



Konferenz Kommunales Infrastrukturmanagement

Biased Quality Investment and Organisational Structures –
An Application to the Railway Industry

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Motivation

1 Organisational Structures

- Vertical structures still a hot topic for network industries
- EU legislation requires at least accounting separation for the Railway Industry (Directive 91/440)
- Literature focuses mainly on complete vertical integration and separation

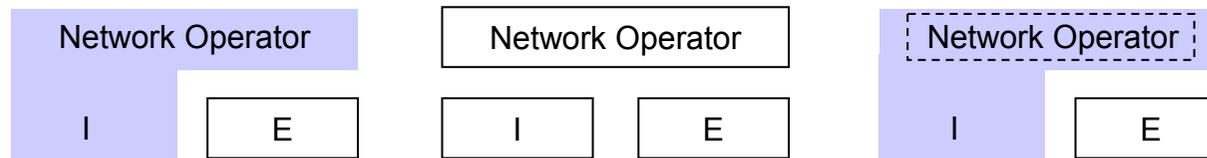
2 (Biased) Quality Investments

- Network investments of overwhelming importance (up to 60% of total industry cost)
- Upgrading tracks often favours one transportation mode (e.g. high-speed tracks)
- Higher network quality may attract new consumers, but may be considered as a form of discrimination

Background – Organisational Structures

- Crémer/ Cremer/ De Donder (2006): Introduce legal unbundling to economic theory and find that legal unbundling creates highest investment incentives in a homogeneous goods context
- Höffler/ Kranz (2007a/b): Use a similar framework with a focus on sabotage incentives and find that quantities on the network are highest under legal unbundling
- The different organisational forms are modelled as follows:

Vertical Integration (VI) Ownership Unbundling (OU) Legal Unbundling (LU)



I Incumbent
E Entrant

I do not refer to the literature on investments.

Contribution

- **Horizontal product differentiation**
 - linear quadratic utility function (with a differentiation parameter varying between 0 and 1)
 - to capture the demand increasing effect of product differentiation
 - to represent different transportation modes

- **Vertical product differentiation**
 - Induced by the investment of the network operator (**biased investment**)
 - Increases the willingness to pay for the services of one of downstream companies, e.g. high-speed services

Contribution – the Modeling Specification

- **Horizontal product differentiation**
 - linear quadratic utility function (with a differentiation parameter varying between 0 and 1)
 - to represent different transportation modes
- **Vertical product differentiation**
 - through the investment in the network (**biased investment**)
 - Increases the willingness to pay for the services of one of downstream companies, e.g. high-speed services



$$U = (1 + x)q_I + q_E - \frac{q_I^2}{2} - \frac{q_E^2}{2} - s q_E q_I$$

Vertical differentiation induced by the biased upstream investment

Horizontal differentiation (0 ≤ s ≤ 1)

The Model

- **Demand** is derived from the linear quadratic utility function
- **Supply:**
 - Upstream network operator with quadratic investment cost function for the quality investment
 - Two symmetric downstream service providers
 - Note: no extra cost for high quality supply on the downstream level
 - Note: uniform and linear access charge: a reflects the investment cost
 - Assumption: Very small amount of market entering cost for the entrant
- **Bertrand** competition
- 2 or 3 stage game: **without** (benchmark) and **with regulator** (full commitment)

