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## Regulatory Threat in Vertically Related Markets: The Case of German Electricity

***Gert Brunekreeft***

The Cambridge-MIT Institute

*Massachusetts Institute of Technology*
*Center for Energy and*
***Environmental Policy Research***

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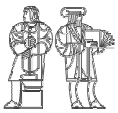

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# REGULATORY THREAT IN VERTICALLY RELATED MARKETS; THE CASE OF GERMAN ELECTRICITY

Gert Brunekreeft[1]
University of Cambridge
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Corresponding address:
Department of Applied Economics
University of Cambridge
Sidgwick Avenue
CB3 9DE, Cambridge, UK
tel: (+44)-(0)1223-335473
fax: (+49)-(0)1223-335299
email: g.brunekreeft@econ.cam.ac.uk
http://www.econ.cam.ac.uk/dae/index.htm

*Abstract*: This paper applies the concept of regulatory threat to analyse the electricity supply industry in Germany, where in contrast to other European member states there is no ex-ante regulation of network access charges. Instead, network access relies on industrial self-regulation and ex-post control by the Cartel Office. The paper modifies the concept of regulatory threat to vertically related markets, stressing the balance between the level of the network access charges and (non-price) discrimination against third parties. The conceptual framework appears to explain developments in the German electricity sector accurately and thus provides a useful tool for policy analysis.
*JEL-classification*: L42, L51, L94
*Keywords*: regulation, discrimination, network industries, electricity

## *1. Introduction*

The European electricity directive of 1997 gives member states the choice between *negotiated* and *regulated* Third Party Access (TPA). The rationale for regulated TPA is that electricity (transmission and distribution) networks are considered to be monopolistic bottlenecks with market power. Non-discriminatory access to the networks is key to sustaining competition in the generation and retail stages of electric power production. If generators or retailers require access to a network owned by another firm, they are called third parties. The market power of the networks is commonly considered to be sufficiently strong to justify sector-specific ex-ante regulation of network access charges; hence, regulated TPA. In contrast to all other member states the German government did not opt for regulated TPA, but instead chose negotiated TPA. Negotiated TPA means that there is no ex-ante regulation of the network access charges; instead, control of market power is basically left to industrial self-regulation and ex-post control by the Cartel Office, relying on general competition law. The option of regulated versus negotiated TPA has recently been discussed by the European Commission

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with a proposal to amend the directive which would have removed negotiated TPA [European Commission, 2001a]. The proposal was politically not acceptable yet, but is expected to return to the agenda in due time. The meaning and implications of negotiated TPA as in the German ESI will be examined in this paper, relying heavily on the concept of regulatory threat.

Two characteristics of the German ESI are crucial:

- first, a lack of ex-ante regulation with reliance on unspecified ex-post control and
- second, strong vertical integration of monopolistic and competitive businesses.

To take account of the first characteristic, the paper applies a formal approach of regulatory threat relying on Glazer & McMillan [1992].[2] Regulatory threat may be defined as the change of the probability of an intervention upon an agent's behaviour by some outside authority as a response to the agent's prior behaviour. The interesting feature is of course that firms internalise regulatory threat and subsequently modify their behaviour. The definition includes two cases: first, the case that the legislator decides to introduce ex-ante regulation and second, the possibility that a cartel office intervenes, both as a response to the firm's behaviour. The definition thus focuses on ex-post interventions. Examples of regulatory threat have been documented. Erfle, McMillan & Grofman [1990] study pricing behaviour in the US oil industry, using media coverage as an indicator for public pressure. Driffield & Ioannidis [2000] observe a long-term decline in the profit margin in the UK petrol industry as a consequence of a Monopolies and Merger Commission investigation, although no undertaking followed the investigation. Starkie [2000] suggests that the threat to regulate the UK-airports Glasgow and Edinburgh might have convinced the operator (British Airport Authority) to cap the airport charges voluntarily. Acutt & Elliott [2000] study the compliance of two UK electricity generators to a "voluntary" price-cap proposed by the electricity regulator; the regulator threatened to refer the case to the Monopolies and Mergers Commission, which might have had more severe consequences. Sweeting [2001] argues that regulatory threat seems to have restrained the bidding of the dominant generators in the electricity pool in England & Wales early 1990s. Lastly, the ESI in New Zealand relies explicitly and heavily on regulatory threat and provides an interesting case study.[3]

To take account of the second characteristic of the German ESI (i.e. vertical integration), the Glazer & McMillan [1992] approach must be formally extended to a two-dimensional setting.

[2] Alternative names are "potential regulation" or "quasi regulation".

[3] The interested reader may be referred to the websites of the Ministry of Economic Development and the Commerce Commission in New Zealand for more details or to Brunekreeft [2002b, ch. 10] for an overview and details. Furthermore, n/e/r/a [1999] critically examines a proposal of the New Zealand government to increase the credibility of regulatory threat by imposing some predetermined criteria.

The approach in Glazer & McMillan is one-dimensional because it considers only one production stage with only one variable (i.e. end-user price). In an ESI the competitiveness of generation and retail is heavily affected by the access conditions to the monopolistic networks, and thus a two-stage (upstream-downstream) setting is required. The vertically integrated network operator basically has two variables at its disposal: first, the network access charges and second, the potential to discriminate against third parties other than by price (also called non-price discrimination or raising rivals' costs). Taking account of these two variables explicitly gives a two-dimensional setting and is crucial for the analysis in this paper. Hence, the paper marries the concept of regulatory threat and the theory of vertical relations and applies the approach to the German ESI. Brunekreeft [2002a] concludes that the theory of vertical relations can well be applied to the German ESI. To include regulatory threat, emphasising ex-post control, seems a natural extension and gives a more complete picture; it will be argued that the approach can well explain recent developments. Section 2 will characterise the institutions and developments in the German ESI. Section 3 develops the formal approach of regulatory threat in vertically related markets; the analysis emphasises first, potential free-riding which potentially undermines the effectiveness of a threat (cf. result 3) and second, the reoccurrence of incentives for non-price discrimination as a result of a mere (partial) threat of intervention (cf. result 4). Section 4 then discusses the main lessons for the German ESI, highlighting the crucial role of the Cartel Office in the current institutional framework.

## *2. The electricity supply industry in Germany: What happened?*

Figure 1 gives a stylised representation of the German electricity supply industry (ESI). An ESI consists of four successive stages: generation, the high-voltage transmission network, low-voltage distribution networks and retail.[4] Generators produce power, whereas retailers sell power to the end-users. Generation and retail are potentially competitive stages; in contrast, the networks are considered monopolies with market power. The complementary vertical relation is strict; the generators and retailers cannot substitute away from using the network. Thus, a necessary condition to allow competition in generation and retail is non-discriminatory access to the networks, called Third Party Access (TPA). Firms are called third parties if they use the network of others. In the German ESI, transmission and generation are supraregional activities and concentrated in only a few hands, whereas distribution and retail are largely communal activities. There are now 4 firms (so-called *Verbundunternehmen*; from hereon "VUs"), which are strongly vertically integrated between generation and transmission, and also own a significant part of the distribution networks and corresponding retail activities

[4] The interested reader may be referred to Brunekreeft & Keller [2000a] and Brunekreeft [2001 and 2002a] for a more detailed description and analysis of the German ESI.

