Regulation, Supervision, and Bank Risk-Taking

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Introduction (i)

- 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

- In fact, many (mainly US) academics confused regulation with supervision

  → Agarwal et al. (*QJE* 2014), "Inconsistent regulators"

  → The paper was about federal and state supervisors

Introduction (ii)

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

  → Reluctance to share supervisory information

- Drivers of change

  → Use of stress testing in banking supervision

  → Arrival of macroprudential supervision

  → Appointment of researchers to top positions in supervision

Introduction (iii)

- Situation has changed in recent years

  → Many academic papers on bank supervision

- Almost all the research on bank supervision is empirical

  → Number of facts that lack a theoretical explanation

- Purpose of this paper

  → Understanding the mechanisms behind some of these facts

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 regulation

  → Are they complements or substitutes?

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 on 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

- Regulation (capital requirements) 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
- Discussion
- Concluding remarks

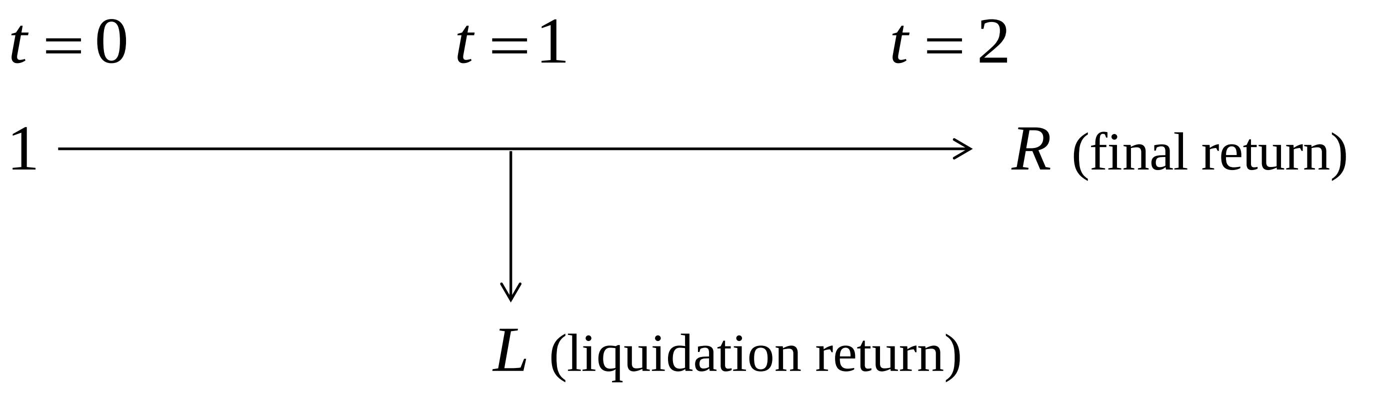
Part 1

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 $\bar{R} > 1$, $0 < a < 1$, $0 < c < 1$, and $c^2 < b < 1$

Comments on the assumptions (i)

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

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

  → Expected final return > Face value of deposits

  → 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)

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

- $Cov(L, R) = c > 0$

  → 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

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

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

→ Deviating from it (in either direction) is costly

→ Key assumption of model: concavify objective function

Part 2

Laissez-faire

Bank’s objective function

- In the absence of regulation and/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

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

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

  → 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

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

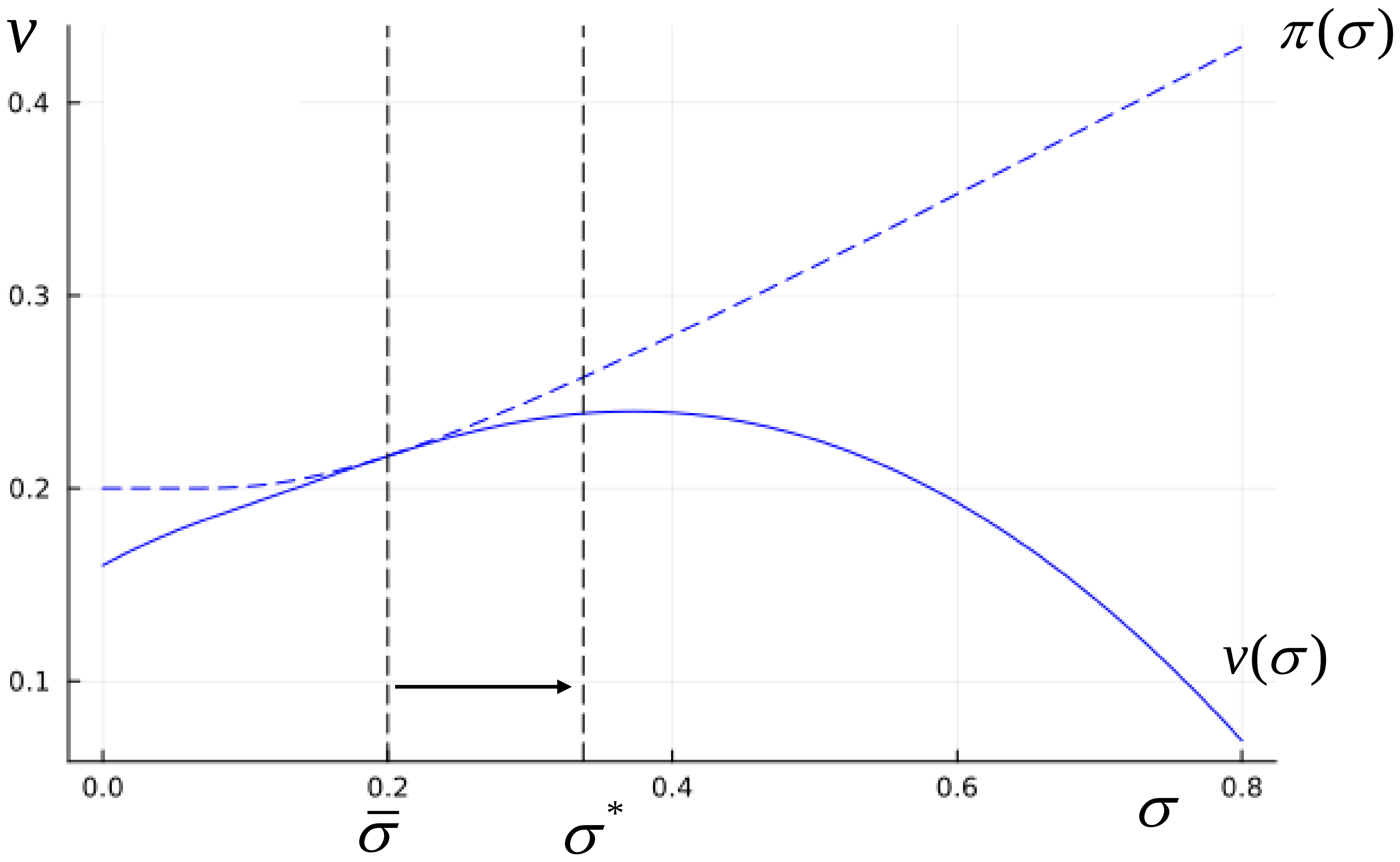
→ which implies

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

- 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 (i)

- The following parameter values are used in all the figures

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

→ These values are not intended to provide a calibration

→ Chosen to facilitate the graphical representation of the qualitative results

Effect of market power on risk-taking

- Differentiating the first-order condition gives

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

→ By second-order condition the denominator is negative

→ $\bar{R}-1>0$ implies that numerator is negative

- Hence, **higher market power reduces bank risk-taking**

→ In line with the classical "charter value view"

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

  → 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

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

$\rightarrow$ which implies

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

$\rightarrow$ 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

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

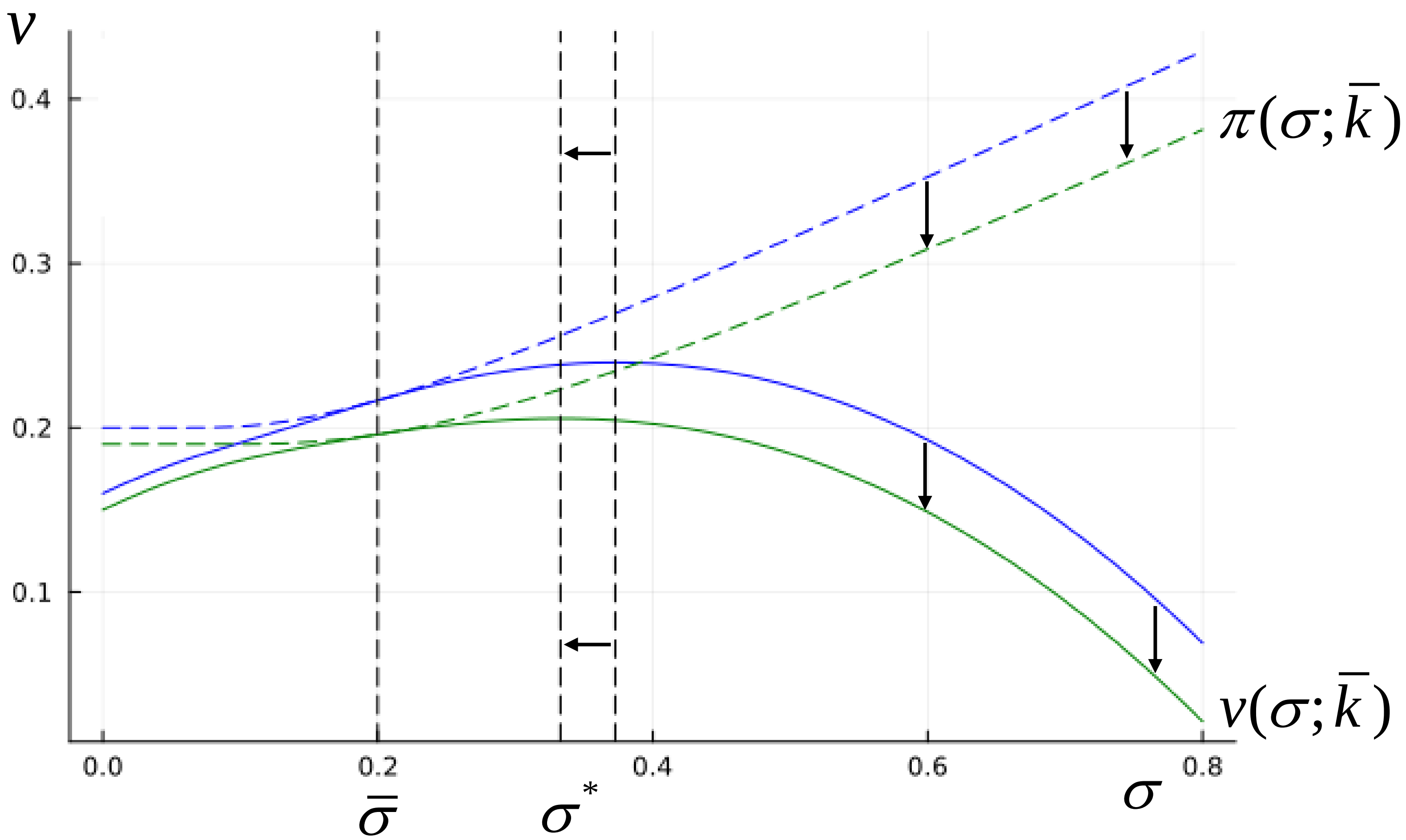
→ First-order condition

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

→ which implies

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

Risk-taking with capital requirements



Parameter values (ii)

