Organizational Theory and Decision Making

Part I: Foundations and Boundaries of Organizations

Christian Zehnder
Department of Management
HEC, University of Lausanne
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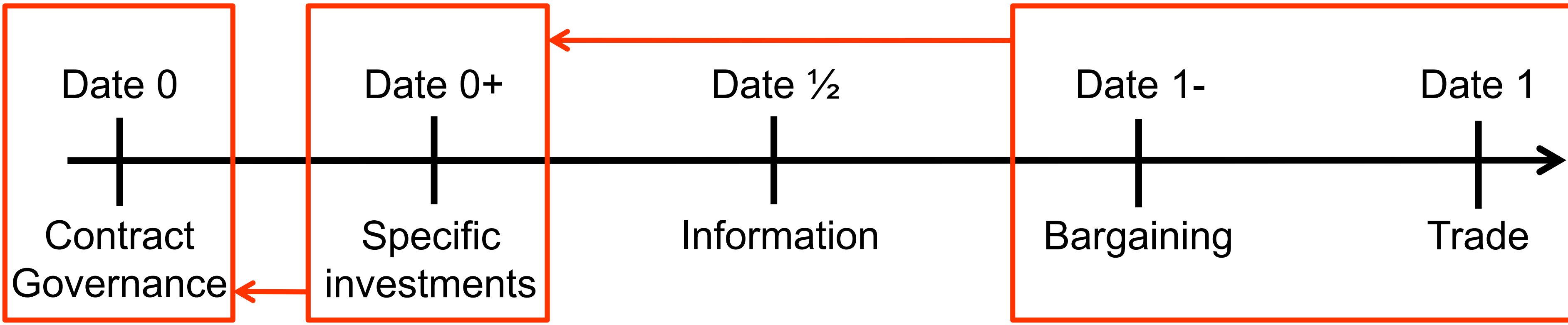
Part I.B:
The Property Rights Approach

Video 3:
Solving the Model

Solving the Model

- Structure of the model:



- We solve the model backwards:
  - We start with the bargaining and trade stages (Date 1 & Date 1-) and determine the ex-post outcome for given investments i,e
  - Then we move to the investment stage (Date 0+) and determine the investment choices under the assumption that the parties anticipate the ex-post outcome
  - Last we look at the governance structure (Date 0) and determine the conditions under which NI, FI, or BI are optimal

Solving the Model (1): Coasian Bargaining

- We take investments (i,e) as given and only look at ex-post payoffs (i.e., payoffs net of investments)
- Firm 1 and Firm 2 will never accept a payoff which is lower than the payoff they can get on the market
  - Firm 1: $r(i,A) - \overline{P}$
  - Firm 2: $\overline{P} - c(e,B)$
- We assume that the gains from trade are divided 50:50 (Nash Bargaining, symmetric Hold-Up)
  - Firm 1: $r(i,A) - \overline{P} + ½[R(i) - C(e) - r(i,A) + c(e,B)]$
  - Firm 2: $\overline{P} - c(e,B) + ½[R(i) - C(e) - r(i,A) + c(e,B)]$
- Solving for P yields the following bargaining outcome:

  $P = \overline{P} + ½[R(i) - r(i,A)] - ½[c(e,B) - C(e)]$

Note: Derivation of P

- How is P derived on the previous slide:
  - We assume that in the case of trade Firm 1 gets his return minus the price he has to pay to Firm 2

    Payoff Firm 1 = R(i) – P
  - We have assumed that this must be equal to his outside option plus half of the difference between the surplus of trade and the surplus of no-trade

    Payoff Firm 1 = $r(i,A) - \overline{P} + \frac{1}{2}[R(i) - C(e) - r(i,A) + c(e,B)]$
  - Now, we simply equalize these terms:

    $R(i) - P = r(i,A) - \overline{P} + \frac{1}{2}[R(i) - C(e) - r(i,A) + c(e,B)]$

    $P = R(i) - \{r(i,A) - \overline{P} + \frac{1}{2}[R(i) - C(e) - r(i,A) + c(e,B)]\}$

