

## **Yardstick Competition**

**An insight into network utilities and the airport sector with particular regard to benchmarking as regulatory tool (*Work in Progress*)**

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## **1. Introduction**

This paper<sup>1</sup> is concerned with application of yardstick competition in the electricity industry as well as in the airport sector.

First of all, there will be an overview given on what the theory of yardstick competition combines and how it can be applied (section 3). Compared to rate-of-return and price-cap regulation yardstick competition does not take into account the costs of the individual firm at all. Instead, there is a benchmark analysis of the relative performance of the various firms in the industry.

Section 4 takes a look at the energy sector in Germany, Great Britain, Norway and the Netherlands. Primarily, the intention is to compare the different regulatory regimes and analyse the various advantages as well as drawbacks the regulators and firms are confronted with. With Germany introducing the new incentive regime in January 2008, it will be interesting to see whether there is potential for improvement compared to the regulatory regimes in the other countries. Up until now, the electricity industry in Germany and the Netherlands have been analysed<sup>2</sup> and there are already some significant differences as to how yardstick competition is implemented.

Taking the above analysis into account section 5 will examine whether yardstick competition can be applied to the airport industry. First of all, the monopolistic bottleneck will be identified in order to test whether the characteristics of comparability, plausibility and verifiability can be applied to it. Furthermore, the paper will inquire whether the methods that are used in the electricity industry can be easily transferred to the airport sector and if not where the problems in doing so are. However, these steps have not yet been completed and are therefore not presented.

The paper closes with a preliminary summary and an outlook on further research.

## **2. Rationale for Economic Regulation**

This paper deals with the existence of natural monopolies in various industries and the regulation of these. Therefore, it is important to illustrate what factors contribute to the emergence of natural monopolies and why it is necessary to implement regulation. There are different theories that give an explanation about how regulation evolved and how it is applied (see Stigler 1971 and Posner 1974).

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<sup>1</sup> The paper is based on a master thesis I am currently writing. The thesis is supervised by Hans-Martin Niemeier and Jürgen Müller.

<sup>2</sup> Great Britain and Norway will be analysed at a later stage.

Due to economies of scale, declining average costs and the existence of subadditivities it is more efficient if only one producer serves the entire market (see Fritsch 2005: 185). However, in the absence of competition the natural monopolist is not induced to charge competitive prices and to produce the level of output that is socially efficient. Instead, the price this particular firm charges is above marginal costs which in turn results in a too high price and too little output. This in turn results in an overall welfare loss and in a transfer of surplus from consumers to producers (see Baldwin 2002: 10).

Before implementing regulation one has to consider the concept of the contestability of the natural monopoly (see Baumol, Panzar, Willig 1982). This theory suggests that the threat of entry of potential competitors will restrain the monopolistic price setting behaviour of the incumbent. In order for this to apply, market entry has to be free and costless which implies that there has to be no form of sunk costs (see Baumol 1983: 271). Sunk costs arise with the existence of networks, for example, since these are costly to duplicate. An entrant is therefore not able to fully recover its costs once it leaves the market. Hence, regulation should be applied to the so called essential facility or monopolistic bottleneck. An essential facility represents an infrastructure or an institution the entrant needs access to in order to be able to supply the market (see Knieps 1997: 138–140).

The implementation and enforcement of regulatory schemes require high costs and effort and should thus be considered carefully. A natural monopoly might become obsolete due to technological progress or a shift in demand (see Fritsch 2006: 216). Therefore, the costs and benefits of regulation have to be considered carefully beforehand.

### **3. Regulatory Regimes in Practice**

#### **3.1 Introduction**

In practice, there are different types of economic regulation. These include the regulation of price, quality, quantity, entry and exit, and investment. The objectives of regulation include the protection of consumers, the promotion of productive, allocative and dynamic efficiency as well as the sustainability and the low cost of regulation.

The regulator is seen as the principal who sets incentives in order to get the regulated firm (the agent) to produce at welfare maximising levels (see Kunz 2003: 47/ 51). Taking all these factors into consideration the next section puts its emphasis on the regulatory regimes applied in practice.

There will be an overview given of rate-of-return regulation as well as price-cap regulation and what the underlying theories of these concepts are. In addition to that, the idea of yardstick competition is introduced.

### **3.2 Rate-of-Return Regulation**

The evolution of rate-of-return as well as cost-plus regulation aimed at finding a consensus between the interests of investors and consumers and voters. Regarding rate-of-return regulation, the regulator sets the rate of return on capital the firm is allowed to earn, i.e. the fair rate of return on investment in capital (s) which also includes an adequate risk premium (see Fritsch 2006: 237).

AVERCH and JOHNSON 1986 analysed the behaviour of the firm under rate-of-return regulation and concluded that there are incentives for the regulated firm to employ more capital than in the absence of regulation. The so called Averch-Johnson effect illustrates the situation when the firm utilizes an inefficiently high capital-labour ratio for the particular level of output (see Borrmann 1999: 347). The output could thus be produced with less capital and a higher input of labour. Another criticism of this particular form of regulation concerns the effects it has on allocative, productive as well as dynamic efficiency. It does not give incentives for productivity enhancement and cost savings since higher costs will be offset by higher prices in the next regulation period. In addition to that, the price structure that is embodied with this form of regulation does not reflect scarcity.

In regard to this, there has been demand for a new regulatory scheme that enables the regulator to promote efficiency in a better way.

### **3.3 Price-Cap Regulation**

Price-cap regulation was initiated in 1983 when Stephen Littlechild was given the task to find a new regulatory instrument in order to set prices for British Telecom which had just been privatised (see Newberry 2002: 207). The basic idea was to find a form of regulation that is easy to implement and that concentrates just on the monopolistic bottleneck compared to an end-to-end regulation which could often be found with rate-of-return regulation (see Knieps 2000: 7). In addition to that, price-cap regulation is seen as a transitory step towards deregulation and competition (see Littlechild 1983: 1).

The following table illustrates the differences in the two approaches and aims at highlighting why price-cap regulation is superior to rate-of-return regulation.