- The excess cost of capital is assumed to be $\delta = 0.1$
- All other parameters are as in the laissez-faire section

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

Effect of regulation on risk-taking

- Differentiating the first-order condition gives

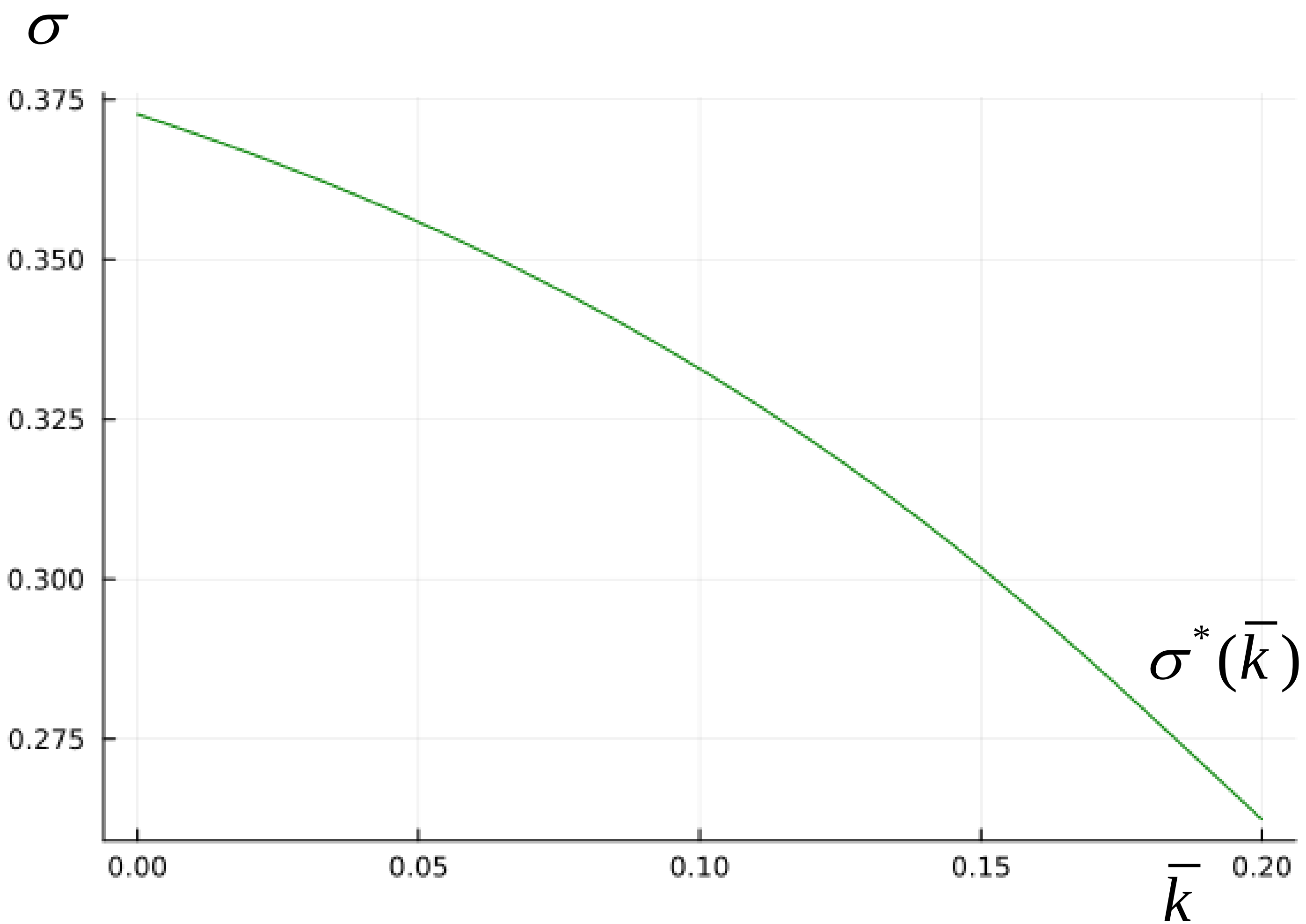
$$\frac{d\sigma^*(\bar{k})}{d\bar{k}} = -\frac{\frac{1}{\sigma}\phi'\left(\frac{\bar{R}-(1-\bar{k})}{\sigma}\right)}{\frac{\partial}{\partial\sigma}\left[\phi\left(\frac{\bar{R}-(1-\bar{k})}{\sigma}\right)-\gamma(\sigma-\bar{\sigma})\right]}$$

→ By second-order condition the denominator is negative

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

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

Effect of regulation on risk-taking



Effect of regulation on bank failure

- Probability of bank failure under regulation given by

$$\Pr[R < 1 - \bar{k}] = \Phi\left(\frac{(1-\bar{k}) - \bar{R}}{\sigma^*(\bar{k})}\right)$$

- Higher capital requirements

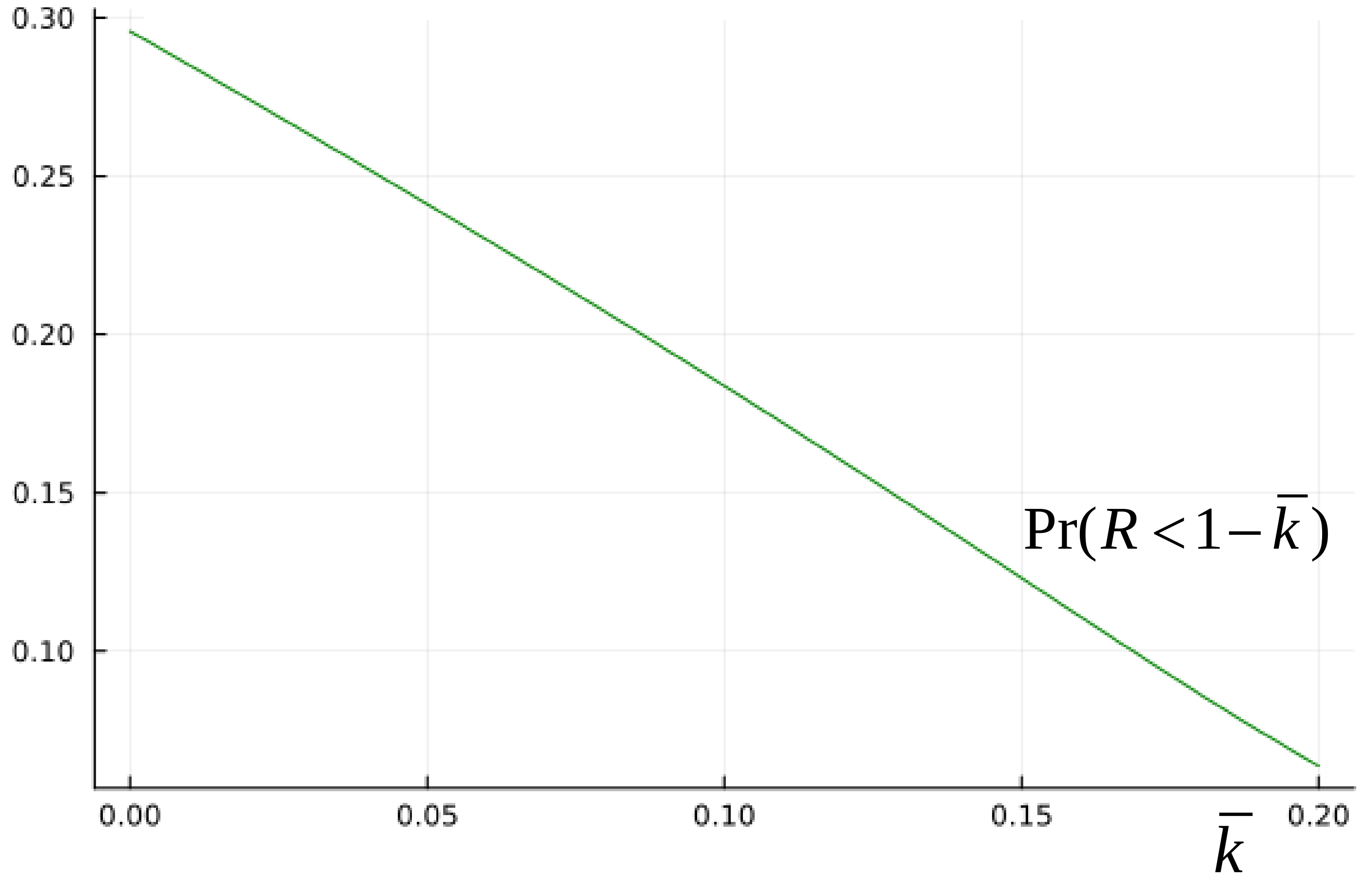
  $\rightarrow$ Decrease numerator $(1-\bar{k}) - \bar{R}$ (which is negative)

  $\rightarrow$ Decrease denominator $\sigma^*(\bar{k})$

  $\rightarrow$ Both effects reduce the value of the ratio (more negative)

