Performance-based regulation of energy utilities in Central Europe and Baltic states

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Abstract

Although it is considered that energy industries have not been dramatically hit by the global financial crisis, a good performance of these industries in essential for a state's stability, economic development and national security. The issues of regulated utilities performance should not be overlooked when dealing with the fast changing environment nowadays. The purpose of performance-based regulation is to induce a company to behave efficiently and reduce its costs in an environment where competition is not feasible. In this paper, we focus on energy tariff regulation practice in post-communist states of Central Europe and Baltic region, namely the Czech Republic, Slovakia, Hungary, Poland, Slovenia, Estonia, Lithuania and Latvia. We present new trends in regional regulatory practices, which apparently tend to shift towards performance-based regulation. In the first part of the paper, we develop the background of economic regulation. Subsequently, we describe basic regulatory regimes – cost-of-service regulation, performance-based regulation and yardstick competition. Then we deal with regulatory benchmarking as a supplement to performance-based regulation and describe the most widely used benchmarking techniques. Then we deal with performance-based regulatory regimes in the individual countries within the surveyed region and we discuss the methods and differences. We have found that within the surveyed region, all countries have been applying some form of performance-based regulation. However, the methods in individual countries vary. Price-cap has been the most widely used methodology within this region. Only Hungary has incorporated quality-of-service incentive directly into revenue requirements setting. Most surveyed countries have been using three-year regulatory periods, although in Western countries which are experienced in modern regulatory practice (U.S., Great Britain) the most common length of regulatory period is five years. However, the Czech Republic and Slovakia have currently adopted the length of five years. Except of the Czech Republic, Slovakia and Lithuania, all countries have used benchmarking methods in tariff setting. The possibilities of development of performance-based regulation in the Central Europe and Baltic states could be extended by reducing market concentration, separing regulated and non-regulated activities, unbundling energy companies or cooperating with the private sector in order to establish an acceptance of the benchmarking results. A harmonization of regulatory frameworks would also facilitate the performance-based regulatory process.

Keywords: regulatory benchmarking, public utilites regulation, regulatory framework, Central Europe, Baltic states

1. Introduction

The energy sector traditionally includes electricity, gas and heat industry. Due to their particular characteristics, the firms operating in this sector, generally referred to as public utilities, are state-regulated. The state usually regulates tariffs, quality of service, market entry and exit conditions, and imposes the so-called public service obligations (Kahn, 1988).

A relative stability of these industries is a logical consequence of regulation. Although it is considered that energy industries have not been dramatically hit by the global financial crisis, a good performance of these industries is essential for a state's stability, economic development, national security and its environmental, social and economic policy. However, traditional cost-of-service methods of regulation do not provide regulated firms incentives to improve their efficiency. The purpose of performance-based regulation is to induce a company to behave efficiently and reduce its costs in an environment where competition is not feasible.

In this paper, we focus on energy tariff regulation practice in post-communist states of Central Europe and Baltic region. These states have similar characteristics; a relatively short time ago, their economies were centrally planned, therefore they have only a short history and a low experience in modern regulation. Their energy markets are concentrated and are being liberalized, a number of mergers and acquisitions are taking place, regulated and non-regulated activities are being legally separed (unbundled) and the firms are being privatised. In this paper, we present new trends in regional regulatory practices, which apparently tend to shift towards performance-based regulation.

2. Economic Background of Tariff Regulation

Under the conditions of competition, a company is operating under competitive pressures. A firm not able to keep its costs below the level of its competitors will eventually go out of business. The main purpose of economic regulation is to achieve competitive results in an environment where (Phillips, 1993)
- competition is feasible but does not last long, so a competitive output is not achievable;
- competition is feasible but a competitive output is not achievable due to market imperfections;
- competition is feasible and a competitive output is achievable, but with regard to the social welfare this output is not sufficient.

Regulatory agencies therefore face the challenge to set such market conditions that should induce a company to behave as if it was exposed to real competition.
Usually, regulated companies have characteristics of natural monopolies, although not all of them (eg trucking in the United States). Sometimes, changing market or technological conditions lead to a demise of natural monopoly. A classical example is the demise of the natural monopoly in the field of telephone communication.

