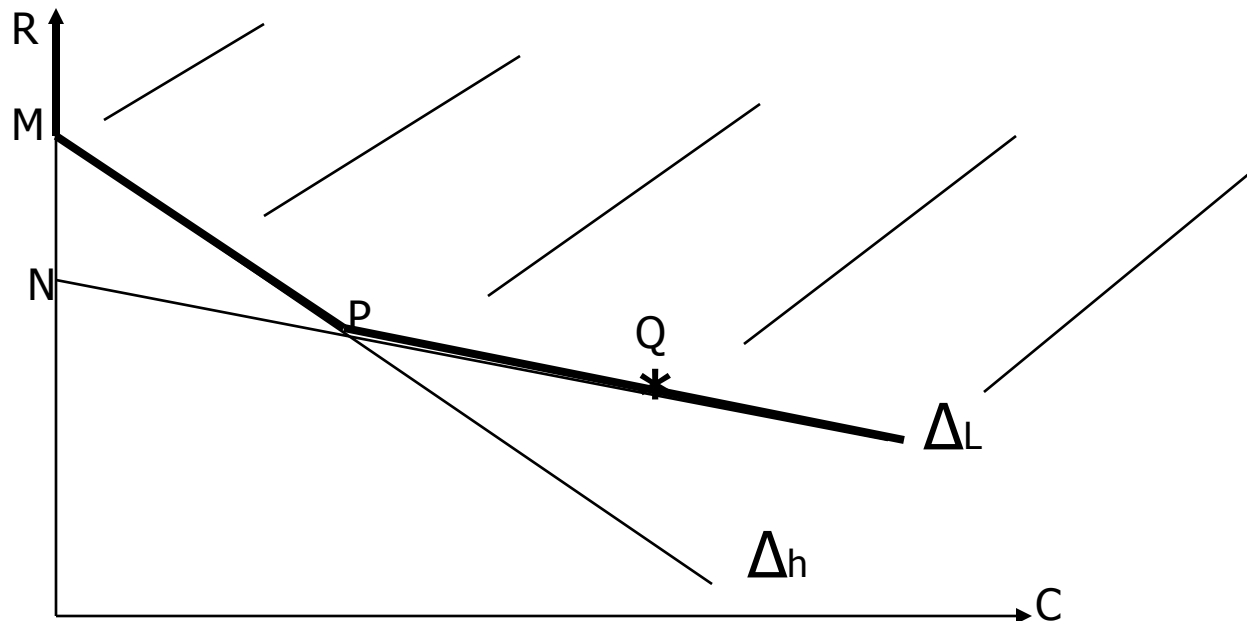
## 2-THE ROLE OF COLLATERAL

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- Benchmark case: symmetric information
  - If the bank observes  $\theta_k$ , it offers contracts such that:
    - $(1 - \theta_k)(y - R_k) - \theta_k C_k = U_k$
  - The corresponding indifference curves in the  $(C, R)$  plane are the 2 lines in the next figure

# 2-THE ROLE OF COLLATERAL

- Figure 1: The borrowers indifference curves





## 2-THE ROLE OF COLLATERAL

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- The borrowers indifference curves
  - The inequality  $\theta_H > \theta_L$  implies that  $\Delta_H$  is steeper than  $\Delta_L$
  - The 2 lines intersect in P
  - Since there are liquidation costs, the bank prefers contracts M and N with no collateral
  - If the bank offers contracts M and N, under asymmetric information, both types claim to be low risk and choose contract N with no collateral
  - High risks obtain an informational rent!