    $P = \overline{P} + \frac{1}{2}[R(i) - r(i,A)] - \frac{1}{2}[c(e,B) - C(e)]$

Doing the same thing for Firm 2 leads, of course, to the same result

Solving the Model (2): Trade

- Since trade is efficient and the parties split the gains from trade, each party earns more than on the outside market
  - Firm 1 and Firm 2 always trade
  - This generates the maximal surplus (given i and e)
- The outcome is independent of the ownership structure
  - Total surplus is always R(i) – C(e)
- The ownership structure defines how the surplus is divided between the firms
  - The more assets a firm owns, the stronger its bargaining position (better alternative available)
  - The stronger the bargaining position, the larger the share of the surplus the firm can obtain

Note: Absence of Bargaining Costs

- This is now the place where you can see why it is difficult to model bargaining costs
  - In the presence of specific investments both parties know that there is always a price which makes both of them better off than their outside-options
  - Of course, you can assume that it is costly to agree on such a price → Firm 1 fights for a low price and Firm 2 fights for a high price and both of them waste resources in the bargaining process
  - The problem is that rational players would foresee this problem and anticipate the outcome → Thus, they would avoid the bargaining and directly jump to the outcome (Coase Theorem)
  - Now, you can say that it is unrealistic to assume that people are so rational or that other motives may also play a role → This is certainly true, but then we need to model this
  - We will see an example of such a model later in the course

Solving the Model (3): Efficiency Benchmark

- Before we solve for the profit-maximizing relationship-specific investments of Firm 1 and Firm 2, we first derive the investments that would maximize efficiency
- This is helpful because it serves as a benchmark relative to which the actual investments can be compared
- The efficient investments maximize the total surplus (including the investments themselves)
- First-best investments:

  $\max R(i) - C(e) - i - e$

Solving the Model (3): Efficiency Benchmark

- First-best investments: Maximize total surplus (TS)

  max TS = R(i) – C(e) – i – e

- First-order condition for investment i:

  $$\frac{\partial TS}{\partial i} = R'(i) - 1 = 0$$

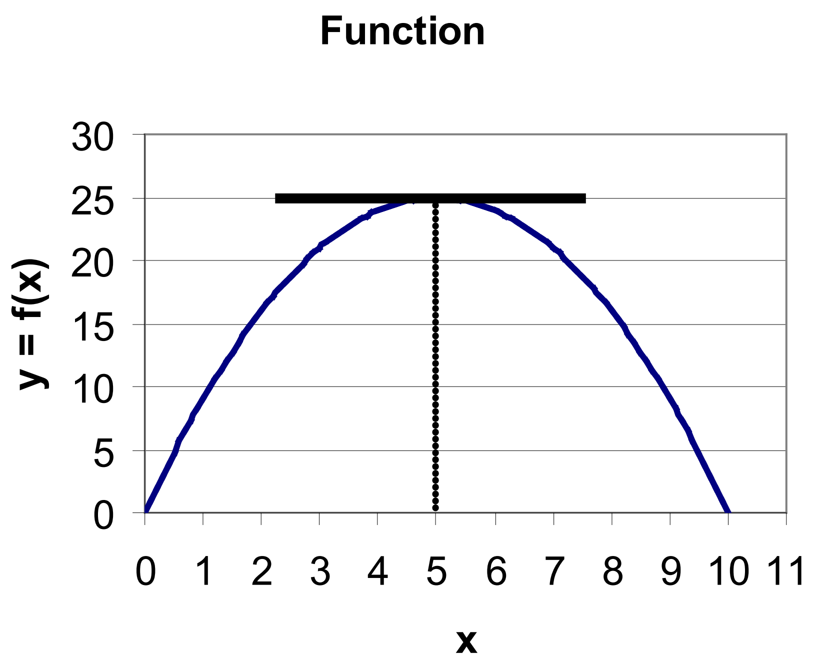
  Efficient investment i**: R'(i**) = 1

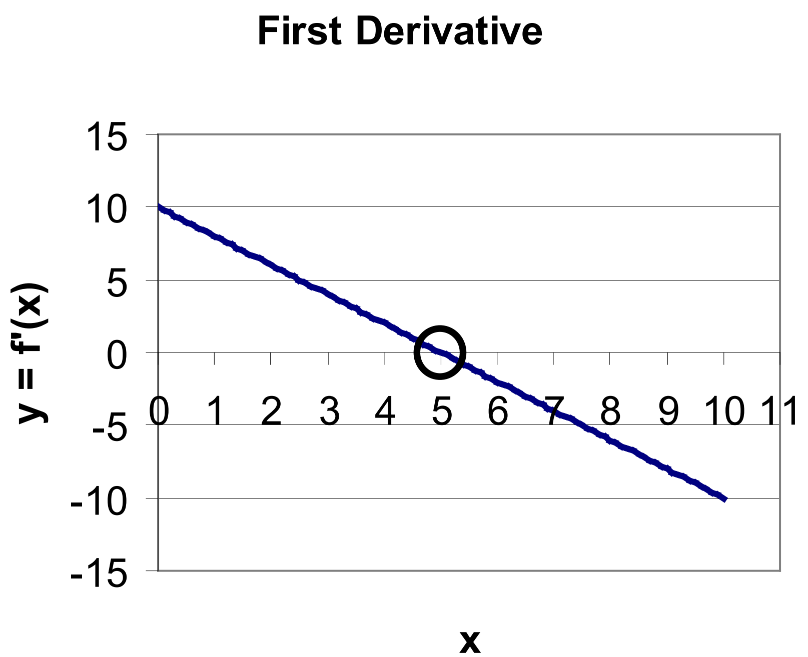
- First-order condition for investment e:

  $$\frac{\partial TS}{\partial e} = -C'(e) - 1 = 0$$

  Efficient investment e**: C'(e**) = –1

Note: First Order Conditions





- $y = f(x) = 25 - (x - 5)^2$
- $f'(x) = -2x + 10$

- FOC: $f'(x) = 0 \rightarrow x = 5$

Solving the Model (4): Profit Maximization

- Firm 1 and Firm 2 do not choose investments to maximize efficiency (the sum of payoffs), but each of them maximizes his own payoff

- Since both payoffs depend on both investments, this is not the same maximization problem

- In particular, the firms do not take into account that their investment also influences the profit of the other firm

- Profit Maximization:

Firm 1: $\max\ r(i,A) - \overline{P} + \frac{1}{2}[R(i) - C(e) - r(i,A) + c(e,B)] - i$

Firm 2: $\max\ \overline{P} - c(e,B) + \frac{1}{2}[R(i) - C(e) - r(i,A) + c(e,B)] - e$

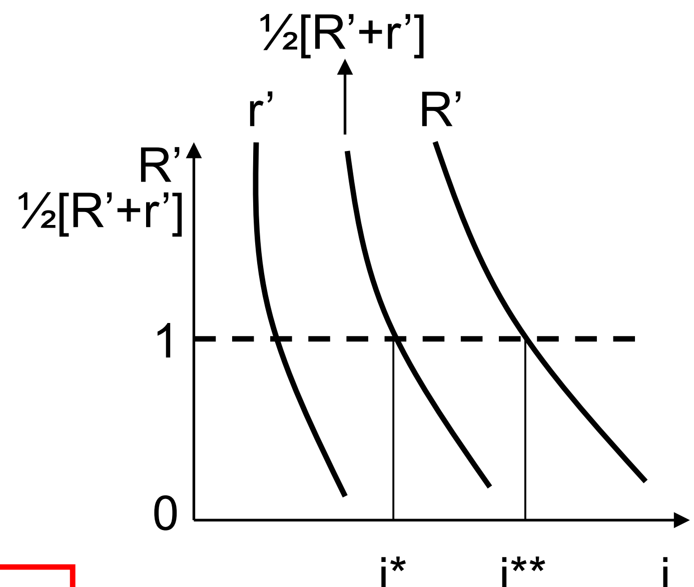
Solving the Model (4): Profit Maximization (1)

- Profit Maximization of Firm 1:

$$\max \ \Pi^1 = r(i,A) - \overline{P} + ½[R(i) - C(e) - r(i,A) + c(e,B)] - i$$

$$\frac{\partial \Pi^1}{\partial i} = r'(i,A) + \frac{1}{2}\left[R'(i) - r'(i,A)\right] - 1 = 0$$

$$\frac{\partial \Pi^1}{\partial i} = \frac{1}{2}\left[R'(i) + r'(i,A)\right] - 1 = 0$$