  $\rightarrow$ Lower probability of bank failure

Effect of regulation on bank failure



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

- Note that

→ τ characterizes the noise in the supervisory information

→ $1/\tau$ 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)

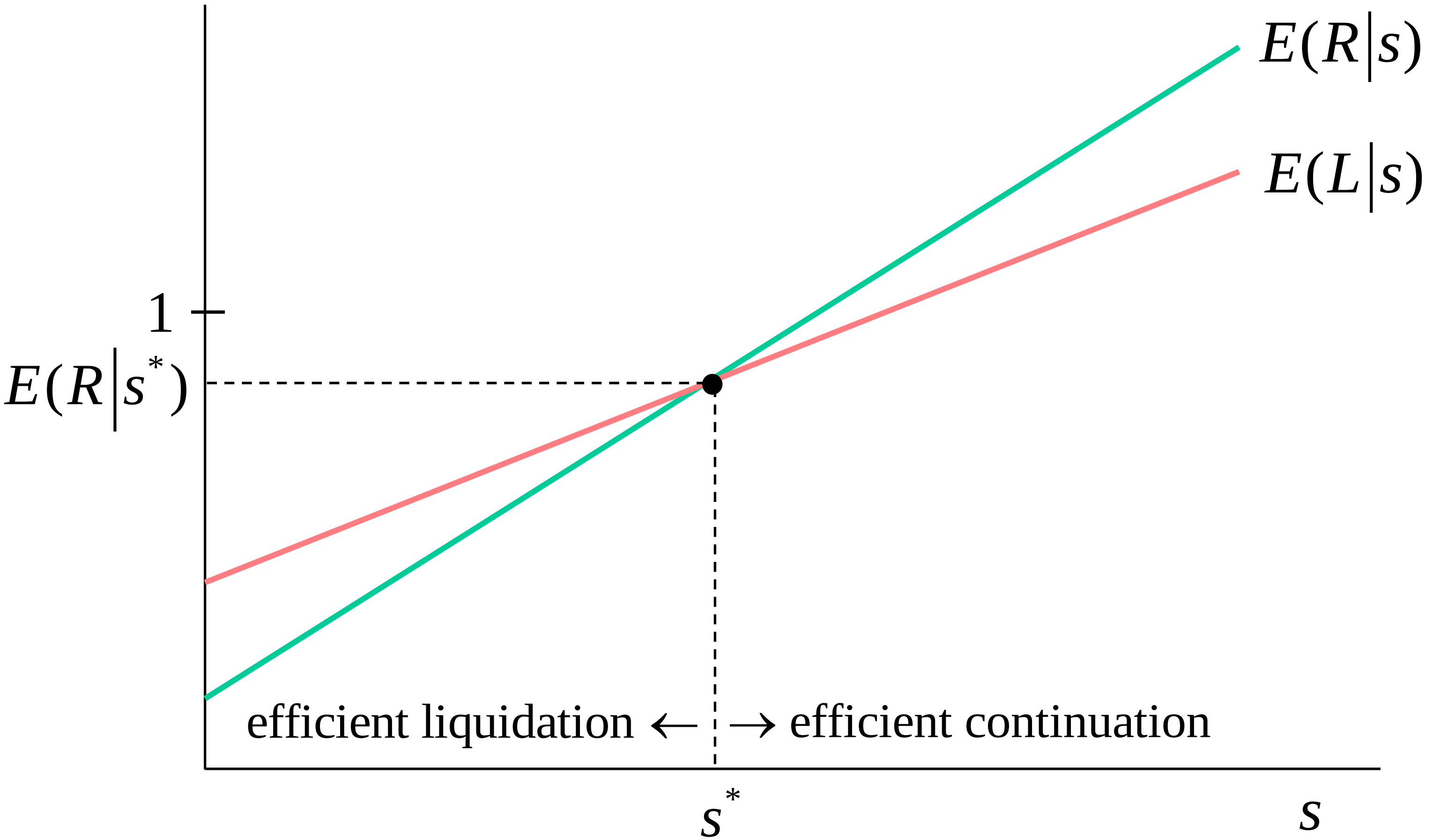
- I will assume that parameter values are such that

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

→ 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 <u>not</u> assume that the supervisor uses the efficient liquidation threshold s^* to decide on closure

  → This will be discussed below

- Instead, we assume that the supervisor uses the **failing or likely to fail** criterion

ECB Banking Supervision guidelines

- There are four reasons why a bank can be declared failing or likely to fail:
  - → It no longer fulfils the requirements for authorization by the supervisor
  - → **It has more liabilities than assets**
  - → It is unable to pay its debts as they fall due
  - → It requires extraordinary financial public support
- At the time of declaring a bank as failing or likely to fail, one of the above conditions must be met or be likely to be met

Supervisor’s closure decision (ii)

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

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

- By our previous results

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

→ Supervisor’s closure threshold is $\hat{s}$

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

→ Key (nice) feature of model

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 supervisor

- By our previous assumption we have

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

$\rightarrow$ 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?
- If so, what are the channels for this effect?
- Is a lower noise τ (or 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 noise 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 noise τ (ii)

- When $\tau \to \infty$

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

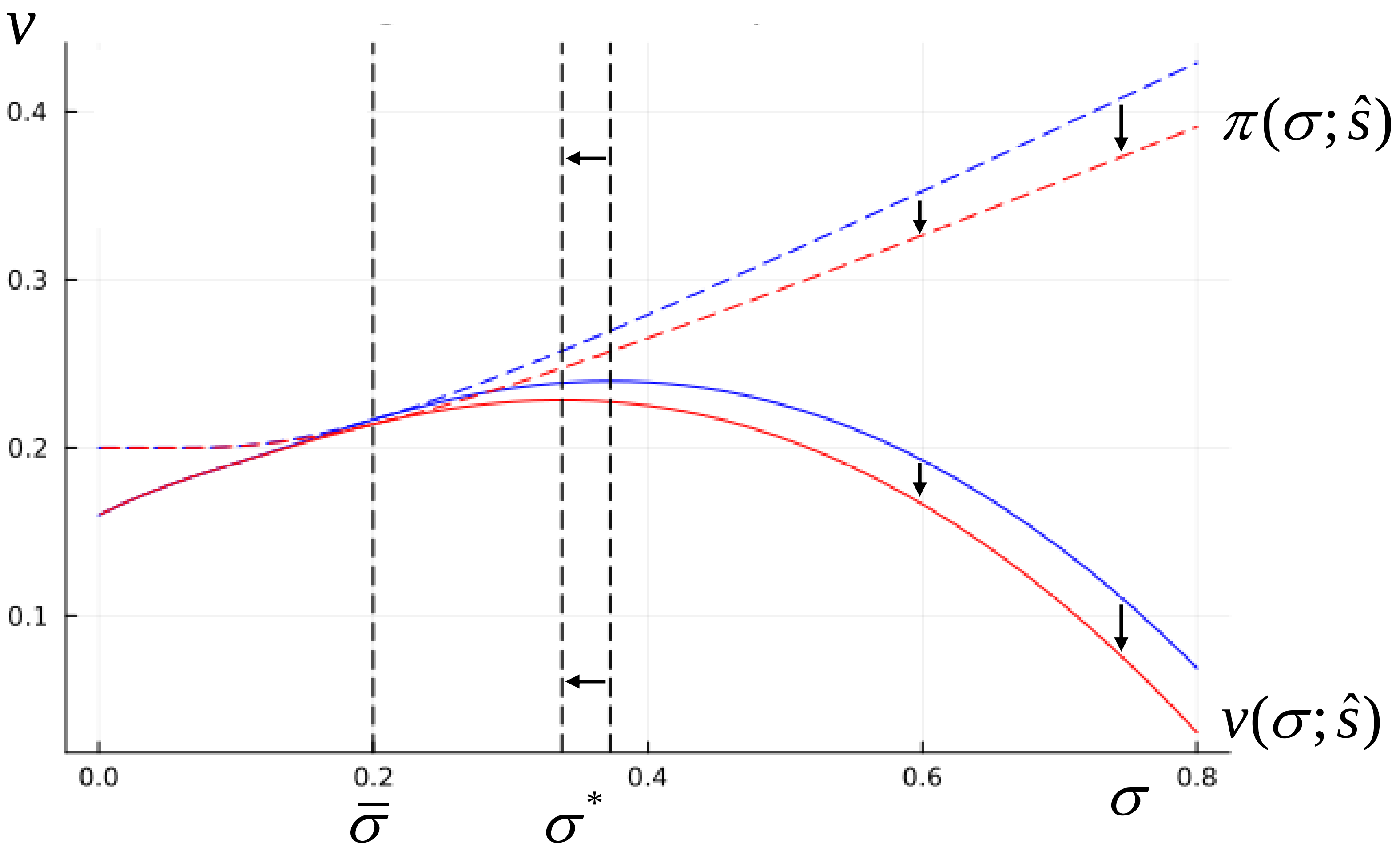
$\rightarrow$ Bank will never be closed by the supervisor

$\rightarrow$ 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



Parameter values (iii)

- Noise in supervisory information is assumed to be $\tau = 1$

- All other parameters are as in the laissez-faire section

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

Effect of noise on risk-taking (i)

