Hierarchical Bank Supervision

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Motivation

"The European Council agreed on a roadmap for the completion of the Economic and Monetary Union, based on deeper integration and reinforced solidarity. This process will begin (…) with the adoption of a Single Supervisory Mechanism and of the new rules for recovery and resolution and deposit guarantees."

Brussels, 13-14 December 2012

Pillars of Banking Union

- Single Supervisory Mechanism
  - → New system of banking supervision for Europe
  - → Comprises the European Central Bank (ECB) and national supervisory authorities of participating countries
- Single Resolution Mechanism
  - → For the efficient resolution of failing banks with minimal costs for taxpayers and the real economy
- Common Deposit Guarantee Scheme: Pending

Single Supervisory Mechanism

- Directly supervised banks
  - → ECB directly supervises significant (i.e. large) banks
  - → About 80% of banking assets in the euro area
  - → In cooperation with national supervisors
  - → **Joint Supervisory Teams**
- Indirectly supervised banks
  - → National supervisors in charge of less significant banks

This paper

- Construct model of hierarchical supervision
  - → Central and local supervisor choose supervisory efforts
  - → Central supervisor decides on possible early liquidation
- Compare it with two alternative arrangements
  - → Decentralized supervision: Local supervisor in charge
  - → Centralized supervision: Central supervisor in charge
- Key question
  - → Is hierarchical supervision better (in welfare terms)?

Overview of model (i)

- Bank characteristics
  - → Funded with insured deposits
  - → Invest in asset with random final return
  - → Early liquidation yields random liquidation return
- Supervisory information
  - → Supervisors get signal on bank's returns at a cost
  - → Quality of signal depends on their effort
  - → Signal and effort are not verifiable

Overview of model (ii)

- Efficient liquidation

  → When signal is bad it is efficient to liquidate bank

  → Expected liquidation value > Expected continuation value

- Supervisors' objective functions

  → Supervisors are not social welfare maximizers

  → Have a bias against liquidation

  → Due to reputational concerns or supervisory capture

Overview of model (iii)

- Under hierarchical supervision

  → Supervisors' payoffs depend on effort of both supervisors

  → Characterize Nash equilibrium of this game

- Under decentralized or centralized supervision

  → Local or central supervisor's payoff depends on its effort

  → A simpler problem

Optimal institutional design

- Construct social welfare function

  → Compare three alternative arrangements

  → Hierarchical, decentralized, and centralized supervision

  → Which arrangement maximizes social welfare?

Key assumptions (i)

- Cost of effort is higher for central supervisor

  → Lower familiarity/knowledge of local information

"Central supervisor has informational disadvantages relative to the national authorities, due to their better knowledge of banks, banking systems and regulatory frameworks, as well as their geographical and cultural proximity to them."

Torres (2015)

Key assumptions (ii)

- Bias against liquidation is higher for local supervisor

  → Closer connections to the bank

"The existence of a supranational supervisor allows to increase the distance between supervisors and national lobbies and politicians, which in principle should reduce the risk of supervisors implementing excessively lax policies."

Torres (2015)

Main results (i)

- Hierarchical supervision dominates local supervision when
  - → Cost of getting local information is low
  - → Bias of local supervisor is high
- Central supervision dominates hierarchical supervision when
  - → Cost of getting local information is sufficiently low
  - → Bias of local supervisor is sufficiently high

Main results (ii)

- Hierarchical supervision less likely to dominate when

  → Bank profitability is high (low competition)

  → Bank risk-taking is low (tough regulation)

- Whenever hierarchical supervision dominates

  → Limiting size of central supervisor is welfare improving

Overview of presentation

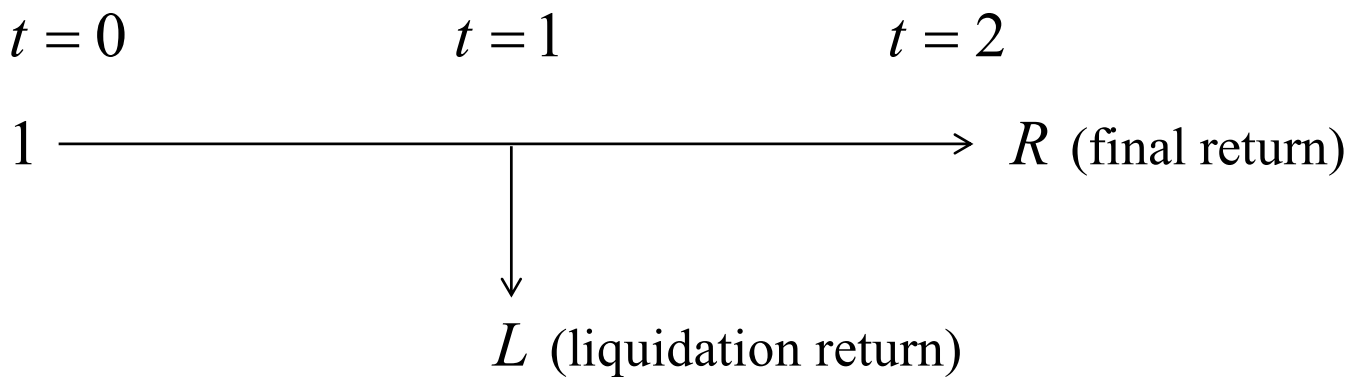
- Model setup (single supervisor)
- Model of hierarchical supervision
- Optimal institutional design
- Limiting size of central supervisor
- Concluding remarks

Part 1

Model setup

Model setup

- Three dates ($t = 0, 1, 2$)
- Agents: → Local bank
  → Local supervisor
- Bank raises deposits at $t = 0$ and invests in asset with returns



Assumptions (i)

- Deposits are insured and deposit rate normalized to zero
- Asset returns are normally distributed (for tractability) with

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

Assumptions (ii)

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

  → Expected final return > Face value of deposits

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

  → Expected liquidation return < Expected final return

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

  → Liquidation return and final return are positively correlated

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

  → Liquidation return is less volatile than final return

Supervisory information (i)

- Supervisor observes at $t = 1$ non-verifiable signal

$$s = R + \varepsilon$$

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

- Variable e is non-verifiable effort of supervisor

→ Related to intensity of banking supervision

→ Positive effect on precision of supervisory signal

Supervisory information (ii)

- Joint distribution of signal and returns

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

- By the properties of normal distributions

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

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

Supervisory information (iii)

- Slope of $E(L|s)$ is lower than slope of $E(R|s)$, so

$$E(L|s) > E(R|s) \quad \Leftrightarrow \quad s < s^*$$

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

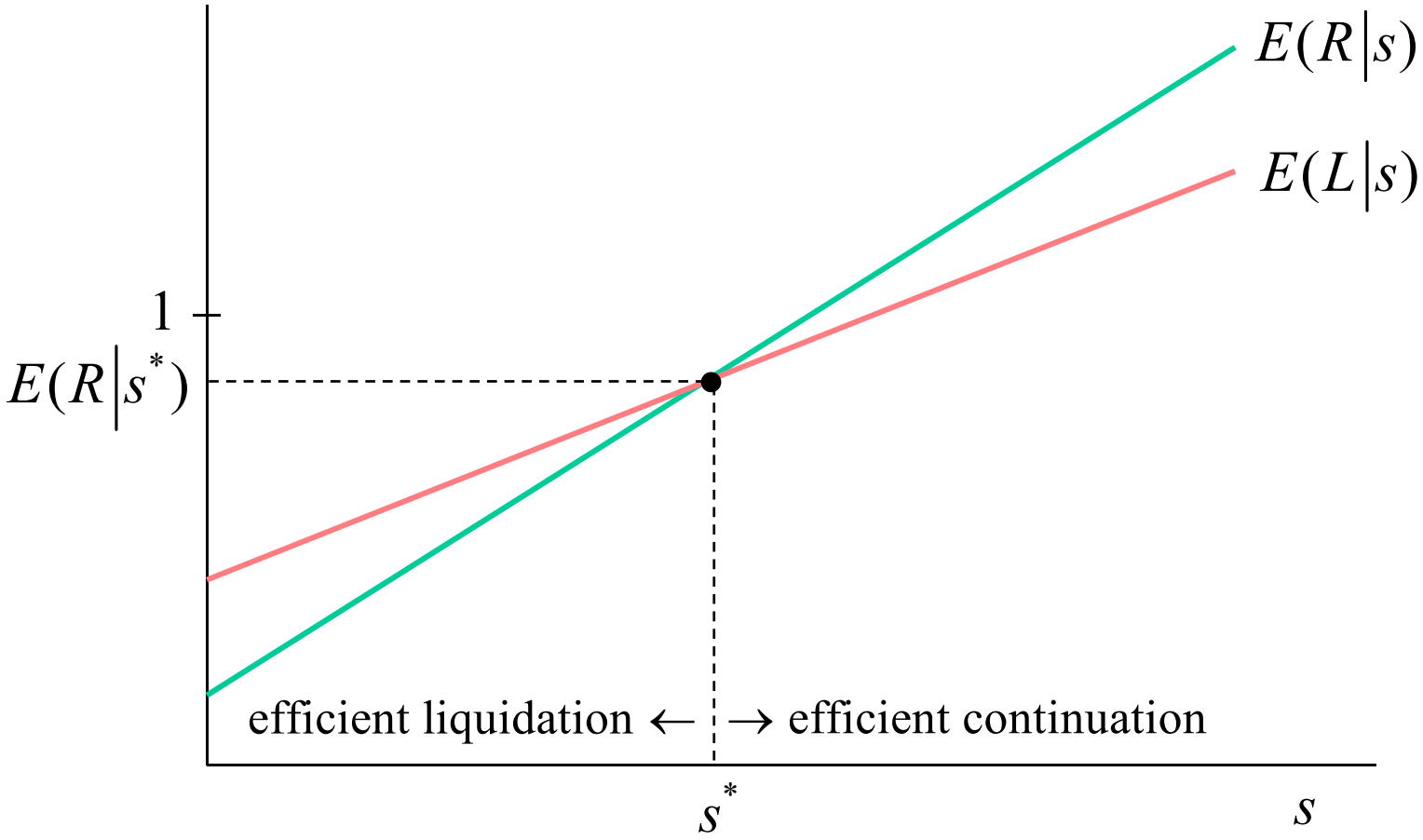
- We assume that parameter values are such that