Feature	Possible Characteristics
	(a) rate-of-return regulation (b) price-cap regulation
(1) Criterion for price constraint	(a) cost based, historical costs and demand, fair rate of return on investment in capital (b) based on productivity/ projected efficient costs, forward looking
(2) Regulatory lag	(a) exogenous price fixing (e.g. every year, every 5 years) (b) endogenous price fixing, ex ante, typically a four- or five-year period (e.g. company might initiate tariff review)
(3) How long are prices fixed for?	(a) fix output prices are given until the next review (b) price indexation happens automatically (inflation, input costs, profit, etc.)
(4) Price flexibility	(a) regulation of price structure (b) regulation of price level, firms can be innovative concerning price structure

Table 3.1: A comparison between price-cap and rate-of-return regulation (see Kunz 2003: 52)

The variables taken to calculate the price-cap formula are exogenous and therefore the regulatory agency does not have to gather information concerning the cost and demand structure of the regulated firm. The variables taken into consideration are the retail price index (RPI) - the inflation rate - minus  $X$ , which accounts for productivity increases (e.g. technological progress) of the regulated firm (see Beesley 1989: 455).

$$P = RPI - X$$

The price cap is imposed on an average price of one or several baskets of goods or services (average or weighted price). The firm is thus allowed to make any price changes, i.e. price-cap regulation affects the price level not the price structure as in rate-of-return regulation, as long as the price the firm chooses does not exceed  $RPI - X$  (see Beesley 1989: 462). Since in price-cap regulation the prices are capped ex ante for a certain period there are incentives for the firm to enhance its productivity and to decrease its costs since it can keep the profit gains to itself, i.e. there is a higher incentive for productive efficiency<sup>3</sup> (see Bernstein 1998: 6). In addition to that, productivity gains are also passed on to the consumer via a higher  $X$  which results in lower prices (see Beesley 1989: 456). Price-cap regulation is therefore considered as a high-powered incentive scheme.

<sup>3</sup> The criticism of price-cap regulation often includes the fact that it is more focused on productive than allocative efficiency.

There are different forms of price-cap regulation. First of all, a price-cap scheme can be pure or include hybrid elements such as sliding scales which adjust for excessive profits of the firms. Furthermore, one can differentiate between the tariff basket approach and the revenue yield approach (see Beesley 1989: 463).

When setting the X factor the regulator takes into account the difference in the input growth rates of the regulated sector and the rest of the industry as well as the productivity growth rates in the above sectors (see Bernstein 1998: 8). Once the initial tariff level is set the regulator faces greater constraint in resetting the X factor which might be due to the greater bargaining power the regulated firm gained by privatisation or the pressure the agency faces by the public to meet certain expectations (see Beesley 1989: 456).

### 3.4 Yardstick Competition

Yardstick competition is also some form of incentive regulation since it aims at inducing the regulated firm to improve both its static as well as its productive efficiency. Yardstick competition implies that the regulator is "placing similar firms in competition with each other with respect to their cost levels" (Baldwin 1999: 243).

In the following, the model of SHLEIFER (1985)<sup>4</sup> regarding the implementation of yardstick competition is explained. The one-period model consists of N identical risk-neutral firms which operate in an environment without uncertainty. Each firm has a downward-sloping demand curve  $Q(P)$ . The regulator knows the market-specific demand curves. The firm  $i$  has an initial marginal cost level of  $MC_0$  which it can reduce to  $MC$  by making an investment in cost reductions of  $R(MC)$ . Shleifer states that the higher the investment in cost reductions, the lower will be the resulting unit cost. In addition to that, the regulated firm receives a lump-sum transfer of  $TS$  from the government. The social optimum under these conditions will be fulfilled if the transfers  $TS$  cover the investments undertaken by the firm to reduce costs [ $R(MC) = TS$ ], price equals marginal costs [ $P = MC$ ] and if the condition for cost minimization to produce  $Q$  is met [ $-R'(MC) = Q(P)$ , where the first term denotes the marginal cost of cost reduction]. In order to lower the unit cost by a certain amount ( $\Delta MC$ ), the firm has to invest a certain amount to reduce the unit costs ( $-R'(MC)\Delta MC$ ). At the social optimum the cost and benefits of the marginal change must be equal. The aim of the regulator is hence to maximise producer as well as consumer surplus. In doing so, the principal first announces the rule according to which he is going to set the prices. After that, the regulated firm embarks on cost reductions which will again be observed by the regulator. According to

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<sup>4</sup> See Shleifer, A. (1985): A theory of yardstick competition

the resulting figures the regulator sets prices and the transfers the firm will receive. Firms produce an output of  $Q(P)$  at a price of  $P$  and receive transfers of  $TS$ .

In implementing yardstick competition, the regulator employs the cost levels of identical firms in order to settle on a certain price. In this case there are two or more firms operating in the market ( $N \geq 2$ ). There will be a so called shadow firm each firm  $i$  will be measured against. The cost level and the investment in cost reduction of firm  $i$  are determined by the mean marginal cost of all other firms ( $j$ ) in the market.

$$\overline{MC}_i = \frac{1}{N-1} \sum_{j \neq i} MC_j$$

$$\overline{R}_i = \frac{1}{N-1} \sum_{j \neq i} R(MC_j)$$

The regulator sets the transfers and prices accordingly [ $TS = \overline{R}_i$  and  $P_i = \overline{MC}_i$ ]. These are set irrespective of any choices, whether efficient or inefficient, firm  $i$  makes. If the regulator commits to these prices and transfers then yardstick competition will yield the first-best outcome.

In Shleifer's model, when there are no transfers from the government the regulator will apply average cost pricing. Under these conditions, firm  $i$  will choose the second-best output. If there are heterogeneous, exogenous characteristics concerning the firms to be compared the regulator can use regression in order to adjust for this heterogeneity. If the regulator obtains a list of all the characteristics that account for the heterogeneity he can achieve the first-best output by determining the coefficients correctly. In case there are heterogeneities that are not accounted for, there will be deviations from the optimum.

Conclusively, there is no link between the costs of the firm and the prices. The principal-agent problem is circumvented by referring to data that is easily available. Moreover, firms have an incentive to provide information for the benchmark study since they do want the outcome to be to their advantage and thus based on the correct data.