(originating from the pre-liberalised world with closed service areas). Concentration ratios in generation are rather high; the aggregate market share of two largest firms (RWE and E.ON) is approximately 66%. Ownership of these firms is largely private. At the distribution level the number of firms is very large (700+). With exceptions, most of these firms are small. The share of the host retailer (i.e. the retailer in its own network area) is still high due to modest switching.[5] Consequently, vertical integration between the distribution network and retail is strong.

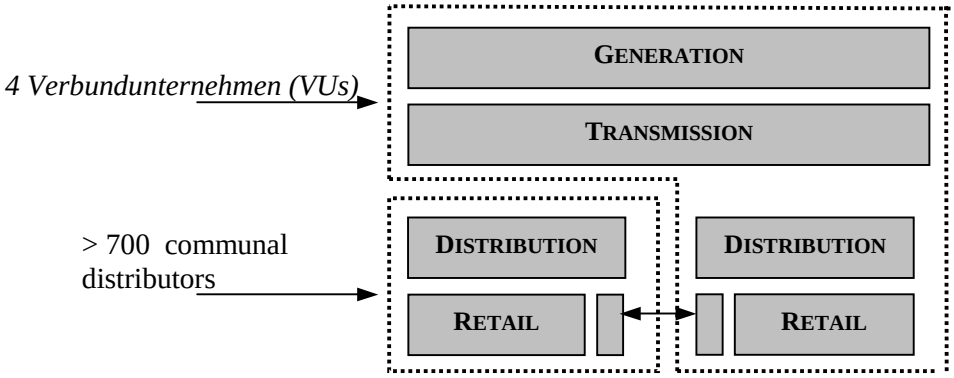


*Figure 1: The ESI in Germany*

The Energy Act of 1998 implemented the European electricity directive in Germany.[6] Three aspects determine the institutional framework. First, 100% end-user eligibility from the start. This means that all end-users are free to choose their retailer which in turn implies that the retail market has been opened for competition de jure. In contrast, the directive only prescribes threshold values for opening the retail markets. Second, the Energy Act does not constrain the industry structure. Control on the industry structure, both vertically and horizontally, is left to the Cartel Office. This implies that vertical integration of the monopolistic networks and competitive businesses was not challenged by law.[7] Third, the German government opted for negotiated TPA as the preferred network access regime, whereas all other member states chose regulated TPA.

Negotiated TPA means in practice that the associations of the ESI and large industrial users have negotiated a general framework for the structure and conditions of network access; this

[5] Approximately 3.7% for domestic and 6% of commercial end users actual switched. However, up to 30% of domestics and almost 50% of commercial end users signed a new contract with their host retailer.
[6] EC electricity directive 96/92/EC of 19 Feb. 1997 and the Energy Act (*Energiewirtschaftsgesetz*) BGBl. 1998, I, 23. Cf. Bergman et. al. [1999] for a more comprehensive analysis of the EU electricity directive.
[7] The EU directive prescribes management unbundling with accounting separation as a minimum rule; this has of course been implemented in the Energy Act, but is not controlled in practice, as became clear from an enquiry of the federal government by parliament about the lack of control; cf. BT-Drs. 14/5519.

is the so-called *association agreement* (abbreviated with VV).[8] Up to January 2000, the VV I was in force, which for various reasons was biased against relatively small, short-term contracts. More importantly, the resulting network access charges were intransparent and hindered the development of competition. It was replaced by the VV II in January 2000, which by and large complies to European standards and appears non-discriminatory on paper. Since January 2002, VV II+ has been in force. Whereas VV II concentrated on the *structure* of network access, VV II+ adds "voluntary" conditions on the *level* of the network access charges; these developments are highly illustrative of regulatory threat and will be discussed in detail in section 4.

In an explanatory note to a proposal to amend the electricity directive the EU-Commission [European Commission, 2001a][9] clarified that regulated TPA means an agency with the (sector-specific) authority to set or approve the level of the network access charges *ex ante*. Such authorisation simply does not exist for the German ESI. Although VV II+ attempts to strengthen industrial self-regulation, it should be stressed that the level of the network access charges is to be determined by the individual network operators. With several clauses the Energy Act explicitly mentions the possibility to introduce ex-ante regulation, should the results of negotiated TPA be unsatisfactory; this requires parliamental authorisation, however. Issues concerning network access are referred to the Cartel Office. To strengthen the powers of the Cartel Office, the legislator included an essential-facilities doctrine into the Competition Act (clause 19(4)4 GWB), which states:

- that access to an essential facility should be non-discriminatory *and*
- that access charges should be fair and reasonable.

The Competition Act authorises the Cartel Office to intervene in case of a justified suspicion of an abuse of market power, which by definition is *after* the event. Hence, there is some *ex-post* control of the level of the access charges. This clause in the Competition Act turned out to become the main regulatory instrument. In April 2001, a task force of the Cartel Office published a review of network access [Bundeskartellamt, 2001] which explores the possibilities to apply the essential-facilities doctrine, shifting policy attention towards the (excessive) level of the network access charges.

Consistent with theoretical arguments, empirical observations suggest that the main developments in the liberalised German ESI have been as follows [cf. Brunekreeft, 2002a]:

[8] German original: *Verbändevereinbarung*.

[9] The clarification was made necessary because the amendment proposed to omit negotiated TPA and concentrate solely on regulated TPA which raises the obvious questions to the exact meaning.

- First, the network access charges are high, both relative to comparators abroad and relative to end-user prices. This appears to apply especially to low voltage network levels.
- Second, the margins at the competitive stages have been very low; both at wholesale and retail level; possibly as low as short-run marginal costs.
- Third, (non-price) discrimination against third parties has been moderate [cf. Bundeskartellamt, 2001]. Discrimination against third parties corresponds to increasing the costs of third parties, other than by the access charge. In an electricity network a transmission system operator has ultimate control of the dispatch of the power stations and thus controls power production and thereby to some extent the costs and revenues of *all* firms; especially the so-called balancing mechanism is vulnerable for discriminatory behaviour by the transmission system operator.
- Fourth, and the main surprise, the end-user prices fell significantly as a result of an initial round of retail competition.