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

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

→ Efficient liquidation only if bank has negative equity

Efficient liquidation threshold



Supervisor's decisions (i)

- At $t = 0$ supervisor chooses effort e at a cost

$$c(e) = \gamma_0 + \frac{\gamma}{2} e^2$$

- At $t = 1$ supervisor observes signal s and decides on liquidation

Supervisor's decisions (ii)

- Supervisor liquidates the bank if

$$E(L|s) - \delta > E(R|s)$$

  → where $\delta > 0$ is a supervisory liquidation cost

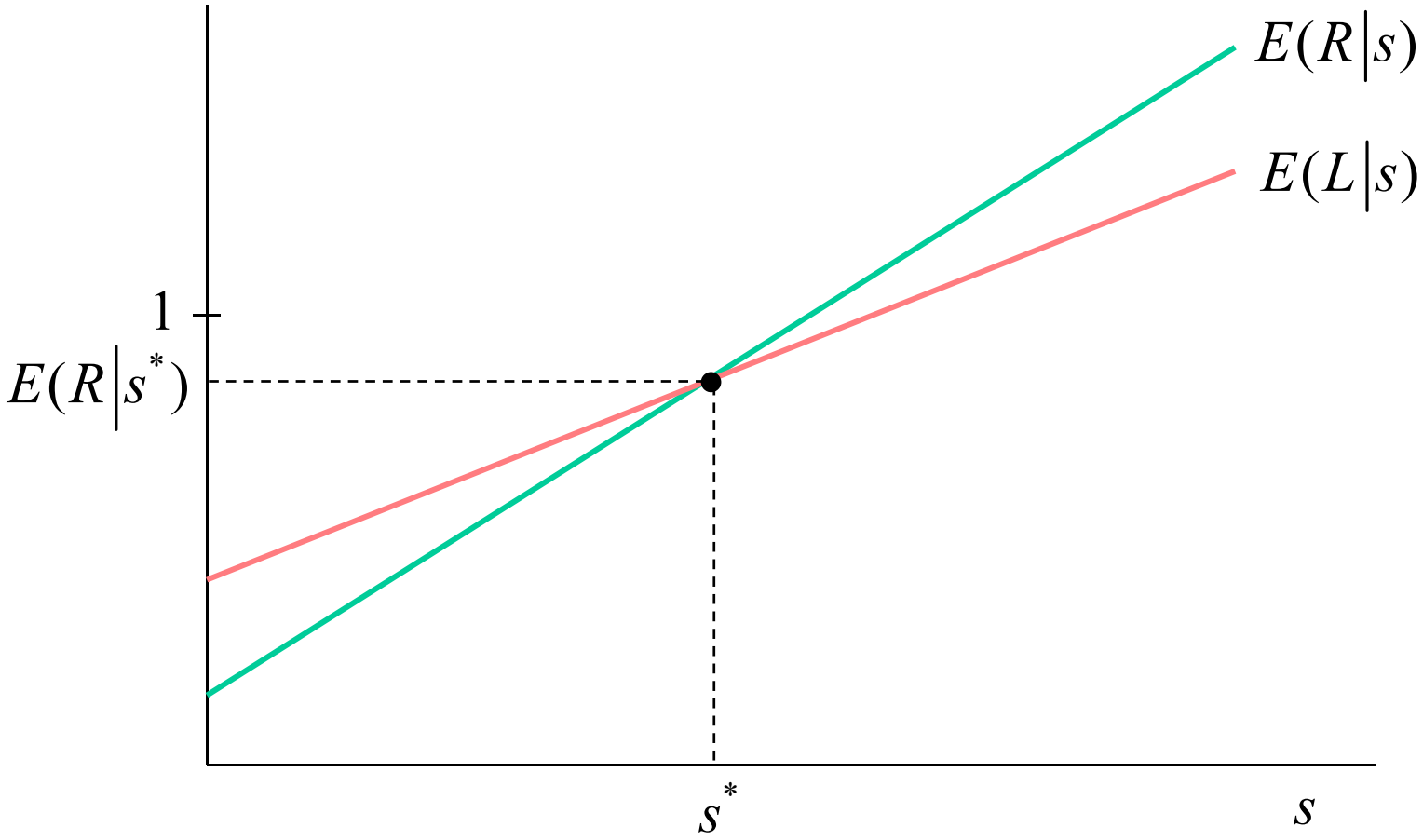
  → bias against liquidation

- What is behind δ?

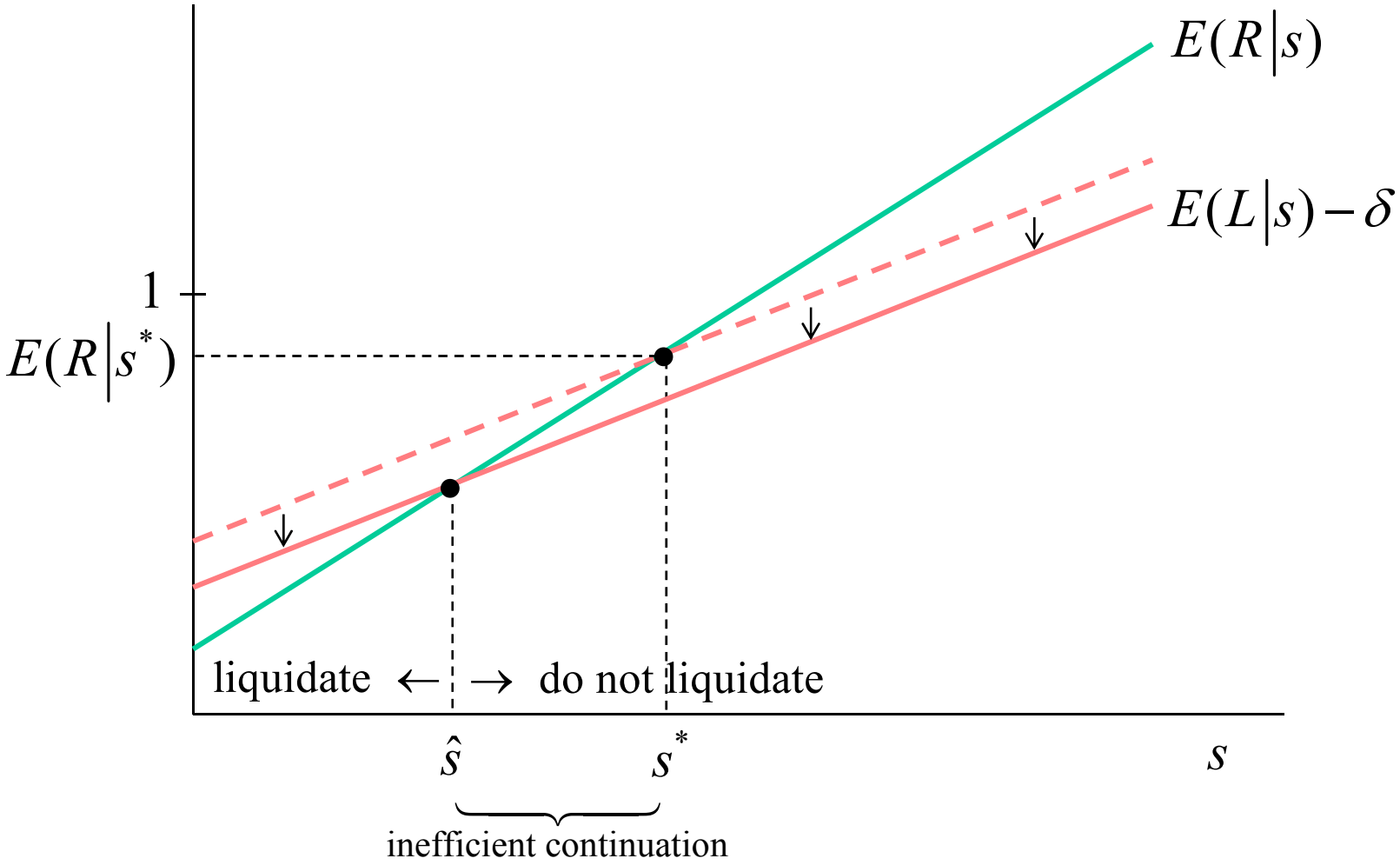
  → Reputational concerns

  → Supervisory capture (e.g. revolving doors)