The application of regulation by yardstick competition might not be feasible in all industries. There are several factors that have to be taken into consideration when evaluating the implementation of this form of regulation.

First of all, there has to be some form of **market failure** which in turn requires regulation. In addition to that, the so called **comparability** requirement (homogeneity and multiple agents) has to be fulfilled. There have to be firms or industries the regulated firm can be compared to, otherwise yardstick regulation is not possible. Quite often there is a regional natural monopoly which will then be compared to other regional ones that exhibit the same or at least similar characteristics concerning the technological environment (see Laffont

1993: 84). The third requirement is related to **private information**. The company in question has superior information compared to the regulatory agency, including information on the firm’s cost and demand. By using benchmarking methods to establish a sector standard the regulator extracts this private information from the agents in the sector and therefore does not need to have the same information as the firm. Most importantly, the data on demand and costs the regulator uses has to be reliable and **verifiable** since there might be cases where the firm does not accept the price level the regulator establishes and therefore might appeal against it in court (see Canoy 2000: 22).

A form price-cap regulation might take is the so called relative performance price cap. This specific form of yardstick competition regulates the firm’s price level by comparing the cost and demand functions of the firms in the concerned sector, i.e. the price cap is based on relative performance (see Kunz 2003: 70). Therefore, it has to be considered whether it is applicable to set the X factor in price-cap regulation plans by the benchmarking of similar firms. This might also be limited to partial processes of the firms. This particular issue will be discussed in detail later when considering network utilities.

Benchmarking is only part of yardstick competition and therefore cannot be used as a substitute for the above concept. Once some form of benchmarking concerning the relative performance of the different firms in the sector has taken place, the results have to be linked to the price level the regulatory agency determines (see Canoy 2000: 29). The comparative indicators chosen in order to set a price cap for the firm to be regulated are exogenous to this firm but endogenous to the whole industry (see Burns 2005b: 302). The table below illustrates the different methods that can be used in order to conduct a benchmarking analysis.

<i>Non-parametric</i>	Data Envelopment Analysis (DEA) → <i>Coelli 1998</i>	Stochastic or chance constrained Data Envelopment Analysis (SDEA)
<i>Parametric</i>	Corrected/ Modified Ordinary Least Squares CRS & VRS regression	Stochastic Frontier Analysis (SFA)
	<i>Deterministic</i>	<i>Stochastic</i>

Table 3.2: Different benchmarking techniques (see Riechmann 2006: 207)

The methods differ concerning the relevant variables that are used and the objectives the regulatory authority pursues with their regulatory scheme.

## **4. Network Utilities and Yardstick Competition**

### **4.1 Introduction**

One important industry which will be considered is the electricity industry which was subject to enormous change especially during the last decade. The EU countries were compelled to introduce electricity market reform into national legislation based on the European Electricity Directive 96/92/EC (see Riechmann 2000: 362). The guideline of the EU aimed at opening up electricity markets to competition in the various countries. Concerning the electricity generation, the EU specifies entry to take place via a tendering and/or an authorization procedure<sup>5</sup>. Furthermore, the directive dictates the access to the system. At first, the nations had the choice between negotiated third party access (negTPA), regulated third party access (regTPA) or via a single buyer procedure (see AIB homepage, EU directive 96/92/EC). New guidelines in the years after 1998 oblige countries to implement regulated TPA regarding the access to the particular network (see BNetzA homepage). Furthermore, in Germany, every consumer is able to switch to their own electricity provider (see Brunekreeft/ Keller 2003: 132).

This led many countries to liberalise their electricity markets as well as to introduce new regulatory regimes. Section 4.3 thus highlights examples from different countries where changes have taken place. In accordance to that, the extent of liberalisation, the features of the national electricity industry as well as the current regulatory regimes are illustrated. Concerning the latter, especially the implementation of yardstick competition and the extent to and form in which it is implemented are regarded. The Bundesnetzagentur (BNetzA) in Germany is obliged to introduce some form of incentive regulation in the national electricity market in 2008. The section will hence discuss the proposal regarding the form of incentive regulation that is supposed to be implemented and whether it can promote competition as well as increase efficiency in the industry. Other examples of some form of yardstick regulation in electricity, water, and gas industries stem from The Netherlands, Great Britain and Norway. These countries have been chosen because they were affected by the EU directive as well and therefore had to reform their prevailing regulatory regime. Furthermore, the features of the regulatory scheme of these countries are similar to the one the BNetzA intends to introduce in January 2008 since they all contain some form of yardstick competition. Hence, they provide good examples and conclusions can be drawn for the German method from the problems that occurred in the other countries.

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<sup>5</sup> For a more detailed description of the construction of new generation capacity and conditions of network access see [http://www.aib-net.org/portal/page/portal/AIB\\_HOME/AIB\\_ASS/DOCUMENTS/EU\\_DOCUMENTS/Directive%2096-92-EC.htm](http://www.aib-net.org/portal/page/portal/AIB_HOME/AIB_ASS/DOCUMENTS/EU_DOCUMENTS/Directive%2096-92-EC.htm)

## 4.2 Network Utilities and Essential Facilities

“Network utilities are public utilities that require a fixed network to deliver their services, and include gas, electricity, water, rail, and fixed linked telephony.” (Newberry 2002: 1)

Network utilities are further characterized by economies of scale, high sunk cost, and high cost of duplication (see Newberry 2002: 3). This implies that there is only one supplier of the network utility, i.e. there is a natural monopoly. In addition to that, network utilities often include the existence of an essential facility. However, not all elements of the vertical chain of a network utility have a monopolistic character. The intention of the EU in defining directives is to open up these sectors to competition and therefore increase efficiency. For the monopolistic bottlenecks, on the other hand, there has to be some form of incentive regulation that determines the access prices.

The next figure illustrates the different elements of an electricity network and highlights those sections where a monopolistic bottleneck can be found and where some form of regulation is implemented.

