Regulation, Supervision, and Bank Risk-Taking

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Introduction (i)

- Bank regulation is about requirements to operate as a bank

  → Capital or liquidity requirements

- Bank supervision involves

  1. Assessment of compliance with regulation
  2. Assessment of liquidity and solvency through monitoring
  3. Use of this information to request corrective actions

- Key distinction

  → Regulation is about verifiable (eg accounting) information

  → Supervision is (mostly) about non-verifiable information

Introduction (ii)

- Until the Global Financial Crisis academics paid little attention to bank regulation and supervision

  → Bank regulation was isolated from mainstream economics

  → Bank supervision was even more isolated

- Supervisors had little interest in interacting with researchers (inside or outside central banks)

  → Reluctance to share supervisory information

- Situation has changed in recent years

Introduction (iii)

- Drivers of change

  → Use of stress testing in banking supervision

  → Arrival of macroprudential supervision

  → Appointment of researchers to top positions in supervision

- Many academic papers on bank supervision

  → Almost all the research on bank supervision is empirical

  → Number of facts that lack a theoretical explanation

  → This paper: understanding the mechanisms behind them

Some research with US data (i)

- Agarwal, Lucca, Seru, and Trebbi (*QJE* 2014)
  - → Federal supervisors are tougher than state supervisors
  - → Leniency of state supervisors leads to higher failure rates
- Hirtle, Kovner, and Plosser (*JF* 2020)
  - → Compare “district top” banks to similar institutions in other districts that are not ranked largest
  - → Bank supervision lowers risk-taking

Some research with US data (ii)

- Costello, Granja, and Weber (*JAR* 2019)

  → Role of supervisors in enforcing reporting transparency

  → Restatements of banks' call reports

- Kandrac and Schlusche (*RFS* 2021)

  → Natural experiment of a decline in supervisory oversight

  → Causal effect on higher risk-taking

Some research with US data (iii)

- Eisenbach, Lucca, and Townsend (*JF* 2022)
  - → Structural model of allocation of supervisory hours
  - → Significant effect of supervision on bank risk
  - → Importantly, they note:

> "In estimating the effect of supervision on bank risk, we do <u>not</u> explicitly specify the channel through which supervision operates"

Some research with European data (i)

- Abbassi, Iyer, Peydró, and Soto (2023)
  → Banks reduced their riskier loans and securities following the 2013 announcement of the Asset Quality Review
- Kok, Müller, Ongena, and Pancaro (*JFI* 2023)
  → Banks that participated in the 2016 EU-wide stress test reduced their credit risk

Some research with European data (ii)

- Altavilla, Boucinha, Jasova, Peydró, and Smets (2024)

  → Supranational supervision in Europe reduces credit supply to riskier firms

- Bonfim, Cerqueiro, Degryse, and Ongena (*MS* 2023)

  → On-site inspections in Portugal reduced zombie lending

This paper

- Understanding mechanisms behind these empirical results

    → Effect of supervision on bank risk-taking

    → Interaction with bank capital regulation

Overview of model

- Two agents (bank and supervisor) and three dates (t = 0, 1, 2)

- At t = 0 the bank raises one unit of insured deposits

  → Chooses the (unobservable) risk of its investment

- At t = 1 the supervisor gets a signal of the return of investment

  → Assesses whether the bank is "failing or likely to fail"

  → If so, supervisor closes the bank

- At t = 2 final return is realized (if bank is not closed at t = 1)

Main results

- In laissez-faire (without regulation or supervision)

  → Bank has an incentive to take excessive risk

- Bank capital regulation reduces risk-taking

- Supervision also reduces risk-taking (in addition to regulation)

  → Disciplining effects of supervision come from the fact that supervisory information is noisy

Outline

- Model setup
- Laissez-faire
- Bank capital regulation
- Bank supervision
- Regulation and supervision
- Concluding remarks

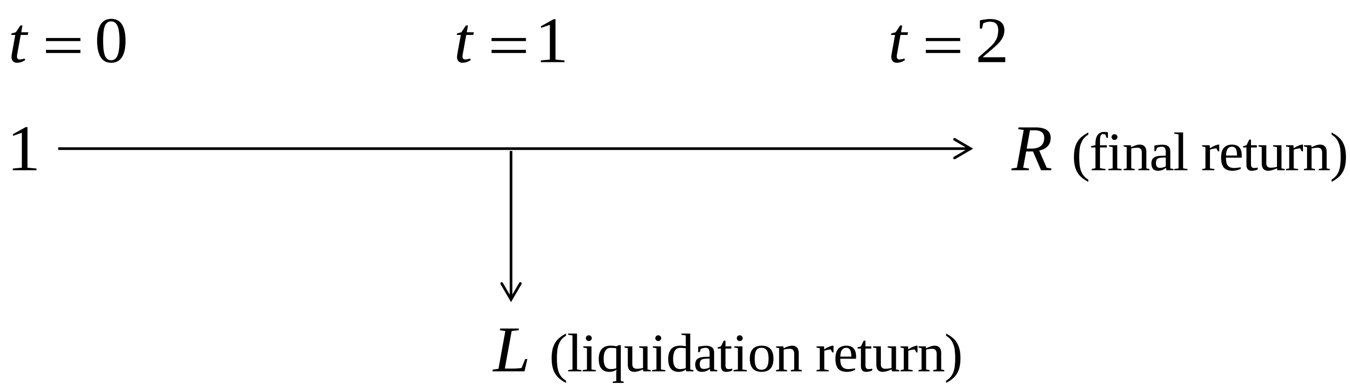
Part 1

Model setup

Model setup

- Three dates (t = 0, 1, 2)
- Two agents: risk-neutral bank and supervisor
- Bank raises one unit of deposits at t = 0

  → Invest these funds in an asset with returns at t = 1 or t = 2



Assumptions

- Deposits are insured and deposit rate is normalized to zero

- Asset returns are normally distributed (for tractability) with

$$\begin{bmatrix} L \\ R \end{bmatrix} \sim N\left(\begin{bmatrix} a\bar{R} \\ \bar{R} \end{bmatrix}, \sigma^2 \begin{bmatrix} b & c \\ c & 1 \end{bmatrix} \right)$$

$\rightarrow$ where $\bar{R} > 1,\ 0 < a < 1,\ b < 1$, and $c > 0$

Comments on the assumptions (i)

$$\begin{bmatrix} L \\ R \end{bmatrix} \sim N\left(\begin{bmatrix} a\bar{R} \\ \bar{R} \end{bmatrix}, \sigma^2 \begin{bmatrix} b & c \\ c & 1 \end{bmatrix} \right)$$

- $E(R) = \bar{R} > 1$

  $\rightarrow$ Expected final return > Face value of deposits

  $\rightarrow$ Positive NPV investment

Comments on the assumptions (ii)

$$\begin{bmatrix} L \\ R \end{bmatrix} \sim N\left(\begin{bmatrix} a\bar{R} \\ \bar{R} \end{bmatrix}, \sigma^2 \begin{bmatrix} b & c \\ c & 1 \end{bmatrix} \right)$$

- $E(L) = a\bar{R} < \bar{R} = E(R)$

  → Expected liquidation return < Expected final return

  → Inefficient liquidation in the absence of information

Comments on the assumptions (iii)

$$\begin{bmatrix} L \\ R \end{bmatrix} \sim N\left(\begin{bmatrix} a\bar{R} \\ \bar{R} \end{bmatrix}, \sigma^2 \begin{bmatrix} b & c \\ c & 1 \end{bmatrix} \right)$$

- $Cov(L, R) = c\sigma^2 > 0$

  → Liquidation return and final return are positively correlated

  → Bank invests in financial assets, not real assets that could be redeployed to other sectors at price independent of R

Comments on the assumptions (iv)

$$\begin{bmatrix} L \\ R \end{bmatrix} \sim N\left(\begin{bmatrix} a\bar{R} \\ \bar{R} \end{bmatrix}, \sigma^2 \begin{bmatrix} b & c \\ c & 1 \end{bmatrix} \right)$$

- $Var(L) = b\sigma^2 < \sigma^2 = Var(R)$

  → Liquidation return is less volatile than final return

  → Not strictly needed, but realistic (passage of time)

- Since $Cov(L,R)^2 < Var(L)Var(R)$

  → This implies $c < 1$

Bank risk-taking

- Bank chooses risk of its investment σ at $t = 0$
- Deviating from reference value $\bar{\sigma} > 0$ entails nonpecuniary cost

$$c(\sigma) = \frac{\gamma}{2}(\sigma - \bar{\sigma})^2$$

$\rightarrow$ $\bar{\sigma}$ characterizes business model of the bank

$\rightarrow$ Deviating from it (in either direction) is costly

$\rightarrow$ Key assumption of model: concavify objective function

Part 2

Laissez-faire

Bank's objective function

- In the absence of regulation or supervision

  → Bank maximizes expected payoff at $t = 2$, denoted $\pi(\sigma)$, net of the cost of risk-taking $c(\sigma)$

- Bank's choice of risk

$$\sigma^* = \arg\max_{\sigma} v(\sigma) = \pi(\sigma) - c(\sigma)$$

Bank's expected payoff (i)

- Bank's expected payoff at $t = 2$

$$\pi(\sigma) = E\left[\max\left\{R - 1, 0\right\}\right]$$

→ By the properties of normal distributions

$$E\left[\max\left\{R - 1, 0\right\}\right] = (\bar{R} - 1)\Phi\left(\frac{\bar{R} - 1}{\sigma}\right) + \sigma\phi\left(\frac{\bar{R} - 1}{\sigma}\right)$$

→ where $\phi(\cdot)$ and $\Phi(\cdot)$ are pdf and cdf of standard normal

Bank's expected payoff (ii)

- Since the function $\max\{R-1,0\}$ is convex

  $\rightarrow$ By second-order stochastic dominance, the bank would like to choose an infinite amount of risk

$$\pi'(\sigma) = \phi\left(\frac{\bar{R}-1}{\sigma}\right) > 0$$

  $\rightarrow$ Cost of risk-taking $c(\sigma)$ ensures an interior solution

Bank’s choice of risk

- Bank’s choice of risk characterized by first-order condition

$$v'(\sigma) = \pi'(\sigma) - c'(\sigma) = \phi\left(\frac{\bar{R}-1}{\sigma}\right) - \gamma(\sigma - \bar{\sigma}) = 0$$

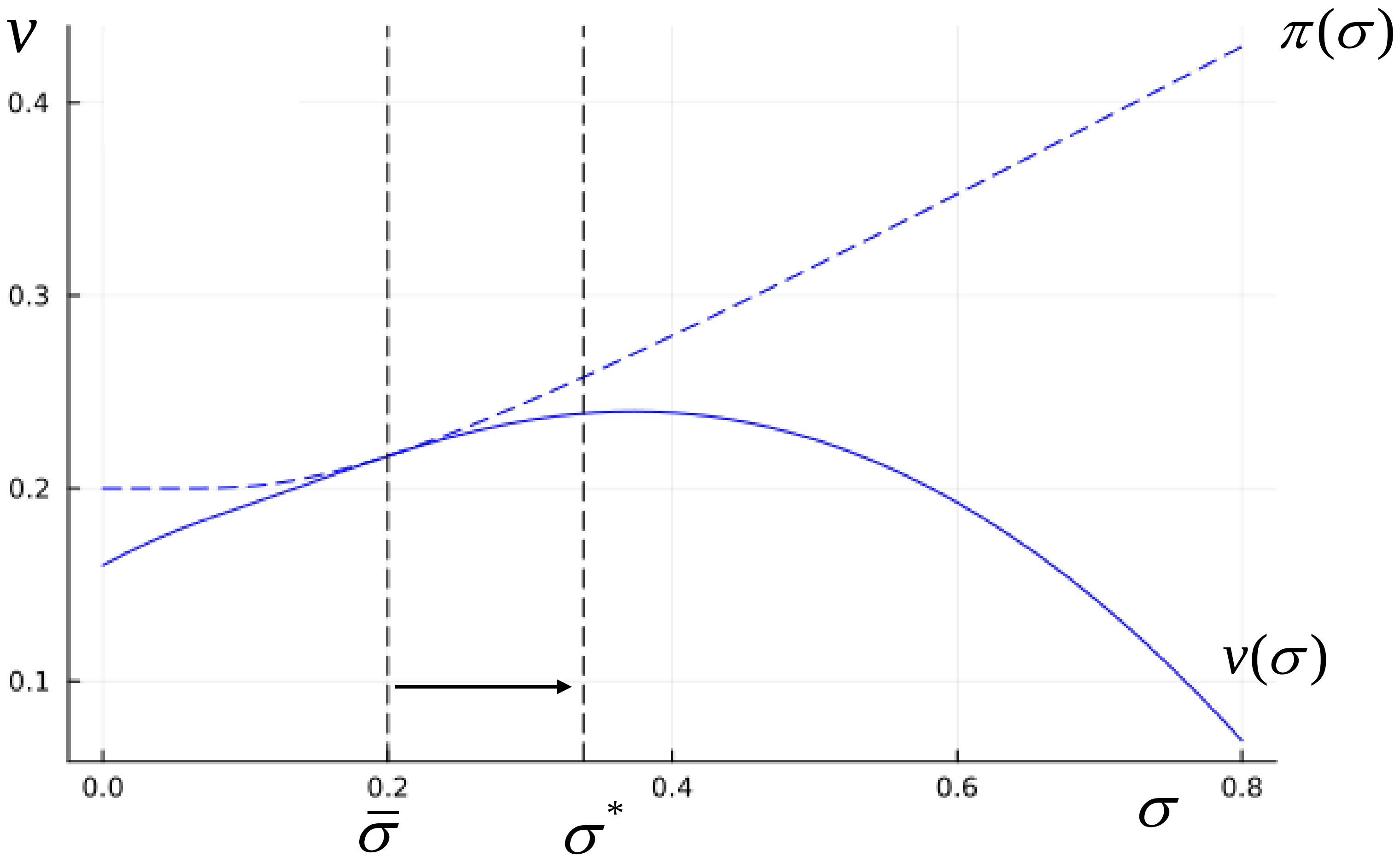
→ which implies

$$\sigma^* > \bar{\sigma}$$

- Summing up: Under laissez-faire the **bank will increase the asset risk above the reference value** $\bar{\sigma}$