Supervisor's liquidation decision



Supervisor's liquidation decision



Supervisor's effort decision (i)

- Supervisor's objective function

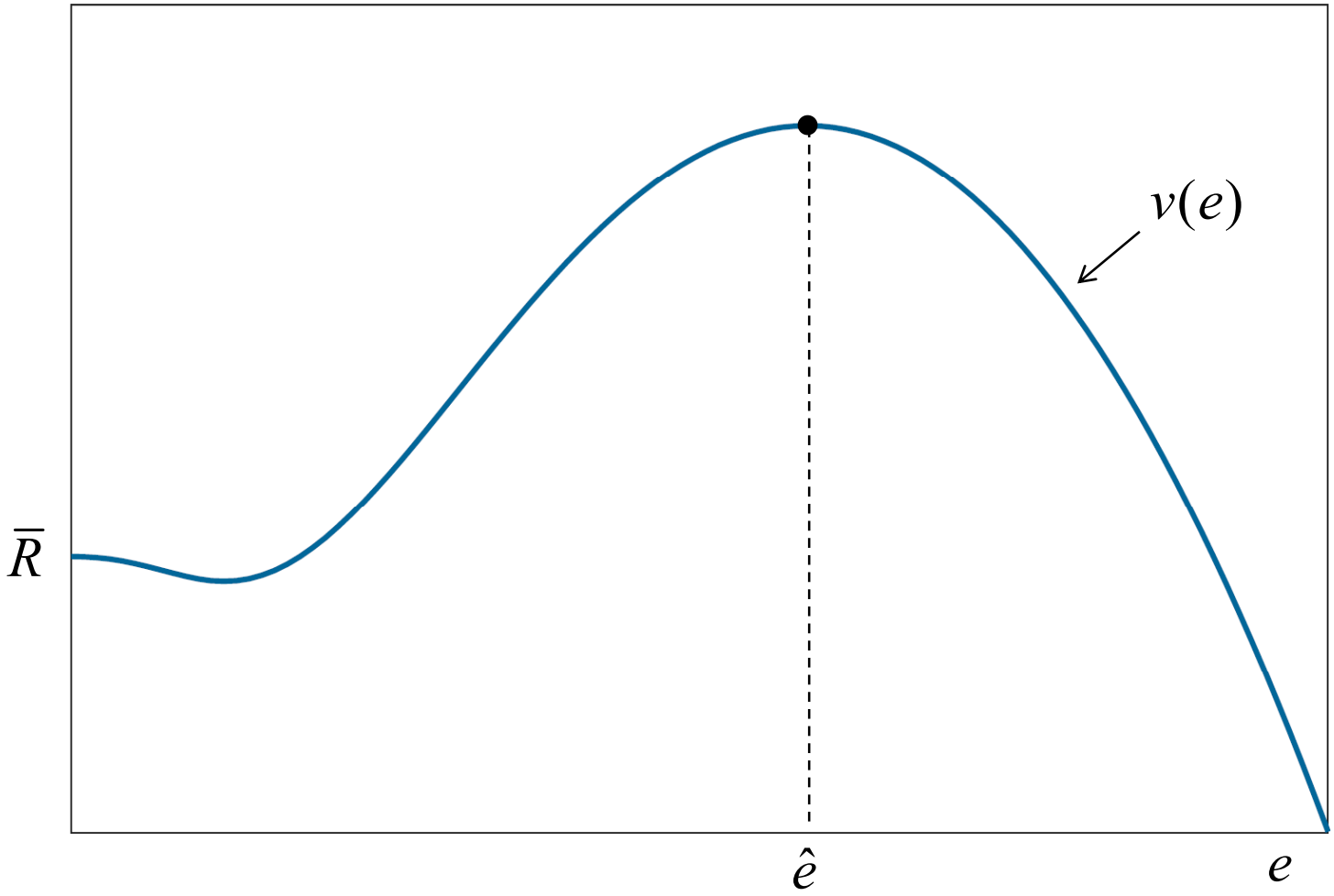
$$v(e) = \underbrace{\int_{-\infty}^{\hat{s}} [E(L|s) - \delta] dF(s)}_{\text{Liquidation}} + \underbrace{\int_{\hat{s}}^{\infty} E(R|s) dF(s)}_{\text{Continuation}} - c(e)$$

→ where $F(s)$ is the cdf of the signal $s \sim N(\bar{R}, \sigma^2(1+e^{-1}))$

- Supervisor chooses

$$\hat{e} = \arg\max_e v(e)$$

Supervisor's payoff function



Comparative statics

- Whenever the supervisor chooses positive effort $\hat{e} > 0$ we have

$$\frac{\partial \hat{e}}{\partial \gamma} < 0, \quad \frac{\partial \hat{e}}{\partial \delta} < 0, \quad \frac{\partial \hat{e}}{\partial \bar{R}} < 0, \quad \frac{\partial \hat{e}}{\partial \sigma} > 0$$

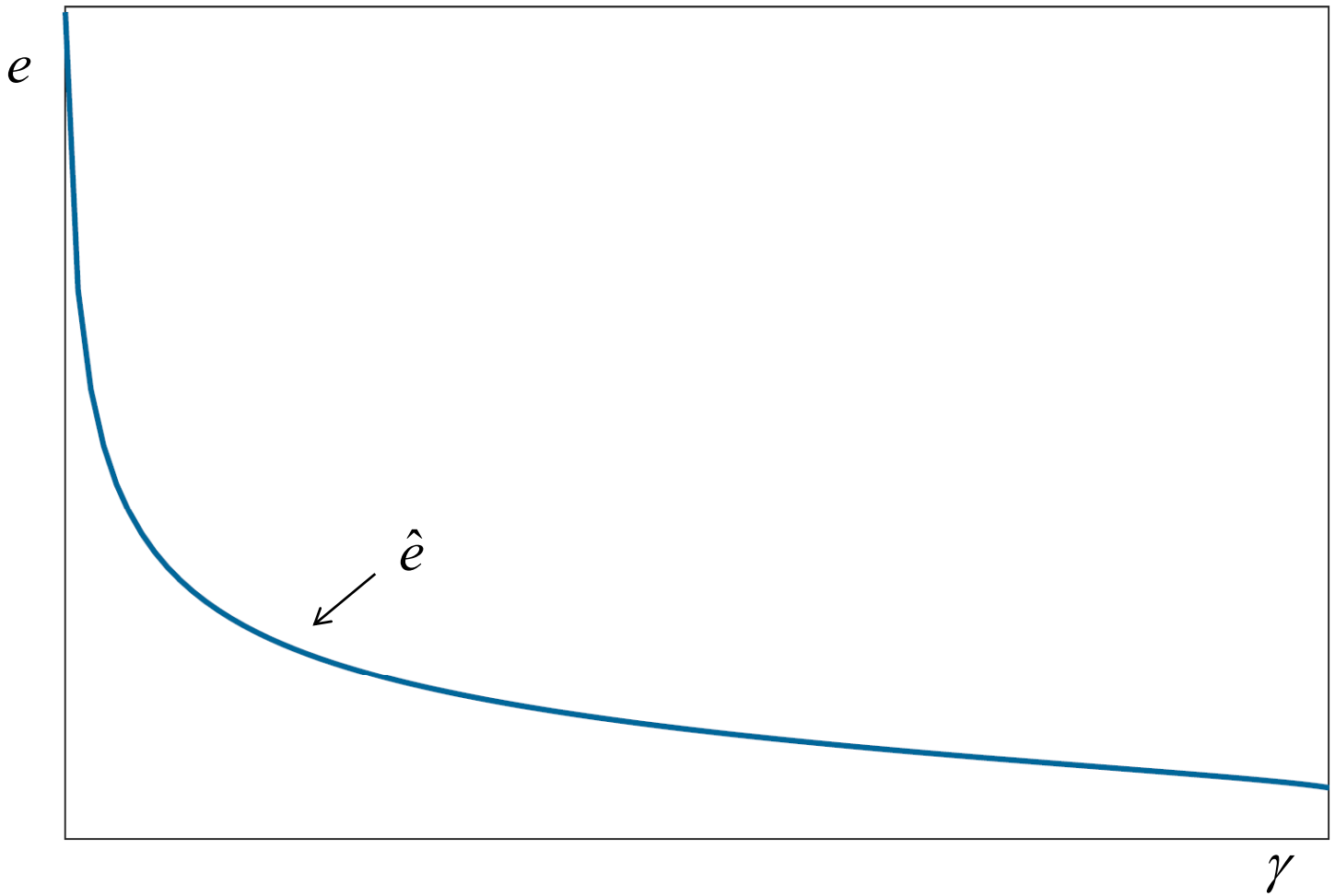
→ Effort is decreasing in supervisory cost of effort γ