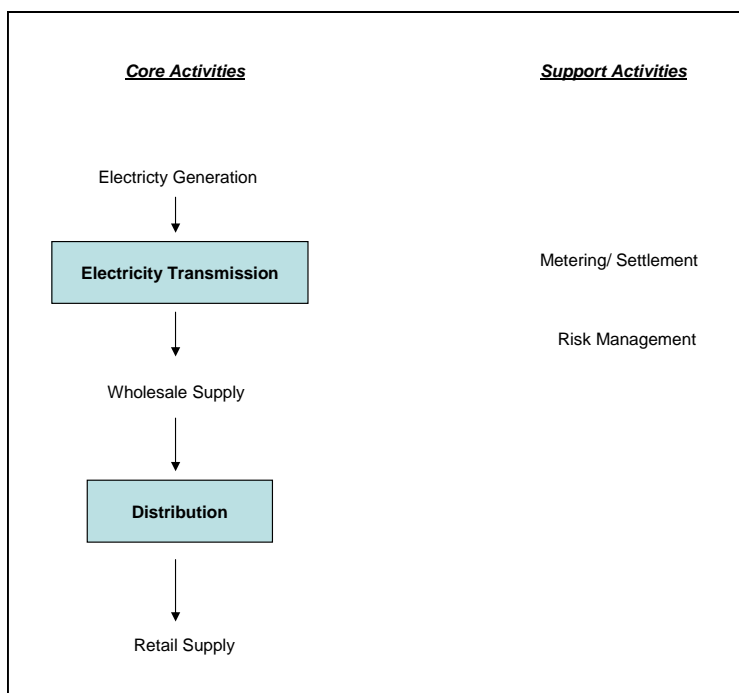


Figure 4.1: Electricity industry segments (based on Riechmann 2000: 366)

The functions in the box illustrate the monopolistic bottlenecks within the electricity industry. Conclusively, competition is possible in the sectors of electricity generation, wholesale supply, and retail supply. However, characteristics of a natural monopoly exist in electricity transmission and distribution and therefore regulation has to be implemented in these

segments. Before dealing with the monopolistic bottlenecks there will be a short overview of the competitive sectors of the electricity industry (see Riechmann 2000: 365-367).

1. Electricity generation involves power plants of different types such as coal, gas, oil, or nuclear energy. They are also grouped according to their length of operation as well as to their voltage level (e.g. high-voltage level compared to low-voltage level).
2. Wholesale supply defines the trade between the producers of electricity and the retailers. The exchange between these two parties happens via power exchange or bilateral contracts at the transmission level.
3. Retail supply involves the sale of electricity to end consumers such as companies or households.
4. Metering/ settlement and risk management can also be separated from the monopolistic bottlenecks and therefore become subject to competition.

At these stages competition is possible because there are no or hardly any sunk costs and the different functions (generation and wholesale/ retail supply) can be copied easily by other firms<sup>6</sup>.

The electricity transmission and distribution, on the other hand, are so called grid functions since there is some form of network involved that is necessary in order to allocate the electricity supply (see Riechmann 2000: 369). The transmission stage involves the distribution at extra-high-voltage level whereas the distribution stage entails the supply via local or regional networks at high-voltage level (see Brunekreeft/ Keller 2003: 136). Since the set up and maintenance of these particular networks involve high sunk cost and high cost of duplication as well as economies of scale the two functions display a natural monopoly. However, in order to promote competition in the upstream as well as the downstream market, as intended by the EU, the access to these networks (essential facilities) has to be ensured by setting fair and competitive access tariffs. Furthermore, the essential facilities are vertically separated from the other segments. The so called unbundling of these activities takes either place by management or accounting separation (see Brunekreeft/Keller 2003: 139). The tariffs for accessing the transmission and distribution networks are then imposed by a regulatory agency that has been established for this purpose (see AIB homepage, EU directive 96/92/EC)<sup>7</sup>.

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<sup>6</sup> For a more detailed description of the development of the electricity industry such as the influence of technological progress and thus the orientation towards a more competitive environment see Riechmann 2000.

<sup>7</sup> In Germany, the access charges are regulated by the Bundesnetzagentur (BNetzA).

### 4.3 The Application of Yardstick Competition in Different Countries

First of all, there will be a short overview of the concept of revenue-cap regulation which is often applied in the energy sector. The second part of section 4.3 deals with the implementation of yardstick competition in different countries and tries to give some evaluation regarding the efficiency of the implemented regimes.

#### 4.3.1 Revenue-Cap Regulation

Revenue-cap regulation is also some form of incentive regulation and similar to price-cap regulation. Thus, this mechanism induces the regulated firms to enhance their productive as well as allocative efficiency and allows cost savings to be kept within the firm during the regulatory period until a new revenue cap is fixed (see Jamasb 2000: 6). Concerning revenue-cap regulation, however, the revenues instead of the prices of the industry are fixed and adjusted for inflation. A simple formula for calculating the revenue cap is as follows

$$EO_t = EO_{t-1}(1 + \Delta RPI - X_{gen} - X_{ind}) + Z,$$

with  $EO_t$  displaying the revenue cap for the year  $t$ ,  $\Delta RPI$  the change of the (retail) price index,  $X_{gen}$  the general X factor,  $X_{ind}$  the individual X factor for each company, and the Z factor which accounts for costs that the firm cannot influence (see Schäfer 2006: 175). The same author states that the calculation of the individual X factor can be based on the benchmarking of the various firms in the industry in order to get a frontier or average efficiency level (see 175). The general X factor, on the other hand, will be the same for all companies in the industry (see 176). When setting the revenue cap the regulator does not take into account the level of output the firm produces. That means that an increase in output levels does not change the level of revenues the firm is allowed to earn. In order to maintain the fixed level it has to lower prices. In a price cap regulation, on the other hand, a rise in output incorporates a rise in revenues. This also goes along with an adjustment in prices according to the obligations imposed by the regulator (see Franz/ Schäffner 2005: 96). Hence, price-cap regulation induces firms to extend their output levels whereas a revenue cap rather encourages regulated companies to reduce their level of output. However, regulatory regimes tend to include some hybrid elements by adjusting for fluctuations in output, for instance (see Franz/ Schäffner 2005: 97).