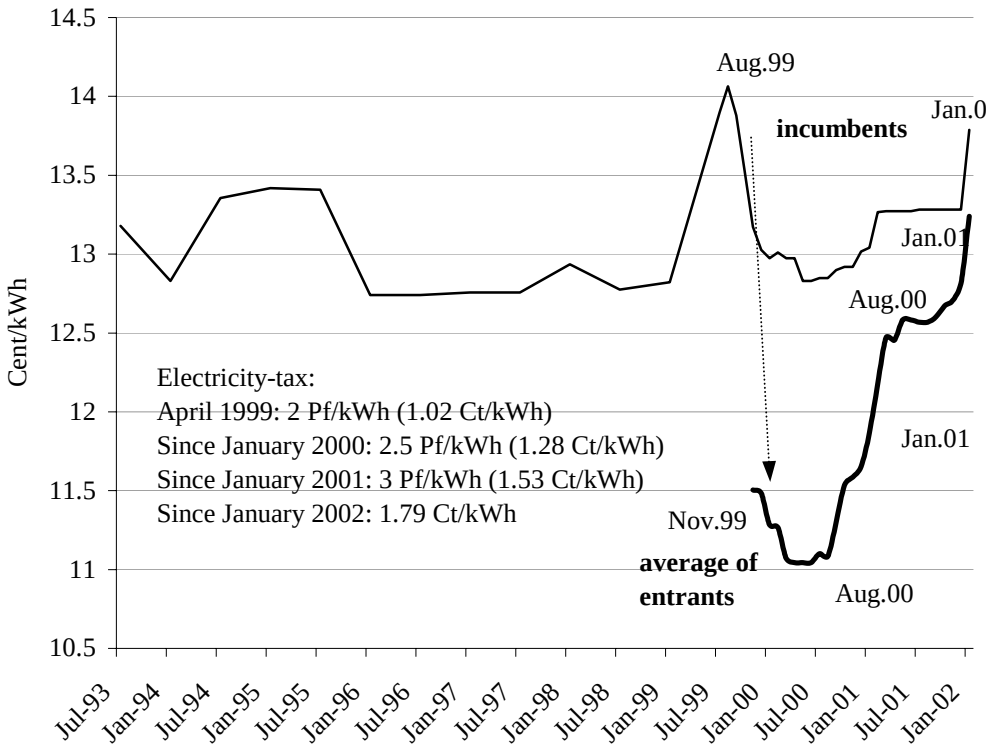


*Figure 2: Price developments for a typical domestic end-user (3500 kWh/year); including electricity tax, excluding VAT. Cent is Eurocent.*
*Source: Based on Brunekreeft & Keller [2000a].*

Deviating from the European standard, the Energy Act in Germany opened up the market for end users completely; i.e. 100% eligibility from the start. Around August 1999, the VUs started a large-scale attack at the market for small end-users. Within weeks, the four largest

VUs launched their retail-subsidiaries with nationwide uniform offers and large marketing campaigns. Apart from these new retail-subsidiaries of otherwise incumbent firms, a vast amount of new firms entered the retail market. The prices of the entrants at the retail market were considerably lower than those of the incumbent retailers, which swiftly responded by lowering their prices. In sum, the average end-user price for domestic users fell within weeks up to 20%. The development of the end-user price for a typical domestic end-user (3500 kWh/year) is plotted in figure 2; the striking feature is the drop from highest point on the upper line (Aug. 99) to the lower line briefly afterwards (Nov. 99). This represents the price saving a domestic end-user could make at that moment.

The increase in the end-user price in the period before August 1999 is caused by a pass-through of an electricity tax, which was introduced in April 1999 (1.02 Ct/kWh), raised (to 1.28 Ct/kWh) in Jan. 2000, again raised (to 1.53 Ct/kWh) in Jan. 2001, and once again in Jan. 2002 (to 1.79 Ct/kWh). In figure 2, the "average of entrants" represents an unweighted average of ten best-practice entrants on the retail market. The "incumbent" is an average of a sample of the incumbent communal retailers. It may be stressed that the price drop has been initiated by the new retail subsidiaries of the otherwise incumbent VUs. One explanation and the focus of this paper may be that in particular the larger VUs may have taken the initiative to reduce the probability of regulatory intervention.

## *3. The formal approach*

The analysis below relies strongly on an upstream monopoly and competitive downstream setting. Notation is summarised in figure 3.

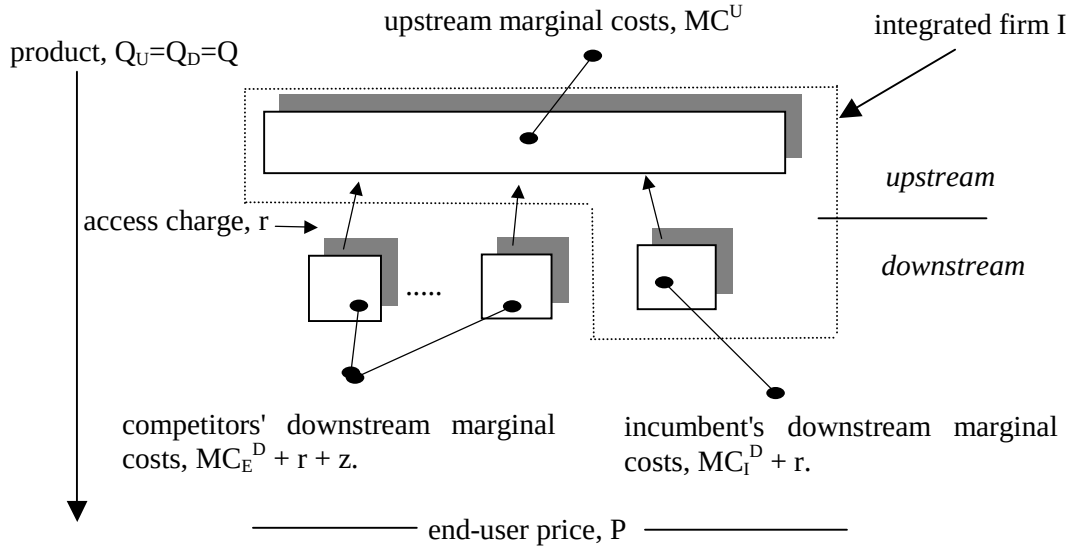


*Figure 3: Overview of notation.*

Denote superscript $U$ for "upstream", superscript $D$ for "downstream", subscript $I$ for "incumbent/integrated firm", and subscript $E$ for "entrant(s)/competitor(s)". Furthermore, denote $MC^U$ for constant upstream marginal costs. Similarly, denote $MC_I^D$ for constant downstream marginal costs of firm $I$ and $MC_E^D$ constant downstream marginal costs of a firm $E$ (*net* of the costs of the access charge and the costs of third-party discrimination). $Q_E$ denotes the total output of the competitors and, due to strict complementarity, thus is derived demand for network access from the third parties. Upstream and downstream output is normalised 1:1, such that $Q = Q_I + Q_E = Q_U$. Denote $P(Q_E, Q_I)$ for the inverse (final) demand for good $Q$ with price $P$ ($\partial P/\partial Q<0$). Last, denote $r$ for the access charge and $z$ as an indicator for third-party discrimination. The latter can be any means which asymmetrically increases the competitors' (marginal) costs and is assumed costless for the integrated firm. Sections 3.1. and 3.2 give two preliminaries, whereas sections 3.3, 3.4 and 3.5 derive the main results of regulatory threat.