→ Positive cost of excess risk-taking $c(\sigma^*) > 0$

Risk-taking in laissez-faire



Parameter values

- The following parameter values are used in all the figures

$$\bar{R} = 1.2,\ a = 0.8,\ c = 0.2,\ \bar{\sigma} = 0.2,\ \text{and}\ \gamma = 2$$

$\rightarrow$ These values are not intended to provide a calibration

$\rightarrow$ Chosen to facilitate the graphical representation of the qualitative results

Part 3

Bank capital regulation

Bank capital regulation

- Examine the effect of a regulation that requires the bank to fund a fraction $\bar{k} > 0$ of its unit investment with equity capital

- Assume that capital is more expensive than insured deposits

  $\rightarrow$ Let $\delta > 0$ denote the excess cost of capital

Bank's expected payoff

- Bank's expected payoff at $t = 2$

$$\pi(\sigma;k) = E\left[\max\left\{R-(1-k),0\right\}\right]-(1+\delta)k$$

→ where $k \geq \bar{k}$ denotes the bank's capital

- In principle, the bank could have more capital than $\bar{k}$

→ but this will be suboptimal (see below)

Capital requirement is binding

- By our previous results we can write

$$\pi(\sigma;k) = [\bar{R}-(1-k)]\Phi\left(\frac{\bar{R}-(1-k)}{\sigma}\right)+\sigma\phi\left(\frac{\bar{R}-(1-k)}{\sigma}\right)-(1+\delta)k$$

→ which implies

$$\frac{\partial}{\partial k}\pi(\sigma;k) = \Phi\left(\frac{\bar{R}-(1-k)}{\sigma}\right)-(1+\delta)<0$$

→ Constraint $k \geq \bar{k}$ will always be binding

Bank's choice of risk

- Bank's objective function

$$v(\sigma;\bar{k}) = \pi(\sigma;\bar{k}) - c(\sigma)$$

- Bank's choice of risk

$$\sigma^*(\bar{k}) = \arg\max_{\sigma}\left[\pi(\sigma;\bar{k}) - c(\sigma)\right]$$

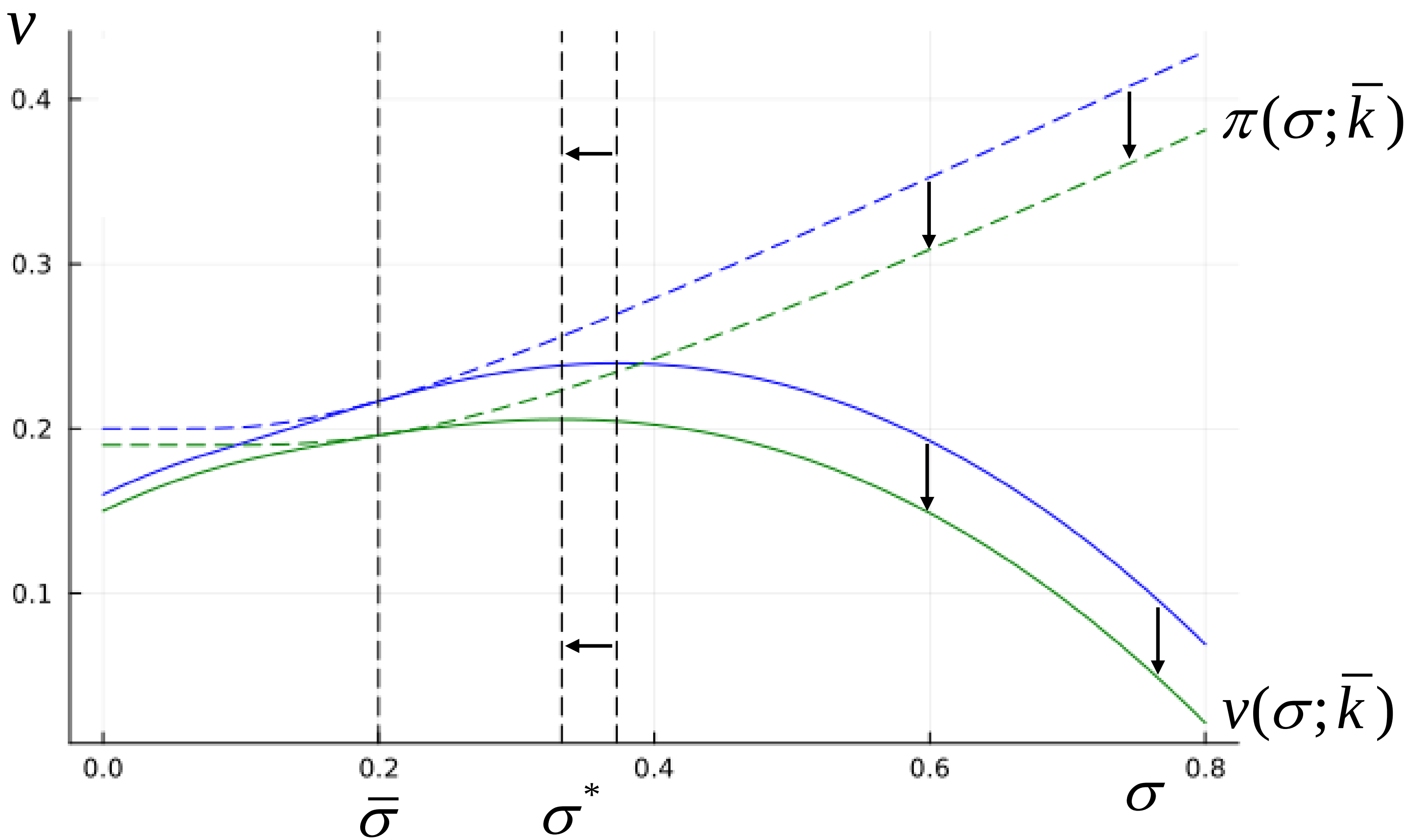
→ First-order condition

$$\frac{\partial}{\partial\sigma}\pi(\sigma;\bar{k}) - c'(\sigma) = \phi\left(\frac{\bar{R} - (1-\bar{k})}{\sigma}\right) - \gamma(\sigma - \bar{\sigma}) = 0$$

→ which implies

$$\sigma^*(\bar{k}) > \bar{\sigma}$$

Risk-taking with capital requirements



Effect of regulation on risk-taking

- Differentiating the first-order condition gives

$$\frac{d\sigma^{*}(\bar{k})}{d\bar{k}} = -\frac{\frac{1}{\sigma}\phi'\left(\frac{\bar{R}-(1-\bar{k})}{\sigma}\right)}{\frac{\partial}{\partial\sigma}\left[\phi\left(\frac{\bar{R}-(1-\bar{k})}{\sigma}\right)-\gamma(\sigma-\bar{\sigma})\right]} < 0$$

$\rightarrow$ By second-order condition the denominator is negative

$\rightarrow$ $\bar{R}-(1-\bar{k}) \geq 0$ implies that numerator is negative

Effect of regulation on risk-taking

- Differentiating the first-order condition gives

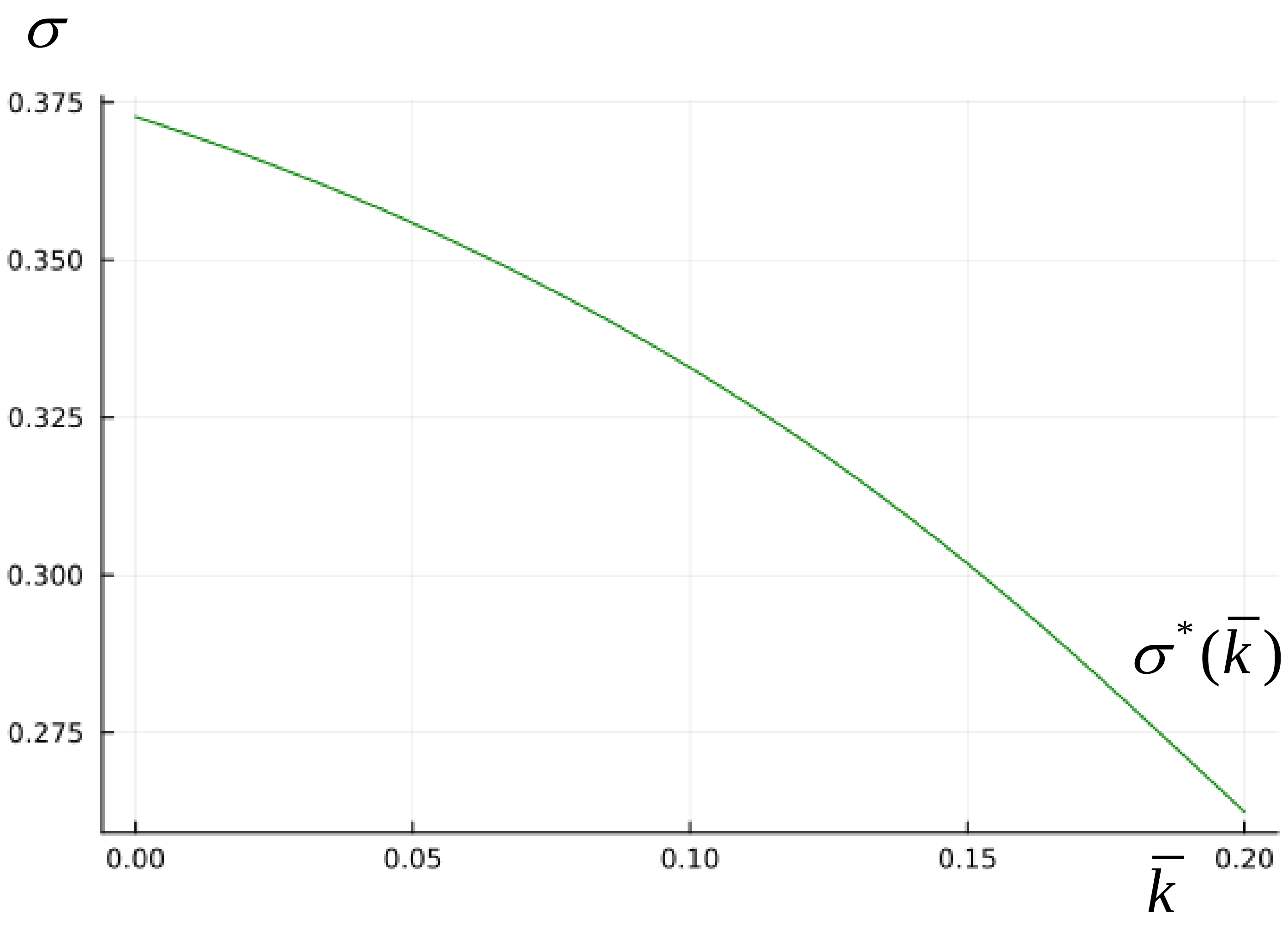
$$\frac{d\sigma^*(\bar{k})}{d\bar{k}} = -\frac{\dfrac{1}{\sigma}\phi'\left(\dfrac{\bar{R}-(1-\bar{k})}{\sigma}\right)}{\dfrac{\partial}{\partial\sigma}\left[\phi\left(\dfrac{\bar{R}-(1-\bar{k})}{\sigma}\right)-\gamma(\sigma-\bar{\sigma})\right]} < 0$$