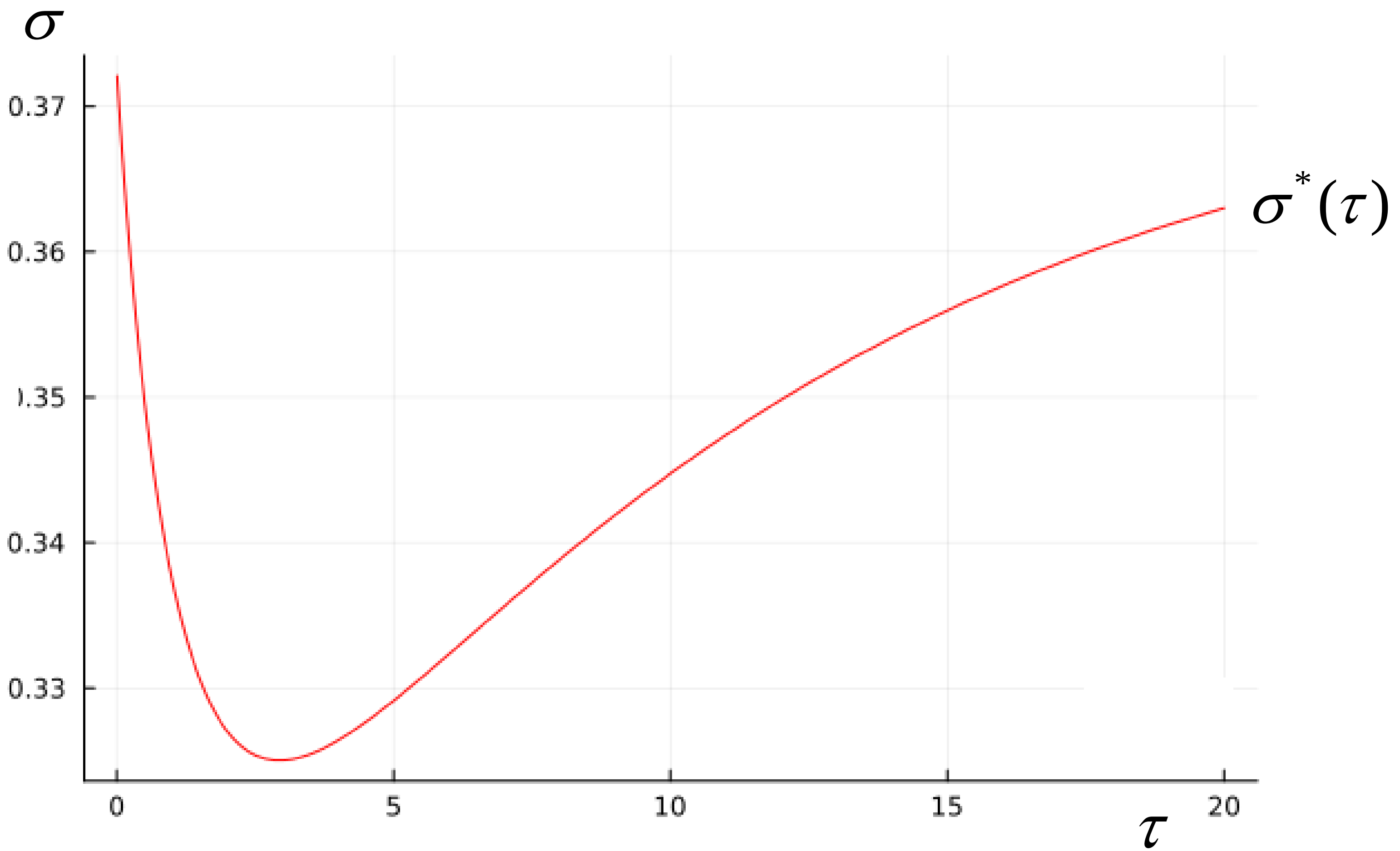
- Since

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

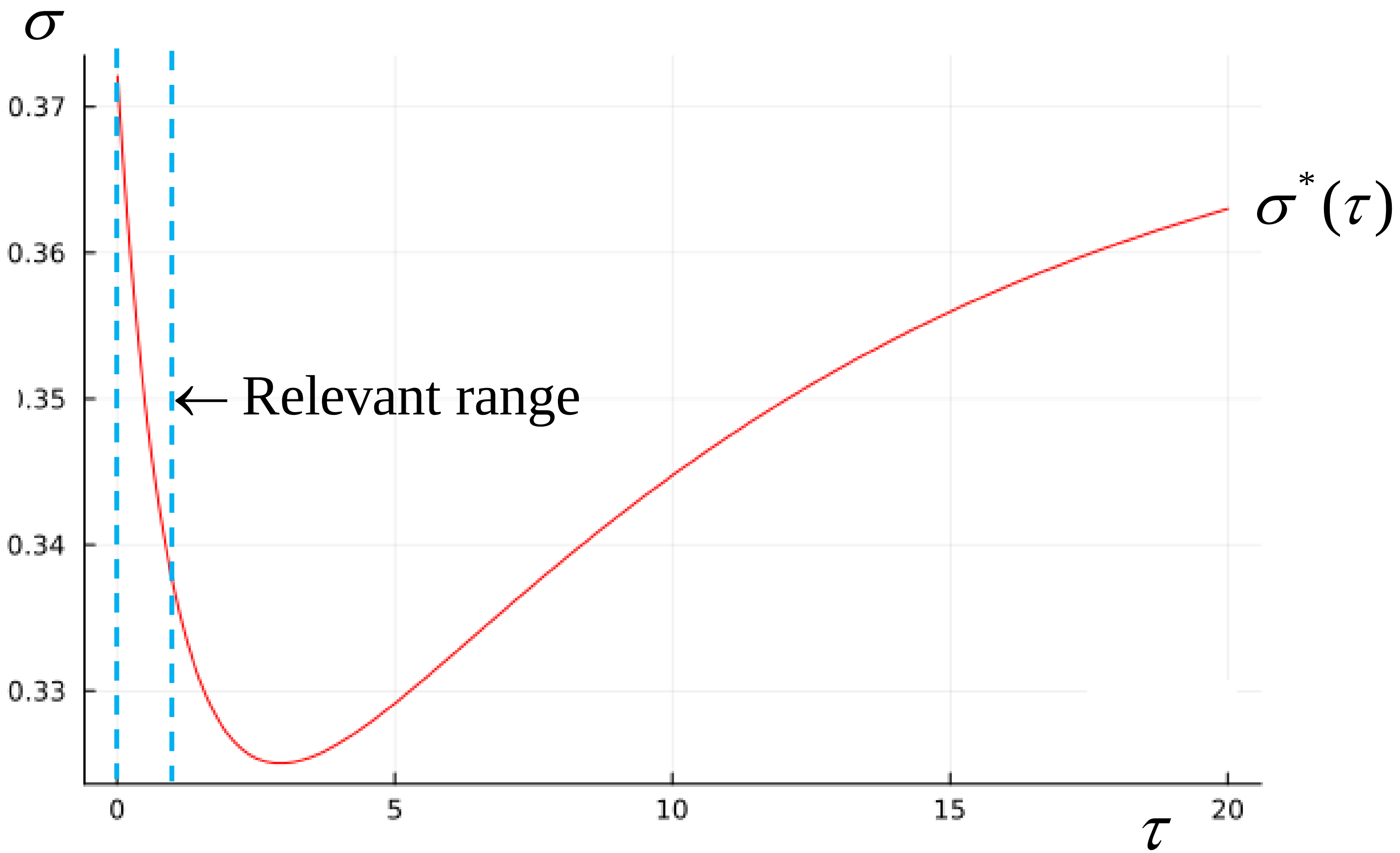
→ relationship between τ and $\sigma^*(\tau)$ cannot be monotonic