→ Effort is decreasing in supervisory liquidation cost δ

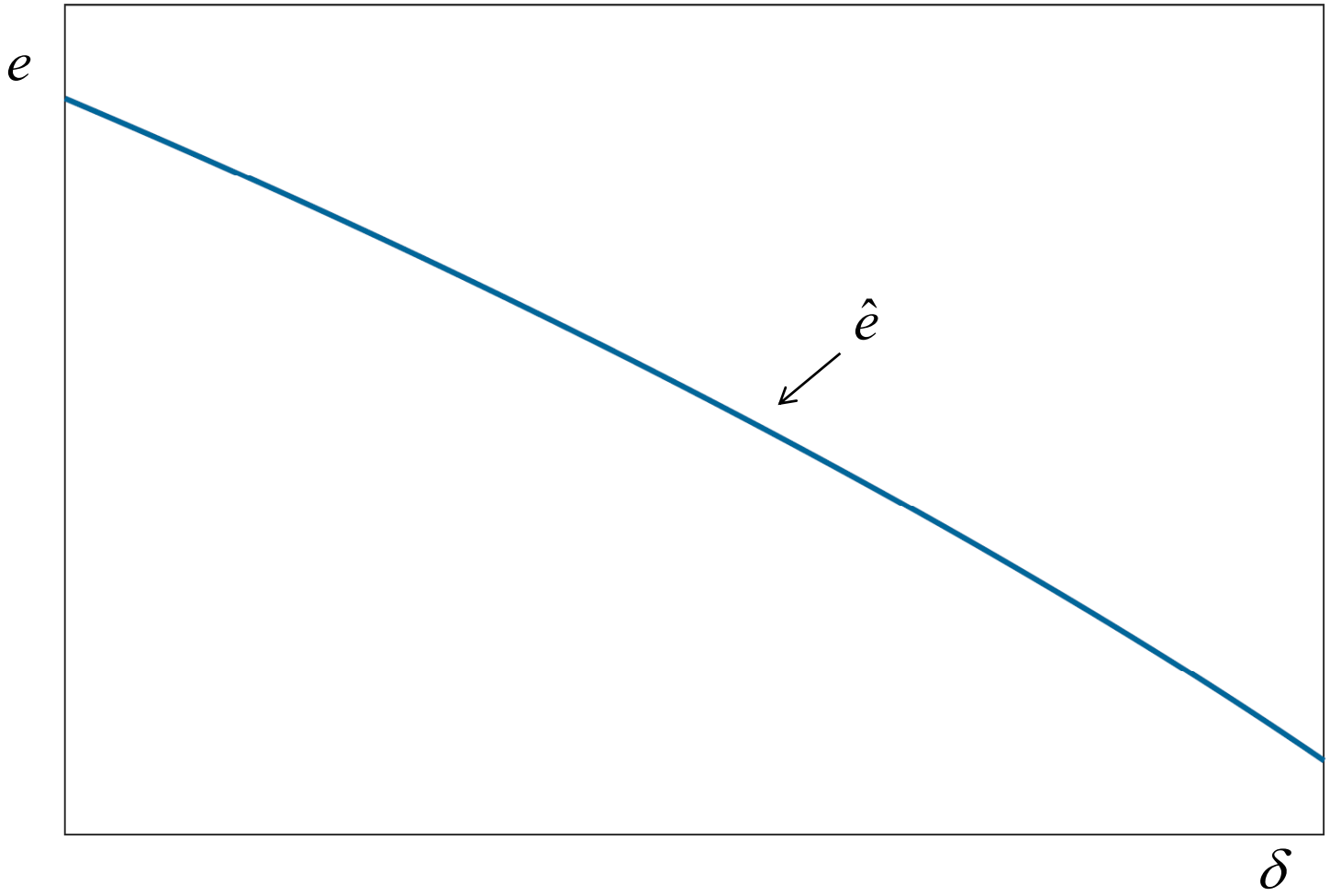
→ Effort is decreasing in expected asset return $\bar{R}$

