Andreas Krause

Chapter 8.2.1

Identifying company types through collateral

Collateral use

Collateral use

- Banks do not always know the risks companies are taking

Collateral use

- Banks do not always know the risks companies are taking, but companies might be more aware of their own risks

Collateral use

- Banks do not always know the risks companies are taking, but companies might be more aware of their own risks
- Setting loan rates too high to account for high-risk companies, might crowd out low-risk companies due to the lower return they obtain from their investment

Collateral use

- Banks do not always know the risks companies are taking, but companies might be more aware of their own risks
- Setting loan rates too high to account for high-risk companies, might crowd out low-risk companies due to the lower return they obtain from their investment
- Collateral can be used to distinguish between the two types of companies

Collateral use

- Banks do not always know the risks companies are taking, but companies might be more aware of their own risks
- Setting loan rates too high to account for high-risk companies, might crowd out low-risk companies due to the lower return they obtain from their investment
- Collateral can be used to distinguish between the two types of companies, allowing for loan rates to be set according to the risk of the company

Collateral use

- Banks do not always know the risks companies are taking, but companies might be more aware of their own risks
- Setting loan rates too high to account for high-risk companies, might crowd out low-risk companies due to the lower return they obtain from their investment
- Collateral can be used to distinguish between the two types of companies, allowing for loan rates to be set according to the risk of the company

Company profits

Company profits

- Companies obtain their investment return
- $\Pi_C^i = \quad \left((1+R)\, L \qquad\qquad\qquad \right)$

Company profits

- Companies obtain their investment return and repay the loan
- $\Pi_C^i = \quad \left((1+R)\, L - \left(1+r_L^i\right) L \right)$

Company profits

- Companies obtain their investment return and repay the loan if they are successful
- $\Pi_C^i = \pi_i \left((1 + R) L - \left(1 + r_L^i\right) L \right)$

Company profits

- Companies obtain their investment return and repay the loan if they are successful, if they are unsuccessful they lose their collateral
- $\Pi_C^i = \pi_i \left((1+R) L - \left(1 + r_L^i\right) L \right) - (1 - \pi_i) C_i$

Company profits

- Companies obtain their investment return and repay the loan if they are successful, if they are unsuccessful they lose their collateral
- $\Pi_C^i = \pi_i \left((1+R) L - \left(1 + r_L^i\right) L \right) - (1 - \pi_i) C_i$
- The isoprofit curve of companies is given by $d\Pi_C^i = -\pi_i L dr_L^i - (1 - \pi_i) dC_i = 0$

Company profits

- Companies obtain their investment return and repay the loan if they are successful, if they are unsuccessful they lose their collateral
- $\Pi_C^i = \pi_i \left((1+R) L - \left(1 + r_L^i\right) L \right) - (1 - \pi_i) C_i$
- The isoprofit curve of companies is given by $d\Pi_C^i = -\pi_i L dr_L^i - (1 - \pi_i) dC_i = 0$

$\Rightarrow \frac{dr_L^i}{dC_i} = -\frac{1-\pi_i}{\pi_i L}$

Company profits

- Companies obtain their investment return and repay the loan if they are successful, if they are unsuccessful they lose their collateral
- $\Pi_C^i = \pi_i \left(\left(1+R \right) L - \left(1 + r_L^i \right) L \right) - \left(1 - \pi_i \right) C_i$
- The isoprofit curve of companies is given by $d\Pi_C^i = -\pi_i L dr_L^i - \left(1 - \pi_i \right) dC_i = 0$

$\Rightarrow$ $\frac{dr_L^i}{dC_i} = -\frac{1-\pi_i}{\pi_i L}$

- We find a negative trade-off between the loan rate and the size of the collateral

Company profits

- Companies obtain their investment return and repay the loan if they are successful, if they are unsuccessful they lose their collateral
- $\Pi_C^i = \pi_i \left(\left(1 + R\right) L - \left(1 + r_L^i\right) L \right) - \left(1 - \pi_i\right) C_i$
- The isoprofit curve of companies is given by $d\Pi_C^i = -\pi_i L dr_L^i - \left(1 - \pi_i\right) dC_i = 0$

$\Rightarrow$ $\frac{dr_L^i}{dC_i} = -\frac{1-\pi_i}{\pi_i L}$

- We find a negative trade-off between the loan rate and the size of the collateral