→ first decreasing and then increasing

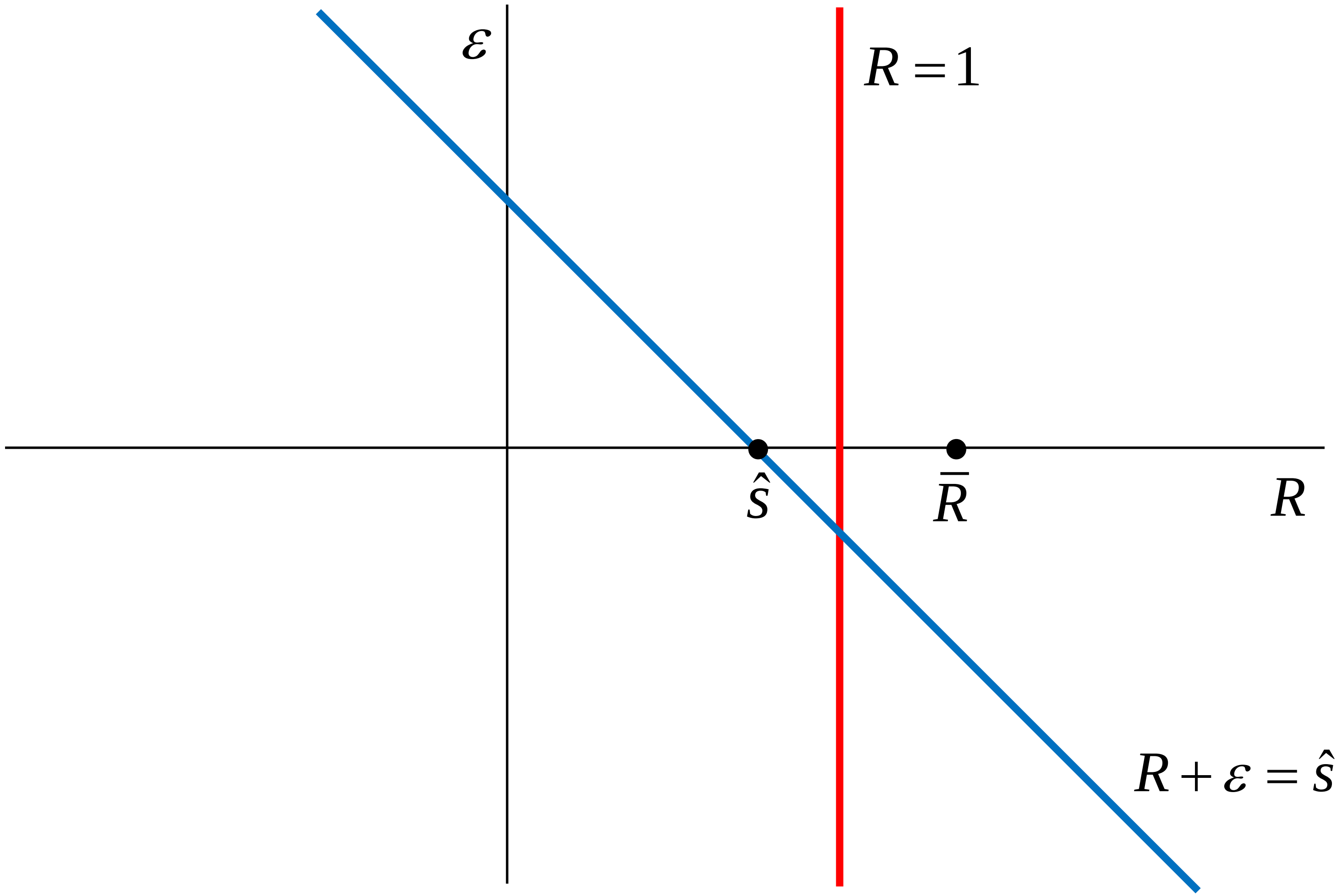
Effect of noise on risk-taking



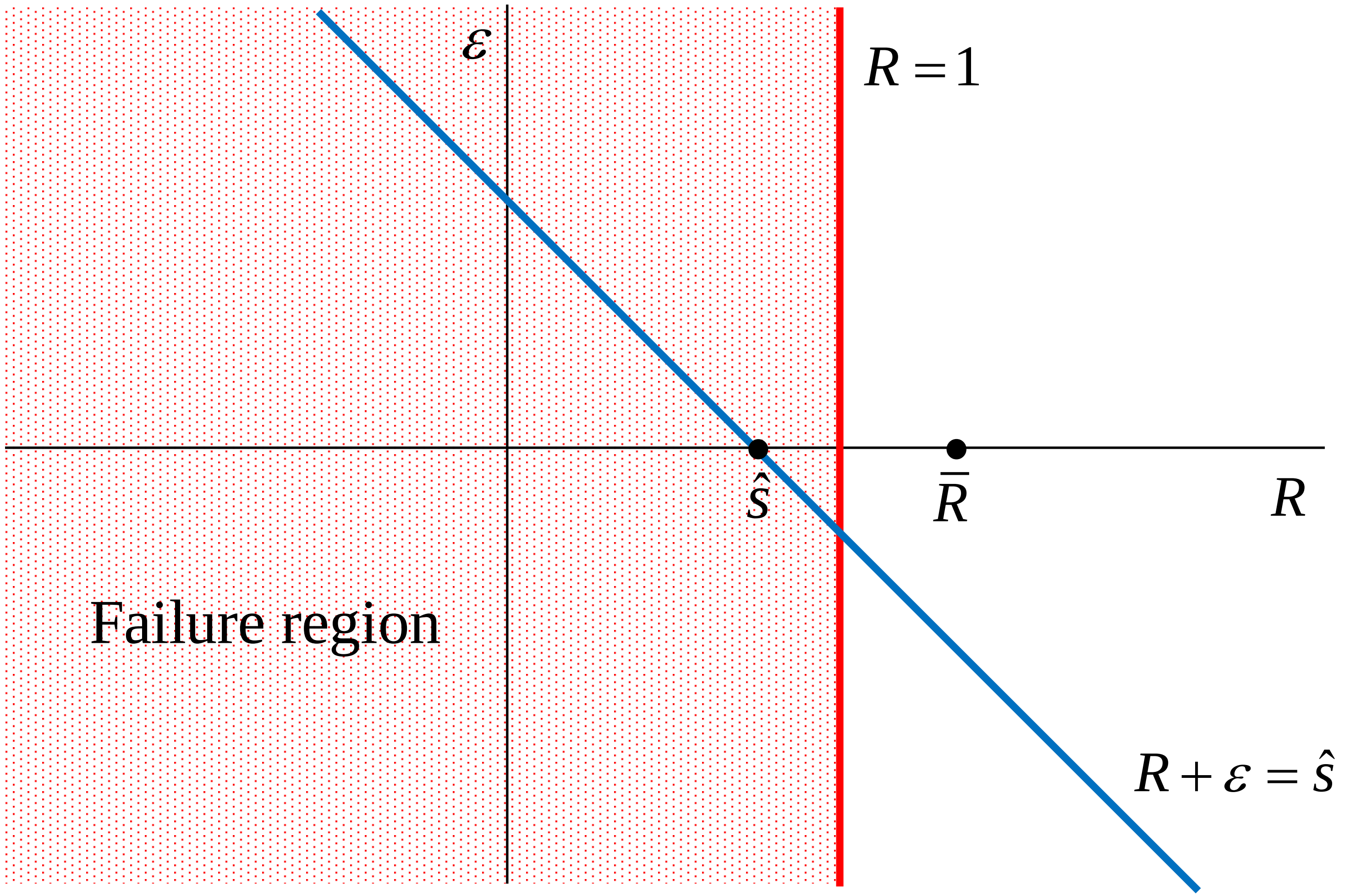
Effect of noise on risk-taking



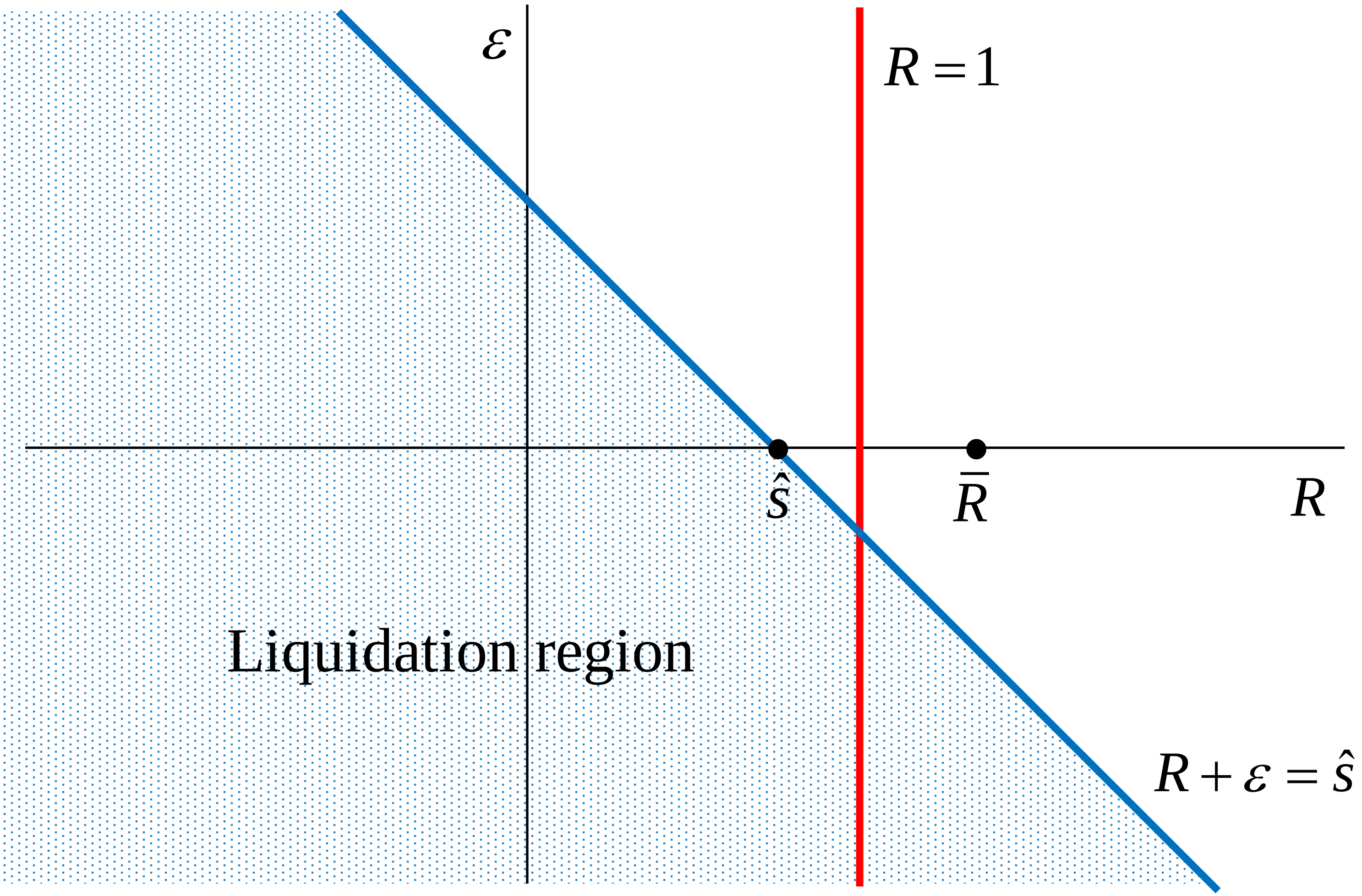
Failure and liquidation regions



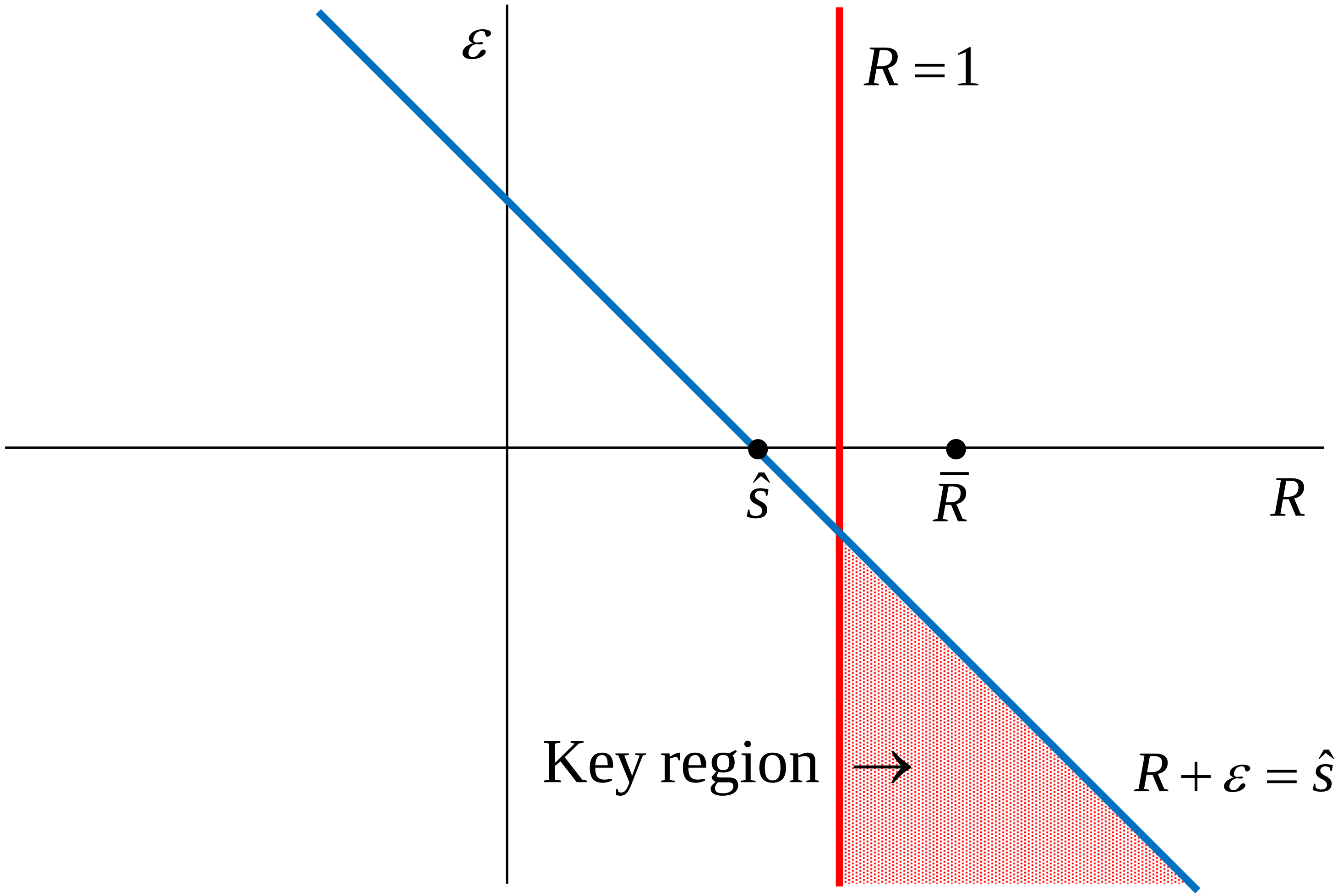
Failure and liquidation regions



Failure and liquidation regions



Failure and liquidation regions



Effect of noise on risk-taking (iii)

- In the key region

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

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

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

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

  → 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 noise on risk-taking (iv)