→ Effort is increasing in volatility of asset return σ

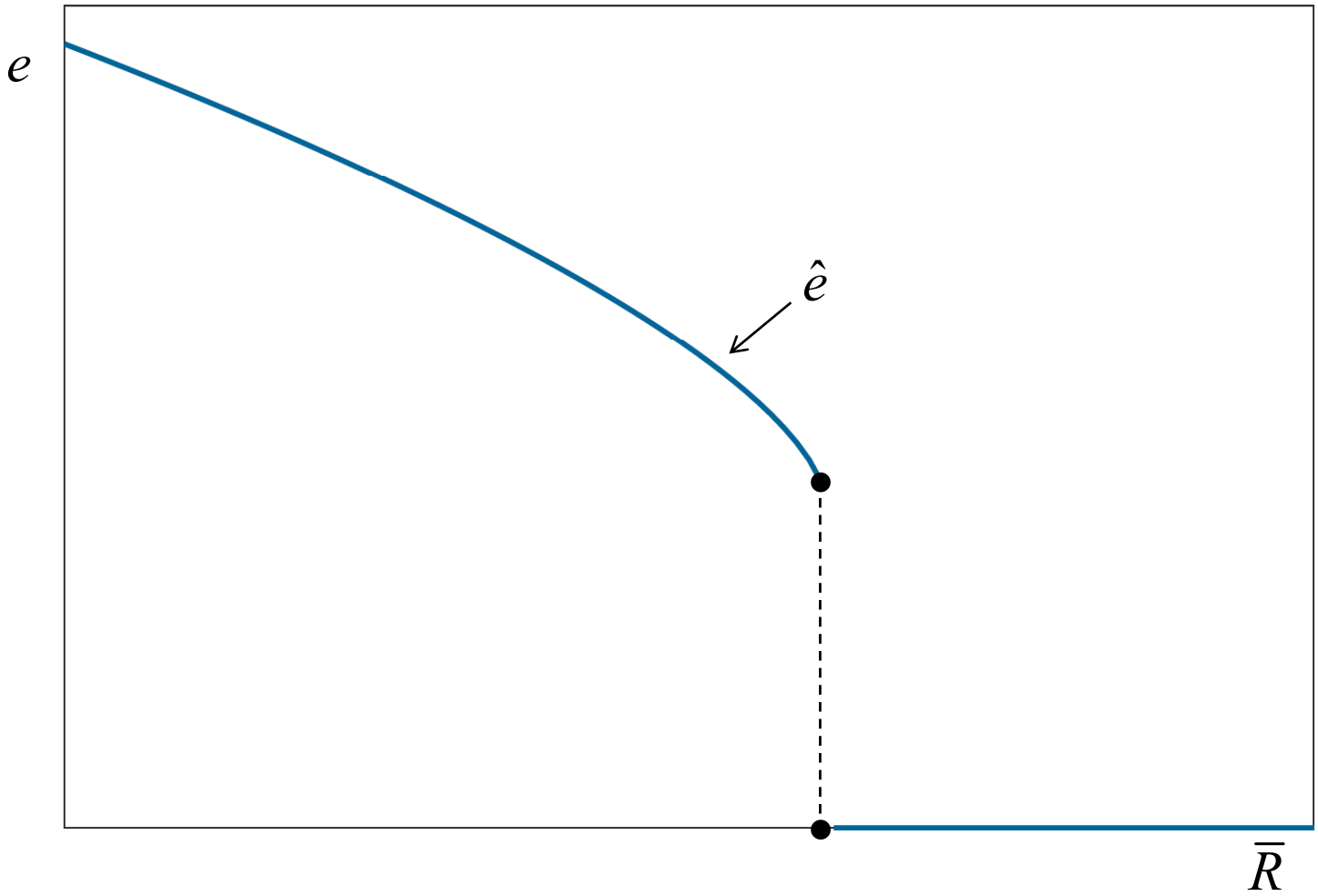
Effect of cost of effort



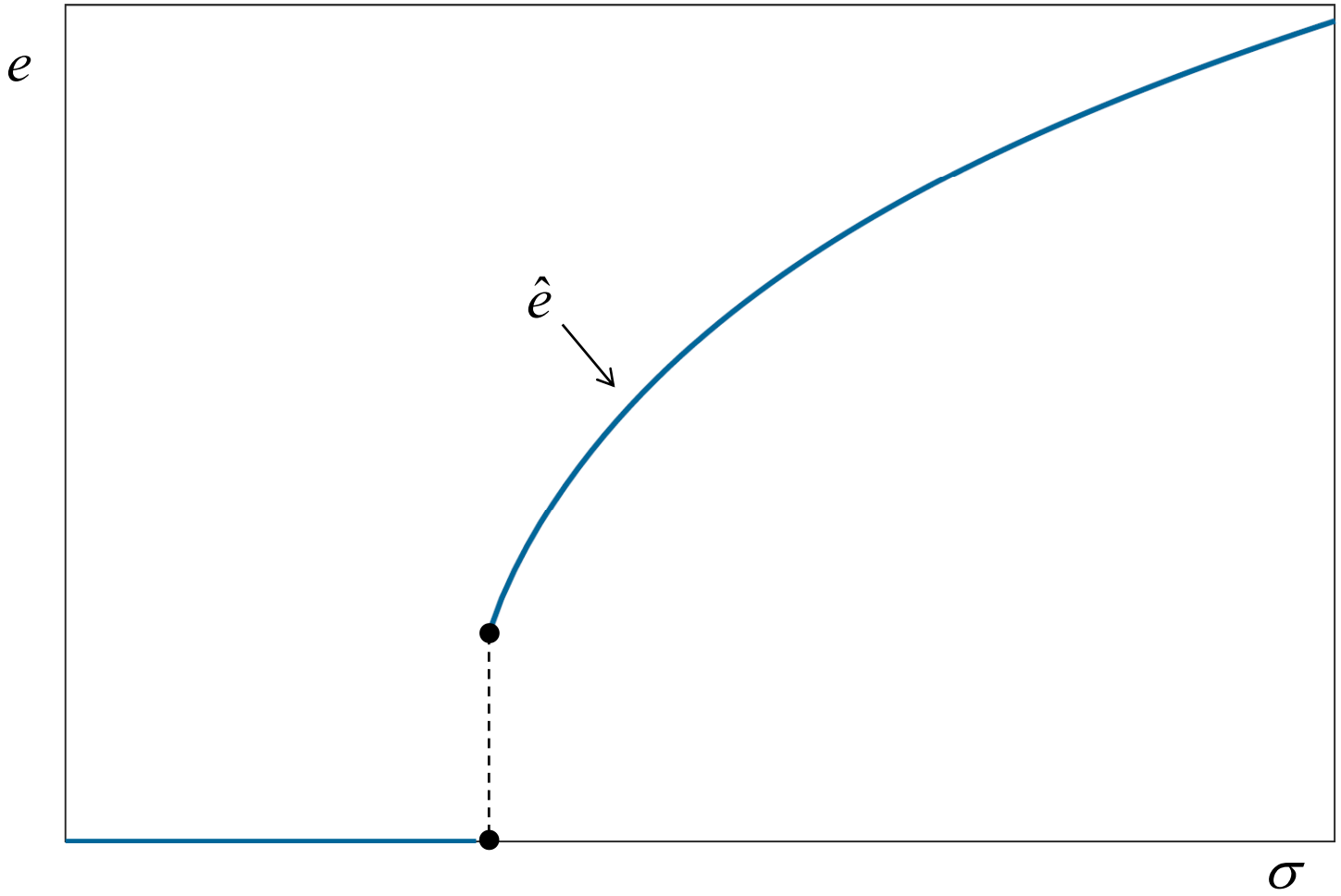
Effect of supervisory liquidation costs



Effect of expected asset return



Effect of volatility of asset return



Summing up

- Model of a single bank and a single supervisor

  → Interpreted as local bank and local (national) supervisor

- Bank is completely passive

- Supervisor is not social welfare maximizer

  → Bias in favor of continuation (supervisory capture)

- Would a supranational supervisor do better?

  → Trade-off: higher costs of supervision but lower bias

Part 2

Model of hierarchical supervision

Model setup

- Three dates ($t = 0, 1, 2$)
- Agents: → Local bank
  → Local supervisor
  → Central supervisor
- Same structure of asset returns
- Hierarchical supervision
  → Central and local supervisor jointly supervise bank
  → Central supervisor decides on early liquidation

Supervisory information

- Central supervisor observes at $t = 1$ non-verifiable signal

$$s = R + \varepsilon$$

→ where $\varepsilon \sim N(0, \sigma^2 / (e_c + e_l))$ and independent of L and R

→ e_c is non-verifiable effort of central supervisor

→ e_l is non-verifiable effort of local supervisor

Key assumptions

- Cost of effort is higher for central supervisor

$$\gamma_c > \gamma_l$$

→ Justified by reference to lower local knowledge

- Supervisory liquidation cost is higher for local supervisor

$$\delta_l > \delta_c$$

→ Justified by reference to closer connections to bank

- To simplify presentation, assume that $\delta_c = 0$

→ Central supervisor has zero liquidation cost

Structure of the game

- At $t = 0$ central and local supervisor choose efforts e_c and e_l

  → Nash equilibrium

- At $t = 1$ signal s is observed

  → Central supervisor decides on liquidation

Central supervisor's liquidation decision

- By the properties of normal distributions

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

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

- From here it follows that

$$E(L|s) > E(R|s) \text{ if and only if } s < s^{**}$$

→ where s^{**} is the efficient liquidation threshold

Payoff function of central supervisor

$$v_c(e_c, e_l) = \underbrace{\int_{-\infty}^{s^{**}} E(L|s)dF(s)}_{\text{Liquidation}} + \underbrace{\int_{s^{**}}^{\infty} E(R|s)dF(s)}_{\text{Continuation}} - c_c(e_c)$$

→ where $F(s)$ is the cdf of the signal s

- Central supervisor does not take into account cost of effort of local supervisor

Payoff function of local supervisor

$$v_l(e_c, e_l) = \underbrace{\int_{-\infty}^{s^{**}} [E(L|s) - \delta_l] dF(s)}_{\text{Liquidation}} + \underbrace{\int_{s^{**}}^{\infty} E(R|s) dF(s)}_{\text{Continuation}} - c_l(e_l)$$

→ where $F(s)$ is the cdf of the signal s

- Local supervisor takes into account liquidation threshold s^{**} chosen by central supervisor

Nash equilibrium

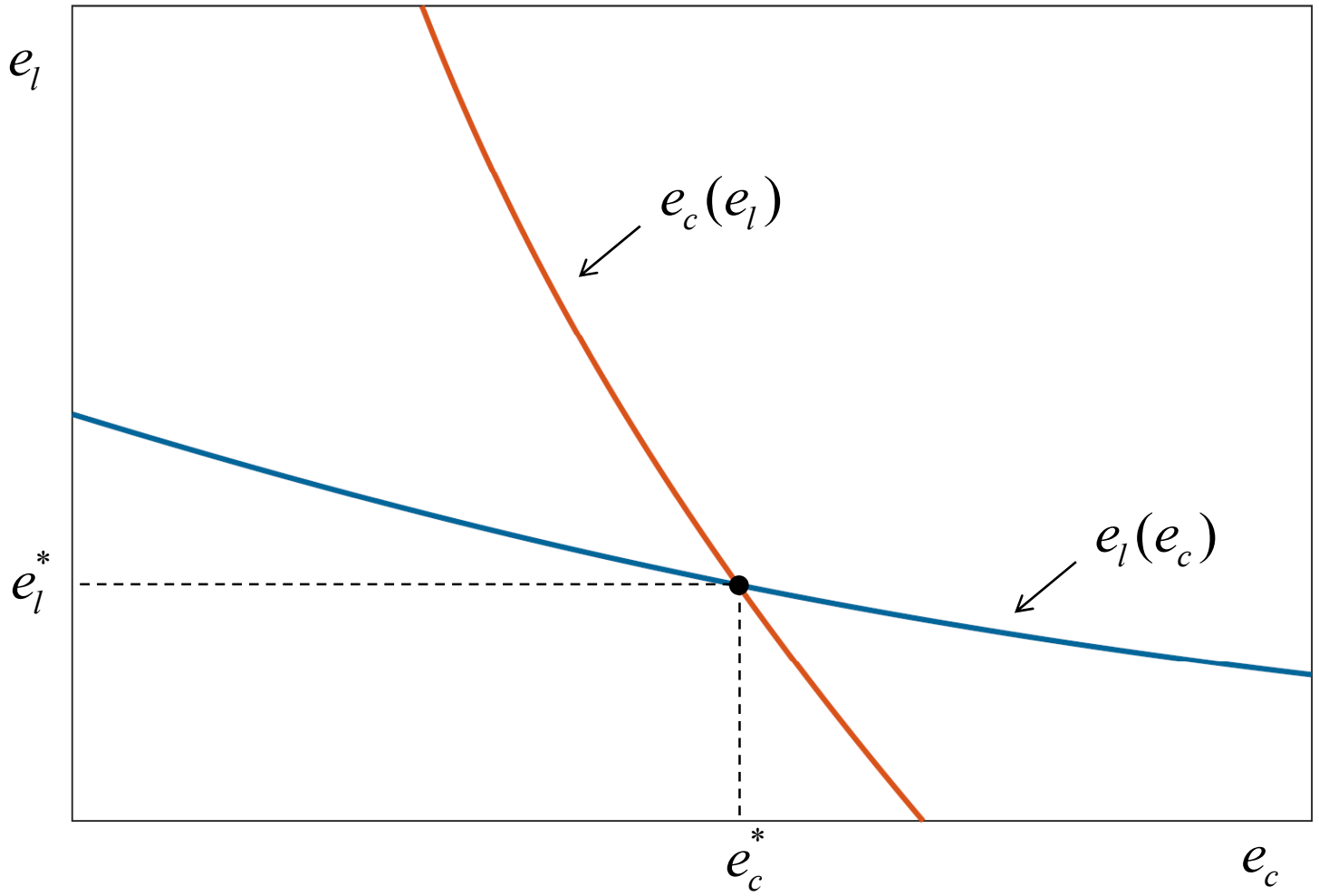
- Reaction function of the two supervisors