### *3.1 The unregulated benchmark case*

For the analysis here it suffices to simplify to the case of perfect downstream competition. The well-known benchmark case from Chicago-school analysis states that without regulation there are no incentives for third-party discrimination.[10] It will be shown here (in result 4) that a mere threat of intervention can induce an incentive to discriminate against third parties. If this is the case for perfect downstream competition then it also holds for imperfect downstream competition and hence it suffices to simplify to perfect downstream competition. A direct consequence of the assumption of perfect downstream competition is that the behaviour of the entrants can be written as a zero-profit condition:

$$P^* = MC_E^D + r + z\,. \tag{1}$$

The entrants can merely achieve a normal profit. By applying third-party discrimination, only the integrated firm can make excess downstream profits. It follows immediately that, for given $r$ and $z$, the downstream stage and thereby the end-user price is solved unambiguously. Derivation of (1) with respect to the key variables $r$ and $z$ gives:

$$\frac{dP^*}{dr} = \frac{dP^*}{dz} = 1\,, \tag{2}$$

Solving the downstream stage implicitly gives the derived demand for network access by the competitors, defined as $Q_E^*$, conditional upon the integrated firm's strategic variables $Q_I$, $r$

[10] Cf. further Brunekreeft [2002a or 2002b, ch. 5] for a literature survey and a more general setting of the unregulated vertical relation allowing and exploiting imperfect downstream competition.

and *z*. From (1) it is clear that the competitors merely pass-through marginal costs. Thus, for perfect downstream competition, the partial derivatives of $Q_E^*$ w.r.t. *r* and *z* are:[11]

$$\left.\frac{\partial Q_E^*}{\partial r}\right|_{\text{z,Q}_\text{I}\text{ constant}} = \left.\frac{\partial Q_E^*}{\partial z}\right|_{\text{r,Q}_\text{I}\text{ constant}} = \frac{\partial Q}{\partial P}. \tag{3}$$

The assumption of perfect competition unambiguously solves the downstream stages as in the zero-profit condition in (1) and hence $Q_I$ can be ignored as a strategic variable; it suffices to continue with *r* and *z*. The integrated firm's optimisation problem is as follows:

$$\pi_I(r,z) = P\cdot Q_I + r\cdot Q_E^* - MC_I^D\cdot Q_I - MC^U\cdot(Q_I + Q_E^*). \tag{4}$$

Differentiating w.r.t. *r* and *z* and using (2) and (3) yields:

$$\frac{\partial \pi_I}{\partial r} = Q_I + Q_E^* + \left(r - MC^U\right)\frac{\partial Q}{\partial P} = 0, \tag{5}$$

$$\frac{\partial \pi_I}{\partial z} = Q_I + \left(r - MC^U\right)\frac{\partial Q}{\partial P} = 0. \tag{6}$$

Checking the second-order condition w.r.t. *z* gives:

$$\frac{\partial^2 \pi_I}{\partial z^2} = 0. \tag{7}$$

It follows that for given values of $r^*$ and $Q_I^*$, $\frac{\partial \pi_I}{\partial z} < 0$, $\frac{\partial \pi_I}{\partial z} > 0$, or $\frac{\partial \pi_I}{\partial z} = 0$. In words, *z* will either be set to zero, or be set such that it forecloses the market (perfectly),[12] or the firm will be indifferent with respect to third-party discrimination. Which solution prevails depends on the level of the access charge *r* and thus upon whether or not the access charge is regulated. Examination of (5) and (6) quickly reveals that $z = 0$ if access charges are not regulated.[13] This corresponds to the Chicago-school benchmark case and states that if foregone downstream profits can be compensated by upstream profits, the integrated network operator will not have an incentive to discriminate against third parties.

### *3.2 The probability of an intervention*

The next step is to define the probability of an intervention ($\vartheta(\cdot)$) as a function of an observable variable. This probability function depends on the legislator's decision to intervene. We will follow Glazer & McMillan [1992, pp. 1090][14] and modify slightly. Define the legislator's benefit of an intervention as:

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[11] For details see Brunekreeft [2002a, p. 207] and let the number of competitors go to infinity.

[12] The phrase "perfect foreclosure" expresses that *z* is sufficiently high to allow the integrated firm monopoly profits on the downstream market.

[13] While $\partial\pi_I/\partial z > 0$ for *r* sufficiently close to $MC^U$.

[14] The Glazer & McMillan approach in turn relies on Stigler [1971] and Peltzman [1976].

$$B = W(CS(P^R), \pi(P^R)) - W(CS(P), \pi(P)). \quad (8)$$

*W* represents the legislator's utility, which in this case is a function of consumer surplus (*CS*) and the (threatened) firm's profit ($\pi$). The legislator balances the interests of consumers and producers in order to maximise its own utility, which can but need not be the welfare maximum. Since both consumer surplus and firms' profits depend on the product price, the legislator's utility depends on the product price only. The regulated price may be assumed to be smaller than the unregulated price: $P^R < P$.

Two steps are necessary to derive the regulatory threat (as a probability function) from (8). First, as noted by Glazer & McMillan [1992, p. 1090], an intervention should not be costless. If an intervention is costless, the legislator will intervene as soon as the unregulated outcome does not correspond to its desired outcome. The result always is the legislator's utility maximum, with or without regulation, because the threatened firm cannot do otherwise than adjust to this outcome. Importantly, however, positive costs of an intervention may be necessary, but are not sufficient for a non-trivial probability function of an intervention. If everything is known and certain, the threatened firm will simply calculate *P*, beyond which the legislator will intervene. In other words, with certainty, the rational legislator will not intervene if *P* is below this trigger-level and will intervene with certainty if *P* is above this level. Either case is rather trivial for the purpose of this paper.[15] The second step thus is to introduce some uncertainty and/or imperfect information. Glazer & McMillan [1992, p. 1091] adopt a rather elegant approach to introduce uncertainty. In their approach the legislative body consists of many senators, each of whom can propose the regulation. Since the costs of proposing intervention are privately borne, while the benefits have a public-good aspect, a free-rider problem among the senators emerges. Glazer & McMillan then argue that there is a mixed-strategy equilibrium for this situation, resulting in the probability of an intervention as a increasing function of price, *P*: $\vartheta(P)$ and $\vartheta_P > 0$. [16, 17]

### *3.3 The global regulatory threat*

With the preliminaries above, the focus can now shift to regulatory threat. The approach is a multistage game. The firm determines its price level in each stage given the probability-function, $\vartheta(\cdot)$. At the end of each stage the legislator/regulator decides whether or not to intervene. If it intervenes, the firm will have regulated profits of $\pi^R$ in each period for ever

[15] The reader may note that this is in fact ex-ante regulation. This raises the interesting question when the legislator might actually want the threatened firm to *know* its valuation (rather than a probability function).