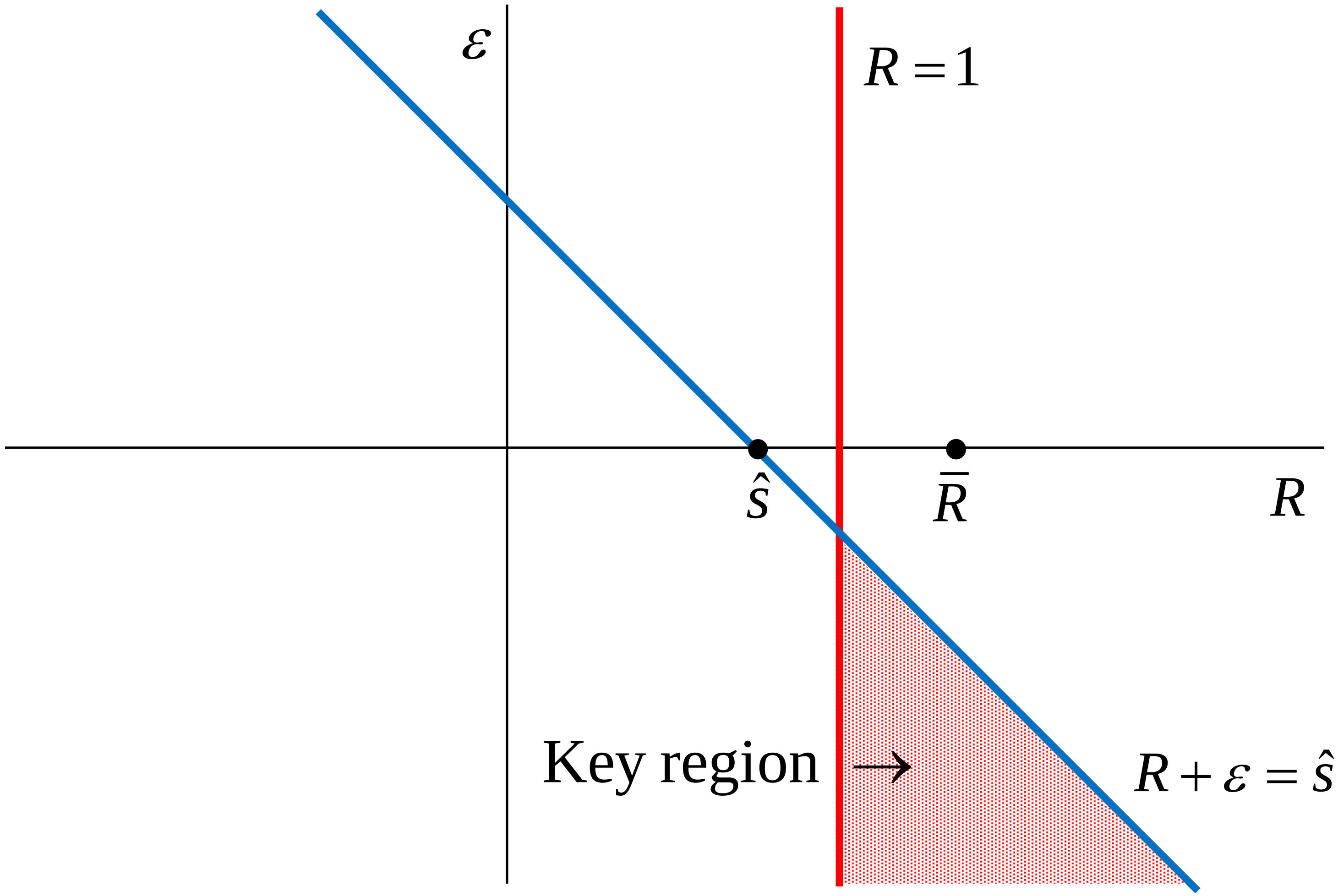
- An increase in τ has two effects

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

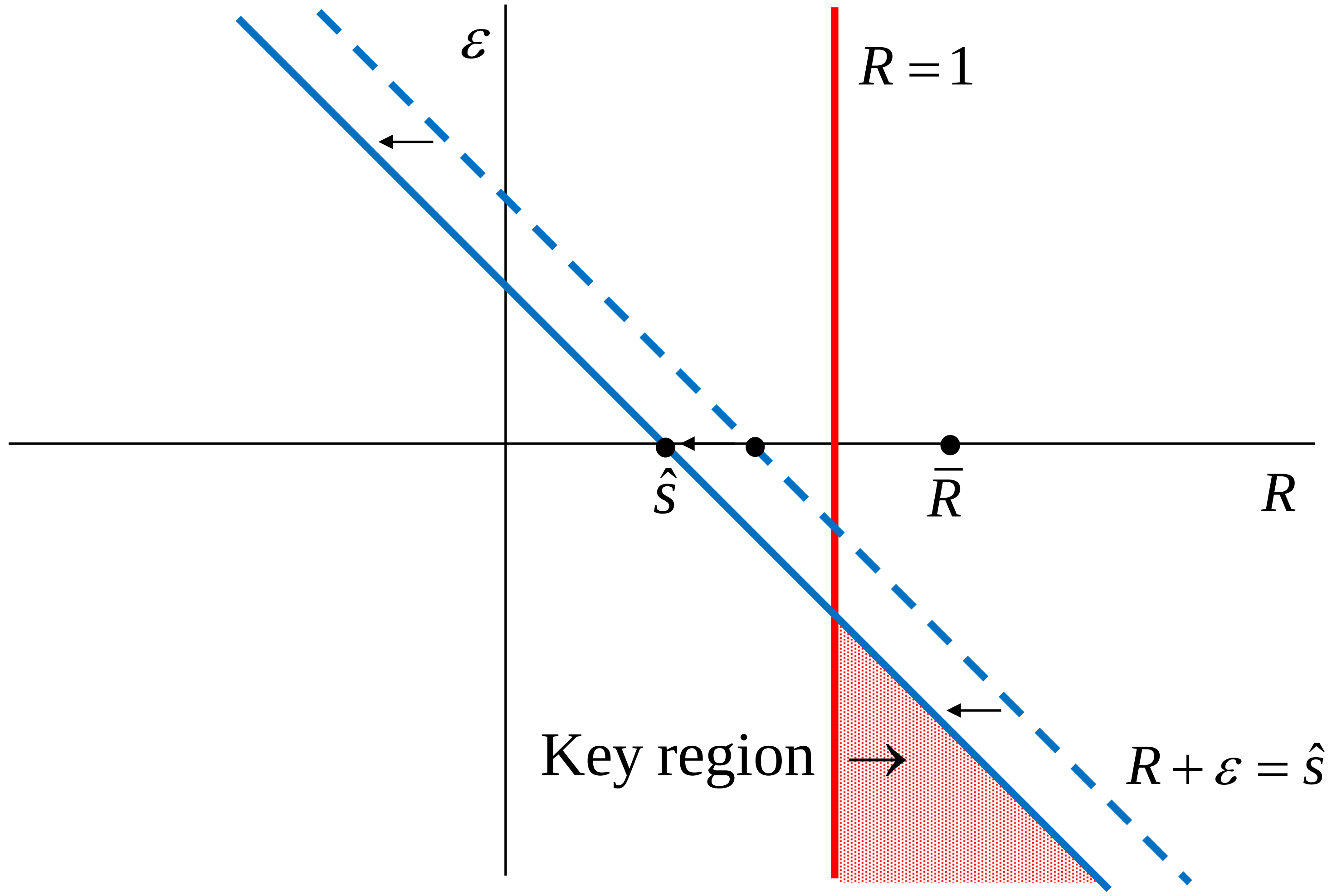
$$\hat{s} = 1 - \tau(\bar{R} - 1)$$

  $\rightarrow$ Increases the variance of the noise ε

Effect on boundary of an increase in noise τ



Effect on boundary of an increase in noise τ



Effect of noise 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**

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

