The design of industry structure in a vertically related market

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SFB 649 "Ökonomisches Risiko" in Motzen

June 3-5, 2010
Outline of the Talk

- Aim of the paper
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- Basic structures of the model
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- Concluding remarks
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  - The Electricity Act of 1989 divided the CEGB of England and Wales in four public limited companies, and transmission grid activities were separated from generation.
  - BT was privatized in 1984 as a vertically integrated monopoly and only in 1995 there was the accounting separation of its operations into network and retail businesses.
  - The EC directives 2009/72 and 2009/73 provide that a transmission system owner must be independent at least in terms of its legal form from other activities. These rules do not create an obligation to separate the ownership of transmission assets from the other activities.
This discussion emphasizes that we can identify two main approaches to the problem of designing the industry structure in markets where regulated and competitive activities are vertically related:

- Ownership separation, which prohibits the upstream regulated monopolist from participating (directly or indirectly) in the downstream competitive segment.
- Legal separation, according to which upstream and downstream operations must be legally unbundled but common ownership is allowed.

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- Cremer et al. [2006] investigate the impact of these two alternative industry patterns on the incentives to invest in the network assets, but they ignore the role of the regulator.
- Höffler and Kranz [2007] compare legal unbundling to vertical integration and vertical separation, but the regulator does not have any informational problem.
We consider a vertically related industry in which two firms - one *incumbent* and one *entrant* - compete downstream.

Under legal separation, the downstream incumbent and the upstream monopolist belong to the same company, even if they are independent in terms of legal form. This implies that both firms maximize joint profits. The main difference with respect to vertical integration is that legal separation allows the agency to regulate only the monopoly earnings and the downstream firm must pay the same access charge as its rival. Ownership separation implies a stronger pattern of unbundling since upstream and downstream activities cannot be subject to the same control.

Economic literature has recognized that one of the most important benefits of ownership separation is the prevention of anticompetitive practices in the unregulated market. Vickers [1995] shows that vertical integration can complicate the regulator's critical control problem, since it increases the monopolist's incentives to overstate the access costs.
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Main Results

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- The idea is that the upstream monopolist’s greater profit from exaggerating input costs can be (at least in part) offset by the losses of the downstream branch which pays a higher access price. Consequently, a trade-off within the vertical group occurs between the incentive to overstate the input costs and the incentive to understate. This relaxes the regulator’s critical control problem and increases (expected) social welfare.
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- Ownership separation should not be necessarily thought of as the best solution to mitigate the upstream monopolist’s incentive to overstate its costs. Indeed, we find that legal separation creates countervailing incentives within the vertical group that the regulator can exploit to make society better off.
The inverse demand function in the downstream market is

$$p(Q) = \alpha - \beta Q,$$  \hspace{1cm} (2.1)

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\[ \pi_E(q_E, Q, a) = [p(Q) - c - a] q_E, \tag{2.4} \]

where \( Q \equiv q_I + q_E \). Both firms incur a payment \( a \) per unit of input to the upstream monopolist. They cannot bypass the monopolistic network, so that exactly one unit of upstream input is needed for each unit of the final product.
The upstream regulated monopolist, which provides the access to a crucial input (the network), has a profit equal to

\[ \pi_N (Q, a, S) = (a - c^u) Q + S, \]  

where \( S \) is the subsidy get via the regulatory process (see below).
Basic Structures (cont.)

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- Under legal unbundling, the downstream incumbent and the upstream monopolist constitute a single vertical group, whose aggregate profit is

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The access price $a$ and the subsidy $S$ are set by a benevolent regulator, which maximizes social welfare $W$, defined as

$$W \equiv CS + \pi_I + \pi_E + \gamma \pi_N - S,$$  \hspace{1cm} (2.7)