[16] Actually, the Glazer & McMillan approach appears to have an important alternative application in a free-rider problem among competitors or entrants, one of which may go to court to enforce an intervention. The court's decision will at least to some extent have a public-good element.

[17] An alternative route is to assume that the threatened firm is uncertain about the legislator's benefit of an intervention [cf. Brunekreeft, 2002b, ch. 9].

after; the regulatory outcome results from the political balance as characterised in section 3.2. The firm's objective is to maximise expected discounted profits, i.e. taking account of the probability of an intervention. Denote the discount factor by $\delta$, and denote the stream of discounted regulated profits by $V^R$:

$$V^R(r^R, z^R) = \frac{\pi^R(r^R, z^R)}{\delta}. \tag{9}$$

Note that here the probability of an intervention depends only on the (global) price level, $P$, and not directly on $r$ and $z$. Thus here the end-user price, $P$, is the observable variable to which the politician responds; this assumption will be modified in section 3.5. The firm's objective function is [cf. Glazer & McMillan, 1992, p. 1092]:

$$\max_{r,z} V(P(r,z)) = \left(\pi + \vartheta \cdot V^R + (1-\vartheta)\cdot V\right)/(1+\delta), \tag{10}$$

which can be rewritten as:

$$\max_{r,z} V(P(r,z)) = V^R + \frac{\pi(P(r,z)) - \pi^R}{(\vartheta(P(r,z)) + \delta)}. \tag{11}$$

Derivation w.r.t. $r$ and $z$ using $dP^*/dr = dP^*/dz = 1$ (from (2)) and rewriting gives:[18]

$$\frac{\partial V}{\partial r} = \frac{d\pi^*}{dr} - \left(\pi - \pi^R\right)\frac{\vartheta_P}{(\vartheta + \delta)} = 0, \tag{12}$$

$$\frac{\partial V}{\partial z} = \frac{d\pi^*}{dz} - \left(\pi - \pi^R\right)\frac{\vartheta_P}{(\vartheta + \delta)} = 0. \tag{13}$$

$\vartheta_P$ denotes the first derivative of the $\vartheta$ w.r.t. $P$. The first term of either condition is the marginal profit of increasing $r$ (or $z$); it is the direct increase in profits. The second term can be seen as the marginal costs of an increase in $r$ (or $z$). It is the conditional increase in the probability of an intervention multiplied by the set-back in profits should regulation occur. If this profit difference is large, the firm loses much from an intervention and will have a stronger incentive to be moderate.[19] The important factor is $\vartheta_P$, i.e. the change in the probability of an intervention as a response to the firm's behaviour. It may be noted, that if $\vartheta_P = 0$, the second term is equal to zero; irrespective of the absolute value of the probability of an intervention, it will be ignored if the probability is insensitive to the firm's behaviour. The mere fact that there exists some fixed possibility of an intervention does not suffice to affect the firm's behaviour. It is necessary that the firm realises that it is punished for bad behaviour and rewarded for good behaviour. In other words, $\vartheta_P > 0$. Ceteris paribus, if $\vartheta_P$ is larger, the

[18] Note that, strictly speaking, the expressions in both (12) and (13) should be multiplied by $1/(\vartheta+\delta)$, which is positive and the same for both, and will be dropped to save on notation.

[19] Upon checking the second-order conditions, it gets clear that the corresponding solution is "likely" to be a maximum and "likely" to be unique. Unfortunately, it is neither guaranteed to be a maximum, nor that it is unique. It depends on the specification of the probability function. Further details can be found in the appendix.

second term of the condition is larger (in absolute terms) and thus marginal profit should be larger to compensate, implying that the firm restrains its behaviour more seriously.[20]

***Result 1***: If the regulatory threat is real and credible (i.e. $\vartheta_P > 0$), the threatened firm will in general have an incentive to restrain its behaviour. The resulting end-user price will be lower than the unconstrained profit-maximising end-user price.

This is basically what was argued and shown by Glazer & McMillan [1992] for the one-dimensional setting. A non-trivial insight for the two-dimensional setting follows in result 2:

***Result 2***: If an intervention is possibly triggered by the *global* situation (i.e. by the end-user price), then the threat mimics a global price cap. It implies that the integrated firm would not have an incentive to discriminate against third parties. As in the benchmark case of no regulation, the firm would make its profits with the access charge and refrain from third-party discrimination.

This can be seen readily by examining (5) and (6):

$$\frac{\partial \pi_I}{\partial r} = \frac{\partial \pi_I}{\partial z} + Q_E^* \geq \frac{\partial \pi_I}{\partial z}, \text{ for } Q_E^* \geq 0. \tag{14}$$

and thus from (12) and (13):

$$\frac{\partial V}{\partial r} = \frac{\partial V}{\partial z} + Q_E^* \geq \frac{\partial V}{\partial z}, \text{ for } Q_E^* \geq 0. \tag{15}$$

Thus if $Q_E^* > 0$, using $r$ will always be preferred to using $z$ and thus $z = 0$. If $Q_E^* = 0$ conditions (12) and (13) are equivalent and the firm would be indifferent. If the threat is global (in contrast to the regulation, should it occur), the effects mimic what has come to be known as the global price cap [cf. Laffont & Tirole, 1997]. The global price cap regulates the end-user price rather than the access charge. It follows that the so-called parity principle applies and thus an explicit global price cap does not induce an incentive to discriminate against third parties. Result 2 argues that the same holds for a global threat. Only if the threat is directed towards both variables ($r$ and $z$) separately, an incentive to discriminate against third parties arises, which will be discussed in section 3.5.