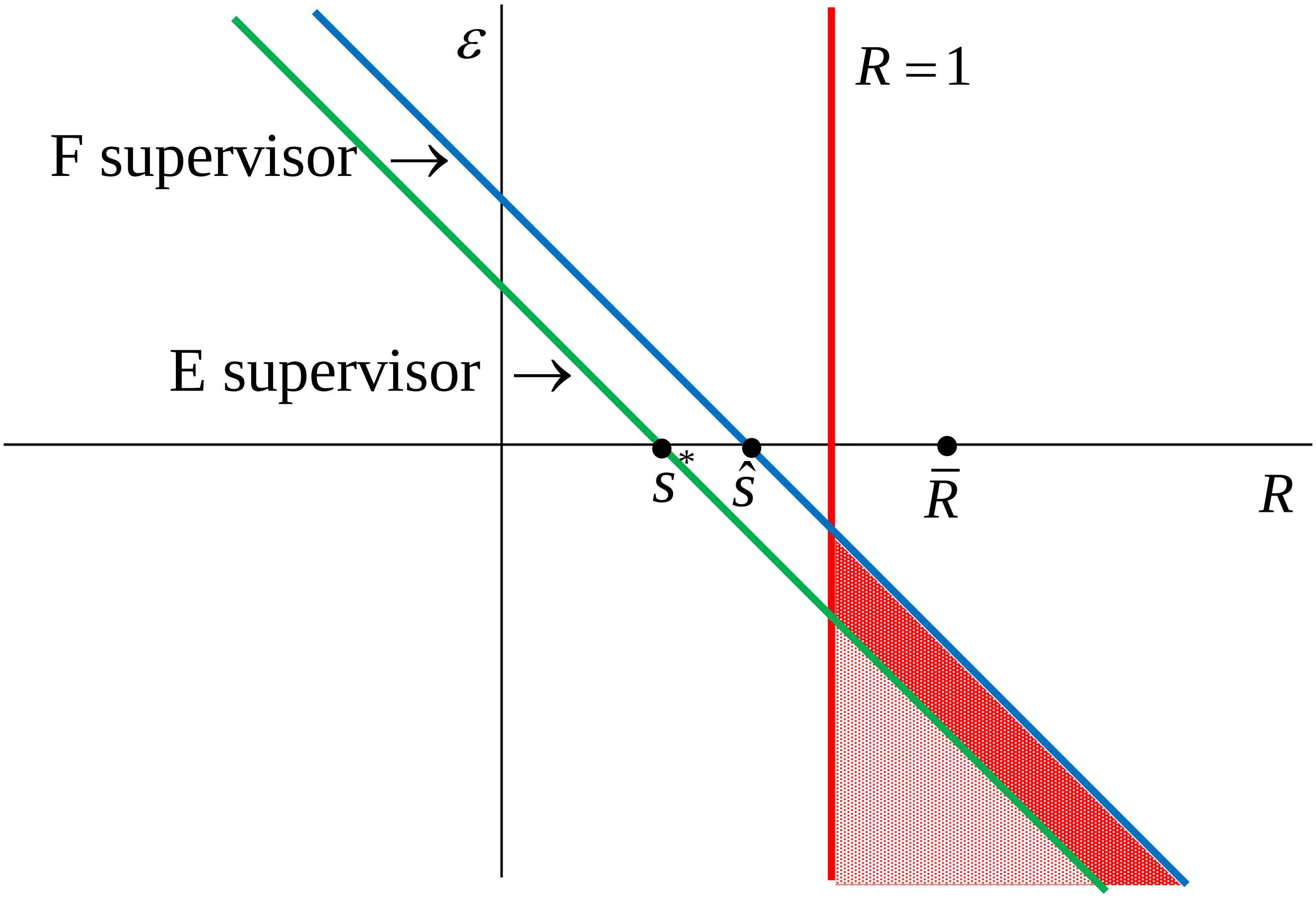
- Why is this the case?

  → Recall our previous result

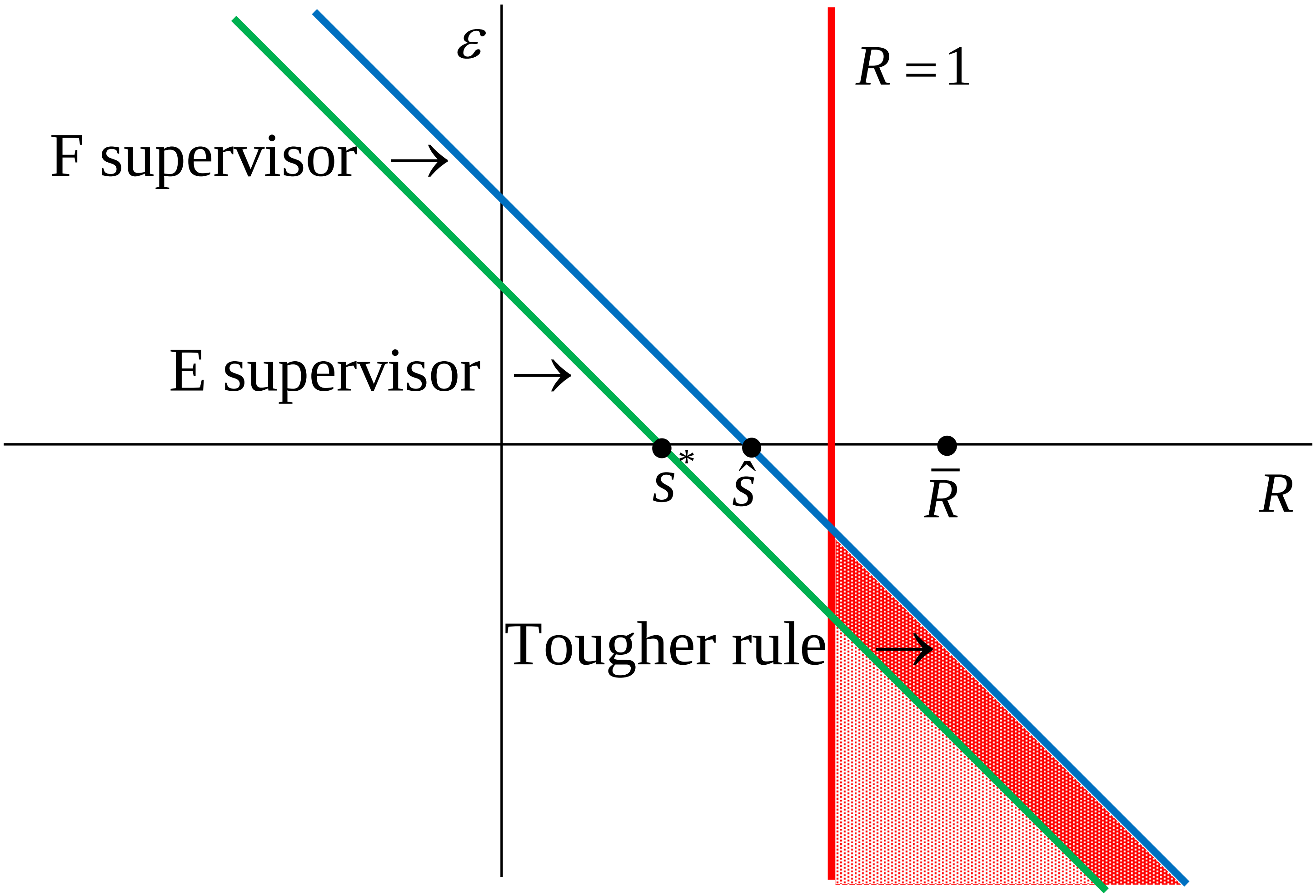
$$\hat{s} = s^* + (1+\tau)\left(1 - \frac{a-c}{1-c}\bar{R}\right) > s^*$$

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

F and E supervisors



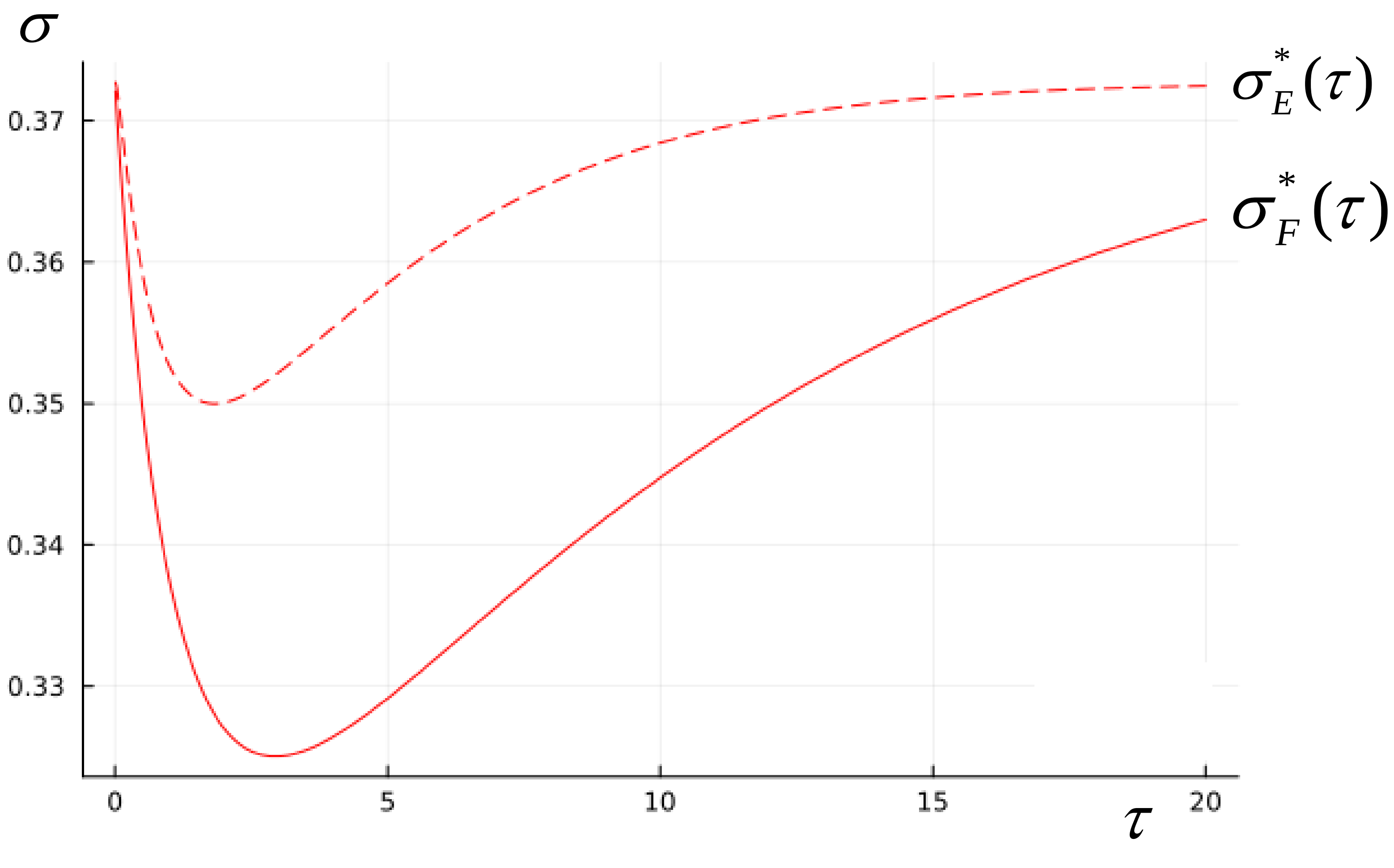
F and E supervisors



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 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 $\bar{k}$?