Bank profits

Bank profits

- Banks obtain collateral, but they can only sell this with a discount λ

Bank profits

- Banks obtain collateral, but they can only sell this with a discount λ
- If the investment of the company is successful, the loan is repaid

- $\Pi_B^i = \pi_i \left(1 + r_L^i\right) L$

Bank profits

- Banks obtain collateral, but they can only sell this with a discount λ
- If the investment of the company is successful, the loan is repaid, if the investment is not successful, the bank obtains the value of the collateral

- $\Pi_B^i = \pi_i \left(1 + r_L^i\right) L + \left(1 - \pi_i\right) \lambda C_i$

Bank profits

- Banks obtain collateral, but they can only sell this with a discount λ
- If the investment of the company is successful, the loan is repaid, if the investment is not successful, the bank obtains the value of the collateral
- Loans are fully financed by deposits
- $\Pi_B^i = \pi_i \left(1 + r_L^i\right) L + (1 - \pi_i) \lambda C_i - (1 + r_D) L$

Bank profits

- Banks obtain collateral, but they can only sell this with a discount λ
- If the investment of the company is successful, the loan is repaid, if the investment is not successful, the bank obtains the value of the collateral
- Loans are fully financed by deposits
- $\Pi_B^i = \pi_i \left(1 + r_L^i\right) L + \left(1 - \pi_i\right) \lambda C_i - \left(1 + r_D\right) L$
- The isoprofit curve of banks is given by $d\Pi_B^i = \pi_i L dr_L^i + \lambda \left(1 - \pi_i\right) dC_i = 0$

Bank profits

- Banks obtain collateral, but they can only sell this with a discount λ
- If the investment of the company is successful, the loan is repaid, if the investment is not successful, the bank obtains the value of the collateral
- Loans are fully financed by deposits
- $\Pi_B^i = \pi_i \left(1 + r_L^i\right) L + (1 - \pi_i) \lambda C_i - (1 + r_D) L$
- The isoprofit curve of banks is given by $d\Pi_B^i = \pi_i L dr_L^i + \lambda (1 - \pi_i) dC_i = 0$

$\Rightarrow \frac{dr_L^i}{dC_i} = -\lambda \frac{1-\pi_i}{\pi_i L}$

Bank profits

- Banks obtain collateral, but they can only sell this with a discount λ
- If the investment of the company is successful, the loan is repaid, if the investment is not successful, the bank obtains the value of the collateral
- Loans are fully financed by deposits
- $\Pi_B^i = \pi_i \left(1 + r_L^i\right) L + \left(1 - \pi_i\right) \lambda C_i - \left(1 + r_D\right) L$
- The isoprofit curve of banks is given by $d\Pi_B^i = \pi_i L dr_L^i + \lambda \left(1 - \pi_i\right) dC_i = 0$

$\Rightarrow$ $\frac{dr_L^i}{dC_i} = -\lambda \frac{1-\pi_i}{\pi_i L}$

- The slope is negative, but flatter than the isoprofit curve for companies

Bank profits

- Banks obtain collateral, but they can only sell this with a discount λ
- If the investment of the company is successful, the loan is repaid, if the investment is not successful, the bank obtains the value of the collateral
- Loans are fully financed by deposits
- $\Pi_B^i = \pi_i \left(1 + r_L^i\right) L + \left(1 - \pi_i\right) \lambda C_i - \left(1 + r_D\right) L$
- The isoprofit curve of banks is given by $d\Pi_B^i = \pi_i L dr_L^i + \lambda \left(1 - \pi_i\right) dC_i = 0$

$\Rightarrow \frac{dr_L^i}{dC_i} = -\lambda \frac{1-\pi_i}{\pi_i L}$

- The slope is negative, but flatter than the isoprofit curve for companies

Bank offering a single contract only

Bank offering a single contract only

- Banks know the composition of low-risk and high-risk companies

Bank offering a single contract only

- Banks know the composition of low-risk and high-risk companies, the average success rate is $\pi = p\pi_H + (1-p)\,\pi_L$

Bank offering a single contract only

- Banks know the composition of low-risk and high-risk companies, the average success rate is $\pi = p\pi_H + (1-p)\,\pi_L$