$$e_c(e_l) = \arg\max_{e_c} v_c(e_c, e_l)$$

$$e_l(e_c) = \arg\max_{e_l} v_l(e_c, e_l)$$

- The intersection of these function is a Nash equilibrium

Nash equilibrium



Part 3

Optimal institutional design

“The assignment of decision rights influences incentives to acquire information. (…) Determining the optimal level of decentralization requires balancing the costs of bad decisions owing to poor information and those owing to inconsistent objectives.”

Jensen and Meckling (1990)

Three alternative arrangements

- Decentralized supervision

  → Only local collects information & decides on liquidation

- Hierarchical supervision

  → Both supervisors exert effort

  → Central supervisor decides on liquidation

- Centralized supervision

  → Only central collects information & decides on liquidation

Social welfare function (i)

- Two components
  - → Expected bank returns (given liquidation decision)
  - → Cost of supervisory effort
- Supervisory liquidation costs are not taken into account
  - → Related to loss of transfers from bank to supervisors
  - → Supervisory capture

Social welfare (ii)

- Decentralized supervision

$$w_l = \int_{-\infty}^{\hat{s}_l} E(L|s)dF(s) + \int_{\hat{s}_l}^{\infty} E(R|s)dF(s) - c_l(\hat{e}_l)$$

- Centralized supervision

$$w_c = \int_{-\infty}^{\hat{s}_c} E(L|s)dF(s) + \int_{\hat{s}_c}^{\infty} E(R|s)dF(s) - c_c(\hat{e}_c)$$

- Hierarchical supervision

$$w_h = \int_{-\infty}^{s^{**}} E(L|s)dF(s) + \int_{s^{**}}^{\infty} E(R|s)dF(s) - c_l(e_l^*) - c_c(e_c^*)$$

Two key parameters

- Liquidation cost of local supervisor δ_l

  → Rationale for taking decisions at higher level

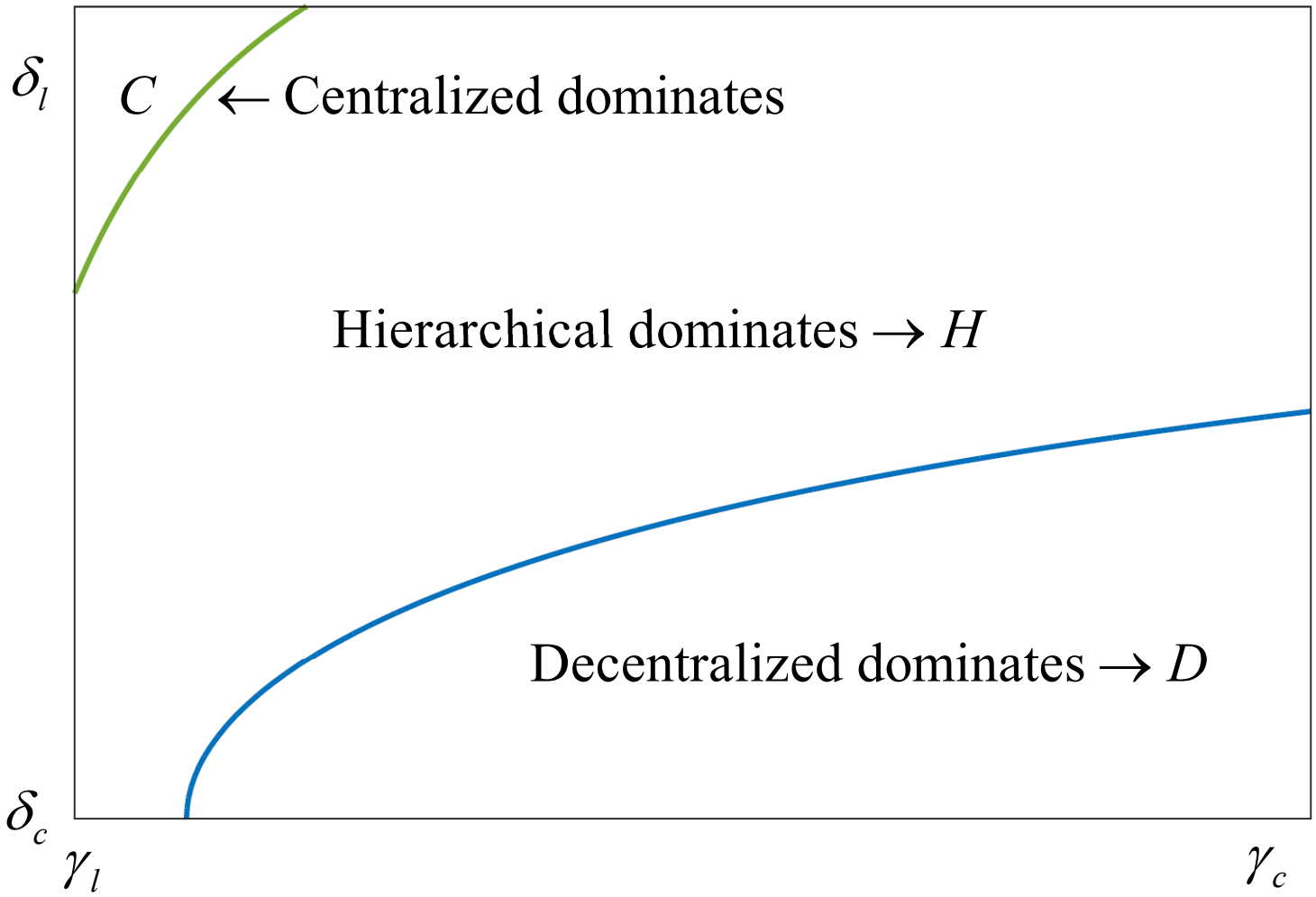
- Supervisory cost of central supervisor γ_c (relative to γ_l)

  → Rationale for keeping decisions at local level

Main result

- Hierarchical model dominates decentralized model when
  - → Liquidation cost of local supervisor δ_l is high
  - → Supervisory costs of central supervisor γ_c are low
- Centralized model dominates hierarchical model when
  - → Liquidation cost of local supervisor δ_l is much higher
  - → Supervisory costs of central supervisor γ_c are much lower