- Closure 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

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

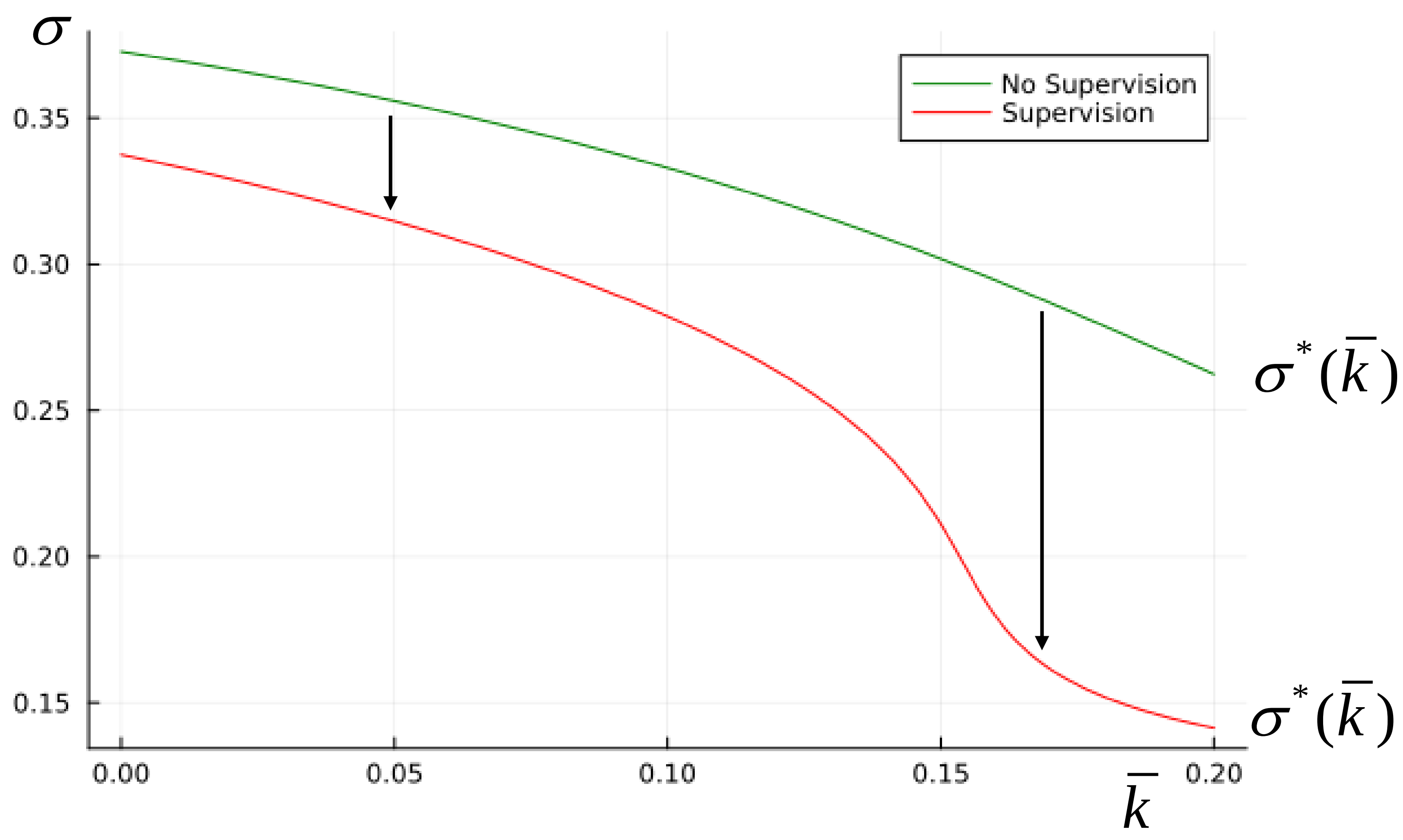
→ where $\hat{s}(\bar{k}) = \hat{s} - (1+\tau)\bar{k}$

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

→ For a range of values of $\bar{k}$

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

Effect on risk-taking



Probability of bank failure

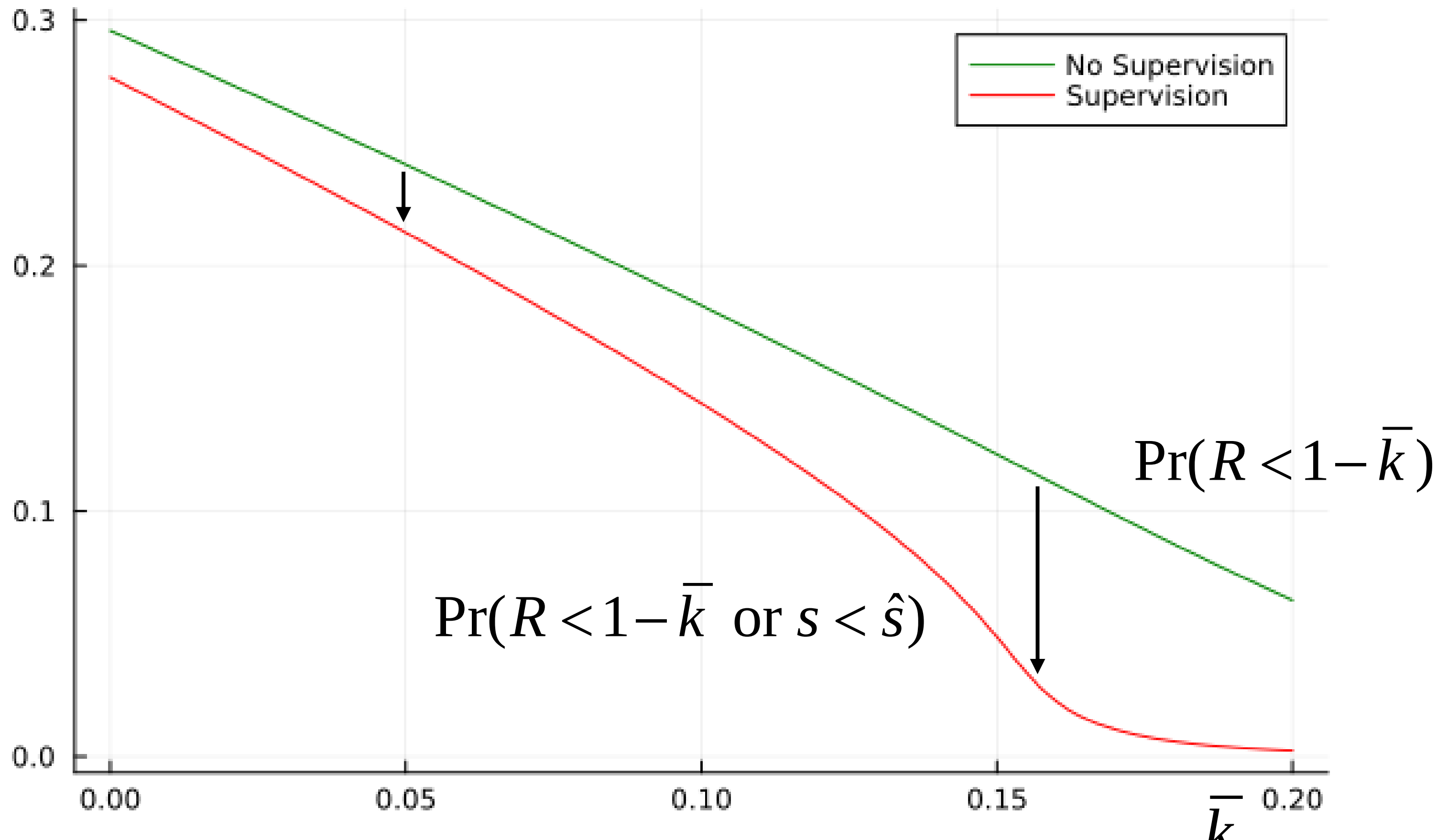
- The following figure plots

$$\Pr[R < 1 - \bar{k} \text{ or } s < \hat{s}(\bar{k})]$$

→ For a range of values of $\bar{k}$

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

Effect on bank failure



Summing up

- Regulation and supervision are complements

    → Supervision is more effective for high capital requirements

Part 6

Discussion

Discussion

- Comments on three features of model with bank supervision

  → Beneficial effects of tough supervisor

  → Beneficial effects of noisy supervisory information

  → Supervisory "closure" need not imply liquidation

Effects of tough supervisor

- 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

Effects of noisy supervisory information

- It may be surprising that higher noise (in relevant range) leads lower risk-taking

  → But this is the result in recent empirical paper by Agarwal, Morais, Seru, and Shue (2024) entitled “Noisy experts?”

  “**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**”

Closure need not imply liquidation

- 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

  → Management will be fired: key for risk-taking incentives

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)

- Paper focuses of effects of regulation and supervision on bank risk-taking, but what about welfare?

  → Lower risk-taking may be welfare improving if deposit insurance payouts are funded with distortionary taxation

  → One should also consider that both bank regulation and supervision are costly

¡Muchas gracias!