$\Rightarrow$ $\Pi_B^P = \pi\,(1 + r_L)\,L + (1-\pi)\,\lambda C - (1 + r_D)\,L$

Bank offering a single contract only

- Banks know the composition of low-risk and high-risk companies, the average success rate is $\pi = p\pi_H + (1-p)\,\pi_L$

$\Rightarrow$ $\Pi_B^P = \pi\,(1 + r_L)\,L + (1-\pi)\,\lambda C - (1 + r_D)\,L$

$\Rightarrow$ $\frac{dr_L}{dC} = -\lambda \frac{1-\pi}{\pi L}$

Bank offering a single contract only

- Banks know the composition of low-risk and high-risk companies, the average success rate is $\pi = p\pi_H + (1-p)\pi_L$

$\Rightarrow$ $\Pi_B^P = \pi(1+r_L)L + (1-\pi)\lambda C - (1+r_D)L$

$\Rightarrow$ $\frac{dr_L}{dC} = -\lambda\frac{1-\pi}{\pi L}$

- This slope is between banks only lending to high-risk and low-risk companies

Bank offering a single contract only

- Banks know the composition of low-risk and high-risk companies, the average success rate is $\pi = p\pi_H + (1-p)\,\pi_L$

$\Rightarrow$ $\Pi_B^P = \pi\,(1+r_L)\,L + (1-\pi)\,\lambda C - (1+r_D)\,L$

$\Rightarrow$ $\frac{dr_L}{dC} = -\lambda\frac{1-\pi}{\pi L}$

- This slope is between banks only lending to high-risk and low-risk companies
- If this bank is competitive then we require $\Pi_B^P = 0$

Bank offering a single contract only

- Banks know the composition of low-risk and high-risk companies, the average success rate is $\pi = p\pi_H + (1-p)\pi_L$

$\Rightarrow \Pi_B^P = \pi(1+r_L)L + (1-\pi)\lambda C - (1+r_D)L$

$\Rightarrow \frac{dr_L}{dC} = -\lambda\frac{1-\pi}{\pi L}$

- This slope is between banks only lending to high-risk and low-risk companies
- If this bank is competitive then we require $\Pi_B^P = 0$

$\Rightarrow 1 + r_L = \frac{1+r_D}{\pi} - \frac{1-\pi}{\pi}\frac{C}{L}$

Bank offering a single contract only

- Banks know the composition of low-risk and high-risk companies, the average success rate is $\pi = p\pi_H + (1-p)\,\pi_L$

$\Rightarrow$ $\Pi_B^P = \pi\,(1+r_L)\,L + (1-\pi)\,\lambda C - (1+r_D)\,L$

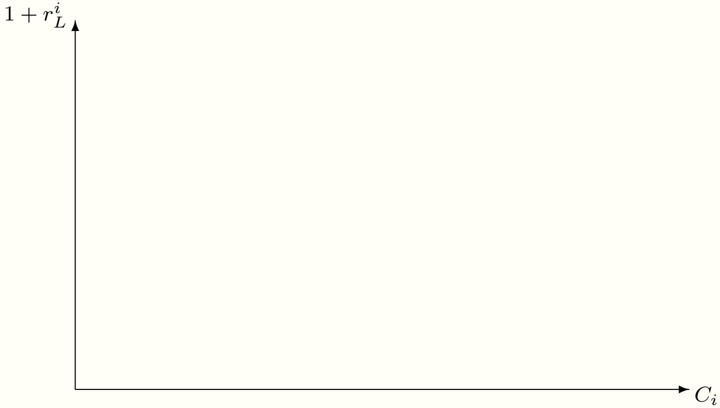
$\Rightarrow$ $\frac{dr_L}{dC} = -\lambda\frac{1-\pi}{\pi L}$

- This slope is between banks only lending to high-risk and low-risk companies
- If this bank is competitive then we require $\Pi_B^P = 0$