#### 4.3.2 Germany

In Germany, the authority responsible for the regulation of the electricity sector is the so called Bundesnetzagentur (BNetzA) which also regulates the telecommunications as well as the post sector. The objective of this agency is to implement a lean and efficient regulatory

regime that reduces prices and hence enhances welfare for consumers. Furthermore, the BNetzA has to ensure provision and quality of electricity supply. The Energiewirtschaftsgesetz (EnWG)<sup>8</sup> which came into effect in July 2005 obliges the regulator to ensure competition in the upstream and downstream markets and to grant access to the essential facility (transmission and distribution) as well as to implement some form of incentive regulation.

Concerning the structure of the electricity network, there are currently four transmission network operators as well as more than 900 distribution network operators which used to be mainly regional or local monopolies (see Brinker 2005: 89). In comparison to other European countries that will be discussed below there is a much higher degree of heterogeneity concerning the distribution companies and a rather decentralised structure of the German electricity industry.

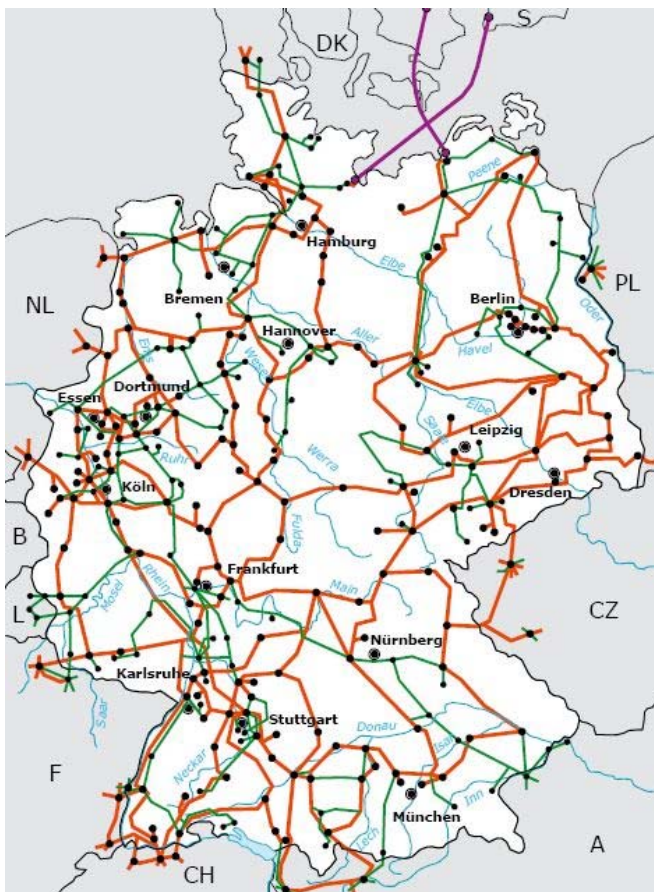


Figure 4.2: The transmission network in Germany (source: VDN website)

<sup>8</sup> For a more detailed overview concerning the content of the EnWG see:

[http://bundesrecht.juris.de/enwg\\_2005/index.html](http://bundesrecht.juris.de/enwg_2005/index.html)

With the implementation of the EnWG the regional and local monopolies in Germany were split up into the competitive sections of the vertical chain and the monopolistic bottlenecks (BNetzA website). In accordance with the regulation of the essential facilities, namely transmission and distribution, the BNetzA is obliged to introduce some form of incentive regulation so as to induce the regulated companies to produce in a more efficient way. The BNetzA has to consider that the implemented form of regulation is going to be accepted by the public as well as by the political parties. The next section will highlight the main features of this form of incentive regulation, which will be introduced on January 1, 2008, and the elements of yardstick competition it is supposed to contain.

The main elements will be discussed in accordance with §21a of the EnWG (see BNetzA Bericht: 44). First of all, the BNetzA has to collect data of all the companies to be regulated in Germany. The data is required to be consistent, plausible, and verifiable. Once the data is collected the BNetzA has to detect inefficiencies in order to determine the general as well as the individual X factor for the regulated companies. By doing this the BNetzA establishes the revenue cap in combination with objectives concerning efficiency gains the network operators have to follow (see Lundborg 2005: 123). If the companies' revenue is below or above the required revenue cap there will be a so called 'Regulierungskonto' (regulation account) where the differences are adhered to (see Leprich 2006: 202).

First of all, there are certain aspects that the BNetzA has to take into consideration when establishing incentive regulation. These include the permanent supply of energy for the consumers as well as the prevention of natural monopolies. In addition to that, the BNetzA has to ensure consumer protection and fair processes concerning its objectives (see Leprich 2006: 197). With the introduction of yardstick competition the consumers and the producers are confronted with a so called win-win situation, i.e. the producers can enhance their profits and at the same time the consumers pay a lower price for the products (see Schäfer 2006: 173). In order to ensure permanent quality and supply the BNetzA puts an emphasis on the consideration of the total cost or expenditures (TOTEX) and on an annual comparison calculation of the costs. Moreover, there will be a technical-economical register that captures the standard costs for investment (see BNetzA Bericht: 52). The revenue cap will also account for investment that has to be made in order to maintain and further develop the electricity network and integrate a component that ensures a certain standard of quality.

The first step in establishing a revenue cap for the regulation of the German electricity industry is to analyse the costs that are taken into account. The BNetzA differentiates between three different groups of costs. First of all, there are those costs that cannot be influenced by the regulated company. This group can be split into permanent non-

influenceable costs and temporarily non-influenceable costs. The first category of costs cannot be changed by the regulated firm, neither by increasing efficiency nor by changing the structural environment (see Steinbach 2006: 33). This category includes costs such as prices the network operator has to pay for inputs from the upstream market or taxes that have to be paid to the government (see Steinbach 2006: 33). The latter type denotes costs that arise due to the different structural environments the various firms are operating in (see BNetzA Bericht: 22). The figure below illustrates how the BNetzA accounts for the various cost types in its efficiency analysis.