$\rightarrow$ By second-order condition the denominator is negative

$\rightarrow$ $\bar{R}-(1-\bar{k}) \geq 0$ implies that numerator is negative

- Hence, **higher capital requirements reduce bank risk-taking**

Effect of regulation on risk-taking



Part 4

Bank supervision

Supervisory information (i)

- Supervisor observes at t = 1 non-verifiable signal

$$s = R + \varepsilon$$

on the final return of the bank's investment R

→ where $\varepsilon \sim N(0, \tau\sigma^2)$ and independent of L and R

→ $1/\tau$ measures the quality of the supervisory information

Supervisory information (ii)

- Joint distribution of signal and returns

$$\begin{bmatrix} L \\ R \\ s \end{bmatrix} \sim N\left(\bar{R}\begin{bmatrix} a \\ 1 \\ 1 \end{bmatrix}, \sigma^2 \begin{bmatrix} b & c & c \\ c & 1 & 1 \\ c & 1 & 1+\tau \end{bmatrix} \right)$$

Supervisory information (ii)

- Joint distribution of signal and returns

$$\begin{bmatrix} L \\ R \\ s \end{bmatrix} \sim N\left(\bar{R}\begin{bmatrix} a \\ 1 \\ 1 \end{bmatrix}, \sigma^2 \begin{bmatrix} b & c & c \\ c & 1 & 1 \\ c & 1 & 1+\tau \end{bmatrix} \right)$$

- Note that

$$E(s) = E(R+\varepsilon) = \bar{R}$$

Supervisory information (ii)

- Joint distribution of signal and returns

$$\begin{bmatrix} L \\ R \\ s \end{bmatrix} \sim N\left(\bar{R}\begin{bmatrix} a \\ 1 \\ 1 \end{bmatrix}, \sigma^2 \begin{bmatrix} b & c & c \\ c & 1 & 1 \\ c & 1 & 1+\tau \end{bmatrix} \right)$$

- Note that

$$Var(s) = Var(R+\varepsilon) = Var(R) + Var(\varepsilon) = (1+\tau)\sigma^2$$

Supervisory information (ii)

- Joint distribution of signal and returns

$$\begin{bmatrix} L \\ R \\ s \end{bmatrix} \sim N\left(\bar{R}\begin{bmatrix} a \\ 1 \\ 1 \end{bmatrix}, \sigma^2 \begin{bmatrix} b & c & c \\ c & 1 & 1 \\ c & 1 & 1+\tau \end{bmatrix} \right)$$

- Note that

$$Cov(R,s) = Cov(R, R+\varepsilon) = Var(R) = \sigma^2$$

Supervisory information (ii)

- Joint distribution of signal and returns

$$\begin{bmatrix} L \\ R \\ s \end{bmatrix} \sim N\left(\bar{R}\begin{bmatrix} a \\ 1 \\ 1 \end{bmatrix}, \sigma^2 \begin{bmatrix} b & c & c \\ c & 1 & 1 \\ c & 1 & 1+\tau \end{bmatrix} \right)$$

- Note that

$$Cov(L,s) = Cov(L, R+\varepsilon) = Cov(L,R) = c\sigma^2$$

Supervisory information (iii)

- By the properties of normal distributions

$$E(L|s) = a\bar{R} + \frac{c(s-\bar{R})}{1+\tau}$$

$$E(R|s) = \bar{R} + \frac{s-\bar{R}}{1+\tau}$$

- Note that these conditional expectations do not depend on the risk σ chosen by the bank

Supervisory information (iv)

- Since $c < 1$, slope of $E(L|s)$ is lower than slope of $E(R|s)$, so

$$E(L|s) > E(R|s) \text{ if and only if } s < s^* = \bar{R} - \frac{(1+\tau)(1-a)}{1-c}\bar{R}$$

→ where s^* is the efficient liquidation threshold (given τ)

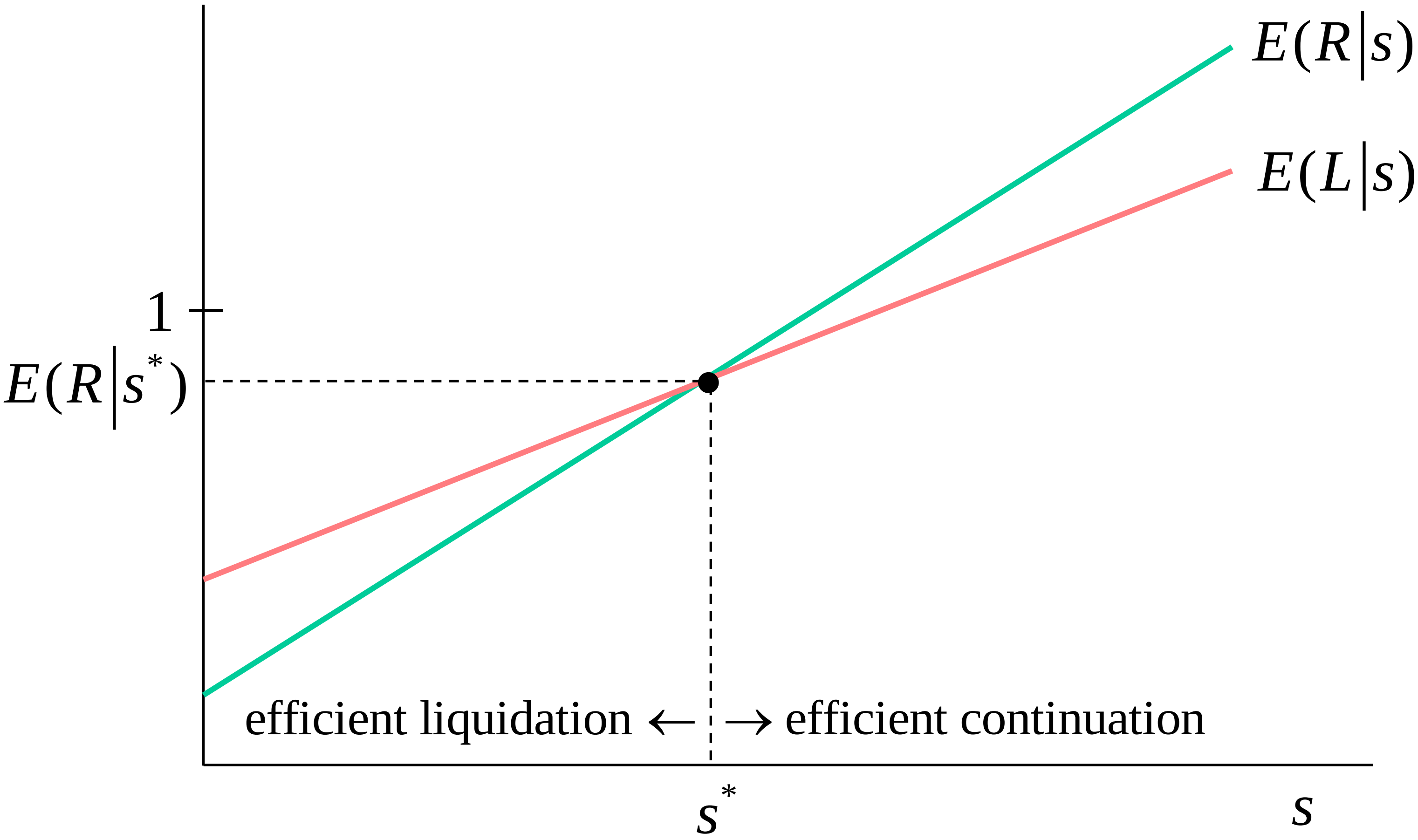
- I will assume that parameter values are such that

$$E(L|s^*) = E(R|s^*) = \frac{a-c}{1-c}\bar{R} < 1$$

→ Expected final return at s^* is smaller than value of deposits

→ Efficient liquidation only if bank has negative equity

Efficient liquidation threshold



Supervisor's closure decision (i)

- I do not assume that the supervisor uses the efficient liquidation threshold s^* to decide on closure

  → This threshold will be discussed below

- Instead, we assume that the supervisor uses the **failing or likely to fail** criterion (ECB Banking Supervision guidelines)

  → Bank has more liabilities than assets

Supervisor's closure decision (ii)

- Supervisor assesses that bank has **more liabilities than assets** if

$$E(R|s) < 1$$

- By our previous results

$$E(R|s) = \bar{R} + \frac{s - \bar{R}}{1+\tau} < 1 \text{ if and only if } s < \hat{s} = 1 - \tau(\bar{R} - 1)$$

$\rightarrow$ Supervisor's closure threshold is $\hat{s}$

- Note that closure threshold does <u>not</u> depend on the risk σ chosen by the bank

Terminology

- Supervisor that uses the failing or likely to fail rule $s < \hat{s}$ will be called an ***F*** **supervisor**

- Supervisor that uses the efficient liquidation rule $s < s^*$ will be called an ***E*** **supervisor**

Comparison of two types of supervisors

- By our previous assumption we have

$$\hat{s} - s^{*} = (1+\tau)\left(1 - \frac{a-c}{1-c}\bar{R}\right) > 0$$

→ Range of signals $s \in (s^{*}, \hat{s})$ for which closure is inefficient

Comparison of two types of supervisors

- By our previous assumption we have

$$\hat{s} - s^{*} = (1+\tau)\left(1 - \frac{a-c}{1-c}\overline{R}\right) > 0$$

$\rightarrow$ Range of signals $s \in (s^{*}, \hat{s})$ for which closure is inefficient

- ***F* supervisor is tougher than *E* supervisor**

Some questions to be addressed

- Does supervision reduce bank risk-taking σ?

- Is a higher quality ($1/\tau$) of supervisory information conducive to lower risk-taking?

- Is an F supervisor more effective in reducing risk-taking than an E supervisor?

- How does supervision interact with regulation?

Bank's objective function

- I assume that supervisor uses liquidation proceeds to cover deposit insurance payouts

  → Bank gets zero payoff when $s < \hat{s}$

- Bank's choice of risk

$$\sigma^*(\tau) = \arg\max_\sigma v(\sigma;\hat{s}) = \pi(\sigma;\hat{s}) - c(\sigma)$$

→ where $\hat{s} = 1 - \tau(\bar{R} - 1)$

Bank's expected payoff

- Bank's expected payoff at t = 2

$$\pi(\sigma;\hat{s}) = E\left[R-1 \middle| R \geq 1, s \geq \hat{s}\right]\Pr(R \geq 1, s \geq \hat{s})$$

→ By the properties of truncated normal distributions

$$\pi(\sigma;\hat{s}) = (\bar{R}-1)\Phi\left(\frac{\bar{R}-1}{\sigma}, \frac{\sqrt{1+\tau}(\bar{R}-1)}{\sigma}; \frac{1}{\sqrt{1+\tau}}\right)$$

$$+\sigma\phi\left(\frac{\bar{R}-1}{\sigma}\right)\Phi\left(\frac{\sqrt{\tau}(\bar{R}-1)}{\sigma}\right) + \frac{\sigma}{2\sqrt{1+\tau}}\phi\left(\frac{\sqrt{1+\tau}(\bar{R}-1)}{\sigma}\right)$$

→ where $\Phi(\cdot,\cdot;\rho)$ is the cdf of standard bivariate normal distribution with correlation coefficient ρ

Effect of variance of noise parameter τ (i)

- Recall that supervisor observes at t = 1 non-verifiable signal

$$s = R + \varepsilon$$

where $\varepsilon \sim N(0, \tau\sigma^2)$ and independent of L and R

- When τ = 0 the supervisor observes final return R. Since

$$\lim_{\tau \to 0} \hat{s} = 1 - \tau(\overline{R} - 1) = 1 \quad \Rightarrow \quad s < \hat{s} \Leftrightarrow R < 1$$

→ Bank will be closed by supervisor at t = 1 if and only if it would fail at t = 2

→ Equivalent to laissez-faire

Effect of variance of noise parameter $\boldsymbol{\tau}$ (ii)

- When $\tau \to \infty$

$$\lim_{\tau\to\infty} \hat{s} = 1 - \tau(\bar{R} - 1) = -\infty \quad \Rightarrow \quad \Pr(s < \hat{s}) = 0$$