$\Rightarrow$ $1 + r_L = \frac{1+r_D}{\pi} - \frac{1-\pi}{\pi}\frac{C}{L}$

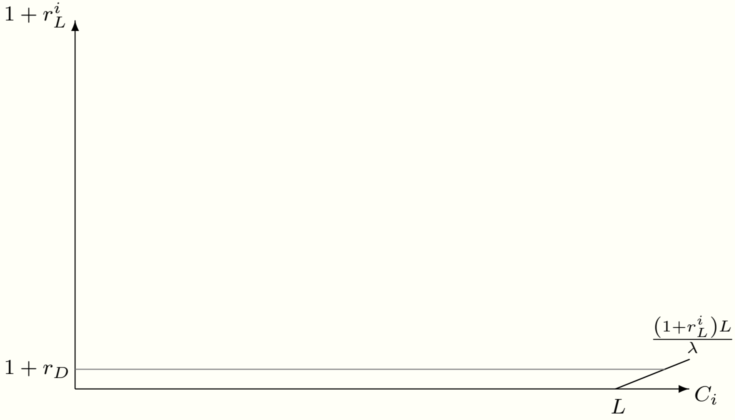
Separating equilibrium with collateral

Separating equilibrium with collateral

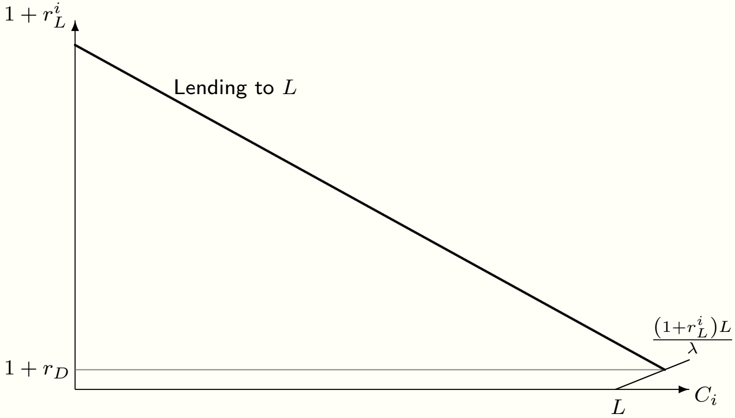


Separating equilibrium with collateral

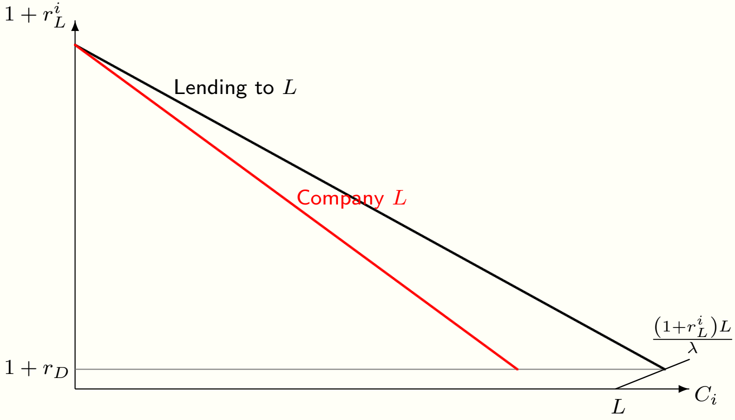
Separating equilibrium with collateral



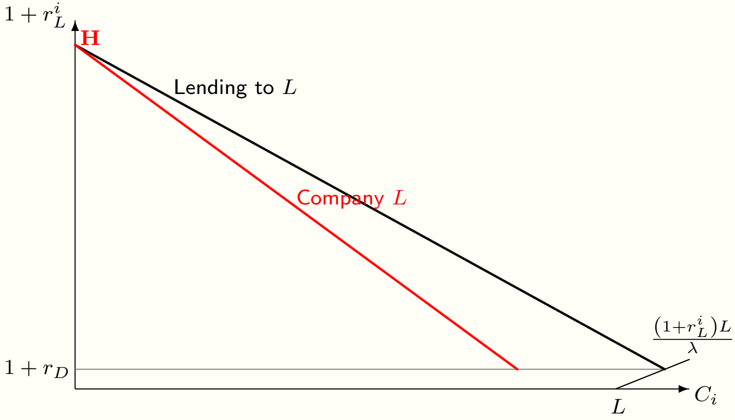
Separating equilibrium with collateral



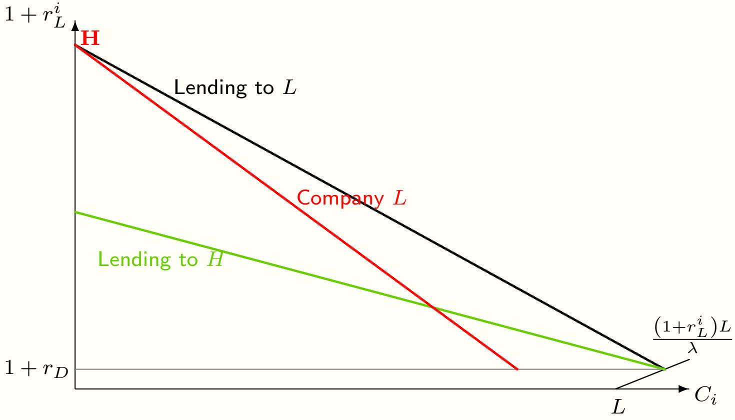
