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

Benjamin Pakula & Georg Götz
Justus Liebig Universität Gießen

Research Question

The paper analyses the investment incentives in vertically related network industries under (1) different organisational structures if upstream (2) investment are highly biased towards one of the downstream firms.

(1) Organisational Structures in Network Industries

- EU legislation prescribes at least accounting separation for the railway market:
  "*The aim of this Directive is to facilitate the adoption of the Community railways to the needs of the Single Market and to increase their efficiency; [...] by separating the management of railway operation and infrastructure from the provision of railway transport services, separation of accounts being compulsory and organizational or institutional separation being optional, [...].*" (Directive 91/440).
  → A lot of different regimes are conceivable.
- Focus in the literature mainly on vertical integration and vertical separation
- Rare exceptions: Crémer/ Cremer/ De Donder (2006) and Höffler/ Kranz (2007): Both introduce legal unbundling to economic theory in a context with homogeneous goods.
- Here: **differentiated goods**

(2) Biased Quality Investments

- In general, upgrading railway tracks often favours one transportation mode.
- Upgrading tracks for the supply of high-speed rail can be interpreted as favouring the incumbent service provider because it has a lead over the entrants concerning the use of high-tech products.
- Investment incentives under different organisational structures in the literature: Buehler et al (2004), Foros (2004) and Vareda (2007) among others.
- Here: biased investment in a **Bertrand competition regime** (similar: Foros (2004): Cournot competition).

Modeling Approach

Demand Side

- Linear quadratic utility for the representative consumer

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

where
q… quantity
s… differentiation parameter (0<= s<=1=homog. goods)
x… increase in the WTP induced by the quality investment

Supply Side

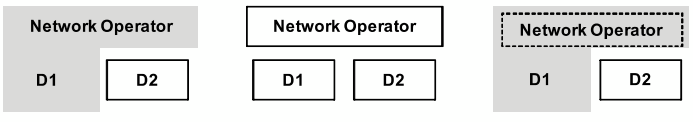
- Two uniform downstream companies with zero marginal cost, the only cost they incur is the access charge.
- One network operator with zero marginal operating cost and with quadratic investment cost.

Welfare Measures

- Consumer surplus is defined as utility net of expenditure on goods purchased.
- Total welfare is the sum of consumer and producer surplus.

Organisational Forms

- Vertical Integration (VI), Ownership Unbundling (OU), Legal Unbundling (LU).
- In case of LU, the network operator is owned by the downstream company D1, but maximises its profit as if it were independent.

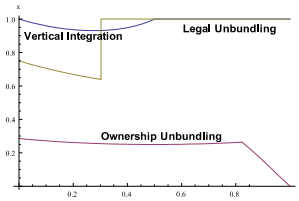


Results

- The game is played for the three organisational structures and is solved recursively (the first stage does not apply in the model without regulator):
  1. The regulator chooses the welfare-maximising access charge a under a break-even constraint for the network company.
  2. The upstream company decides on the investment level *x*.
  3. The downstream companies compete in prices (Bertrand competition).

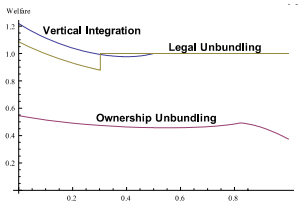
The Model without Regulator (Benchmark Case)

- **Investments** are highest under VI and LU and lowest under OU



depend on the degree of horizontal oduct differentiation;
differ under VI and LU if the entrant is in e market;
are zero under OU if downstream oducts are homogeneous.

- Investments may lead to **foreclosure** of the entrant under VI and LU as products get more similar; foreclosure never appears under OU (reason: avoid double marginalisation).
- **Welfare** (and CS) is equally highest under VI and LU



elfare under VI is higher than under LU as ng as there is no monopoly outcome under ne of the two regimes (same monopoly sults in both regimes).
U: Welfare much lower due to double arginalisation (no regulation).

The Model with Regulator

- **Investments** under VI are positive and almost at the same level as without regulation.
- Investments are crowded out under OU and LU: in the optimum the regulator does not allow a mark-up on the upstream marginal cost and sets the access charge equal to zero.
- There is never **foreclosure** under OU and LU, but foreclosure appears under VI similarly to the unregulated case.
- **Welfare** is highest under VI. This holds equally for Consumer Surplus (CS): Prices are lower and investments at almost the same level as without regulation.
- Under OU with regulation, welfare and CS are higher than without regulation: no market power due to vertical product differentiation, zero access fee, and lower consumer prices. Welfare equals CS if downstream products are homogeneous.
- Under LU, the case is reverse: the effect of the investments on the willingness to pay is stronger than the decrease in prices. Moreover, most of the profit without regulation comes from the upstream unit. This source of profit is wiped out. Consequently, welfare and CS decrease.

Conclusion

- The results from previous literature on legal unbundling do not hold necessarily when applying a differentiated product approach.
- With regulation, investments are crowded out under legal and ownership unbundling.
- In this model, ownership unbundling is always inferior to vertical integration and legal unbundling, the order of the latter depending on the level of product differentiation and on whether there is regulation or not.