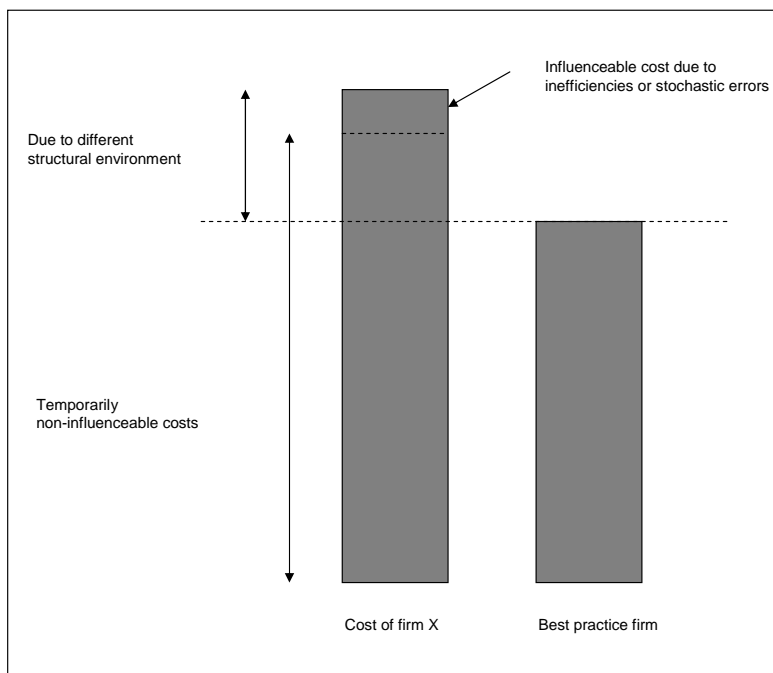


Figure 4.3: Different cost types the BNetzA takes into account when calculating the revenue cap (source: Steinbach 2006: 33)

At the beginning of the regulatory period the BNetzA determines the revenue cap for the operators of the electricity networks by taking the cost data of the last finished financial year of each regulated firm and undertaking a regulatory review. The next step will be to determine the permanent and the temporarily non-influenceable costs. The latter are detected by an efficiency comparison with the best practice firm (see Steinbach 2006: 33). Furthermore, the differences in the structural environment are included via different structural parameters (see Schäfer 2006: 177). Once the above cost types have been subtracted the remaining group is the so called influenceable costs. The inefficiencies (figure 4.3) are ascribed to the latter costs and are supposed to be reduced within two regulatory periods, i.e. within six to eight years (see Steinbach 2006: 34). There will also be an efficiency analysis concerning the proportion of inefficiencies of the TOTEX, operating

expenditures OPEX and capital expenditures CAPEX. Inefficiencies which are due to OPEX have to be reduced within three years, those resulting from CAPEX, on the other hand, have to be eliminated within six to eight years. The efficiency objectives concerning the reduction are determined for each firm individually. (See BNetzA Bericht: 67) In addition to that, there is going to be an adjustment factor that corrects for extreme deviations of costs in order to maintain the comparability of these costs.

The data that has been collected and analysed so far is used in the following formula which illustrates in detail the revenue cap that is going to be implemented in the German electricity industry.

$$EO_t = KA_{dnb,t} + (KA_{vnb,0} + (1 - EV_{ind,t}) * KA_{b,0}) * \left( \frac{VPI_t}{VPI_0} - PF_t \right) * EF_t + Q_t \geq \sum_{i=1}^n P_{i,t} + Q_t \geq \sum_{i=1}^n P_{i,t} + \Delta RK_t$$

$EO_t$  illustrates the revenue cap for the year t.  $KA_{dnb,t}$  denotes the permanent non-influenceable costs in the year t,  $KA_{vnb,0}$  the temporarily non-influenceable costs in the base year and  $KA_{b,0}$  the influenceable costs in the base year.  $VPI$  is the consumer price index (CPI).

$EV_{ind,t}$  stands for the individual efficiency guideline for each company in the year t ( $X_{ind}$ ). The term  $1 - EV_{ind,t}$  adjusts for differences in the individual efficiency levels and is gradually being reduced to zero (see Steinbach 2006: 34).  $PF_t$ , on the other hand, is the general efficiency improvement in year t ( $X_{gen}$ ). The individual X factor is calculated by benchmarking the different network operators and it accounts for the various efficiency levels of the individual firms in the electricity industry (see Schäfer 2006: 176). The BNetzA intends to directly convert the results from the benchmarking process into efficiency objectives for the firms (see Schäfer/ Schönefuß 2006: 173). The general X factor is the same for all operators and stands for the productivity gains of the whole industry that might be due to technological progress, for example (see Schäfer 2006: 176). The calculations regarding the general X factor are based on BERNSTEIN and SAPPINGTON 1998.  $X_{gen}$  intends to induce those firms to further enhance their productivity that are always operating on the efficiency frontier. Once these firms realise efficiency increases there will be an outward shift of the efficiency frontier (see BNetzA Bericht: 166). Moreover, the BNetzA plans to pay these firms some form of rent for performing most efficiently (see BNetzA Bericht: 81). However, the firms that have not reduced their full amount of inefficiencies have to catch up with the frontier as well as with the frontier shift. The general X factor is going to be set between 1.5% and 2.0% and refers to international experience (see Steinbach 2006: 34).

$EF_t$  is an incorporated hybrid element which allows the firms to adjust for unexpected costs such as the increase in supply interfaces, i.e. the regulated firm receives a return per interface (see Franz/ Schäffner 2005: 97).  $Q_t$  denotes the revenues above or below the cap

for quality of supply in the year  $t$ . A factor relating to the quality of the output supplied is important because otherwise the network operators might reduce quality in order to save costs and therefore increase profits (see Leprich 2006: 203).

$P_{i,t}$  and  $M_{i,t}$  are the price for the product  $i$  and the output of  $i$  in the year  $t$ , respectively.  $E_{sonst,t}$  describes the cost reducing revenues in the year  $t$  and  $\Delta RK_t$  is the difference in revenues which will be booked to the regulation account in the year  $t$  (e.g. due to volatility of prices). (See BNetzA Bericht: 78)

After the two regulatory periods (six to eight years) the BNetzA plans to abolish the above revenue cap and replace it by yardstick regulation since this method best imitates competition (see Steinbach 2006: 32).