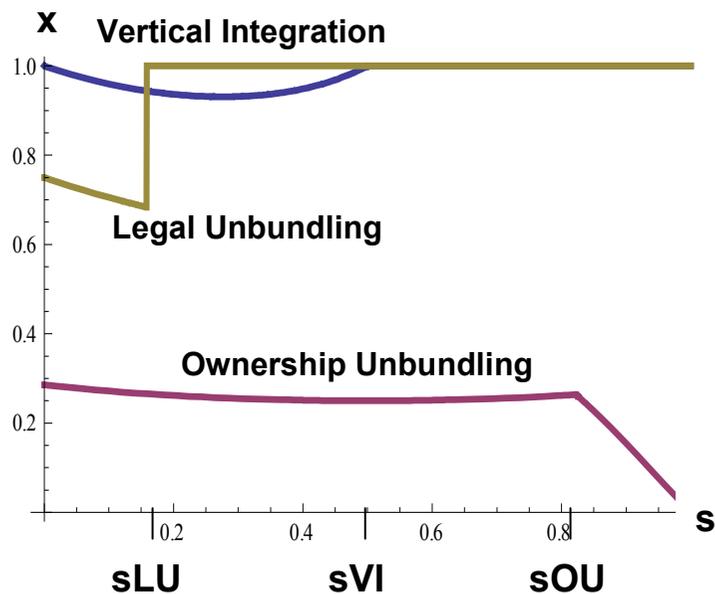


The Basic Trade-Off

The network operator must balance the trade-off between investing and **favouring the incumbent** (increasing quantities) and **putting the entrant at a disadvantage** (decreasing quantities) at the same time.

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- Does investment lead to foreclosure?
 - What level of investment is reached?
 - (What is the resulting welfare level?)

No Regulation: Results (2/2): Investments are Higher under VI and LU than under OU



Ownership Unbundling

- Lower investment level because of double marginalisation
- For $s > s_{OU}$, investment is reduced to keep the entrant in the market and to keep competition viable

Vertical Integration

- High level of investments and low access charge (not depicted): investment is chosen to maximise own downstream profits, the access charge to maximise profits from selling access (two instruments)

Legal Unbundling

- Lower level of investment for $s < s_{LU}$ compared to VI because upstream company maximises its profits only by considering revenue generated by the access charge
- Trade-off: Higher investments \rightarrow higher access charge \rightarrow higher (less) revenue from the incumbent's (entrant's) downstream unit

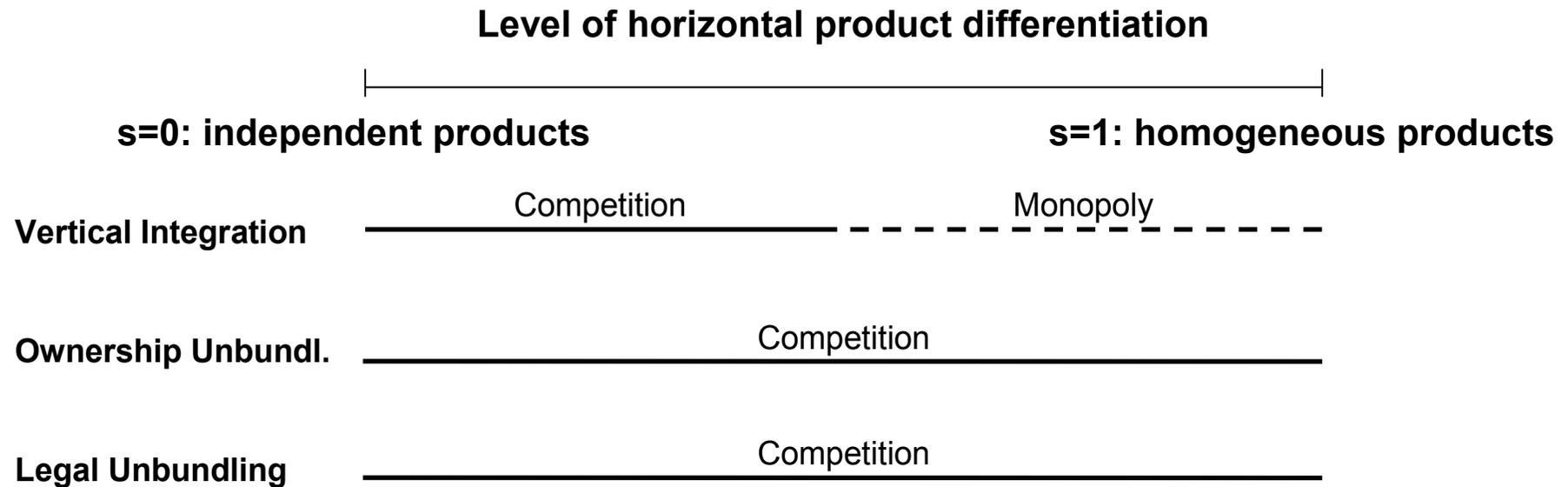
Regulation:

Break-even Regulation with Full Commitment

- Regulator sets the **access** charge by maximising welfare (consumer surplus and profits) under a **break-even constraint** for the network operator
- Two-stage game becomes a three-stage game: **regulatory decision as first step in the maximisation problem** → full commitment

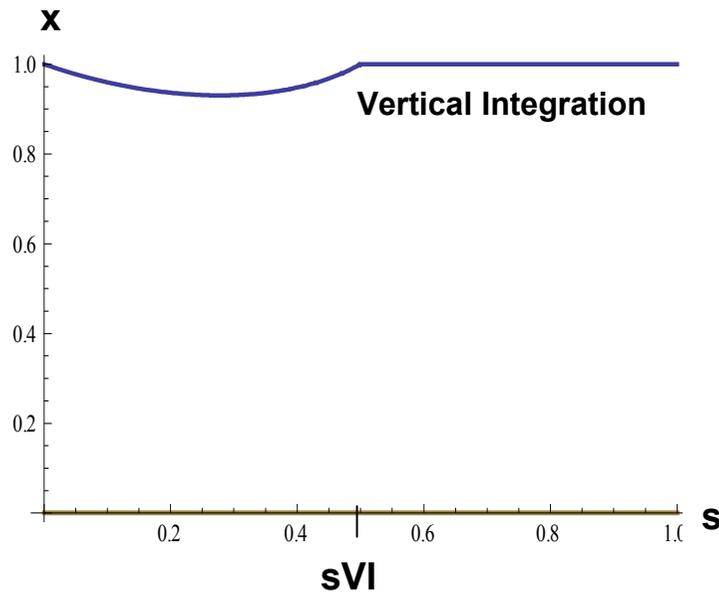
Regulation: Results (1/2):

Under OU and LU there is no Foreclosure



- No incentive to foreclose for sufficiently highly differentiated products under VI
- Trade-off between selling access and increased competition under VI
- No possibility to foreclose under OU and LU since the access charge is regulated down to zero so that there is no investment

Regulation: Results (2/2): Under OU and LU Investments are Crowded Out



■ Vertical Integration

- Investments nearly unchanged compared to non-regulated benchmark
- Reason: Most profit is made in the downstream market even without regulation

■ Legal Unbundling=Ownership Unbundling

- No investment since the regulator does not allow a mark-up on the marginal cost
- Consequences: stronger competition in the downstream market compared to the benchmark case (Bertrand competition: prices as strategic complements)
- LU: No investment although this could increase integrated profit but network operator only considers own profit

Conclusion

- Accounting for **product differentiation** and **demand-increasing investments** changes conclusions compared to CCD (2006) und HK (2007a/b):
 - Without regulation, **VI** and **LU** generate **highest investment** and **welfare**, but the **entrant is foreclosed** for some levels horizontal product differentiation
 - With regulation, a **VI** regime is **superior** to LU and OU with respect to investment and welfare, although there is always competition under LU and OU
- Possible **extensions**:
 - Price discrimination
 - Sabotage

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Literature

- **Unbundling**

- **Cremer, Helmuth/ Crémer, Jacques/ De Donder, Philippe (CCD (2006))**: Legal vs Ownership Unbundling in Network Industries, CEPR Discussion Papers 5767, C.E.P.R. Discussion Papers.
- **Höffler, Felix / Kranz, Sebastian (HK (2007a))**: Legal Unbundling can be a Golden Mean between Vertical Integration and Separation, Bonn Econ Discussion Papers 15/2007.
- **Höffler, Felix / Kranz, Sebastian (HK (2007b))**: Imperfect Legal Unbundling of Monopolistic Bottlenecks, Bonn Econ Discussion Papers 16/2007.

- **Investments**

- **Buehler, Stefan/ Schmutzler, Armin/ Benz, Men-Andri (2004)**: Infrastructure quality in deregulated industries: is there an underinvestment problem?, International Journal of Industrial Organization 22 (2), pp. 253-267.
- **Foros, Oystein (2004)**: Strategic investments with spillovers, vertical integration and foreclosure in the broadband access market, International Journal of Industrial Organization, 22 (1), pp. 1-24.
- **Vareda, Joao (2007)**: Unbundling and Incumbent Investment in Quality Upgrades and Cost Reduction, FEUNL Working Paper Series, No. 526.