F1's investment:

i*: ½[R'(i*) + r'(i*,A)] = 1

First best investment:

i**: R'(i**) = 1

$\boxed{i^* < i^{**}}$

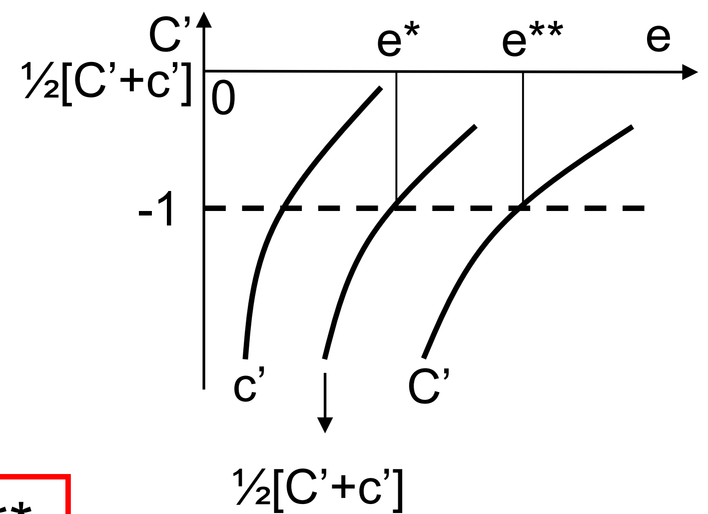
Solving the Model (4): Profit Maximization (2)

- Profit Maximization of Firm 2:

$$\max \ \Pi^2 = \overline{P} - c(e,B) + ½[R(i) - C(e) - r(i,A) + c(e,B)] - e$$

$$\frac{\partial \Pi^2}{\partial e} = -c'(e,B) + \tfrac{1}{2}\left[-C'(e) + c'(e,B)\right] - 1 = 0$$

$$\frac{\partial \Pi^2}{\partial e} = -\tfrac{1}{2}\left[C'(e) + c'(e,B)\right] - 1 = 0$$



F2’s investment:

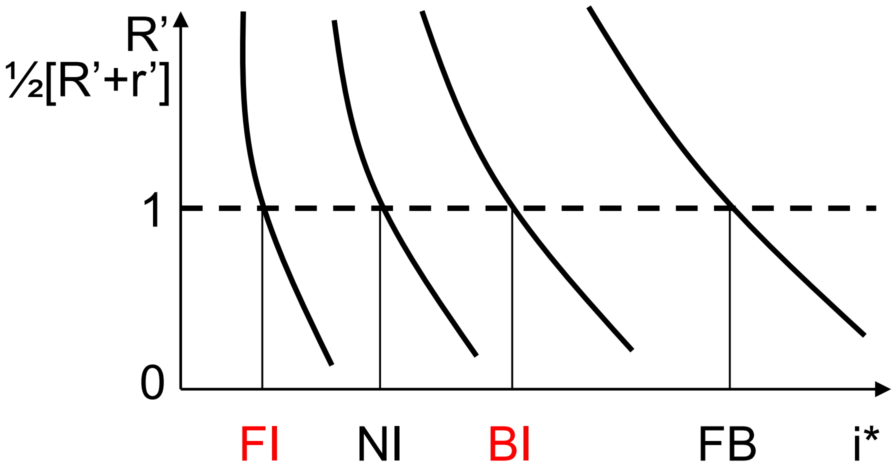
e*: ½[C’(e*) + c’(e*,B)] = –1

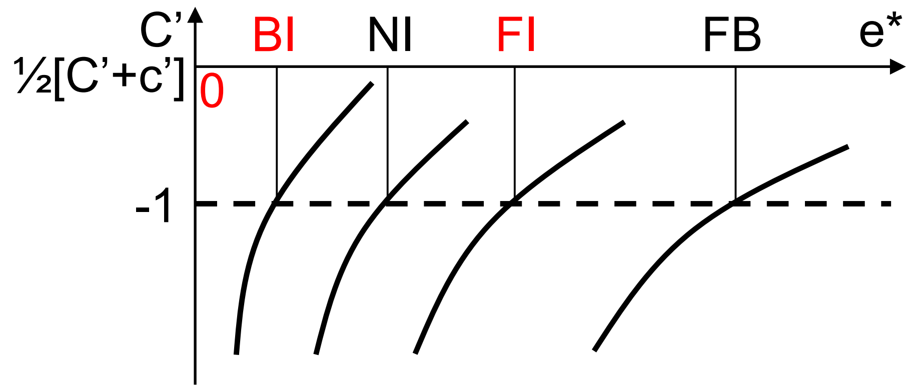
First best investment:

e**: C’(e**) = –1

$\boxed{e^* < e^{**}}$

Result 1: Ex-ante Underinvestment





NI: Non-Integration / FI: Forward Integration / BI: Backward Integration

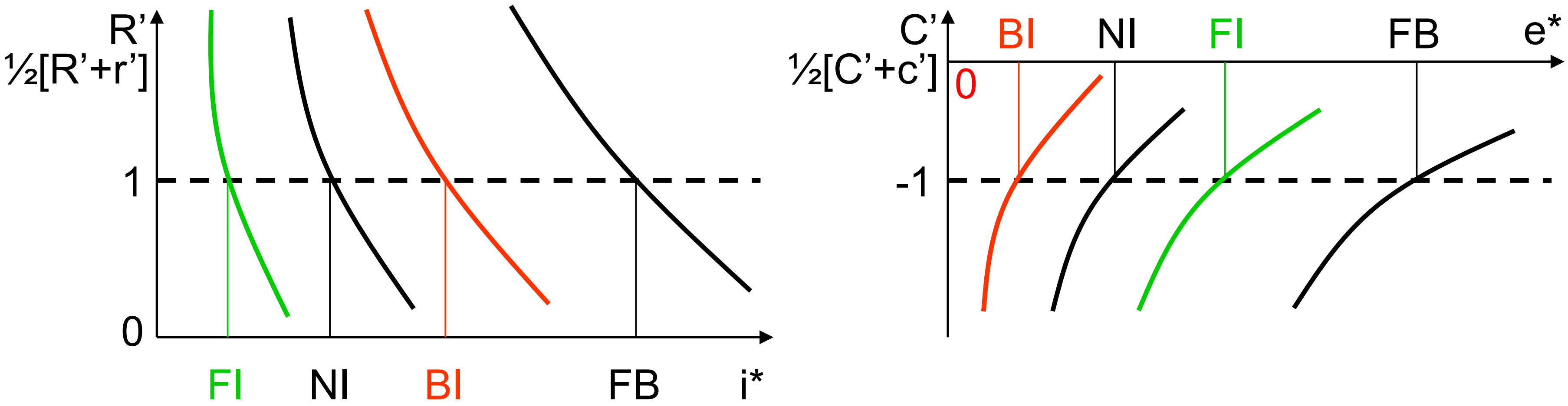
- Both firms always underinvest relative to the first best

  Intuition: If a firm increases its ex-ante investment, part of the returns go to the other firm through ex-post bargaining

- The more assets a firm has, the more the firm invests

  Intuition: More assets mean that the firm's investment has a stronger positive effect on its bargaining position

Result 2: The Effects of Vertical Integration



NI: Non-Integration / FI: Forward Integration / BI: Backward Integration

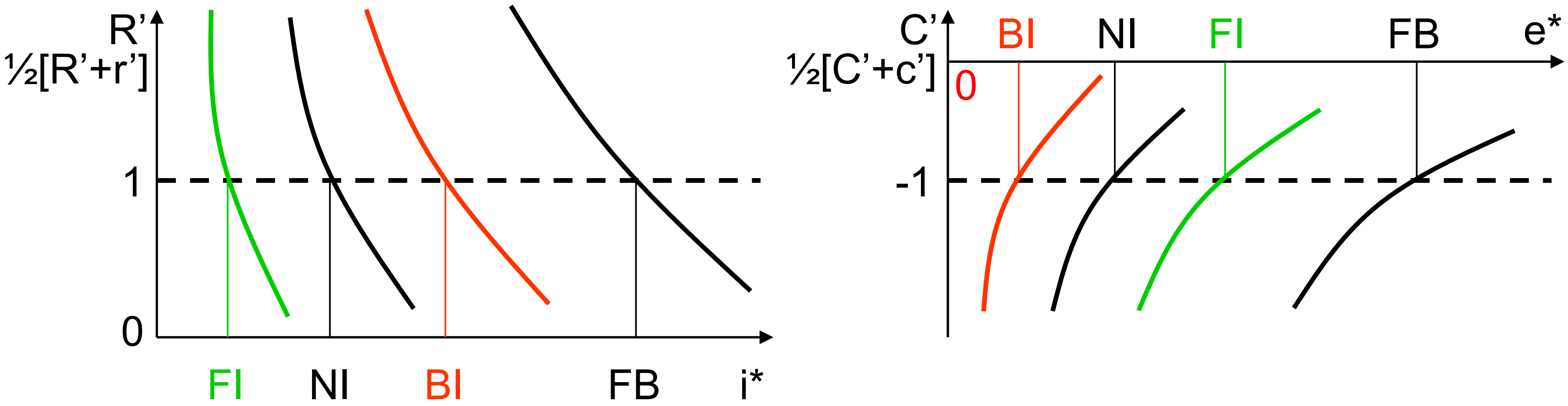
- Vertical integration increases investment incentives for one firm, but decreases investment incentives for the other firm