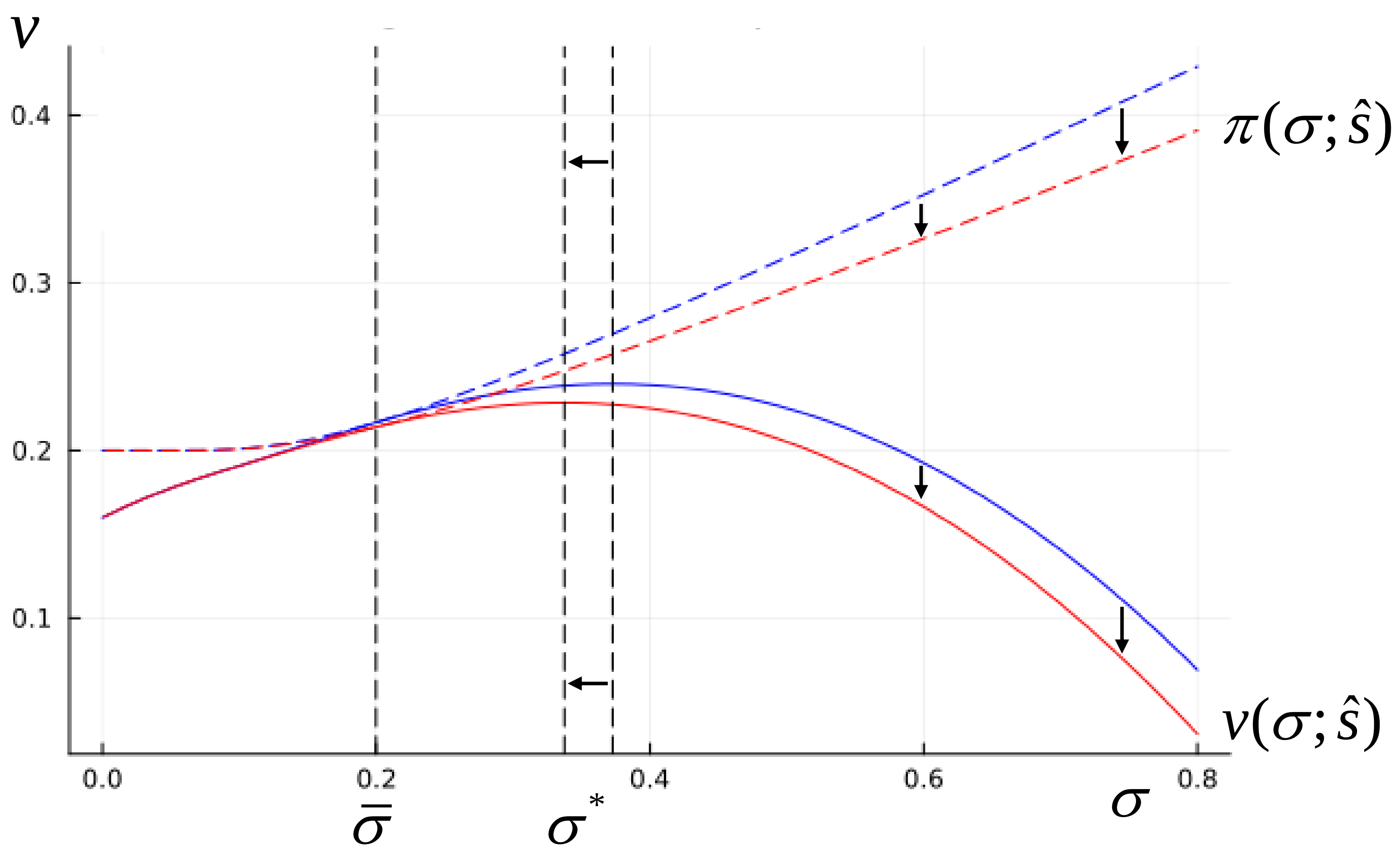
$\rightarrow$ Bank will never be closed by the supervisor

$\rightarrow$ Equivalent to laissez-faire

- What happens when $0 < \tau < \infty$?

$\rightarrow$ Supervision reduces bank's risk-taking (compared to laissez-faire)

Risk-taking with supervision



Effect of τ on risk-taking (i)

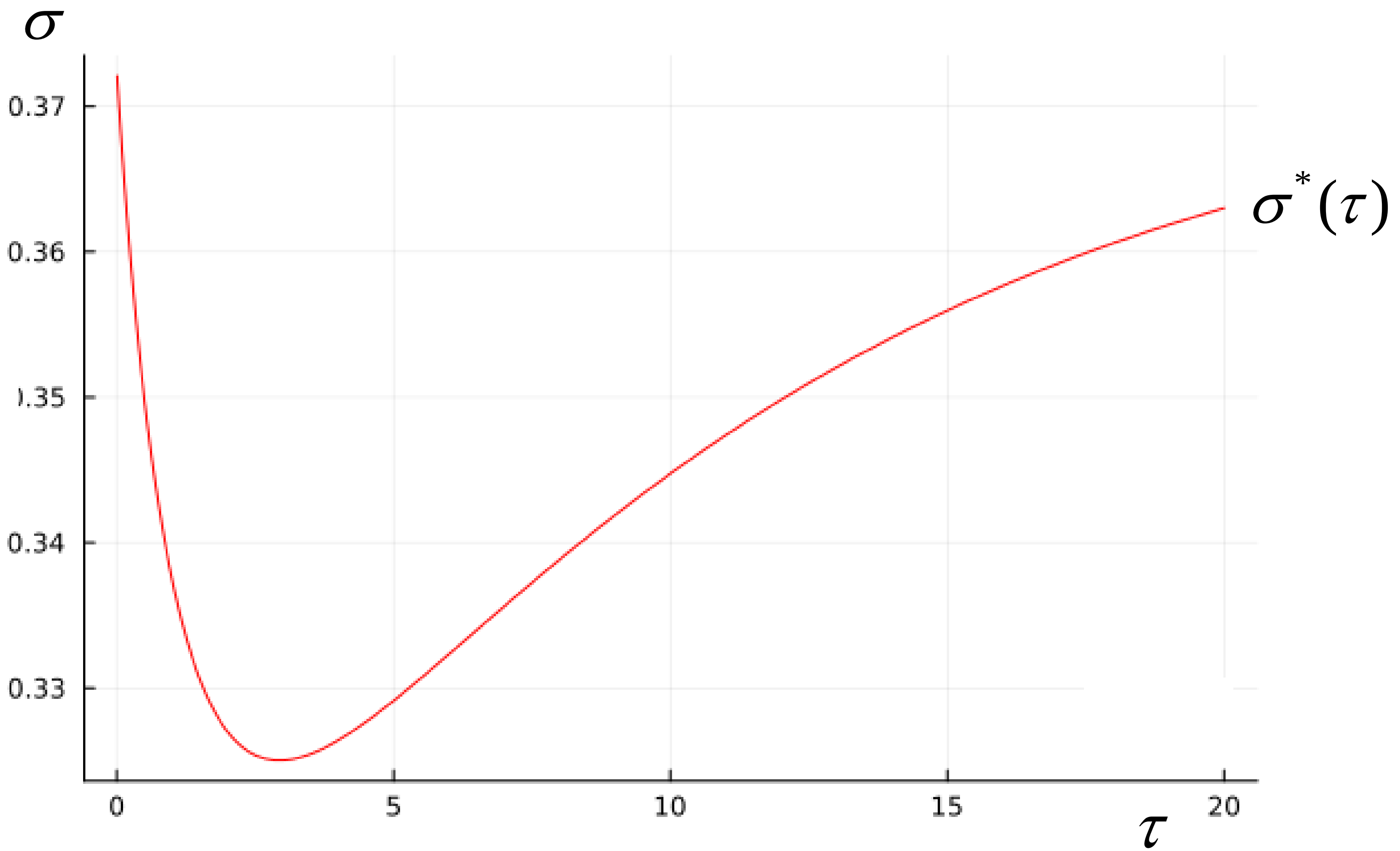
- Since

$$\lim_{\tau \to 0} \sigma^*(\tau) = \lim_{\tau \to \infty} \sigma^*(\tau) = \sigma^*$$

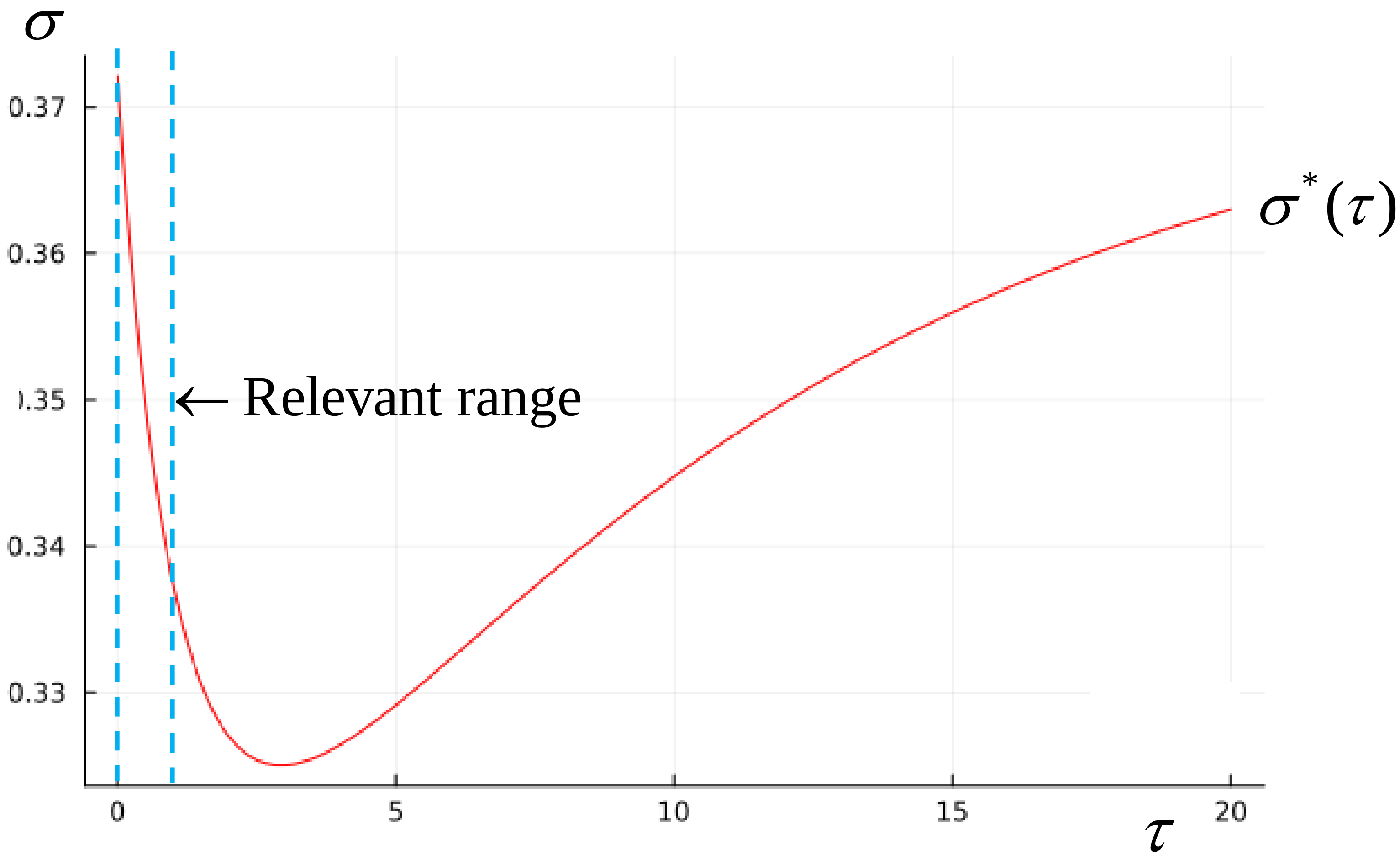
→ relationship between τ and $\sigma^*(\tau)$ cannot be monotonic