Optimal institutional design



Comparative statics

- Increase in expected asset return $\overline{R}$

  → Related to extent of banking competition

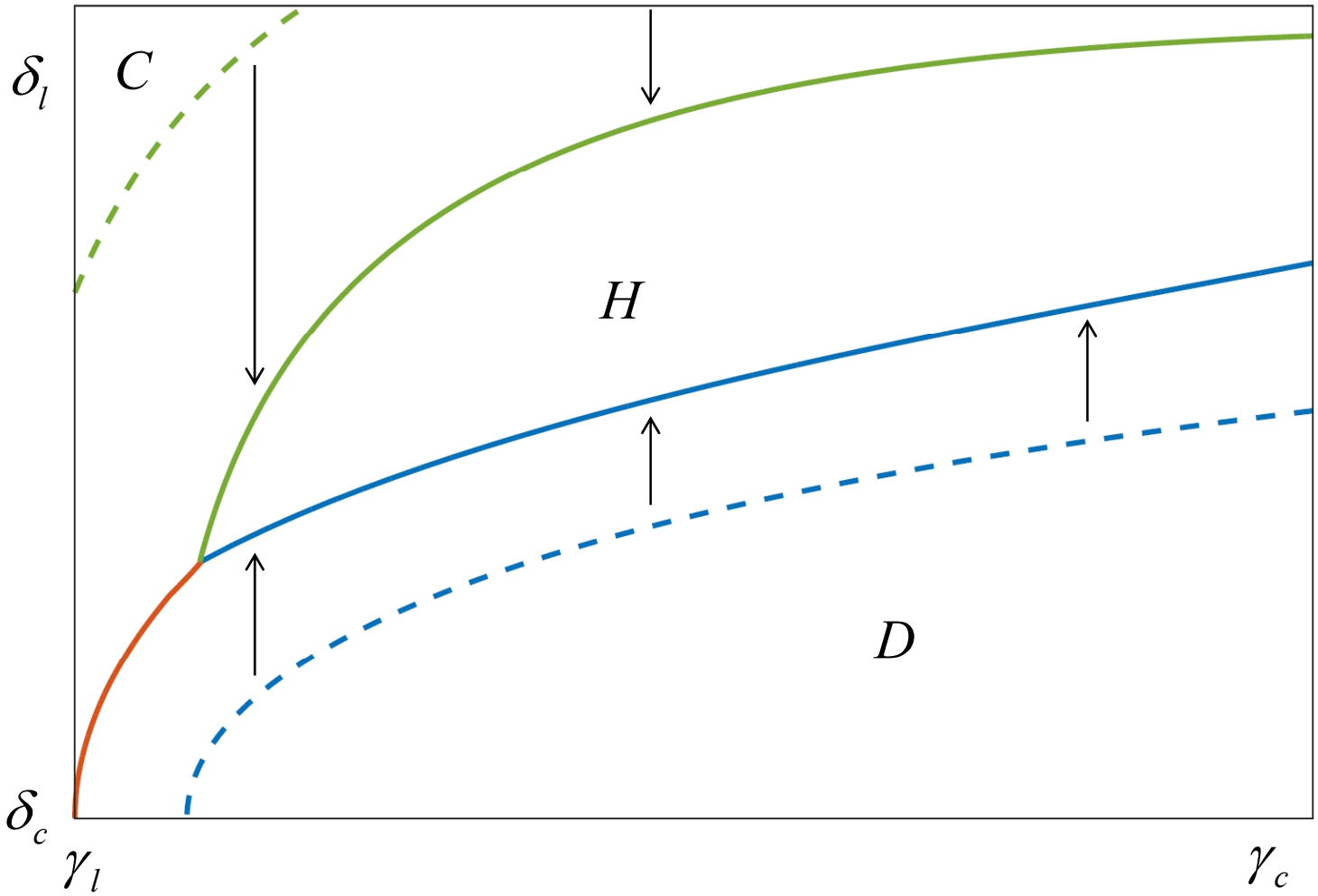
  → Or favorable macroeconomic conditions

- Decrease in volatility of asset return σ

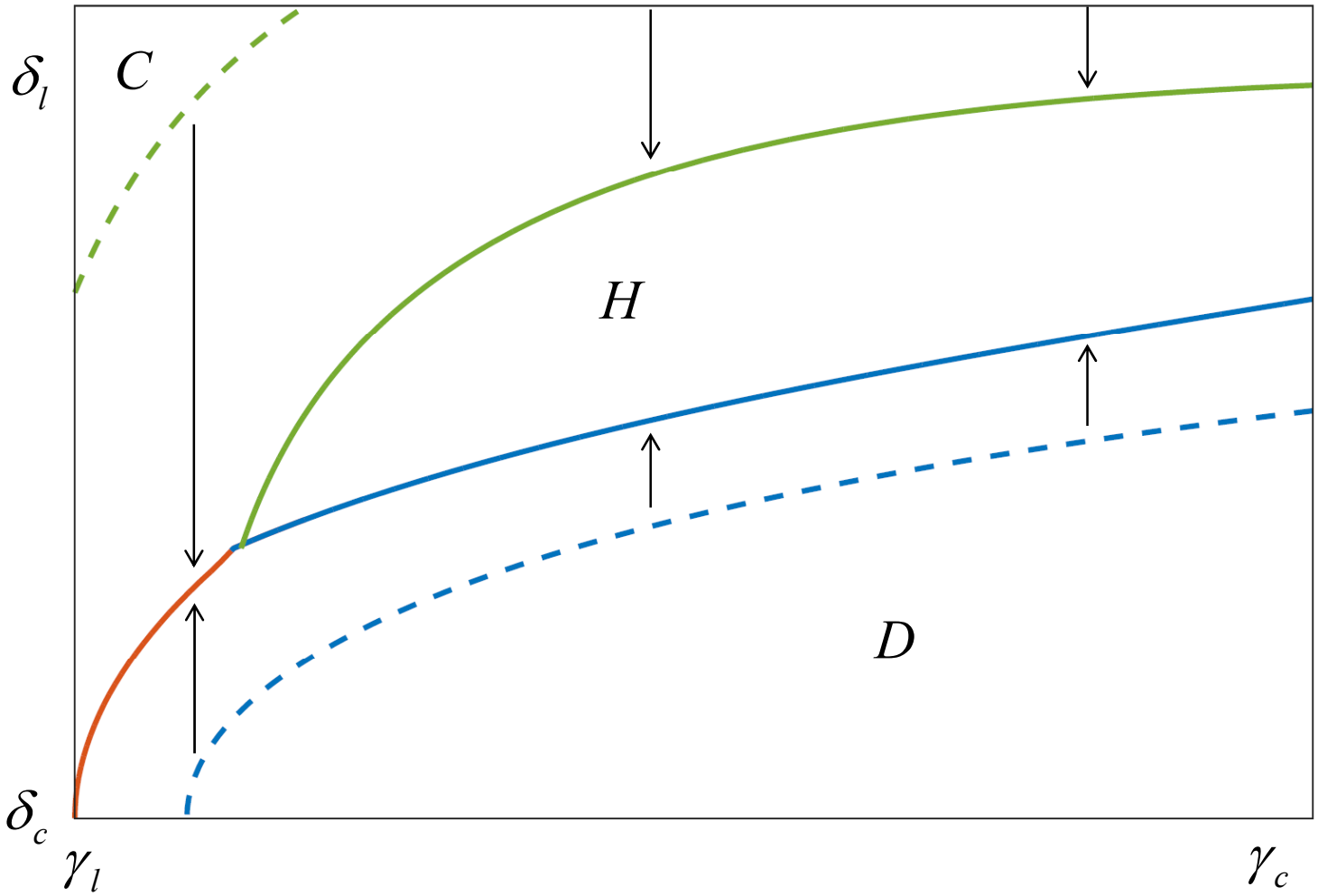
  → Possibly related to tightening prudential requirements

  → But choice of bank risk is not modeled

Increase in expected asset return



Decrease in volatility of asset return



Summing up

- Hierarchical supervision less likely to dominate when
  - → Bank profitability is high (low competition)
  - → Bank risk-taking is low (tough regulation)

Part 4

Limiting size of central supervisor

“It is always optimal for the firm to be in a situation of overload so as to credible commit to rewarding initiative.”

Aghion and Tirole (1997)