Separating equilibrium with collateral



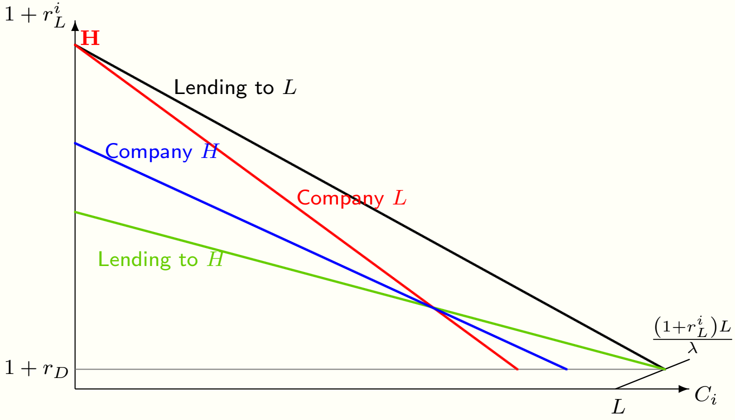
Separating equilibrium with collateral



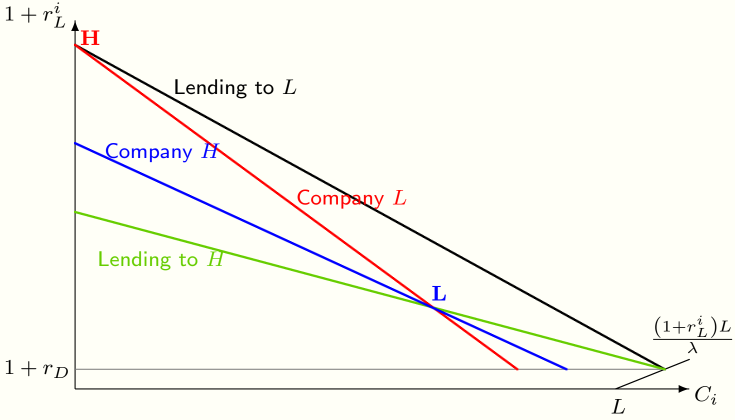
Separating equilibrium with collateral



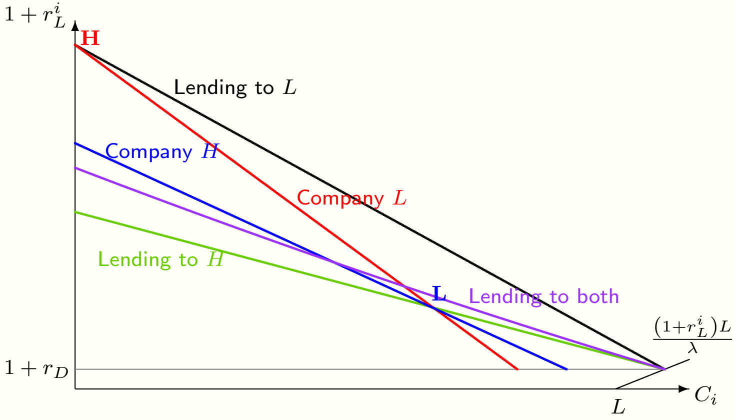
Separating equilibrium with collateral



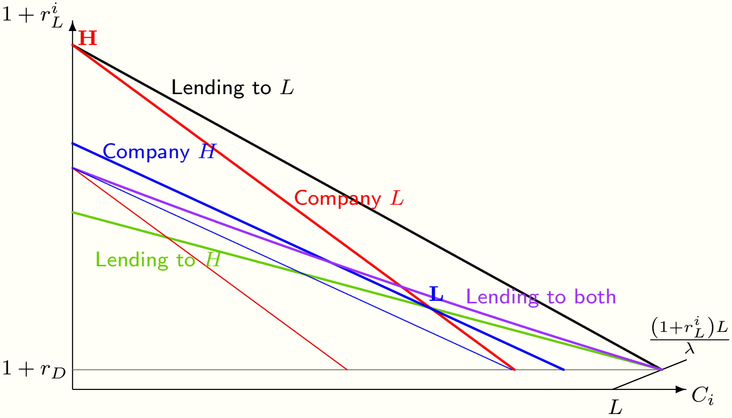
Separating equilibrium with collateral



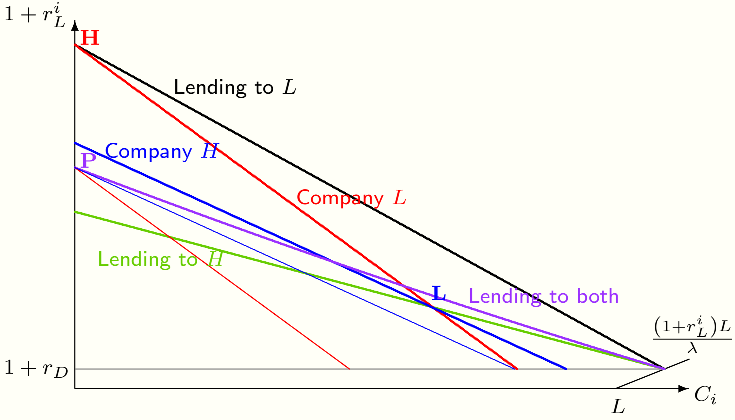
Separating equilibrium with collateral



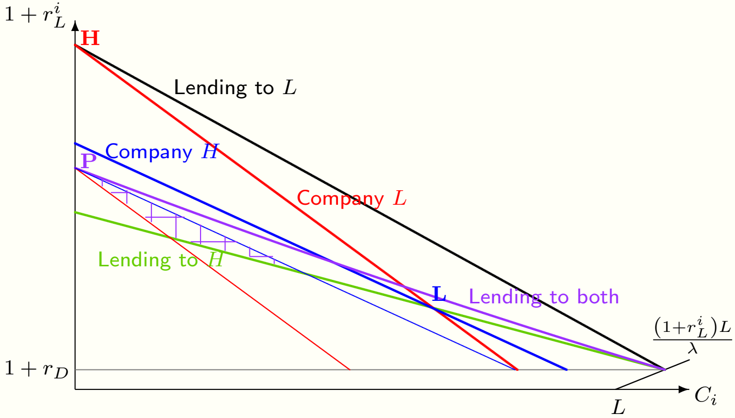
Separating equilibrium with collateral