By establishing the above revenue cap the BNetzA refers to the obligation of the EU directive to implement a regulatory system that is based on costs. The system introduced in the German electricity industry takes into consideration the costs of comparable firms but not of the individual firm itself (see BNetzA Bericht: 42). For the operators of the transmission network there will be some specifications that account for their particular role in the electricity industry. They have to ensure the stability of the whole system and it will be their responsibility to build up networks that include other European suppliers (see BNetzA: 71). Since there are only four operators in the German market, there will be a so called relative reference network analysis (RNA) that also takes into account other international transmission network providers.

The benchmarking process which the BNetzA applies to the costs of the network operators requires several methods that ensure a consistent and verifiable outcome which can be translated into efficiency guidelines. Therefore, the BNetzA uses a combination of different methods including DEA, SFA, and the above RNA as well as a model network analysis (MNA)<sup>9</sup>. The intention of this approach is to come to a convergence of results and hence to a high level of consistency, plausibility and verifiability of the efficiency guidelines produced (see BNetzA Bericht: 65). The parameters used for input and output variables are TOTEX, CAPEX, OPEX, quality variables, and supplied area, number of interfaces, annual peak load, respectively. Structural variables include geographical, topological and geological features (see BNetzA Bericht: 87). By using MNA it is possible to determine the influence of different structural parameters in different regions (see VDN Nitzschke et al).

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<sup>9</sup> For a more detailed description of the methods used in the benchmarking process see BNetzA Bericht pp. 175-193.

One main point of criticism refers to the direct translation of benchmarking results into individual efficiency guidelines. The reason is that the wide variety of benchmarking methods makes it almost impossible to determine the 'true' efficiency of a firm. The level of efficiency one receives always depends on the choice of input and output variables (see Schäfer 2006: 180). Ibidem also states that a direct translation of the benchmarking results into efficiency guidelines might increase the requirements for firms to enhance their productivity and therefore lead to a decrease of the economic stability as well as the supply guarantee (181). Before and once the above form of regulation has been implemented there has been and still will be ongoing discussion whether the chosen regulatory regime will be able to provide a strong enough incentive mechanism in order to enhance productivity in the electricity industry. The transition to a more competitive environment and hence lower prices for the network access is the main objective of the EU and the BNetzA. With the introduction of the new regulatory regime consumers in Germany are thus hoping for a reduction of electricity prices (see Bauchmüller 2006).

The next sections will illustrate examples of some form of incentive regulation in other countries. The aim is to highlight strengths and weaknesses of the regimes in order to enhance the German regulatory regime in the energy industry.

#### **4.3.2 Great Britain**

#### **4.3.3 Norway**

#### **4.3.4 Netherlands**

The Energy Act in 1998 established the Office of Energy Regulation (DTe) as the authority that is responsible for the introduction of an incentive regulation scheme in the electricity industry in the Netherlands. It is a chamber of the Netherlands competition authority (see Electricity Act 1998: 3). Its tasks include the assurance of security of supply, the promotion of competition in the relevant sectors and the setting of tariffs for the regional network companies (see DTe website). In the Netherlands, there is only one national grid operator, namely TenneT, which ensures the transmission of electricity at the national level (see DTe Method Decision TenneT 2006: 2). In addition to that, there are several regional grid companies that are responsible for the distribution of energy to the retail level.

With the assignment of competences to the DTe, the whole regulatory system of the energy sector was subject to change. The main objective of the government and thus DTe is to enforce the change from cost based regulation to one that is based on incentives. Basically, DTe first introduced a price cap that the regional network operators had to adhere to. By putting an individual X factor in place the distribution companies were induced to eliminate differences in efficiency levels (see DTe Methods Decision regional grid operators 2006: 4). After these differences have been eliminated the DTe is about to introduce yardstick regulation for the regional distribution companies.

When establishing a revenue cap DTe distinguishes between the national grid operator TenneT (transmission) and the regional grid companies (distribution) in a similar way as the BNetzA by highlighting the different objectives the transmission and the distribution companies pursue (see DTe Method Decision TenneT 2006: 3).

First of all, there will be an overview of the regulatory scheme imposed on the transmission network operator TenneT. For the third regulatory period, DTe increased the regulatory lag from three to four years in order to achieve a higher degree of stability in the system, i.e. the scheme imposed is valid from 2007 to 2010 (included) (see DTe Description of the method 2006: 2). One main difference in the two regulatory approaches is the omitting of a quality term as it can be found in the revenue cap for the regional grid operators. The supply of quality is ensured by the so called Grid Code which obliges the national grid operator to maintain a single reserve for interruptions (see DTe Methods Decision TenneT 2006: 8).

The revenue-cap formula in the Netherlands takes the following form:

$$TI_t = TI_{t-1}(1 + CPI_t - X_p),$$

with  $TI_t$  representing the total allowed returns TenneT is allowed to earn,  $CPI_t$  the relative change in the consumer price index (for all households) and  $X_p$  denoting the efficiency change the operator can achieve each year during the regulatory period (see DTe Technical Description of the Model 2006: 3). The X factor in the formula consists of two different components. The first one is an individual X factor which accounts for inefficiencies that TenneT shows and which were detected by an efficiency comparison undertaken by an external company, SumicSid (see DTe Description of the Method 2006: 9). The results obtained in this study are not translated into efficiency guidelines directly but rather used as a basis for information (see DTE Description of the Method 2006: 14)<sup>10</sup>. In addition to a reference to individual productivity development there will also be a generic X factor which is

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<sup>10</sup> For a more detailed description of the study see DTe Description of the Method 2006 as well as Agrell, P. and Bogetoft, P. (2006): ECOM+ Results 2005, Final Report on

[http://www.dte.nl/images/Addendum%20E%20TSO%20benchmark%20by%20SumicSid%20AB\\_tcm7-98491.pdf](http://www.dte.nl/images/Addendum%20E%20TSO%20benchmark%20by%20SumicSid%20AB_tcm7-98491.pdf)

based on the general efficiency increases in the sector such as technological progress. This X factor indicates a frontier shift that the national grid operator is able to achieve (see DTe Description of the Method 2006: 10).