Central supervisor as Stackelberg leader

- If central supervisor were a Stackelberg leader

  → Central supervisor would reduce its effort e_c

  → Local supervisor would increase its effort e_l

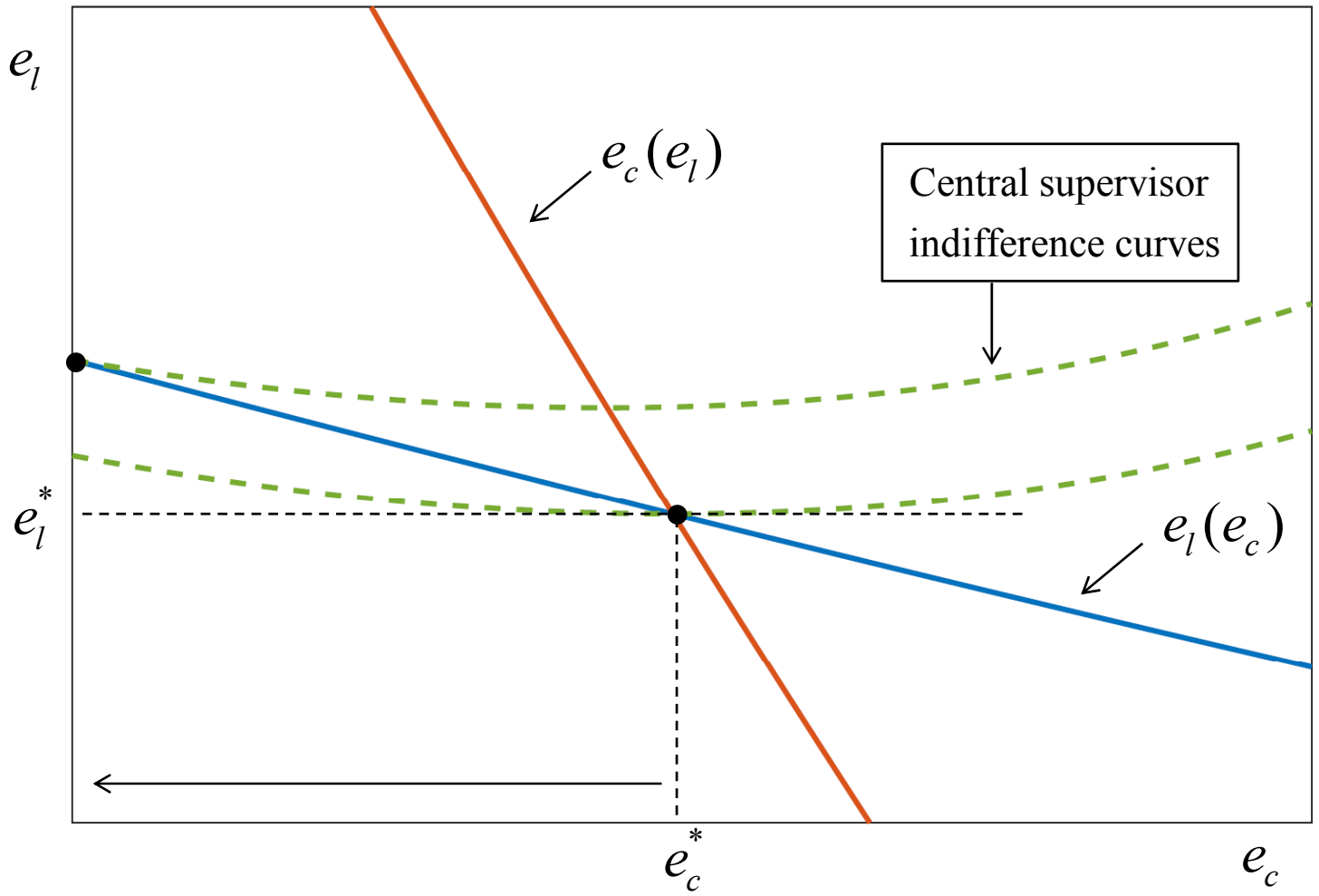
  → Central supervisor would be better off

- Intuition

  → Maximizing over the reaction function of local supervisor

  → Instead of responding to its (Nash) choice of effort

Central supervisor as Stackelberg leader



Limiting size of central supervisor

- How can central supervisor commit to exert lower effort

  → Limiting its size, so $e_c \leq \overline{e}_c$

- Would this be socially optimal? → Yes!

  → Even though central supervisor does not maximize welfare

Why would it be socially optimal?

- Given social welfare function

$$w(e_c, e_l) = v_c(e_c, e_l) - c_l(e_l)$$

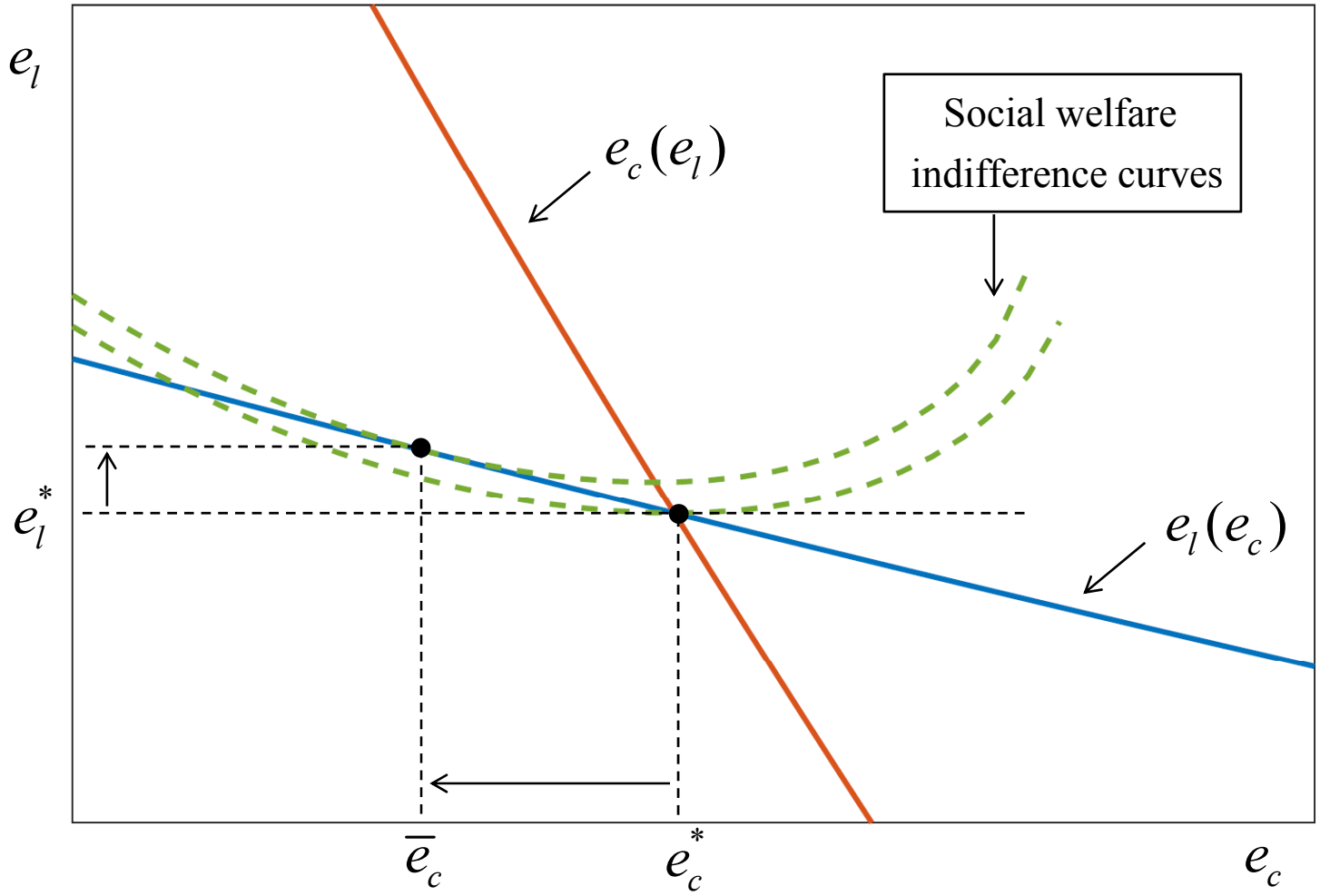
→ We have

$$\frac{\partial}{\partial e_c} w(e_c^*, e_l^*) = \underbrace{\frac{\partial}{\partial e_c} v_c(e_c^*, e_l^*) = 0}_{\text{Nash equilibrium}}$$

→ Reducing central supervisory effort increases welfare!

→ Central supervisor's objectives aligned with society's objectives in costs and benefits of its effort

Limiting size of central supervisor



Concluding remarks

Summing up

- Construct model of hierarchical supervision
  - → Central and local supervisor choose supervisory efforts
  - → Signal on quality of bank's assets
  - → Central supervisor decides on early liquidation
- Compare it with two alternative arrangements
  - → Decentralized supervision: Local supervisor in charge
  - → Centralized supervision: Central supervisor in charge

Main results

- Moving supervision to central authority dominates when
  - → Possible capture of local supervisor is a concern
  - → Cost of getting local knowledge is low
- Going from decentralized to hierarchical to centralized
- Under hierarchical supervision
  - → Limiting size of central supervisor is socially optimal

Implications

- Results are line with design of Single Supervisory Mechanism

  → Capture may be more likely for large banks

  → Large banks supervised by ECB

- Results point to possibility of getting rid of local supervisor

  → When cost of getting local knowledge is sufficiently low

  → A longer run prospect

- Meanwhile, limiting size of central supervisor may be good

Final comments (i)

- Model of hierarchical supervision is isomorphic to model where

  → Central supervisor gets signal

$$s_c = R + \varepsilon_c \text{ with } \varepsilon_c \sim N(0, \sigma^2 / e_c)$$

  → Local supervisor gets signal

$$s_l = R + \varepsilon_l \text{ with } \varepsilon_l \sim N(0, \sigma^2 / e_l)$$

  → Local supervisor truthfully reports s_l to central supervisor

- Institutional design where supervisors work independently

  → But no problem of strategic information transmission

Final comments (ii)

- Model assumes that liquidation cost is driven capture
  - → What if (part of it) is also a social cost?
  - → Biased supervisor may be better than unbiased supervisor
  - → Larger region where decentralized supervision dominates
- Model assumes that bank is completely passive
  - → Interesting to endogenize bank's choice of risk
  - → Effects of regulation and supervision on risk-taking
  - → Is there a trade-off between regulation and supervision?

Final comments (iii)

- Model is static, but could think of dynamic implications
  - → In good times supervisors might reduce capabilities
  - → Not able to increase effort when bad times arrive
  - → (Involuntary) supervisory forbearance
- Model focuses on supervision of a domestic bank
  - → Interesting to explore the case of an international bank