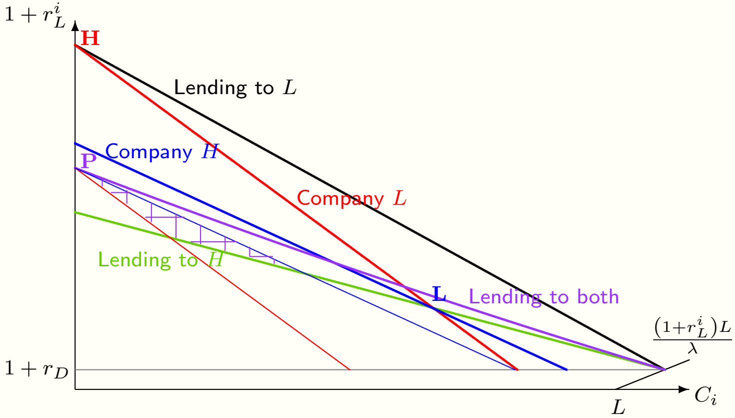
Separating equilibrium with collateral



Separating equilibrium with collateral



Separating equilibrium with collateral



Banks offering distinct contracts

Banks offering distinct contracts

- If banks are competitive, they make zero profits as long as they follow the same strategy

Banks offering distinct contracts

- If banks are competitive, they make zero profits as long as they follow the same strategy: all offer two contracts (separating)