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Even under legal separation the regulator controls only the upstream firm, since it represents the legal entity charged with monopoly operations.
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\[ M = \{ a(\hat{c}^u), S(\hat{c}^u), \hat{c}^u \in [c_-^u, c_+^u] \}, \]

which determines the access charge \( a(\cdot) \) and the subsidy \( S(\cdot) \) to the firm as functions of its report \( \hat{c}^u \in [c_-^u, c_+^u] \), by inducing the firm to reveal honestly its private information, so that in equilibrium \( \hat{c}^u = c^u \).
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In case of acceptance, at the second stage the downstream incumbent determines its production and at the last stage another firm decides to enter the market.
The upstream monopoly has a natural incentive to *overstate* its costs if the regulator ignores asymmetric information and implements the complete-information regulatory policy. This is because a higher declared cost increases the access charge and allows the monopolist to make positive profits.
Legal Separation

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- The downstream branch benefits from an understatement of the upstream cost, since a declared lower value for $c^u$ reduces the access charge and thus increases its profit margin.
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It is evident that the vertical group faces a *trade-off* when it lies.

\[ b^u c^u < c^u (c^u) \]
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Exaggerating the input costs will be desirable when the extraprofit in the upstream market more than offsets the losses on the downstream operations. Such is the case if and only if

$$\hat{c}^u < c^*_u (c^u) .$$  \hspace{1cm} (4.1.6)

The vertical group will not report a value for $\hat{c}^u$ higher than the threshold $c^*_u (c^u)$, otherwise it would incur losses for its statement.
In Figure below the area above the bisecting (broken) line represents the case of firm’s overstatement of its costs, i.e. $\hat{c}^u > c^u$. The part of the graph under the other (solid) line captures condition (4.1.6), i.e. $\hat{c}^u < c^u(c^u)$. 

![Graph showing actual vs. declared costs](image)
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Any type of the firm (with $c^u < c_+^u$) is willing to report a cost parameter $\hat{c}^u \in (c^u, c_+^u (c^u))$ which is strictly lower than $c_+^u$. 
The *access charge* under legal separation is given by

$$\bar{a}^{LS}(c^u) = c^u - \frac{1}{2}(\alpha - c - c^u) + \frac{4}{3}(1 - \gamma)H(c^u). \quad (4.1.11)$$
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Notice that under complete information \((H = 0)\) the regulator finds it optimal to subsidize the input access \((a^{LS} < c^u)\), in order to offset the potential distortion of the (unregulated) downstream price arising from imperfect competition.
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The price is distorted above the complete-information level (equal to total marginal costs), as a consequence of the increase in the access charge.
The profit of the input monopolist, i.e. its informational rent, is given by

\[
\pi_{LS}^N = \int_{c_u}^{c^*_u} \frac{\alpha - c - \tilde{c}^u - \frac{2}{3} (1 - \gamma) H(\tilde{c}^u)}{\beta} d\tilde{c}^u.
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\]

The higher access charge implies a reduction in the total output, captured by the integrand in (4.1.18), which allows the regulator to curb the socially costly rent (if \( \gamma < 1 \)) that the monopolist extracts for its informational advantage.
Social welfare under legal separation is

\[
\overline{W}^{LS} = \frac{1}{2\beta} \left[ (\alpha - c - c^u)^2 - \frac{4}{9} (1 - \gamma)^2 H^2 (c^u) \right] + \\
- (1 - \gamma) \cdot \int_{c^u}^{c^*_u(c^u)} \frac{\alpha - c - \tilde{c}^u - \frac{2}{3} (1 - \gamma) H (\tilde{c}^u)}{\beta} d\tilde{c}^u.
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**Two elements of distortion w.r.t. complete information**

1. the first one, captured by the term in square brackets, concerns the reduction in the consumers' surplus and in the downstream firms' profits
2. the second factor, represented by the integral, refers to the part of the informational rent of the monopolist which represents a mere loss from a social-welfare point of view.
Ownership Separation: Access Charge

- The access charge under ownership separation is

\[ \bar{a}^{OS} (c^u) = c^u - \frac{1}{3} (\alpha - c - c^u) + \frac{4}{3} (1 - \gamma) H(c^u). \]  

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- To reach its objective of minimization of allocative inefficiency downstream, the regulator can (indirectly) affect only the entrant’s output under legal separation, while it can manipulate both quantities under ownership separation, and so here the need for subsidizing the access service is lower.
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- The regulator applies the same distortion in response to asymmetric-information.
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- The regulator applies the same distortion in response to asymmetric-information.