→ first decreasing and then increasing

Effect of τ on risk-taking



Effect of τ on risk-taking



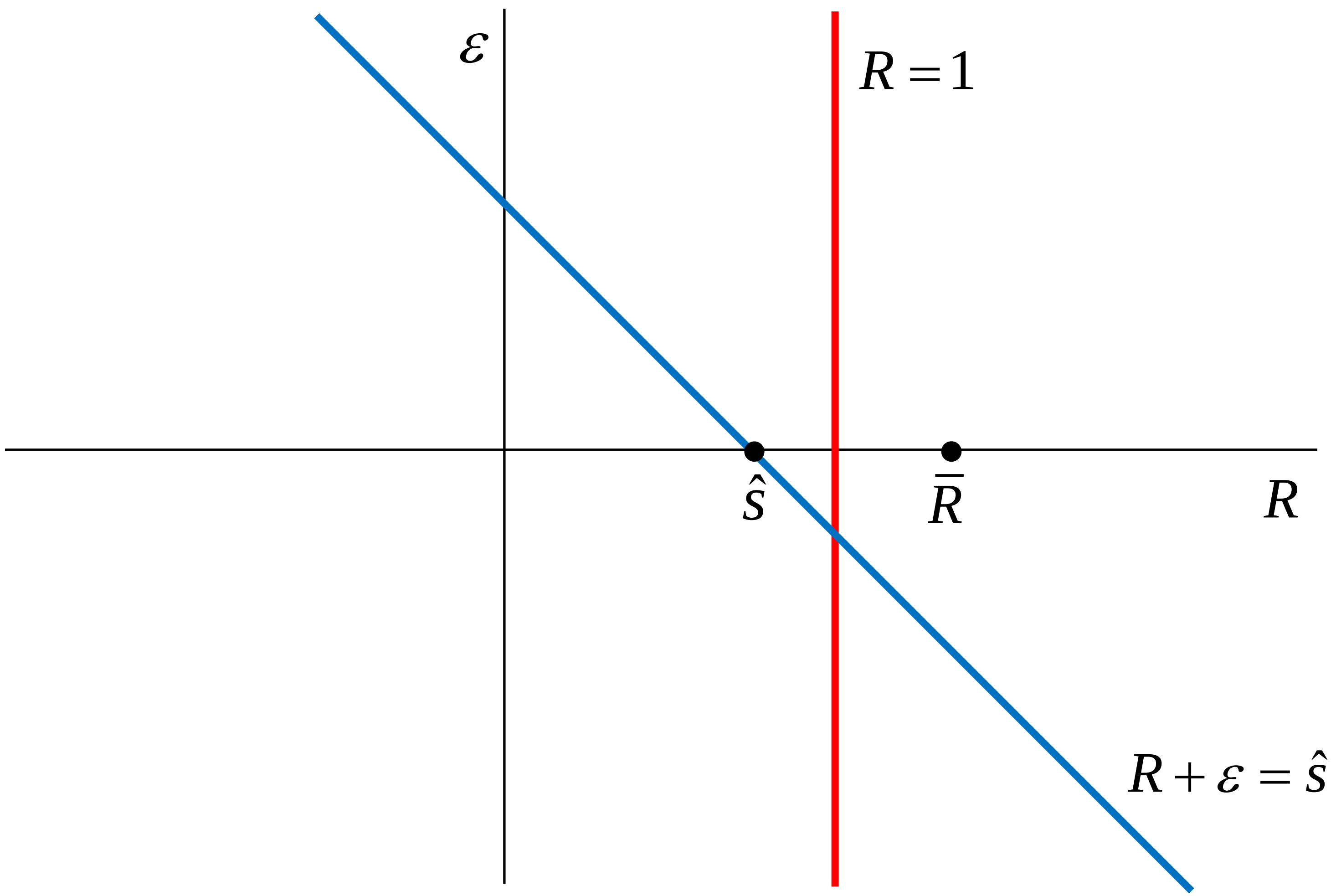
Effect of τ on risk-taking (ii)

- In the relevant (low τ) range, better quality of information (lower τ) increases bank risk-taking

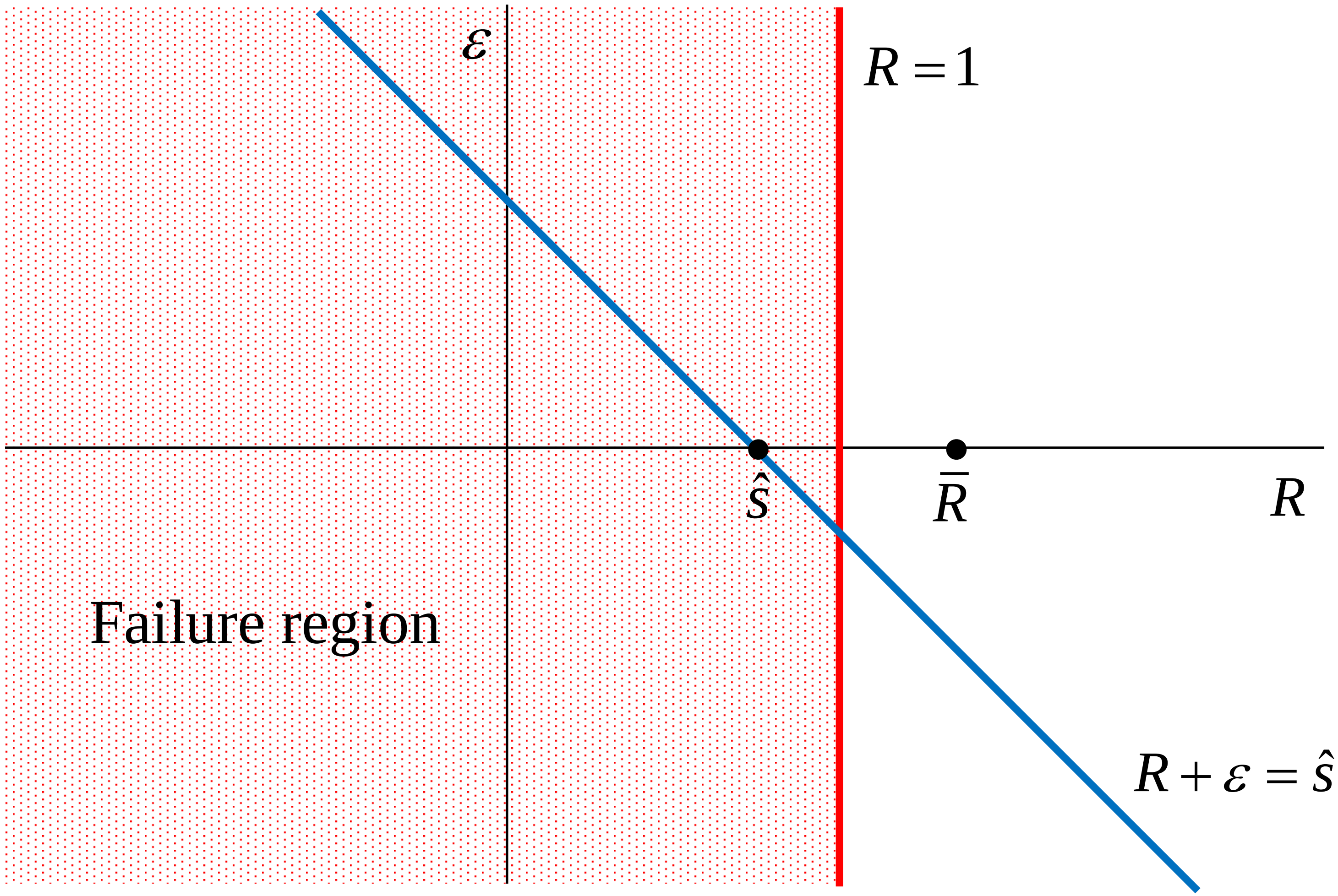
  $\rightarrow$ In the limit $\tau \rightarrow 0$ we go back to laissez-faire

  $\rightarrow$ How can this be explained?