Banks offering distinct contracts

- If banks are competitive, they make zero profits as long as they follow the same strategy: all offer two contracts (separating) or all offer one contract (pooling)

Banks offering distinct contracts

- If banks are competitive, they make zero profits as long as they follow the same strategy: all offer two contracts (separating) or all offer one contract (pooling)
- If a bank offers a single contract, another bank can offer a marginally better contract near $\mathbf{P}$

Banks offering distinct contracts

- If banks are competitive, they make zero profits as long as they follow the same strategy: all offer two contracts (separating) or all offer one contract (pooling)
- If a bank offers a single contract, another bank can offer a marginally better contract near $\mathbf{P}$
- This bank would obtain all low-risk companies

Banks offering distinct contracts

- If banks are competitive, they make zero profits as long as they follow the same strategy: all offer two contracts (separating) or all offer one contract (pooling)
- If a bank offers a single contract, another bank can offer a marginally better contract near $\mathbf{P}$
- This bank would obtain all low-risk companies, but no high-risk companies

Banks offering distinct contracts

- If banks are competitive, they make zero profits as long as they follow the same strategy: all offer two contracts (separating) or all offer one contract (pooling)
- If a bank offers a single contract, another bank can offer a marginally better contract near $\mathbf{P}$
- This bank would obtain all low-risk companies, but no high-risk companies

$\Rightarrow$ $\Pi_B^* = \pi_H (1 + r_L) L - (1 + r_D) L = (1 - p) \frac{\pi_H - \pi_L}{\pi} (1 + r_D) L$

Banks offering distinct contracts

- If banks are competitive, they make zero profits as long as they follow the same strategy: all offer two contracts (separating) or all offer one contract (pooling)
- If a bank offers a single contract, another bank can offer a marginally better contract near $\mathbf{P}$
- This bank would obtain all low-risk companies, but no high-risk companies

$\Rightarrow$ $\Pi_B^* = \pi_H (1 + r_L) L - (1 + r_D) L = (1 - p) \frac{\pi_H - \pi_L}{\pi} (1 + r_D) L$

- The other bank would be left with high-risk companies only

Banks offering distinct contracts

- If banks are competitive, they make zero profits as long as they follow the same strategy: all offer two contracts (separating) or all offer one contract (pooling)
- If a bank offers a single contract, another bank can offer a marginally better contract near $\mathbf{P}$
- This bank would obtain all low-risk companies, but no high-risk companies

$\Rightarrow$ $\Pi_B^* = \pi_H \left(1 + r_L\right) L - \left(1 + r_D\right) L = \left(1 - p\right) \frac{\pi_H - \pi_L}{\pi} \left(1 + r_D\right) L$

- The other bank would be left with high-risk companies only

$\Rightarrow$ $\Pi_B^{**} = \pi_L \left(1 + r_L\right) L - \left(1 + r_D\right) L = -p \frac{\pi_H - \pi_L}{\pi} \left(1 + r_D\right) L$

Banks offering distinct contracts

- If banks are competitive, they make zero profits as long as they follow the same strategy: all offer two contracts (separating) or all offer one contract (pooling)
- If a bank offers a single contract, another bank can offer a marginally better contract near $\mathbf{P}$
- This bank would obtain all low-risk companies, but no high-risk companies

$\Rightarrow$ $\Pi_B^* = \pi_H \left(1 + r_L\right) L - \left(1 + r_D\right) L = \left(1 - p\right) \frac{\pi_H - \pi_L}{\pi} \left(1 + r_D\right) L$

- The other bank would be left with high-risk companies only

$\Rightarrow$ $\Pi_B^{**} = \pi_L \left(1 + r_L\right) L - \left(1 + r_D\right) L = -p \frac{\pi_H - \pi_L}{\pi} \left(1 + r_D\right) L$

Strategic choice of loan contracts

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling		
	separating		

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling	$0,\ 0$	
	separating		

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling	$0, 0$	
	separating		$0, 0$

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling	$0,\ 0$	$\Pi_B^*,\ \Pi_B^{**}$
	separating		$0,\ 0$

Strategic choice of loan contracts

		Bank 1: pooling	Bank 1: separating
Bank 2	pooling	$0,\ 0$	$\Pi_B^*,\ \Pi_B^{**}$
Bank 2	separating	$\Pi_B^{**},\ \Pi_B^*$	$0,\ 0$