- As we will see, the rationale is that ceteris paribus - that is, before considering the different impact of the two regulatory policies on the quantities produced - the regulator’s need for distorting the price upwards is actually higher under ownership separation.
The monopolist’s profit is given by

\[ \overline{\pi}_{OS}^{N} = \int_{c^u}^{c^+_u} \frac{\alpha - c - \tilde{c}^u - (1 - \gamma) H(\tilde{c}^u)}{\beta} d\tilde{c}^u. \]  

(4.2.12)
Ownership Separation (cont.): Informational Rent

- The monoplist’s profit is given by

\[
\bar{\pi}_{OS}^S = \int_{c_u}^{c_u} \frac{\alpha - c - \tilde{c}^u - (1 - \gamma) H(\tilde{c}^u)}{\beta} d\tilde{c}^u. \tag{4.2.12}
\]

- Notice that the range between boundaries of the integral in (4.2.12) is higher than that in (4.1.18), as \( c_+^u > c_u^u (c_u) \) for \( c_u^u \in [c_-^u, c_+^u] \).
Ownership Separation (cont.): Informational Rent

- The monopolist’s profit is given by

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\overline{\pi}^{OS}_N = \int_{c^u}^{c^u_+} \frac{\alpha - c - \tilde{c}^u - (1 - \gamma) H(\tilde{c}^u)}{\beta} d\tilde{c}^u. \tag{4.2.12}
\]

- Notice that the range between boundaries of the integral in (4.2.12) is higher than that in (4.1.18), as \(c^u_+ > c^u_*(c^u)\) for \(c^u \in [c^u_-, c^u_+]\).

- The rationale is that under ownership separation the monopolist with costs \(c^u\) has an incentive to report \(\tilde{c}^u \in (c^u_-, c^u_+]\), i.e. to mimic any more inefficient type of the firm, and it has to be accordingly remunerated in order to reveal the truth. Under legal separation, this incentive is weaker, since the vertical group does not find it profitable to declare \(\tilde{c}^u > c^u_*(c^u)\).
Ownership Separation (cont.): Informational Rent

- The monopolist’s profit is given by

$$\overline{\pi}_{OS}^N = \int_{c^u}^{c^u_+} \frac{\alpha - c - \tilde{c}^u - (1 - \gamma) H(\tilde{c}^u)}{\beta} d\tilde{c}^u. \quad (4.2.12)$$

- Notice that the range between boundaries of the integral in (4.2.12) is higher than that in (4.1.18), as $c^u_+ > c^*_c(c^u)$ for $c^u \in [c^u_-, c^u_+]$.

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- This implies a higher distortion of total output under ownership separation in order to curb the monopolist’s informational rents, as is evident from the comparison between the integrands (which capture the total production) in (4.2.12) and (4.1.18).
The price in the downstream market is

$$p^{OS} = c + c^u + (1 - \gamma) H(c^u).$$  \hspace{1cm} (4.2.7)
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Ownership Separation (cont.): Final Price

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\bar{p}^{OS} = c + c^u + (1 - \gamma) H(c^u). \tag{4.2.7}
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- With *asymmetric information*, consumers are worse off under ownership separation, since they pay a higher price. This is a straightforward consequence of the greater output distortion.
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**Proposition**

*Under asymmetric cost information, legal separation increases consumers’ surplus.*
Social welfare under ownership separation amounts to

\[
\overline{W}^{OS} = \frac{1}{2\beta} \left[ (\alpha - c - c^u)^2 - (1 - \gamma)^2 H^2 (c^u) \right] + \\
- (1 - \gamma) \cdot \int_{c^u}^{c^u_+} \frac{\alpha - c - \tilde{c}^u - (1 - \gamma) H(\tilde{c}^u)}{\beta} d\tilde{c}^u.
\]  