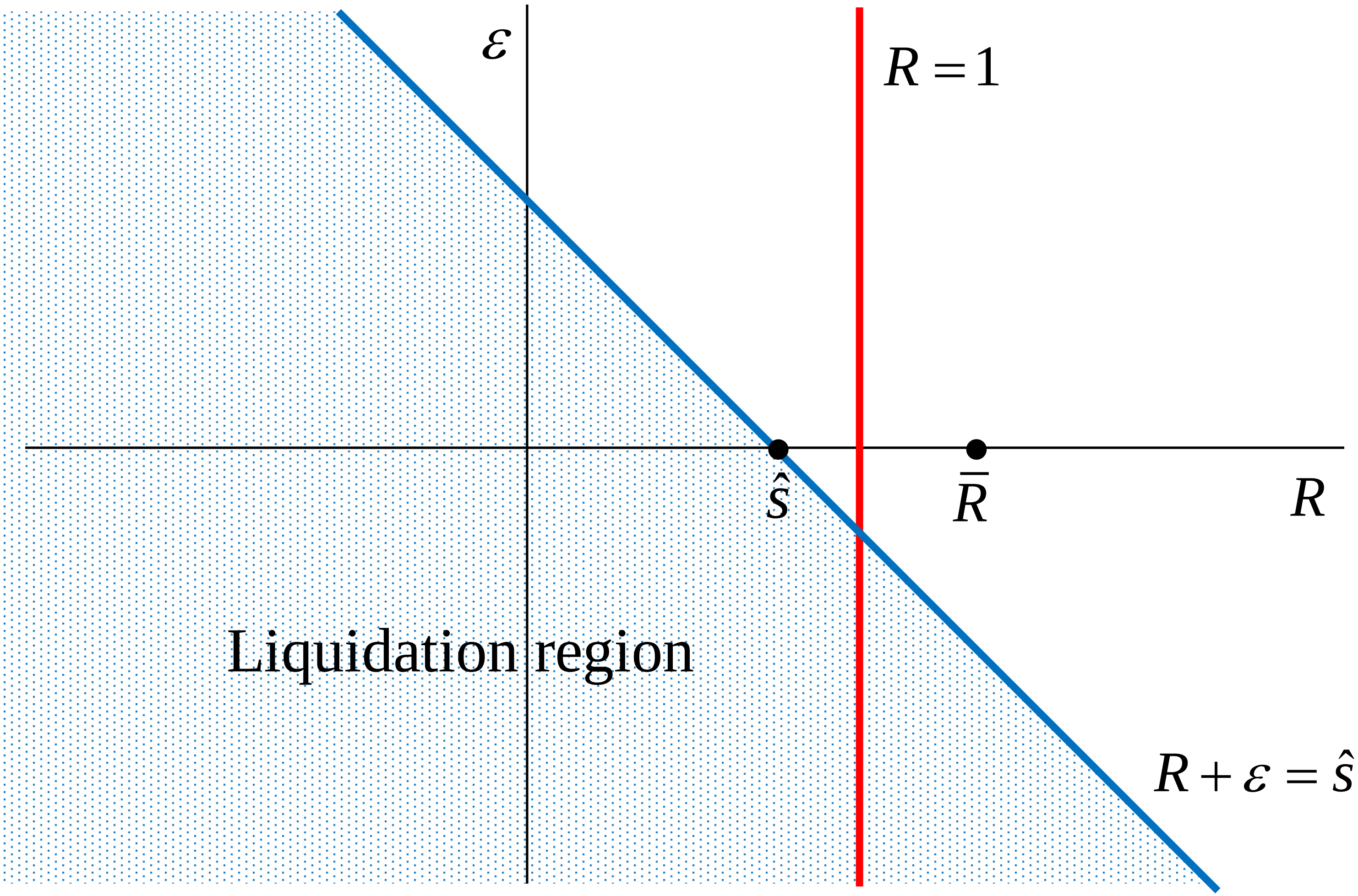
Failure and liquidation regions



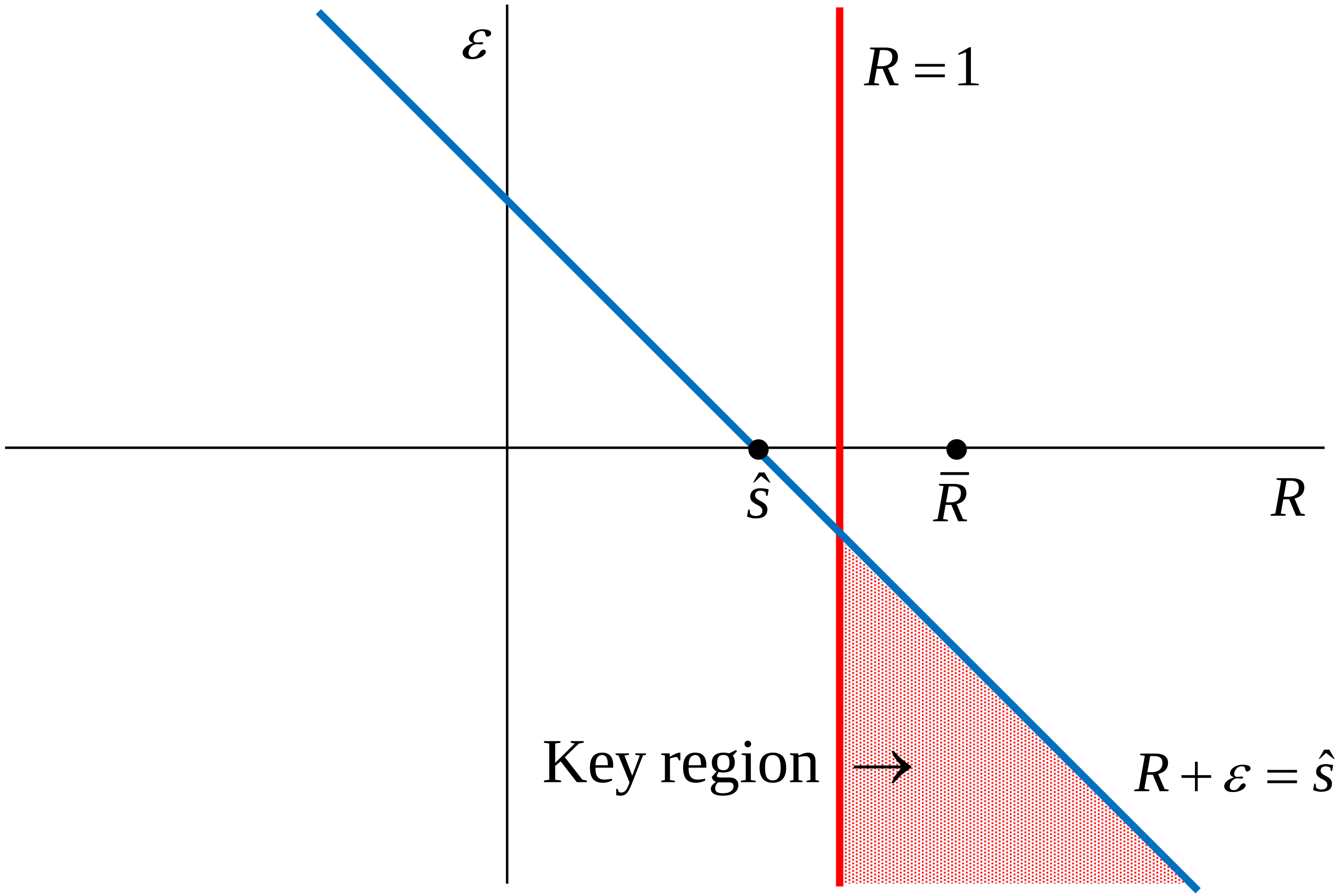
Failure and liquidation regions



Failure and liquidation regions



Failure and liquidation regions



Effect of τ on risk-taking (iii)

- In the key region

  $\rightarrow$ Bank is liquidated at $t = 1$ (since $s < \hat{s}$)

  $\rightarrow$ But would have not failed at $t = 2$ (since $R \geq 1$)

- Moreover, if $\tau > 0$ we have

$$\Pr(s < \hat{s} \text{ and } R \geq 1) > 0$$

  $\rightarrow$ To reduce this probability the bank chooses a smaller σ^*

- Hence, **the disciplining effects of supervision come from the fact that supervisory information is noisy**

Effect of τ on risk-taking (iv)

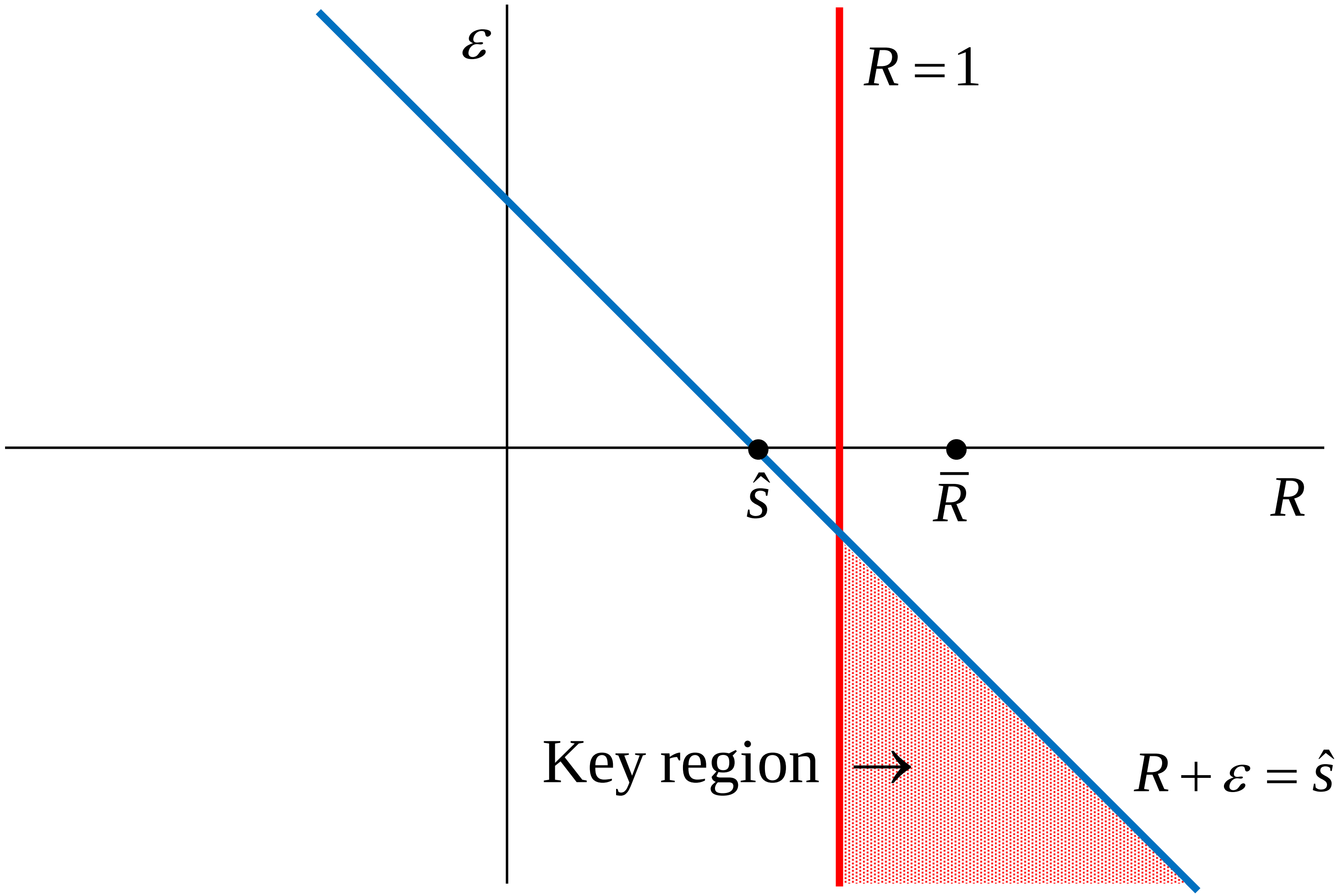
- An increase in τ has two effects

$\rightarrow$ Moves boundary of liquidation region to the left

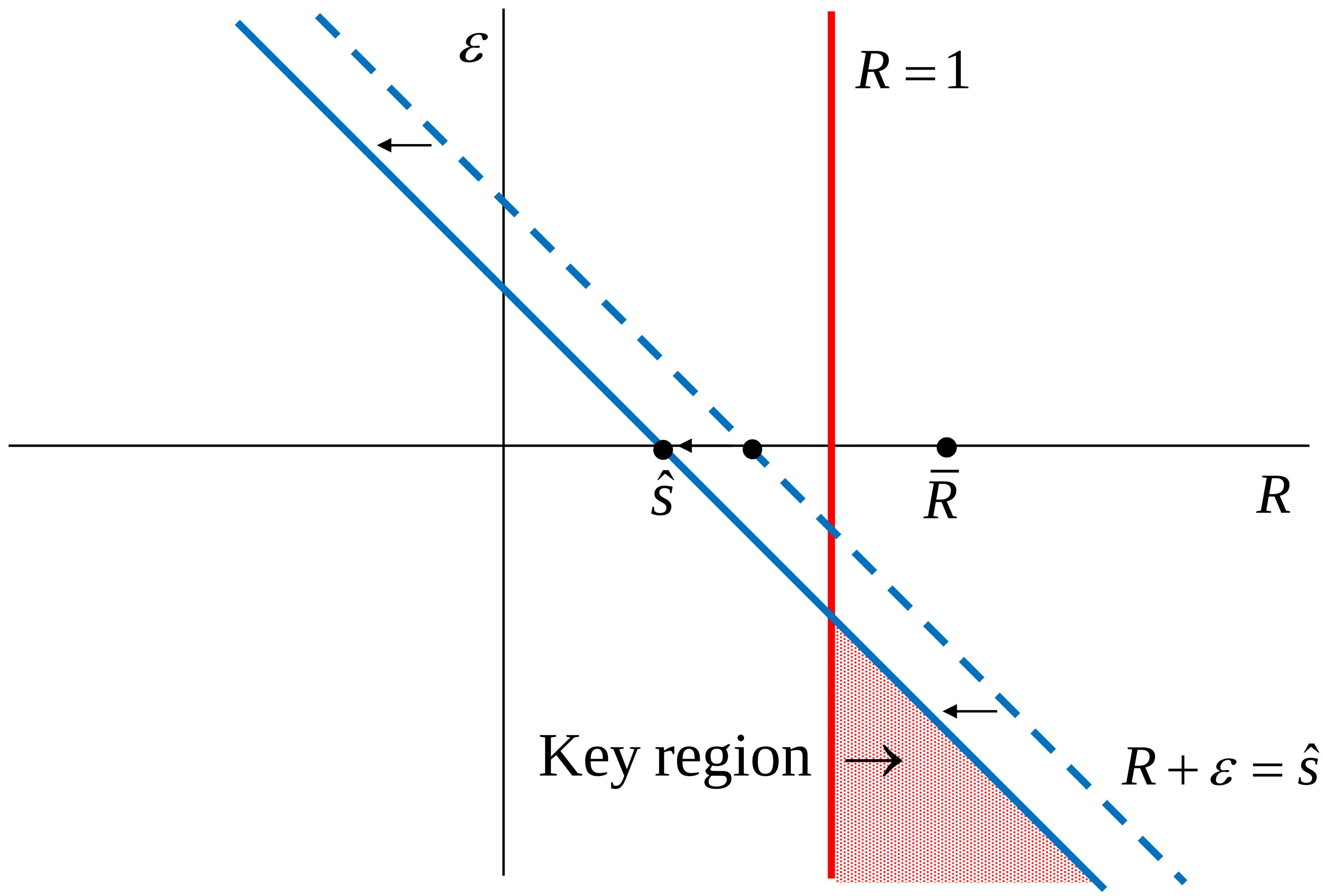
$$\hat{s} = 1 - \tau(\bar{R} - 1)$$

$\rightarrow$ Increases the variance of the noise ε

Effect on boundary of an increase in τ



Effect on boundary of an increase in τ



Effect of τ on risk-taking (v)

- The first effect reduces size of key region

  → Leads to an increase in σ^*

- The second effect increases likelihood of falling into key region

  → Leads to a reduction in σ^*

- For low values of τ the second effect dominates

  → **This explains why a lower quality of the supervisory information leads to lower risk-taking**

Evidence in Agarwal et al. (2024)

- Using data on supervisory ratings of US banks they show that

  → Supervisors exercise significant personal discretion,

  which introduces noise into the supervisory ratings

Evidence in Agarwal et al. (2024)

→ This has significant effects on risk-taking:

> "**Banks located in states where examiners exercise a high degree of absolute discretion** relative to the national average appear to **take precautionary measures** by maintaining more capital and lower loan growth than other banks with similar observable fundamentals."

Evidence in Agarwal et al. (2024)

→ Noise in supervision may be good

"**Some amount of uncertainty** around bank supervisory models such as stress tests may be desirable in that it could limit opportunistic gaming by banks and **encourage conservative actions**"

Part 4a

F and *E* supervisors

F and *E* supervisors (i)

- Question: Is an *F* supervisor (using the failing or likely to fail rule) more effective than an *E* supervisor (using the efficient liquidation rule) in controlling risk-taking incentives?