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling	0, 0	Π_B^*, Π_B^{**}
	separating	Π_B^{**}, Π_B^*	0, 0

$$\Pi_B^* > 0 > \Pi_B^{**}$$

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling	$0,\ 0$	$\Pi_B^*,\ \Pi_B^{**}$
	separating	$\Pi_B^{**},\ \Pi_B^*$	$0,\ 0$

$$\Pi_B^* > 0 > \Pi_B^{**}$$

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling	$0,\ 0$	$\Pi_B^*,\ \Pi_B^{**}$
	separating	$\Pi_B^{**},\ \Pi_B^*$	$0,\ 0$

$$\Pi_B^* > 0 > \Pi_B^{**}$$

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling	$0,\ 0$	$\Pi_B^*,\ \Pi_B^{**}$
	separating	$\Pi_B^{**},\ \Pi_B^*$	$0,\ 0$

$$\Pi_B^* > 0 > \Pi_B^{**}$$

Strategic choice of loan contracts

		Bank 1: pooling	Bank 1: separating
Bank 2	pooling	$0,\ 0$	$\Pi_B^*,\ \Pi_B^{**}$
Bank 2	separating	$\Pi_B^{**},\ \Pi_B^*$	$0,\ 0$

$$\Pi_B^* > 0 > \Pi_B^{**}$$

Strategic choice of loan contracts

		Bank 1: pooling	Bank 1: separating
Bank 2	pooling	$0,\ 0$	$\Pi_B^{*},\ \Pi_B^{**}$
Bank 2	separating	$\Pi_B^{**},\ \Pi_B^{*}$	$0,\ 0$

$$\Pi_B^{*} > 0 > \Pi_B^{**}$$

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling	$0, 0$	Π_B^*, Π_B^{**}
	separating	Π_B^{**}, Π_B^*	$0, 0$

$$\Pi_B^* > 0 > \Pi_B^{**}$$

Strategic choice of loan contracts

Bank 2		Bank 1: pooling	Bank 1: separating
	pooling	$0,\ 0$	$\Pi_B^*,\ \Pi_B^{**}$
	separating	$\Pi_B^{**},\ \Pi_B^*$	$0,\ 0$

$$\Pi_B^* > 0 > \Pi_B^{**}$$

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling	$0,\ 0$	$\Pi_B^*,\ \Pi_B^{**}$
	separating	$\Pi_B^{**},\ \Pi_B^*$	$0,\ 0$

Strategic choice of loan contracts

		Bank 1	
		pooling	separating
Bank 2	pooling	$0,\ 0$	$\Pi_B^*,\ \Pi_B^{**}$
	separating	$\Pi_B^{**},\ \Pi_B^*$	$0,\ 0$

Summary

Summary

- Collateral can be used to separate companies taking different risks

Summary

- Collateral can be used to separate companies taking different risks
- Low-risk companies will offer collateral in exchange for a lower loan rate

Summary

- Collateral can be used to separate companies taking different risks
- Low-risk companies will offer collateral in exchange for a lower loan rate
- High-risk companies will not offer collateral, but pay a higher loan rate

Summary

- Collateral can be used to separate companies taking different risks
- Low-risk companies will offer collateral in exchange for a lower loan rate
- High-risk companies will not offer collateral, but pay a higher loan rate
- Banks will offer contracts with and without collateral for companies to choose

Summary

- Collateral can be used to separate companies taking different risks
- Low-risk companies will offer collateral in exchange for a lower loan rate
- High-risk companies will not offer collateral, but pay a higher loan rate
- Banks will offer contracts with and without collateral for companies to choose

This presentation is based on
Andreas Krause: Theoretical Foundations of Banking, 2025

Picture credits:
Cover: Bernard Spragg, NZ from Christchurch, New Zealand, CC0, via Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Bank_of_China_Hong_Kong_(9532283389).jpg
Back: Florian Lindner, CC BY 2.5 https://creativecommons.org/licenses/by/2.5 via Wikimedia Commons, https://commons.wikimedia.org/wiki/File:Hong_Kong_Panorama_at_night.jpg

Andreas Krause
Department of Economics
University of Bath
Claverton Down
Bath BA2 7AY
United Kingdom

E-mail: mnsak@bath.ac.uk