### *3.4 The free-rider problem*

The developments in the ESI in Germany are determined by over 700 network operators, which are all subject to federal acts and government. Regulatory threat may thus concern

[20] It can be seen that the mere threat of regulation cannot achieve the result of regulation itself (ignoring regulatory costs). In the second term of the condition, the difference ($\pi$ - $\pi^R$) would become zero, and thus marginal profit would have to be zero, which is a contradiction.

several firms (rather than only one) falling under the same jurisdiction and the probability of an intervention may be determined by the behaviour of the firms collectively (as an overall impression), rather than the behaviour of each firm individually. Assume that firms $i = 1,..,m$ are neighbouring upstream monopolies in the same jurisdiction. The probability of a regulatory intervention now is $\vartheta(\Phi)$, where $\Phi$ is the weighted average (end-user) price level and is defined as follows:

$$\Phi \equiv \sum_{i=1}^{m} P_i Q_i \Big/ \sum_{i=1}^{m} Q_i \,, \tag{16}$$

Each firm calculates the effect of its individual price on the average price and thereby on the probability of an intervention, which then flows into its maximising behaviour:

$$\frac{\partial \Phi}{\partial P_i} = \left( \frac{\partial Q_i}{\partial P_i}(P_i - \Phi) + Q_i \right) \Big/ \sum_{i=1}^{m} Q_i \tag{17}$$

The first term in the numerator covers the effect that asymmetry implies different prices, which again results in different quantities. The individual firm's behaviour now is:

$$\frac{\partial V_i}{\partial r_i} = \frac{d\pi_i^*}{dr_i} - (\pi_i - \pi_i^R)\frac{\left(\vartheta_\Phi \cdot \frac{\partial \Phi}{\partial P_i}\right)}{(\vartheta + \delta)} = 0 \quad \text{and} \quad \frac{\partial V_i}{\partial z_i} = \frac{d\pi_i^*}{dz_i} - (\pi_i - \pi_i^R)\frac{\left(\vartheta_\Phi \cdot \frac{\partial \Phi}{\partial P_i}\right)}{(\vartheta + \delta)} = 0\,. \tag{18}$$

The difference with (12) and (13) is the term $\partial\Phi/\partial P_i$. If the number of firms falling under the same jurisdiction is large, the term $\partial\Phi/\partial P_i$ is small and the effect of the regulatory threat will be small (for reasons of comparison, $\vartheta(P) = \vartheta(\Phi)$ is assumed to hold). This is a genuine free-rider problem; each firm only takes account of its own behaviour in the overall increase of the probability of an intervention. It thereby increases its own profits at the expense of the others, because the slight increase in regulatory threat ceteris paribus decreases the expected profits of the others. Since each firm behaves like this, the overall price level is higher than would be if the firms cooperated.[21] Moreover, it follows directly from (17) and (18), that big firms behave more responsibly than small firms. A big firm's share in total output and thereby its weight in the average is larger per assumption and thus the direct effect on the probability of an intervention is larger. The free-riding problem appears to have strong application in the German ESI as will be argued in section 4.

***Result 3***: The regulatory threat is subject to a free-rider problem if various firms falling under the same jurisdiction are assessed collectively rather than individually. The incentive to free-ride gets stronger if a firm is smaller.

[21] Since the anticipated effect of a firm's own behaviour is never zero, the phrase "cheap rider" may be more suitable than "free rider" [cf. Stigler, 1974].

The structure of the problem is analytically equivalent to the theory of collective action [cf. Olson, 1965]. A central coordinator would capture the effect and make each and every firm responsible for the overall effect of its behaviour. A central coordinator (e.g. an industry association) would maximise the sum of profits:

$$\max_{r_i, z_i} \sum_{i=1}^{m} V_i = \sum_{i=1}^{m} V_i^R + \frac{\sum_{i=1}^{m} (\pi_i - \pi_i^R)}{\left(\vartheta(\Phi(P_1,..,P_i,..,P_m)) + \delta\right)} \quad \text{for all } i = 1,..,m. \tag{19}$$

capturing the external effects:

$$\frac{\partial V_j}{\partial P_i} < 0\,, \quad \text{for all } i,j = 1,..,m, \text{ and } i \neq j, \tag{20}$$

which are neglected if each firm behaves individually.

### *3.5 Partial regulatory threat induces an incentive to discriminate*

Suppose that an intervention can be triggered as a response to either of the two strategic variables, third-party discrimination, *z*, or the access charge, *r*. The probability of an intervention as a response to third-party discrimination is denoted by $\vartheta^z$ and as a response to an excessive access charge by $\vartheta^r$. The aggregate probability of an intervention is defined by the probability of the union and thus:

$$\vartheta(r,z) = \vartheta^z + \vartheta^r - \vartheta^z \vartheta^r \tag{21}$$

$\vartheta^r$ denotes the standing-alone probability of an intervention as a response to *r*, while $\vartheta_r^r$ denotes the partial derivative of the probability w.r.t. *r*, and for $\vartheta^z$ and $\vartheta_z^z$ similarly. It will be assumed throughout that $\vartheta_z^r = \vartheta_r^z = 0$. As before, the firm's objective function is:

$$V(r,z) = V^R + \frac{\pi - \pi^R}{(\vartheta(r,z) + \delta)} \tag{22}$$

Derivation w.r.t. *r* and *z* gives:

$$\frac{\partial V}{\partial r} = \frac{d\pi^*}{dr} - \left(\pi - \pi^R\right)\left(\frac{\vartheta_r^r (1 - \vartheta^z)}{\vartheta + \delta}\right) = 0\,, \tag{23}$$

$$\frac{\partial V}{\partial z} = \frac{d\pi^*}{dz} - \left(\pi - \pi^R\right)\left(\frac{\vartheta_z^z (1 - \vartheta^r)}{\vartheta + \delta}\right) = 0\,. \tag{24}$$

Assuming the case that (cf. eqs. (5) and (6)):

$$\frac{d\pi^*}{dr} = \frac{d\pi^*}{dz} = Q^*(r,z) + \frac{\partial Q}{\partial P}\left(r - MC^U\right). \tag{25}$$

it follows from (23) and (24):

$$\frac{\vartheta_r^r}{1-\vartheta^r} = \frac{\vartheta_z^z}{1-\vartheta^z} \tag{26}$$

In words, whereas an unthreatened or globally threatened firm may be indifferent between using *r* and *z* (cf. eq. (25) and result 2), this changes if *r* and *z* are treated separately. To fulfil (26) the firm will in general have to *balance* the use of *r* and *z*; the firm would spread its profit on the upstream and the downstream stage. Hence, despite the lack of explicit regulation, the mere threat of an intervention would induce the incentive to discriminate against third parties. Assume that $\vartheta_r^r$ and $\vartheta_z^z$ are positive and finite. Suppose that the firm concentrates one-sidedly on *r* such that $\vartheta^r$ would go to 1 and thus the expression on the left-hand side in (26) would go to infinity; simultaneously a low *z* implies $\vartheta^z$ lower than 1 and thus that the right-hand side in (26) would be finite. To equate both sides, $\vartheta^r$ should be reduced (lowering *r*) and $\vartheta^z$ increased (increasing *z*).[22]

***Result 4*** (*partial threat*): If an intervention can be triggered by either the access charge or third-party discrimination *separately*, then the threatened firm will have an incentive to *balance* the use of the two instruments. Thus, despite the lack of explicit ex-ante regulation, the firm will have an incentive to discriminate against third parties.