## 2-THE ROLE OF COLLATERAL

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- How to separate the 2 types?
  - The bank needs to offer simultaneously another contract  $(C,R)$  designed specifically for low risks
  - $(1 - \theta_H)(y - R_H) \geq (1 - \theta_H)(y - R) - \theta_H C$ 
    - High risks prefer contract M to  $(C,R)$
  - $(1 - \theta_L)(y - R) - \theta_L C \geq U_L$ 
    - Low risks accept contract  $(C,R)$
  - The set of contracts satisfying these 2 constraints is represented by the shaded area in the figure 1



## 2-THE ROLE OF COLLATERAL

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- The optimal separating contracts
  - Contracts are optimal if they are the closest from the origin ; so, they must lie on the black line
    - For instance,  $(M,Q)$  is an efficient menu
  - Contracts are optimal from the lender's viewpoint if they don't include too much collateral because collateral is costly
    - So, the menu  $(M,P)$  is better than  $(M,Q)$  where  $P$  is the intersection of the 2 indifference curves



## 2-THE ROLE OF COLLATERAL

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- The optimal separating contracts
  - By offering the menu  $(M,P)$ , the bank can separate the two types:
    - High-risk types choose contract M which is on their indifference curve; contract M does not specify any collateral
      - We suppose here that between M and P, high-risks prefer M
    - Low-risk types choose contract P which includes some collateral and leads to the same utility as contract N; P is cheaper than N but includes some collateral



# 2-THE ROLE OF COLLATERAL

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- *Will the bank always separate the 2 types?*
- This decision results from a trade-off
  - Collateral used to separate the 2 types is costly to the bank! So, there is an expected cost of liquidation!
  - Separation results in an expected gain in surplus extraction for the high-risks!
  - When the expected gain in surplus is greater than the expected cost, the bank's interest is to separate the 2 types
    - This condition depends upon the proportion of low and high risks in the economy
    - $\mu_H(1 - \theta_H)(R_H - R_L) > \mu_L\theta_L(1 - \delta)C$



## 2-THE ROLE OF COLLATERAL

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- A paradox!
  - This result seems to be paradoxical because collateral is required only for low-risks. High-risks don't pay any collateral.
  - In that case, collateral plays a double role:
    - To protect the lender who can liquidate that collateral if the project fails
    - To separate the 2 types
      - Low-risks accept contract P with some collateral because they know their low probability to loose C!



## 3-THE INCENTIVE EFFECT OF COLLATERAL AND OTHER VARIABLES

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- Because bankruptcy is more expensive, guarantees:
  - limit risk-taking by firms
  - Induce more effort from the entrepreneur to manage investment projects
  - Limit moral hazard and the risk for strategic default



## 3-THE INCENTIVE EFFECT OF COLLATERAL AND OTHER VARIABLES

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- Debt contracts include some other variables which have incentive effects:
  - Shorter maturity induces frequent renegotiation
    - Which in turn limit risk taking by firms
    - Because banks would otherwise ration the risky firms
  - Debt covenants can also have positive incentive effects:
    - Borrowers have to respect the covenants
    - Because banks would otherwise liquidate the firm or renegotiate the contracts



## 3-THE INCENTIVE EFFECT OF COLLATERAL AND OTHER VARIABLES

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- Empirical findings
  - Most studies underline the positive relationship between the level of guarantees and the risk of the firms
    - This is in line with the incentive hypothesis for guarantees, but contradicts the separating equilibrium hypothesis
  - Most studies underline the fact that guaranteed loans are more risky ex post than unguaranteed loans



# SUMMARY

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- Banks can screen loan applicants by offering a menu of separating contracts
- High-risks pay a high interest rate but are not required to put down any collateral
- Low-risks have to put down some collateral but they pay a lower interest rate
- Empirical findings contradict the separating equilibrium hypothesis and are more in line with the incentive effect of guarantees and collateral



# REFERENCES

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- Freixas, X. and Laffont, J.J., (1990), « Optimal banking contracts », *In essays in honor of E.Malinvand, Vol.2, Macroeconomics*, MIT press, 33-61.
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- Lobe, F and Statnik, J.C., (2001), « L'arbitrage coût-disponibilité du crédit et la concentration de la dette : une approche en termes de contrats séparants », *Revue Economique*, Novembre.
  - Part 2 of that chapter is directly adapted from Freixas and Rochet, *Microeconomics of banking*, (chapter 4).