Public utilities often have the following properties (Bonbright, 1961):
- inherent economies of scale and scope;
- essential product with a low price and cross elasticity of demand;
- capital-intensive production, the product represents an essential input for other industries of the entire economy;
- non-storable and non-transferable product, synchronous production and consumption, excess capacity, fixed connection with customers;
- variable and seasonal character of demand;

- obligation to serve all customers who are able and willing to pay for the service (public service obligation).

The main task of regulatory bodies is to set a competitive price level in conditions where competition is not feasible.

In conditions of natural monopoly (see Fig. 1), the curve of average costs (AC) is decreasing due to the economies of scale. Monopoly power causes that the marginal revenues curve (MR) has a lower slope than the demand curve (D). The competitive output (Q) and price (P) is achieved at the intersect of demand (D) and marginal costs (MC). However, if the price was set at P, total revenues (P × Q) would not cover total costs (AC × Q) and the company would eventually go out of business. The task of regulators is to achieve competitive output and to allow the regulated company to cover its costs and achieve a reasonable rate of return on its capital.
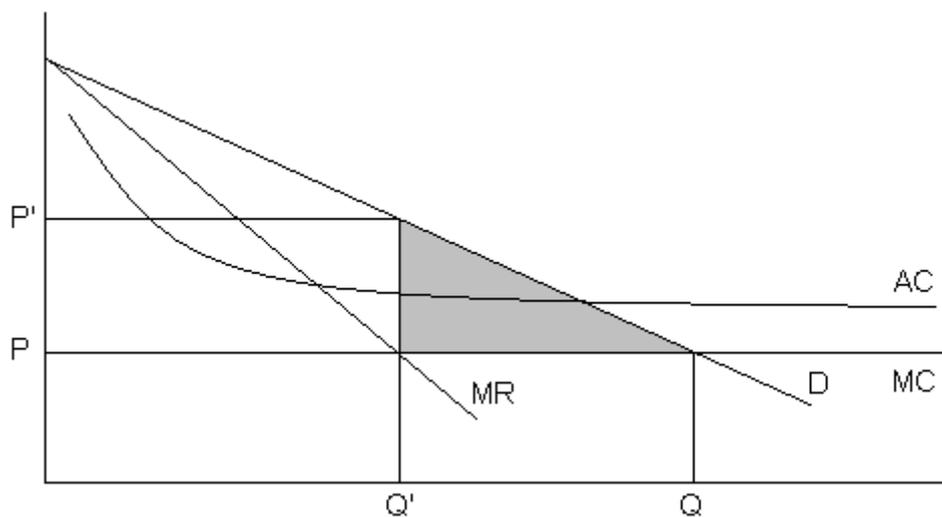

Figure 1: The concept of natural monopoly

3. Methods of Economic Regulation

The idea of traditional tariff regulation is that a company should be allowed to recover its justified expenses and to earn a reasonable rate of return on its invested capital. The expenses which are not „prudent", „known and measurable" and „used and useful" (Lesser, 2009) are not allowed to be recovered. Traditional tariff setting is based on the concept of revenue requirements (RR).
A classical *cost-of-service regulation* (COS regulation) is based on summing operating expenses (operating&maintenance costs, depreciation and taxes) and calculating a required rate of return on the invested capital (rate base). A classical formula is as follows:

RR = O&M + D + T + (RB x RoR),

where *RR* denotes revenue requirements, *D* denotes depreciation, *T* denotes taxes, *RB* is the regulatory asset base (rate base) and *RoR* is the rate of return. This approach has several disadvantages – it does not simulate competition pressures, there are significant information asymmetries between regulator and regulated companies which complicate the regulatory process, the companies have an incentive to overinvest (sometimes referred to as Averch-Johnson effect) or to invest imprudently (gold plating). The price level has to be

reviewed frequently (typically, every year) which makes this method time-consuming and expensive.

The purpose of *performance-based regulation* (PBR regulation) is to reduce the negative impact of information asymmetries and to induce a company to behave efficiently and reduce its costs in order to increase profits. Generally, we distinguish two basic methods: price-cap and revenue-cap.