  → Answer: Yes

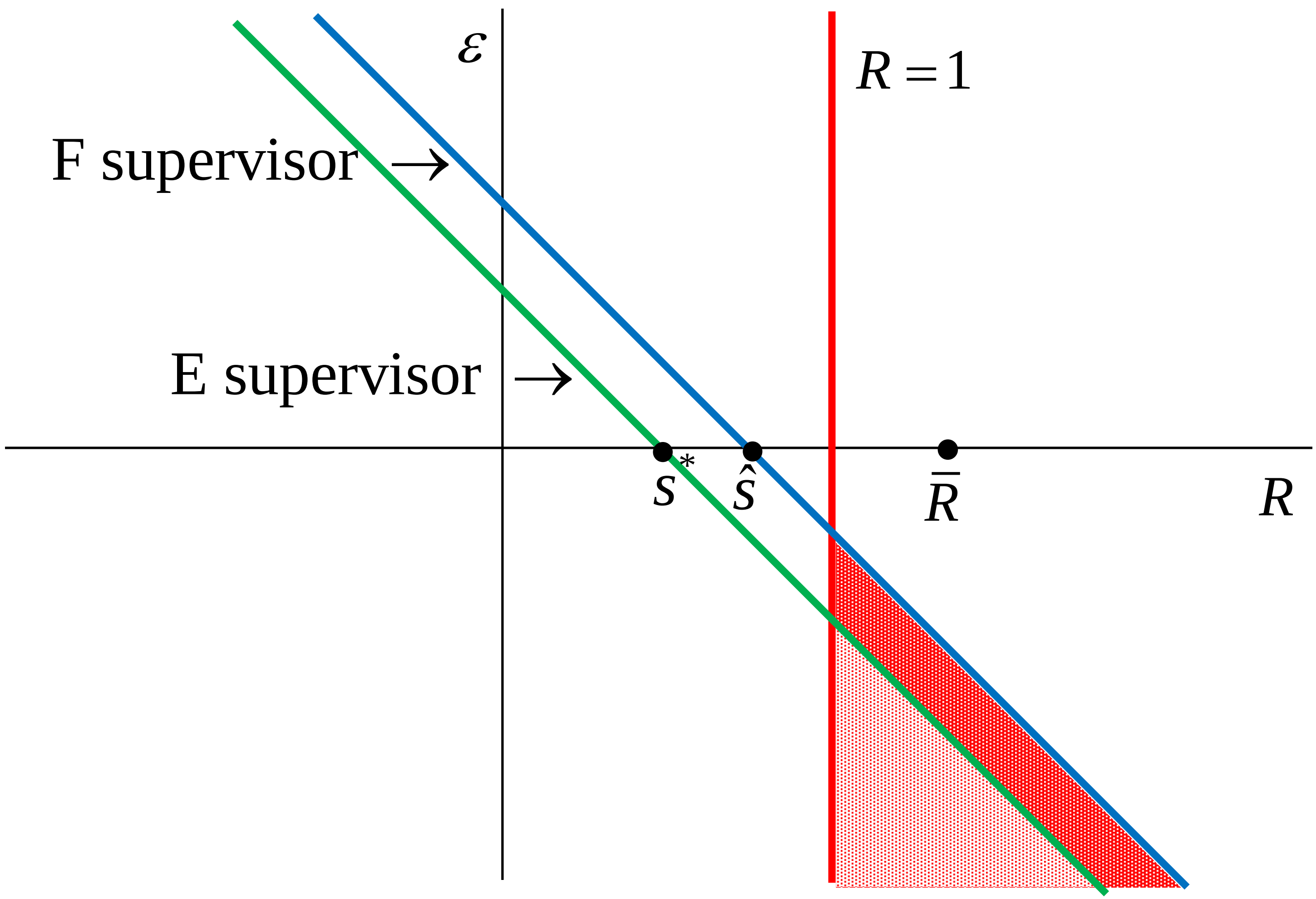
- Why is this the case?

  → Recall our previous result

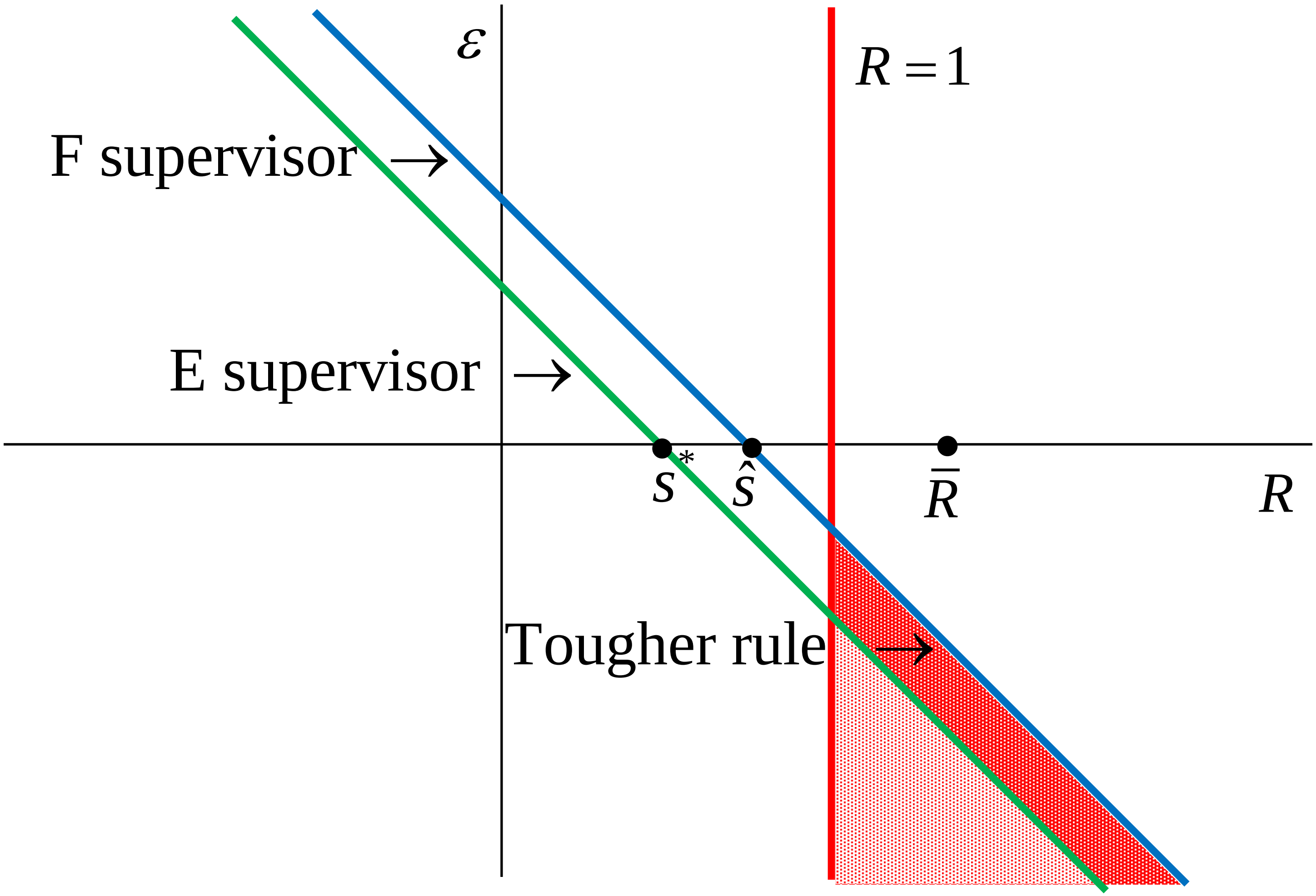
$$\hat{s} = s^* + (1+\tau)\left(1 - \frac{a-c}{1-c}\bar{R}\right) > s^*$$

  → Higher threshold for *F* supervisor (for the same τ)

F and *E* supervisors



F and E supervisors



F and *E* supervisors (ii)

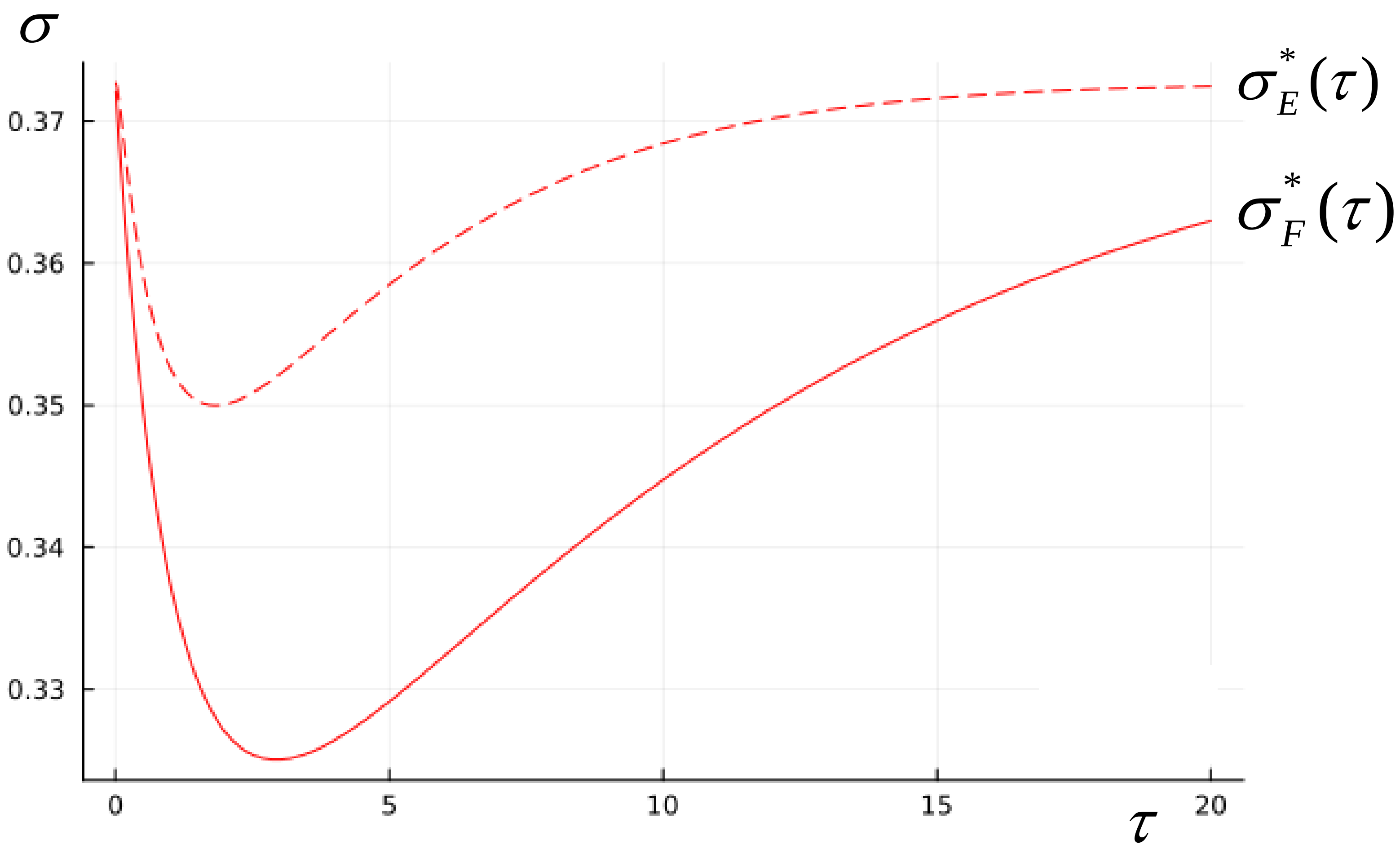
- Higher threshold of *F* supervisor

  → With no change in the variance of the noise ε

  → Leads the bank to choose a smaller σ^*

  → To reduce probability of falling into the key region

F and E supervisors



Part 4b

Welfare analysis

Welfare analysis of bank supervision

- Assumptions

  → No externalities associated with bank liquidation or failure

  → Lump sum taxation to fund deposit insurance payouts

  → Costless bank supervision

- Under these assumptions social welfare is equal to

  → Expected payoff of investment (taking into account the liquidation policy of the supervisor)

  → Minus the bank's cost of risk-taking

  → Minus the unit investment

F and *E* supervisors

- Welfare associated with *F* supervisor

$$w(\sigma;\hat{s}) = E(R\,|\,s \geq \hat{s})\Pr(s \geq \hat{s}) + E(L\,|\,s < \hat{s})\Pr(s < \hat{s})$$
$$-c(\sigma) - 1$$