  Intuition: The bargaining position of one firm becomes stronger, the bargaining position of the other firm becomes weaker

Solving the Model (5): Governance Structure

- Results 1 & 2 imply that the governance structure (asset ownership) influences the investment behavior of both firms
- This allows us now to study the conditions under which vertical integration and non-integration are optimal

Result 3: Optimal Ownership Structure (1)

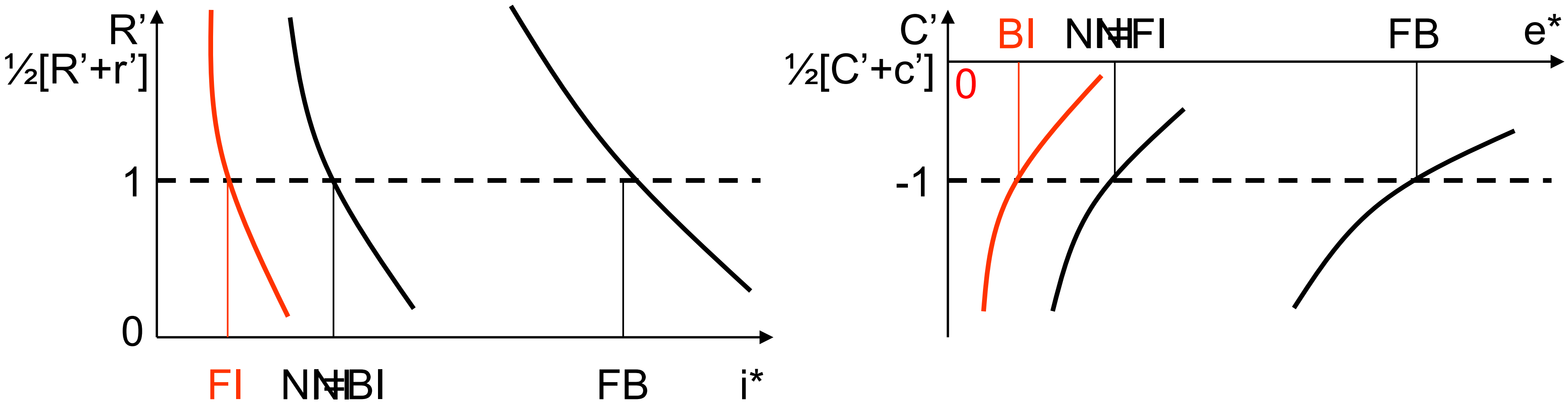


NI: Non-Integration / FI: Forward Integration / BI: Backward Integration

- If one firm's investment is very important, this firm should own all the assets

  Intuition: Vertical integration increases the investment of one firm, but lowers the investment of the other firm. If the higher investment overcompensates, the damage of the lower investment, integration is optimal.

Result 3: Optimal Ownership Structure (2)