The price-cap method is based on setting an upper limit on service tariffs. The formula is

$$P(t) = (1 + RPI - X) . P(t\text{-}1),$$

where $P(t)$ denotes the price in year t, RPI is the inflation rate, X is the productivity growth, and $P(t\text{-}1)$ denotes the price in previous year $t\text{-}1$.

Similarly, the revenue-cap method is based on setting an upper limit on earned revenue according to the following formula:

$$R(t) = (1 + RPI - X) . R(t\text{-}1),$$

where $R(t)$ denotes the revenue in year t, $R(t\text{-}1)$ denotes the revenue in previous year $t\text{-}1$, other variables remaining the same as in the case of the price-cap method. Because the price or revenue is capped according to the inflation rate (RPI-factor) minus the efficiency factor (X-factor), PBR regulation is also often referred to as RPI-X regulation.

However, if the price or revenue cap is based on a company's own costs, then the negative effects of COS regulation (overinvestment, gold plating etc.) are not fully eliminated. Under the conditions of competition, a firm must reduce its costs below the average level of its competitors in order to survive. Setting the cap with respect to the performance of other companies is the main principle of a third regulatory method, *yardstick competition*. In theory, the average costs (AC) of i-th firm on the market should satisfy the following formula:

$$AC_i \leq \frac{\sum AC_j}{n\text{-}1},$$

where AC_j denotes average costs of j-th company and n is the total number of firms operating on the market.

A contemporary complement to traditional approaches has become known as the *negotiated settlement* (Robinson, 2007). This is a way of involving other stakeholders (customers, users etc) in the regulatory process. The aim is to reduce the cost of regulation and the time requirements and to increase the benefits for all stakeholders.

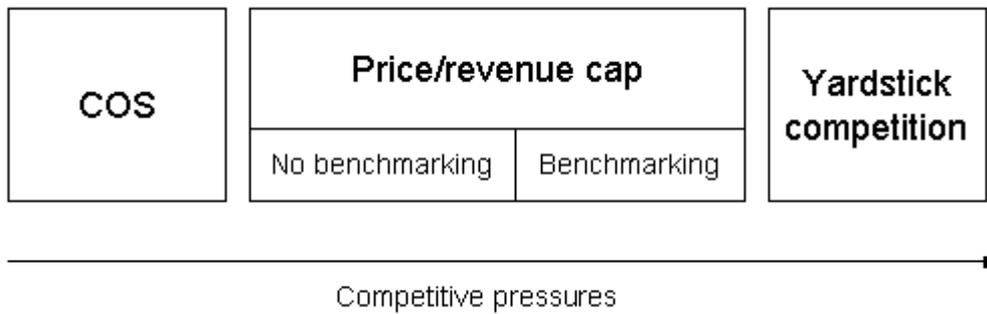The level of incentive provided by a regulatory regime can be illustrated by Fig. 2.