(4.2.17)
Ownership Separation (cont.): Social Welfare

- Social welfare under ownership separation amounts to

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- Under complete information, the two industry regimes yields the same social welfare.
Ownership Separation (cont.): Social Welfare

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W^{OS} = \frac{1}{2\beta} \left[ (\alpha - c - c^u)^2 - (1 - \gamma)^2 H^2 (c^u) \right] + \\
- (1 - \gamma) \cdot \int_{c_u}^{c_u^*} \frac{\alpha - c - \tilde{c}^u - (1 - \gamma) H (\tilde{c}^u)}{\beta} d\tilde{c}^u. \tag{4.2.17}
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- Under complete information, the two industry regimes yields the same social welfare.
- The presence of asymmetric information still produces two effects.
Ownership Separation (cont.): Social Welfare

- **Social welfare** under ownership separation amounts to

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W^{OS} = \frac{1}{2\beta} \left[ (\alpha - c - c^u)^2 - (1 - \gamma)^2 H^2 (c^u) \right] + \\
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- Under *complete information*, the two industry regimes yields the same social welfare.

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  1. the first one, which appears in the expression in square brackets, concerns the distortion in total output.
Ownership Separation (cont.): Social Welfare

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\overline{W}^{OS} = \frac{1}{2\beta} \left[ (\alpha - c - c^u)^2 - (1 - \gamma)^2 H^2 (c^u) \right] + 
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- Under **complete information**, the two industry regimes yields the same social welfare.

- The presence of **asymmetric information** still produces two effects
  1. the first one, which appears in the expression in square brackets, concerns the distortion in total output.
  2. the second factor, which is captured by the integral, refers to the monopolist’s information rent. We cannot know *a priori* whether this effect is stronger under ownership or legal separation.
Welfare Comparison between the Two Regimes

Proposition

*Under asymmetric cost information, legal separation yields a higher expected social welfare level.*
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Under asymmetric cost information, legal separation yields a higher expected social welfare level.

- Legal separation generates a trade-off between the incentive to exaggerate costs to have higher upstream profits and the incentive to understate them to pay a lower access charge. These countervailing incentives within the vertical group allow the regulator to reduce the output distortion, which improves expected social welfare.
Proposition

Under asymmetric cost information, legal separation yields a higher expected social welfare level.

- Legal separation generates a *trade-off* between the incentive to exaggerate costs to have higher upstream profits and the incentive to understate them to pay a lower access charge. These *countervailing* incentives within the vertical group allow the regulator to reduce the output distortion, which improves expected social welfare.

- Ownership separation is commonly thought of as the best solution to the regulator’s critical control problem, since it should remove the monopolist’s practice of exaggerating the input costs in order to harm its downstream rivals.
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- Ownership separation is commonly thought of as the best solution to the regulator’s critical control problem, since it should remove the monopolist’s practice of exaggerating the input costs in order to harm its downstream rivals.

- However, the monopolist’s incentives to exploit its private information continue to play a relevant role. Our model shows that legal separation can be (expected) social welfare improving, since it creates a *conflict of interests* within the vertical group.
In this paper we have dealt with the problem of how to design the industry structure in a vertically related market when the regulator sets the price for the access to an upstream monopolistic input and there is imperfect competition downstream.

A trade-off occurs between the incentive to overstate its costs to get higher upstream profits and incentive to understate them to pay a lower access charge. The regulator can exploit the conflict of interests that emerges between the two branches of the vertical group and reduce the detrimental effects of asymmetric information.

We believe that our analysis can be extended in a variety of directions. Imperfect competition is usually modelled by assuming a dominant firm and a competitive fringe. Would our results change in this case?

Possible bypass of the infrastructure by entrants.
In this paper we have dealt with the problem of how to design the industry structure in a vertically related market when the regulator sets the price for the access to an upstream monopolistic input and there is imperfect competition downstream.

We have found that regulatory limited knowledge about the monopolist's input costs implies that legal separation is (expected) social welfare improving.

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Concluding Remarks

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