Since some degree of threatening can theoretically never be excluded, there will always be a theoretical argument for the existence of some third-party discrimination; the question reduces to whether or not it is empirically relevant for a case at hand. This scenario has direct implications to the application of the essential-facilities doctrine as in the German ESI.

## *4. Discussion*

The developments in the German ESI as characterised in section 2 appear to be strongly in line with the concept of regulatory threat as developed in section 3. Section 2 showed the remarkably strong price drop around August 1999 as a result of the entry of retail subsidiaries of the VUs. Several complementary explanations exist. First, good business practice prescribes to be present on another market segment. Second, especially the larger firms may have had an interest in low prices to lower the value of potential take-over candidates. Third, the vertically integrated firms may have wanted to avoid high mark-ups on the retail stage and concentrate on the network charges instead. Fourth, the sector's productivity has increased in the recent past [cf. Brunekreeft & Keller, 2000b] and thus the price drop can at least partly be explained by lower costs. Fifth, and examined in this paper, it seems that regulatory threat can contribute to an explanation.

[22] Existence of equilibrium is "likely" for a broad support of probability functions. It should be noted, however, that the existence is not guaranteed and depends on the specifications of the probability functions.

Given the exceptional position of the German ESI compared to European counterparts and given the criticism, it is plausible and in line with result 1 that the firms had to convince the authorities that ex-ante regulation would be unnecessary.[23] It may be stressed that prices were pushed down by the entry of newly created retail subsidiaries of the otherwise incumbent VUs. If the sector has indeed responded to regulatory threat it appears plausible and in line with result 3 that the larger VUs behaved more responsibly and seized the initiative in an attempt to discipline free-riding behaviour of the smaller firms.

A claim can be made that the developments around August 1999 had the effect of leaving the impression that competition in the ESI was developing surprisingly well. For instance, the European Commission [2001b] reports successes in Germany by pointing out the average price decrease of 25% between March 1998 and August 2000. Moreover, examination of media coverage provides some empirical support.[24] Examination of coverage by national newspapers reveals that the large-scale entry of large retail competitors and the consequent price drop did attract substantial attention in the media [cf. Brunekreeft, 2002b, ch. 11]. It seems reasonable to expect this to have had a positive impact on public and thereby political opinion concerning the developments in the ESI.

In March 2001, the EU commission published a proposal to amend the EU electricity directive [European Commission, 2001a]. One of the major changes would have been[25] to remove negotiated TPA and concentrate completely on regulated TPA. Obviously this proposal increased the pressure on the German government and thus on the German ESI. Only one month later, the German Cartel Office published the review of network access [Bundeskartellamt, 2001], which may be considered to be a policy turning point. The Cartel Office reviews the possibilities the Competition Act provides to intervene in the level of the network access charges. As mentioned in section 2, the essential-facilities doctrine in the Competition Act requires access to be non-discriminatory *and* against fair and reasonable charges; the latter aspect was the main subject of the review. Thereby the Cartel Office increased the threat of intervention generally and simultaneously shifted policy attention away

[23] This perspective provides an argument against the undoubtedly important claim of Stigler & Friedland [1962]. Basically, they compare the rates of regulated and non-regulated electric utilities in the USA in the first quarter of the 20th century and come to the conclusion that since the differences are insignificant, regulation is ineffective. The counterargument suggested here is that unregulated firms which are surrounded by (effectively) regulated firms will have an incentive to adjust their behaviour such that the difference with the regulated benchmark is not too apparent. Seen from this perspective, one is tempted to conclude that regulation may in fact be very effective, such that it even "regulates" the unregulated neighbours as a by-effect.

[24] Following the methods applied by Erfle, McMillan & Grofman [1990].

[25] French and German opposition made the proposal politically infeasible at that time.

from genuine discrimination against third parties towards the (excessive) level of the network access charges.

Before this policy turning point regulatory threat may largely have been global (as in sections 3.3 and 3.4). The main policy issue was whether or not to install a sector-specific ex-ante regulator, depending on the overall impression (development of competition and end-user prices). As argued above, the sector (i.e. the VUs) appears to have responded by developing retail competition. As shown in result 2, a global threat mimics the effects of a global price cap and thus one would expect, irrespective of the quantitative effect of the threat, the following picture to emerge:

- the network access charges would be high relative to end-user prices,
- the margins at the competitive stages would be relatively small, and,
- the extent of non-price discrimination would be moderate.

As argued in section 2, this is exactly what could be observed.

It is plausible that the review of the Cartel Office triggered the VV II+, which "voluntarily" shifted attention to industrial self-regulation of the level of the network access charges. The review of the Cartel Office explores the possibilities to control the level of the network access charges ex post. The Cartel Office expressed that benchmarking would be the preferred method. A problem with benchmarking is to determine the comparability of firms which requires reliable data. The Cartel Office is only authorised to start an examination with justified suspicion of abuse of market power. For benchmarking this appears to imply that the Cartel Office can require data of supposedly "bad" firms, but by definition not of the "good" firms; these may, but need not cooperate voluntarily.[26] The novel and rather surprising aspect of the VV II+ is that the ESI will assist the Cartel Office with the benchmarking.

Point 2.1.1 of VV II+ proposes that the principles underlying the price calculations will be collectively standardised (optionally by means of external approval) and that (price) benchmarking will be applied. Annex 3, point 4 of VV II+ goes into detail. Two points are interesting. First, the industry will develop a framework, which categorises various network operators according to a few criteria.[27] Applying these criteria results in 18 categories of comparable network operators.[28] The results and the data underlying the categorisation are to be published. Each network operator will then have to publish its access charge, averaged for predetermined end-user profiles. The second point is that the industry will not await the Cartel

[26] Commentators report that the low-voltage networks of the large VUs are used as "good" benchmarks.
[27] This mainly concerns the distribution networks (up to 110 kV). Extra-high-voltage networks (220/380 kV) are excluded.
[28] With some 700 network operators, on average there will thus be some 40 firms in one category.

Office to use the data and intervene. Instead, the industry itself increases pressure on the "black sheep". A network operator whose charges belong to the highest 30% of its category will have to justify the high level to an arbitrator, who will be appointed by the industry. It is not specified, however, what happens if the arbitrator concludes that the level of the access charges is unreasonable. Supposedly, there will be a mediation attempt behind closed doors. Alternatively, in cases where the arbitrator does not report to the parties involved and mediation fails, the Cartel Office may step in immediately. Those firms which do not comply to the (implicit) rules are no longer protected by the umbrella of the VV II+ and are instead handed over to the Cartel Office. Relying on result 3 in section 3.4, it seems a convincing explanation that the industry is internalising free riding.