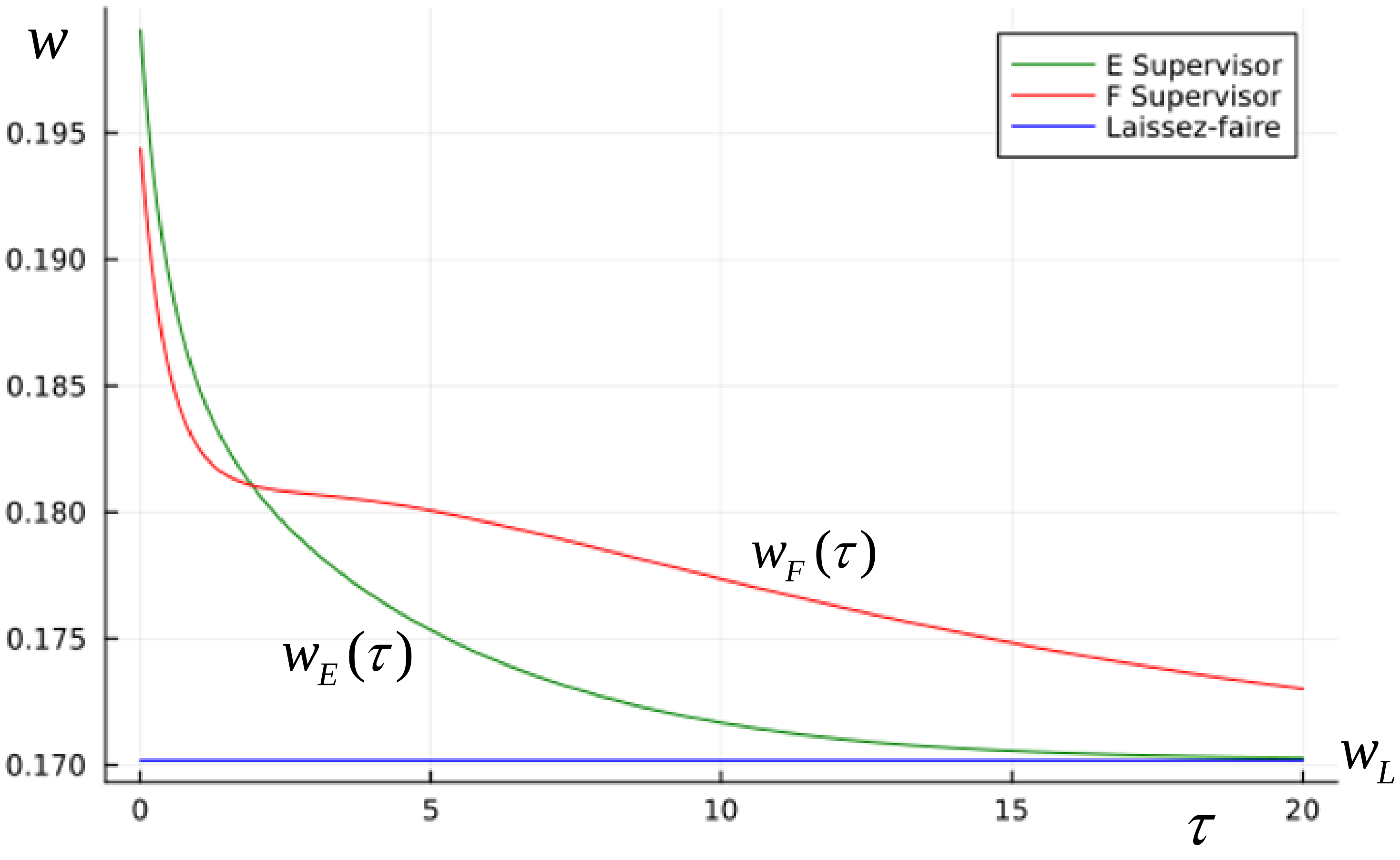
→ where σ is the bank's choice of risk under $\hat{s}$

- Welfare associated with *E* supervisor

$$w(\sigma;s^*) = E(R\,|\,s \geq s^*)\Pr(s \geq s^*) + E(L\,|\,s < s^*)\Pr(s < s^*)$$
$$-c(\sigma) - 1$$

→ where σ is the bank's choice of risk under s^*

Welfare with *F* and *E* supervisors



Welfare with *F* and *E* supervisors

- Both types improve upon welfare under laissez-faire

  → Not surprising since early liquidation may be desirable

- Both functions are decreasing

  → **Lower quality of the supervisory information leads to lower welfare**

  → At same time that it may reduce risk-taking

Evidence in Agarwal et al. (2024)

- Using data on supervisory ratings of US banks they show that

  → Supervisors exercise significant personal discretion, which introduces noise into the supervisory ratings

  → **This noise is potentially costly**

Part 5

Regulation and supervision

Regulation and supervision

- Question: What is the effect of introducing an *F* supervisor in a setup where the bank is subject to a capital requirement $\bar{k}$?

- Liquidation rule of *F* supervisor has to be modified

  → Bank is failing or likely to fail when

$$E(R|s) = \bar{R} + \frac{s - \bar{R}}{1+\tau} < 1 - \bar{k}$$

  → Threshold is decreasing in the capital requirement $\bar{k}$

$$\hat{s}(\bar{k}) = \hat{s} - (1+\tau)\bar{k}$$

Bank's expected payoff

- Bank's expected payoff at t = 2

$$\pi(\sigma;\hat{s}(\bar{k}),\bar{k})$$

$$= E\left[R-(1-\bar{k})\middle| R\geq 1-\bar{k}, s\geq \hat{s}(\bar{k})\right]\Pr[R\geq 1-\bar{k}, s\geq \hat{s}(\bar{k})]-(1+\delta)\bar{k}$$

→ By the properties of truncated normal distributions

$$\pi(\sigma;\hat{s}(\bar{k}),\bar{k}) = [\bar{R}-(1-\bar{k})]\Phi\left(\frac{\bar{R}-(1-\bar{k})}{\sigma}, \frac{\sqrt{1+\tau}[\bar{R}-(1-\bar{k})]}{\sigma}; \frac{1}{\sqrt{1+\tau}}\right)$$

$$+\sigma\phi\left(\frac{\bar{R}-(1-\bar{k})}{\sigma}\right)\Phi\left(\frac{\sqrt{\tau}[\bar{R}-(1-\bar{k})]}{\sigma}\right)$$

$$+\frac{\sigma}{2\sqrt{1+\tau}}\phi\left(\frac{\sqrt{1+\tau}[\bar{R}-(1-\bar{k})]}{\sigma}\right)-(1+\delta)\bar{k}$$

Bank's choice of risk

- Bank's choice of risk

$$\sigma^*(\tau,\bar{k}) = \arg\max_\sigma v(\sigma;\hat{s}(\bar{k}),\bar{k}) = \pi(\sigma;\hat{s}(\bar{k}),\bar{k}) - c(\sigma)$$

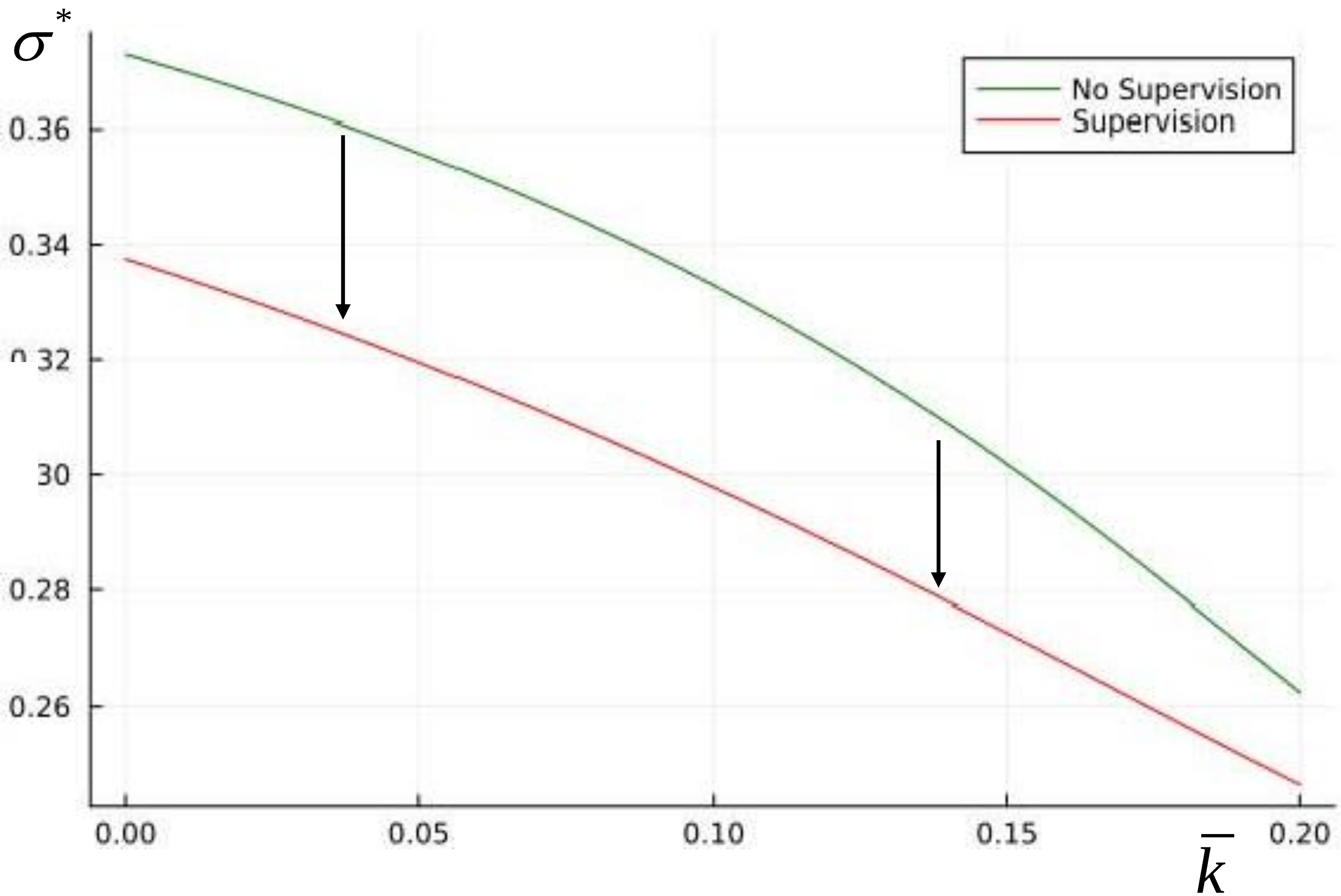
→ where $\hat{s}(\bar{k}) = \hat{s} - (1+\tau)\bar{k}$

- The following figure plots $\sigma^*(\tau,\bar{k})$

  → For a range of values of $\bar{k}$

  → and two values of τ: $\tau \to \infty$ (laissez-faire) and $\tau = 1$

Effect on risk-taking



Summing up

- Effect of supervision on risk-taking and the probability of failure do not vary much with the capital requirement
- Given quality of supervisory information one could target a desired level of safety by adjusting the capital requirement

Concluding remarks

Concluding remarks (i)

- Bank supervision involves
    1. Assessment of compliance with regulation
    2. Assessment of liquidity and solvency through monitoring
    3. Use of this information to request corrective actions
- This paper focuses on the second and third tasks, but the first one is crucial

    → Regulation has large effects on risk-taking but only if it is enforced (e.g. preventing the manipulation of risk-weights)

Concluding remarks (ii)

- Beneficial effects of tough supervisor are reminiscent of the old literature on central bank independence

  → Delegation of monetary policy to an agent with preferences biased toward price stability delivers better outcomes in terms of employment and inflation

  → Here delegation of supervision to an agent with preferences biased towards closure delivers better outcomes in terms of risk-taking

Concluding remarks (iii)

- Closure by supervisor that uses the failing or likely to fail rule need not imply liquidation

  → Rather, transfer to another authority that would decide between resolution and liquidation

- In our setup, resolution could be applied whenever

$$E(L|s) < E(R|s) < 1$$

  → Bank would <u>not</u> be inefficiently liquidated

  → Shareholders would be wiped out: key for risk-taking

Some references

- Agarwal, S., D. Lucca, A. Seru, and F. Trebbi (2014), "Inconsistent Regulators: Evidence from Banking," *Quarterly Journal of Economics*.
- Agarwal, S., B. Morais, A. Seru, and K. Shue (2024), "Noisy Experts? Discretion in Regulation."
- Beyhaghi, M., J. Chae, F. Curti, and J. Gerlach (2024), "The Impact of Banking Supervision on Bank Risk-Taking and Loan Growth."
- Eisenbach, T., D. Lucca, and R. Townsend (2022), "Resource Allocation in Banking Supervision: Trade-Offs and Outcomes," *Journal of Finance*.
- Hirtle, B., A. Kovner, and M. Plosser (2020), "The Impact of Supervision on Bank Performance," *Journal of Finance*.
- Repullo, R. (2004), "Capital Requirements, Market Power, and Risk-Taking in Banking," *Journal of Financial Intermediation*.
- Repullo, R. (2018), "Hierarchical Bank Supervision," *SERIEs - Journal of the Spanish Economic Association*.
- Rosenbaum, S. (1961), "Moments of a Truncated Bivariate Distribution," *Journal of the Royal Statistical Society*.