Figure 2: Methods of economic regulation

4. Regulatory Benchmarking as a Supplement of PBR Regulation

The idea that a firm's revenue requirements should not be based on its own costs, but rather on a relative efficiency measurement is the idea of *regulatory benchmarking* (Schleifer, 1985). Benchmarking means measuring a firm's efficiency against a reference performance. If correctly applied, this approach introduces a new incentive to efficiency and eliminates the negative consequences of information asymmetries. Benchmarking can either be used as a supplement of performance-based regulation or as a pure regulatory method (the above-described yardstick competition). Basic benchmarking methods are illustrated on Fig. 3. Basically, we distinguish frontier and non-frontier methods.
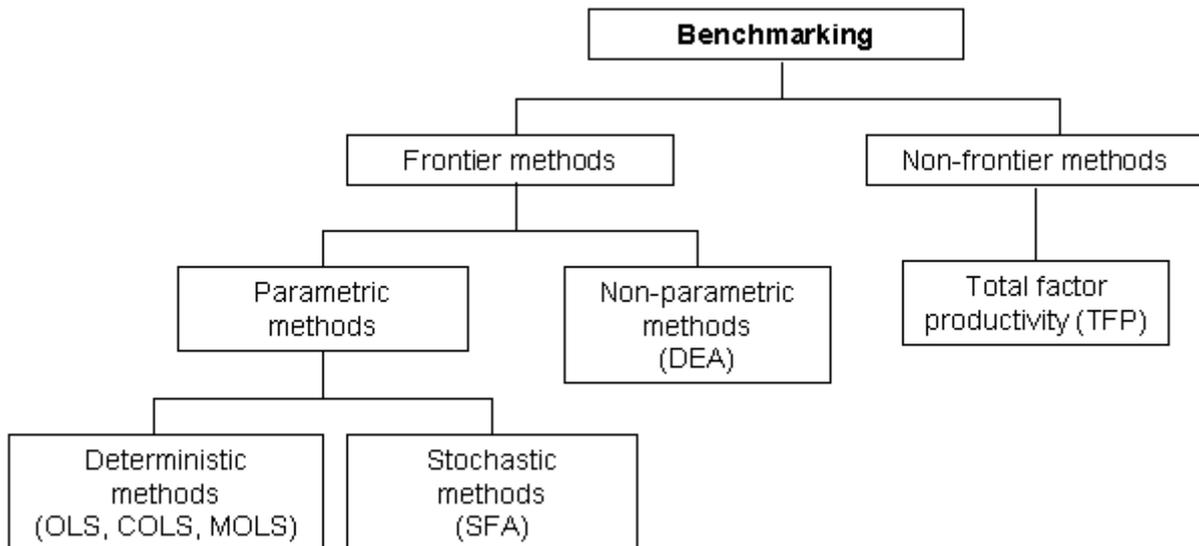

Figure 3: Regulatory benchmarking methods

4.1 Frontier methods

In practice, frontier methods are the most widely used. A cost frontier defines the minimum cost level of producing a given output with a given input. The distance of a company from this frontier represents a firm's inefficiency.

Deterministic methods (OLS, COLS, MOLS) assume that everything is observable and the entire distance from the frontier is due to a firm's inefficiency. No chance or erroneous factors are considered in deterministic methods. OLS (ordinary least squares) is an estimate (a line or other curve fit) of an average cost function of a sample of firms based on the relationship

between total costs and other variables (market conditions, area, grid length etc). This method can be used in the case of companies with relatively similar cost structure and requires large data sets in order to obtain reliable results. COLS and MOLS are modifications of OLS. COLS (corrected OLS) shifts the frontier towards the best performing company. MOLS (modified OLS) also shifts the frontier, but it is less restrictive than COLS. Stochastic methods (stochastic frontier analysis, SFA) take into consideration possible measurement errors and chance and erroneous factors. Typically, higher efficiency scores are achieved than when using stochastic methods, since a firm's distance from the frontier is due to both inefficiency and chance factors.

Data envelopment analysis (DEA) is based on searching for points with the lowest unit costs (per km of pipes, per customer etc) and connecting these points to form an efficiency frontier. Companies not on the frontier are considered inefficients. As with above-mentioned methods, inefficiency is represented by the distance of a company from this frontier.

4.2 Non-frontier methods

Amongst non-frontier methods, total-factor productivity (TFP) methods are the most widely used. Rather than efficiency, TFP estimates a company's productivity. A TFP index is a ratio of an output index divided by an input index. Törnquist and Malmquist indices are widely used in calculating TFP indices. Usually, X-factor is determined using TFP so that the calculation takes into account the difference between TFP growth for the industry and for the economy as a whole.

5. Performance-based Regulation in Central Europe and Baltic States

The states of Central Europe and Baltic Sates – Czech Republic, Slovakia, Poland, Hungary, Slovenia, Latvia, Lithuania and Estonia – are former member states of the Eastern Bloc. Therefore they have only a short history and a low experience in modern regulation and regulatory practices and methods vary within this region. However, several regulatory period have passed since the transition to market economies and foundation of independent regulatory bodies. In this section, we provide a short overview of regulatory frameworks (see Fig. 2).