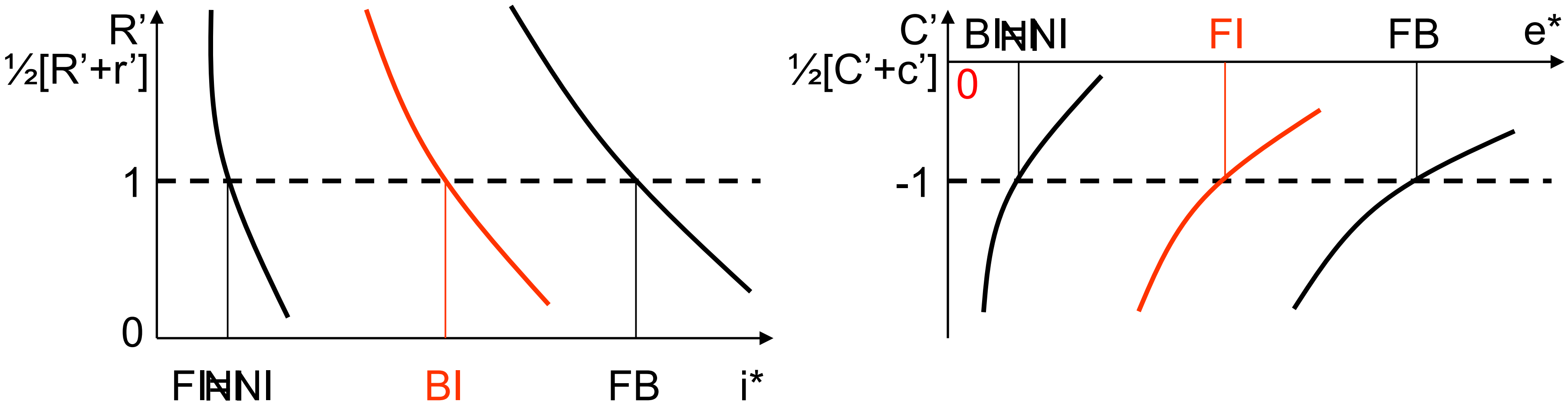


NI: Non-Integration / FI: Forward Integration / BI: Backward Integration

- If assets are independent non-integration is optimal

  Intuition: Independence of assets means that control over a2 is not helpful for Firm 1 and control over a1 is not helpful for Firm 2. In this case vertical integration decreases the investment incentives of one firm without increasing the incentives for the other firm.

Result 3: Optimal Ownership Structure (3)

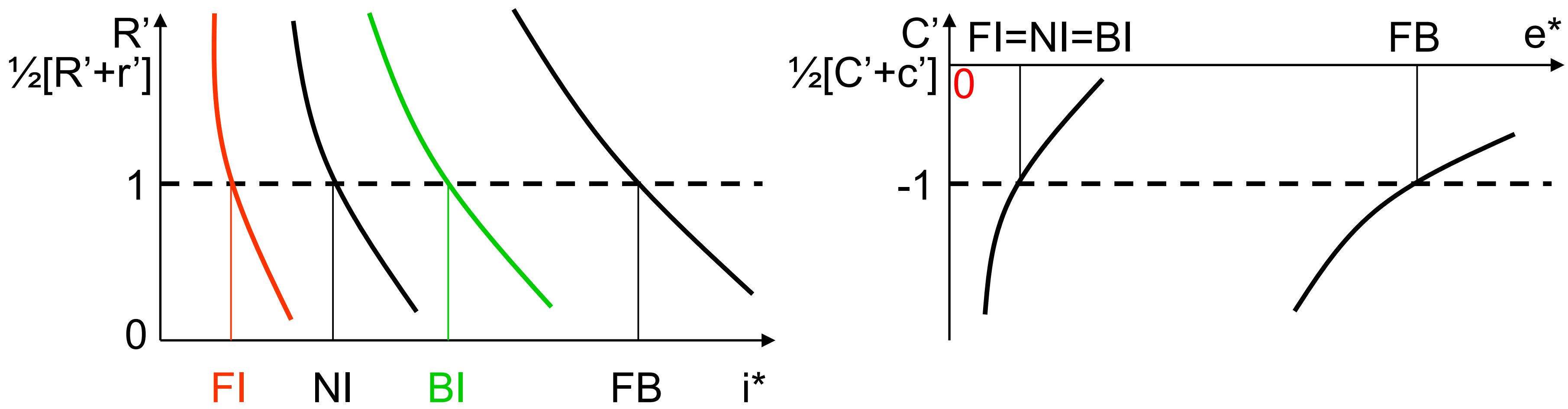


NI: Non-Integration / FI: Forward Integration / BI: Backward Integration

- If assets are perfect complements integration is optimal

  Intuition: Perfect complements means that the assets are only helpful if used together. In this case integration helps, because it increases the incentives to invest for one firm without lowering the incentives for the other firm.

Result 3: Optimal Ownership Structure (4)



NI: Non-Integration / FI: Forward Integration / BI: Backward Integration

- If the human capital of one of the firms is essential, this firm should own both assets

  Intuition: If the assets are useless without Firm 1's human capital, then only Firm 1's incentives increase with more assets. Firm 2's incentives do not depend on ownership.