To the extent that the Cartel Office is credible in increasing pressure on excessive levels of network excess charges a strategic reaction of the firms may be expected and the next problem can be awaited. Result 4 in section 3 predicts that if policy attention is directed towards the level of the network access charges and the discrimination against third parties separately, the firms will correspondingly balance the use of both variables. Thus to the extent that the increased policy attention succeeds to reduce the level of the network access charges, it may be expected that the extent of discrimination against third parties will intensify.[29] The review of network access by the Cartel Office [Bundeskartellamt, 2001] basically concluded early 2001 that discrimination could quite easily be handled by the Cartel Office. However, if the potential to discriminate against third parties is seriously abused, the Cartel Office might not be capable of handling the issues; experience in other countries suggests a tendency towards ownership separation of the essential network elements as a policy response (i.e. remove rather than curb the incentives to discriminate). The next policy focus may thus be on unbundling of the vertically integrated structure.

## *5. Concluding remarks*

The institutional framework of the largely vertically integrated German electricity supply industry relies on negotiated Third Party Access (TPA); all other European member states opted for regulated TPA. Regulated TPA basically means that an agency is authorised to set or approve network access charges ex ante. In contrast, negotiated TPA in the German ESI means that there is no ex-ante regulation of the network access charges. Access to the networks is left to industrial self-regulation and ex-post control to the Cartel Office. To analyse and assess the institutional framework of the ESI in Germany this paper applies the

[29] Curiously, as a reaction to the review of the Cartel Office, an influential consultants (BET, Aachen; www.bet-aachen.de), which consults network operators in tariff policy, published an open letter to its customers, to be cautious and shift attention away from the network access charges.

concept of regulatory threat, taking account of the vertical relations in an ESI: i.e. the relations between the upstream monopolistic network and downstream competitive markets. On the one hand, the approach extends Brunekreeft [2002a] who focuses on vertical relations in the ESI in an unregulated setting. On the other hand, the approach extends the Glazer & McMillan approach [1992] on regulatory threat to include the vertical relations in an ESI.

The paper derives theoretical results and argues that these results can contribute to explaining developments in the German ESI. Despite the lack of ex-ante regulation of the network access charges, competition developed surprisingly well at first glance. One development was a significant drop in the domestic end-user prices as a result of large scale entry into the retail market. Notably the price decrease has been enforced by the larger incumbent firms. Among other explanations, it appears that given the pressure from abroad and the European Commission concerning the lack of ex-ante regulation, the sector may have wanted to show that ex-ante regulation would in fact be redundant. In other words, it seems quite plausible that the threat of regulation had an effect. Meanwhile, the threat seems to have lost effectiveness. The large number of network operators (700+) induces a free-rider problem, which weakens the effects of regulatory threat, as far as the assessment depends on the overall sector's performance. The smaller a firm, the less its behaviour will affect the overall assessment of the sector's performance and thus smaller firms are more likely to free ride. Thus it seems natural to expect larger firms to behave more responsibly and to seize initiatives to internalise free riding. Recent institutional developments stressing stronger industrial self-regulation with respect to the network access charges can readily be explained from this view.

A second focus is on the balance between the level of the network access charges and the discrimination against third parties. It has been argued in this paper that a distinction between a *global* and a *partial* threat of intervention is useful. A global threat assesses the end-user prices, whereas the balance of the network access charges and discrimination of third parties is not decisive for the assessment. The global regulatory threat actually mimics the effects of a global price cap; irrespective of the quantitative effects of the threat, the network access charges would be high relative to end-user prices, the margins at the competitive stages would be low and the incentive to discriminate against third parties would be moderate. In contrast, under a partial threat, it is assumed that the network access charges and discrimination of third parties can trigger an intervention separately. In this case, the threatened firm will have an incentive to balance the use of the strategic variables; in other words, despite the lack of ex-ante regulation of the network access charges, the partial regulatory threat will cause the firm to have an incentive to discriminate against third parties. It has been argued in this paper that the developments in the German ESI fit this perspective, emphasising a policy turning point

around April 2001. With the publication of a review of network access the Cartel Office [Bundeskartellamt, 2001] increased pressure overall and, more importantly, shifted policy attention from prohibition of discriminatory behaviour towards the (excessive) level of the network access charges. The extent to which this threat works out quantitatively depends critically on the credibility of the Cartel Office(s). There are institutional indications that the sector responds by shifting its attention to reduce the level of the network access charges. The inevitable result will be that the incentive to discriminate against third parties increase, which may be far harder to detect and control. The next shift of policy attention can thus be expected to be focused on vertical unbundling of the monopoly businesses.

### *Appendix: the second-order conditions*

The second-order condition of $V(P(r,z))$ with respect to $r$, evaluated at the optimum:

$$\frac{\partial^2 V}{\partial r^2} = \left[ \frac{d^2\pi^*}{dr^2} - \frac{\vartheta_P}{(\vartheta+\delta)} \cdot \frac{d\pi^*}{dr} \right] + \left[ \left( \left( \frac{\vartheta_P}{\vartheta+\delta} \right)^2 - \frac{\vartheta_{PP}}{(\vartheta+\delta)} \right) \cdot (\pi - \pi^R) \right], \tag{27}$$

and for $z$ similarly:

$$\frac{\partial^2 V}{\partial z^2} = \left[ \frac{d^2\pi^*}{dz^2} - \frac{\vartheta_P}{(\vartheta+\delta)} \cdot \frac{d\pi^*}{dz} \right] + \left[ \left( \left( \frac{\vartheta_P}{\vartheta+\delta} \right)^2 - \frac{\vartheta_{PP}}{(\vartheta+\delta)} \right) \cdot (\pi - \pi^R) \right]. \tag{28}$$

The signs of these conditions depend on the specification of the probability function. The second term in squared brackets in both expressions can be positive, and can be sufficiently large so to make the entire expression positive. Close examination reveals that the second term between squared brackets gets large if the term $(\vartheta + \delta)$ gets very small. However, for very low values of $\vartheta$, the difference $(\pi - \pi^R)$ also is very small, which compensates. For positive values of $\delta$, not very close to zero, it turns out to be very unlikely for the second term between brackets to compensate the first term between squared brackets. Assume for the following that the probability function is such that this term always remains sufficiently close to zero. Now, (27) is unproblematic, since the first term in squared brackets is negative for the relevant range. Noting that $d^2\pi^*/dz^2 = 0$, it follows that the sign of (28) depends on $d\pi^*/dz$, which is determined by $r$. Obviously, for the relevant case, $d\pi^*/dz > 0$ and thus the second-order conditions will normally be fulfilled. Nevertheless, there is no guarantee, because it depends on the specification of the probability function. For the second-order conditions in the analysis of the partial threat, the same reasoning applies.

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