5.1 Czech Republic

The Czech Energy Regulatory Agendy (Energetický regulační úřad, ERÚ) began to regulate the Czech energy market in 2001. The first regulatory period lasted three years, the second and the third regulatory period have had five years. The regulatory regime is based on revenue-cap mechanism. In the first regulatory period, the rate of return was calculated using return on assets (ROA), then the Agency has been using the weighed average cost of capital (WACC). No benchmarking has been used in tariff setting. A settlement process took place in 2008 in order to improve the regulatory framework.

5.2 Slovakia

The Slovak energy market is regulated by ÚRSO (Úrad pre reguláciu sieťových odvetví) agency. The first regulatory period started in 2003 and the regime was based on a revenue-cap. In the third regulatory period (2009-2011), the methodology changed to a price-cap scheme. The fourth regulatory period (2012-2016) will be five-year long. No benchmarking has been used in tariff setting.

5.3 Poland

The Polish energy regulator URE (Urząd Regulacji Energetyki) has introduced a performance-based revenue-cap scheme in 2001 for distribution companies. Regulatory periods have been three-year long. The transmission system operator PSE is a monopolist and URE decided to maintain a traditional cost-of-service regime. Benchmarking has been applied only in the field of electricity distribution. Gas transportation and distribution are not regulated using benchmarking techniques. As benchmarking technique, a Bayesian random effect model (a SFA method) in cost efficiency analysis has been used.

5.4 Hungary

The Hungarian energy regulatory agency MEH (Magyar Energia Hivatal) began to regulate the energy market in 1997 and decided to choose four years for the regulatory periods. The price-cap method has been applied in tariff setting. Unlike in other states, quality incentive is incorporated directly into revenue requirements setting. Failure to comply with quality standards is penalized, with a small tolerance in order to mitigate chance factors. MEH is using a special non-frontier method of benchmarking. Average (benchmark) operational costs, corrected in order to mitigate regional differences (wages, consumer structure) and geographical and technical differences, are incorporated into revenue requirements. Both domestic and international data are used for benchmarking.

5.5 Slovenia

The Slovenian regulator (Javna agencija Republike Slovenije za energijo) has been regulating the Slovenian market since 2003. Before, tariffs had been set by the government below the cost level. A price-cap method has been applied. For electricity distribution and transmission, the regulatory period lasts three years and modern benchmarking is used, while for gas distribution and transportation, the period lasts only one year and no benchmarking is used. The Agency has been responsible for gas sector regulation only since 2006. The methodology used for benchmarking has been a crosscheck of both COLS and DEA. Since the Slovenian market and the sample of firms are small, foreign data have been used.

5.6 Estonia

The Estonian energy tariffs are regulated by Konkurentiamet. The agency has been applying a price-cap incentive method with three-year regulatory periods both for electricity and gas sectors since 2006. The methodology used for benchmarking has been the COLS method. Since the operating environment for Estonian companies is similar, the only factor of heterogeneity considered in benchmarking has been the density of supply.

5.7 Lithuania

The Lithuanian energy regulatory agency (Valstybinė kainų ir energetikos kontrolės komisija) has been applying a hybrid cap method (a 50/50 price and revenue cap combination). As there are only two distribution companies, no benchmarking has been used, due to a lack of data. The first regulatory period began in 2002 and the regulatory periods last three years.

5.8 Latvia

The Latvian regulatory authority (Sabiedrisko pakalpojumu regulēšanas komisija) has been applying a price-cap method in tariff setting. At the beginning of each three-year regulatory period (tariff review cycle) the tariff is set using the cost-of-service principle. During the regulatory period the price cap value is calculated for each year according to the traditional formula. The regulatory period beginning years differ for electricity and gas sectors. The Latvian regulator has been applying a non-frontier TFP method (Tornquist TFP indices) for benchmarking.