In regard to the regional grid operators, DTe also applies a revenue cap but one that is based on yardstick competition. The main objective when implementing the regulatory scheme was to achieve a so called level playing field of all the regional distribution companies, i.e. inefficiencies and thus differences in the efficiency level were to be eliminated.

The first regulatory period starting in 2001 contained a CPI-X formula with an X factor of 3.2% which was agreed upon during several consultations with the regulatory agency and members of the industry (see BNetzA Bericht: 113). Individual differences were not considered during the first period. However, in 2000 a benchmarking analysis was conducted taking into account historical investment and in order to determine inefficiencies that are due to excessive OPEX (see Riechmann/ Rodgarkia-Dara 2006: 208). The regulatory lag is three to five years but up until now the regulator preferred a period of three years, i.e. from 2001 to 2003 and from 2004 to 2006.

In the second regulatory period from 2004 to 2006 the DTe undertook several amendments to the revenue cap. Hence, the general productivity indicator  $X_{gen}$  was complemented by an individual X factor  $X_{ind}$  that is supposed to account for structural differences between the different firms in the industry. The difference in the productivity level in 2002 and 2005 was taken as a basis. The benchmarking analysis which was carried out took as input variables the TOTEX (CAPEX is standardised) and as output parameters the weighted transported output as well as the weighted number of customer interfaces. The method used for benchmarking is a simplified DEA approach that sets the input in relation to the output and thus determines the most efficient value. The value of the individual companies is divided by the latter and one receives a result between 0-100%. Other structural parameters are considered in different projects. (See Riechmann/ Rodgarkia-Dara 2006: 208). The generic X factor in this period was 1.5% and the individual one was defined according to the benchmarking results (see Lundborg 2005: 121).

The third regulatory period from 2007 up to 2009 (included) introduces the concept of yardstick regulation. There will not be an individual X factor anymore that accounts for differences in the efficiency levels of the various distribution companies but there will be the same factor for all companies.

$$\pi_{i,t} = \left(1 + \frac{CPI_t \mp X \pm Q}{100}\right) * \pi_{i,t-1}$$

with  $TI_{i,t}$  denoting the total revenues the distribution company  $i$  is allowed to earn and  $TI_{i,t-1}$  representing the total revenue the distributor was allowed to earn in the previous year. Again,  $CPI_t$  stands for the relative change in the consumer price index (for all households). (See DTe Method decision Regional Grid Operators 2006: 2). The factor  $X$  in the formula and the  $Q$  element will be discussed in further detail below.

“The X factor in the third regulatory period is based on the average, annual change in productivity of all grid managers during the years 2003, 2004 and 2005, corrected for differences in efficiency and the effect of the amended cost of capital allowance. The X factor is also based on the difference between the expected total allowed revenues for 2006 and the realised total revenues for 2006 [...]”

(DTe X Factor for Regional Grid Operators 2006: 15)

Hence, the intention of the individual X factor, which was introduced in the second regulatory period, was to adjust the efficiency levels of the different regional distribution companies in order to apply yardstick competition. The government and DTe required the operators to reduce their costs to the determined efficient cost level by the beginning of 2007, the third regulatory period (see BNetzA Bericht 2006: 114). However, DTe takes also into consideration the regional structural differences the various distribution companies face and which they do not have any influence on. In order for DTe to approve of a reduction or an increase of the determined revenue cap the regional differences have to be sustainable and substantial (see DTe X Factor for Regional Grid Operators 2006: 6). Sustainable means that the structural features are persistent over time in that particular area. Substantial, on the other hand, implies that the percentage of the standardised economic costs exceeds the average for the sector by more than one percentage point (see DTe X Factor for Regional Grid Operators 2006: 7).

The Q parameter is the quality component of the revenue cap that sets incentives for investments in quality. The quality is measured by the number of interruption minutes. By investing in the quality, i.e. the reduction in the above number, the distributor is able to charge higher tariffs since it is performing above average (see DTe Methods Decision Regional Grid Operators 2006: 4).

## **5. The Airport Sector**

### **5.1 Introduction**

### **5.2 Identifying the Monopolistic Bottleneck**

### **5.3 Comparability of Airports**

### **5.4 Yardstick Competition in Practice**

## 6. Conclusion and Outlook

Up to this point, some conclusions can already be drawn and an outlook can be given as to what to expect when examining the potential implementation of yardstick competition in the airport sector.

First of all, the implementation of yardstick competition in Germany and the Netherlands differs in regard to several aspects. In Germany, the electricity industry is characterised by heterogeneity with 4 transmission companies and about 900 distribution companies whereas in the Netherlands there is only one national grid operator and about 10 distribution companies. This aspect has to be considered carefully when implementing yardstick competition since it influences the comparability of firms. Secondly, the BNetzA intends to translate the benchmarking results directly into efficiency objectives whereas DTe in the Netherlands uses the results as information that contributes to the establishment of efficiency frontiers. In order for benchmark results to be transferred mechanically they have to be plausible and verifiable, i.e. the results that are obtained during the analysis should be objective and mirror the 'true' efficiency.

In regard to airports, the first problem that might come up is the comparability of these. The question arises what airports have to be included when conducting a benchmarking analysis, regional and international airports are significantly different and therefore difficult to compare. In Germany, for example, airports differ in regard to their size, the type of customer (either passengers or airlines) and the capacity utilisation. Is it reasonable to undertake an international benchmarking and include other European airports such as the Netherlands did for its national grid operator?

Furthermore, the regulatory agency that wants to implement yardstick regulation has to consider whether the existing method shall be fully replaced by the above concept or whether it shall just be complemented by it. Airports also differ in regard to their ownership structure since some are fully privatised, some are subject to partial privatisation and some are still fully publicly owned. In addition to that, the cost structures vary taking into consideration the various levels of outsourcing of activities at airports.

Bearing the above points in mind, the implementation of yardstick competition might appear rather difficult.

The paper will be supplemented by an analysis of other European countries that implemented some form of yardstick competition in the electricity industry. In addition to that, there will be a case study of Dublin Airport in order to evaluate the application of this particular scheme to the airport industry.

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