5.9 Discussion

Fig. 4 summarizes the regulatory methods applied within the region of Central Europe and Baltic states. Since the establishment of independent regulatory bodies, no country within this region has been applying the cost-of-service regulation (except of Poland in the field of electricity transmission), ie all regulatory framework use some form of performance-based regulation. Conversely, no country has been applying the yardstick competition, since this method is very difficult to apply in practice. Price-cap is the most widely used method within this region. Only the Czech Republic, Slovakia and Lithuania use no benchmarking methods in tariff setting. Deterministic methods of benchmarking are applied in Slovenia, Estonia, Latvia and Hungary, whereas in Poland a stochastic method is employed. There have been no significant changes in regulatory regimes and therefore it seems that the regimes do not converge to any particular set of rules.

COS	Price/revenue cap		Yardstick competition
	No benchmarking	**Benchmarking**	
No state	**Price-cap** Slovakia	**Price-cap** Hungary (special) Slovenia (COLS, DEA) Estonia (COLS) Latvia (TFP)	No state
	Hybrid-cap Lithuania		
	Revenue-cap Czech Republic	**Revenue-cap** Poland (SFA)	

Competitive pressures

Figure 4: Performance-based regulation in Central Europe and Baltic States

Tab. 1 summarizes the development of regulatory periods in time. Although there is no optimal length, the countries having a long history of utilities regulation (United States, Great Britain) use five-year regulatory periods. The period should be long enough to make a firm reallocate resources used to provide service. If the period is too short, the incentives to reduce costs are limited because prices closely track costs and price or revenue caps resemble cost-of-service regulation. However, most countries surveyed have been using three-year regulatory periods.

Country	Regulatory period length (years)
Czech Republic	3, 5, 5
Slovakia	3, 3, 3, 5
Poland	3, 3, 3, 3
Hungary	4, 4, 4, 4
Slovenia	3, 3, 3
Estonia	3, 3
Lithuania	3, 3, 3, 3

Latvia	3, 3, 3

Tab. 1: Development of regulatory period length

6. Conclusion

Within the surveyed region, all countries have been applying some form of performance-based regulation. However, the methods in individual countries vary. Price-cap has been the most widely used methodology within this region. Only Hungary has incorporated quality incentive directly into revenue requirements setting. Most surveyed countries have been using three-year regulatory periods, although in Western countries experienced in regulatory practice (U.S., Great Britain) the most common length of regulatory period is five years. However, the Czech Republic and Slovakia have currently adopted the length of five years.

Except of the Czech Republic, Slovakia and Lithuania, all countries have used benchmarking methods in tariff setting. From the point of view of regulation theory, regulatory regimes which apply some form of benchmarking should induce regulated firms to behave more efficiently. However, regulatory agencies have to deal with certain issues. Firstly, they have to choose an adequate sample of firms, but firms and their environment tend to be heterogeneous. Difficulties also arise in gathering and comparing data. Modelling can become more and more costly and marginal benefits of more accurate price setting can be overwhelmed by its marginal costs. There is also a danger of a collusive agreement amogst regulated firms to manipulate with data together. Also, a threat of going out of business has to be credible, but governments usually tend to protect utilities from bankruptcy (Lesser, 2009).

The possibilities of development of performance-based regulation in the Central Europe and Baltic states could be extended by reducing market concentration in order to obtain a larger sample of firms. Domestic benchmarking is more accurate due to more similar environment (including political and economic conditions, legislation, regulatory framework etc). However, this should not be a reason for non-implementation of benchmarking, since generally, foreign data are widely used with good results. Long time series are not available, due to only a short history of modern regulation in these countries, but this issue will be resolved in the future.

In addition, large vertically integrated companies, often state-owned, are still present in the markets, which complicates the separation of regulated and non-regulated activities. Therefore, an unbundling of these companies is needed in order to facilitate data collection and comparability. A cooperation with the private sector is needed in order to establish an acceptance of the regulation results, which would reduce court costs due to companies undertaking legal steps. A closer harmonization of regulatory frameworks would reduce the disparity of companies and data gathered, however, there is no preferred method and regulatory frameworks remain in the hands of individual countries. New regulatory tools have to be developed in order to mitigate data disparity and improve its comparability.

Since a good performance of energy industries is of strategic importance for a state due to its impact on stability, economic development, national security and its environmental, social and economic policy, the issues of performance-based regulation should not be overlooked when dealing with the fast changing environment nowadays.

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