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## Ex post regulation as the method of sectoral regulation in electricity sector

DOI: 10.22367/jem.2017.30.06

Accepted by Editor Ewa Ziemia | Received: June 16, 2017 | Revised: September 25, 2017; September 28, 2017; October 3, 2017 | Accepted: October 5, 2017.

### Abstract

**Aim/purpose** – The aim of the article is to present the essence of ex post approach to sectoral regulation, to show the advantages and disadvantages of ex post regulation and to answer the question whether it is worth using in the electricity sector.

**Design/methodology/approach** – For this purpose, a critical analysis of expert literature was made and an empirical analysis of countries that have applied ex post regulation in the electricity sector in the European Union. Two research methods were used: a case study and a comparison of changes in price and quality of services. The research period covered the period 2000-2016.

**Findings** – It was found that ex post regulation reduces regulatory costs, does not adversely affect the quality of service and long-term rates, gives businesses the freedom of decision-making and the ability to react quickly to changes in the economy. The main disadvantages of ex post regulation are the tendency for companies to over-estimate bills for consumers, the difficulty of pursuing claims by consumers and the need to shift regulatory risk to consumers.

**Research implications/limitations** – In the paper there was identified a research gap, i.e. the effects of ex post regulation in the electricity sector in European Union countries where such regulation was applied. Identifying the research gap will help us understand what are the advantages and disadvantages of ex post regulation and will create a model for when it is good moment to implement this in the economy. Besides identifying the research gap, further studies will be required over ex post regulation.

**Originality/value/contribution** – The additional value of the paper is the study of ex post regulation, its essence and types. The article analyzed the effects of ex post regu-

lation in the electricity sector and provided valuable insights into the potential risks associated with this approach to economic regulation.

**Keywords:** state interventionism, sectoral regulation, electricity sector, ex post regulation.

**JEL Classification:** L50; L43; L94.

## 1. Introduction

Since the early nineties, the electricity sector in the European Union has undergone enormous transformations. The essence was to change the paradigm in relation to that part of the economy, involving the abandonment of the approach preached by normative theories of regulation for the thesis propounded by the advocates of a positive theory of regulation. It began to call in question the validity of the thesis that the state always acts in the public interest, and that its activity always alleviates market failures. Increasingly, the arguments of critics of state intervention appeared [Stigler & Friedland 1962; Jordan 1972; Joskow & Noll 1981], according to which state regulation does not bring benefits to regulated markets. According to the literature, there are only a few specific causes of fundamentally unreliable competition, which make competition difficult [Buko & Czapiewski 2011, p. 26]. For this reason, a decision was made, first in Great Britain (1990-1999), through Scandinavian countries (1995-2003) and later the European Commission, to open that sector of the economy for competition and to largely deregulate it. Regulatory changes in the electricity markets in the EU Member States were followed by the implementation of electricity directives (96/92/EC, 2003/54/EC and 2009/72/EC). In the meantime, these markets have been liberalized and ex ante regulated. The final outcome of these changes was to have a common internal electricity market for the European Union, both for the wholesale and retail market since 2016. Finally, the global financial crisis, the debt crisis in the euro area and the actions taken by governments have led to a return to interventionism and willingness to closely monitor strategic sectors for the country and its security. Hence a fully liberalized and deregulated electricity market is probably impossible to put into practice. However, an indirect solution is possible. Such a solution is the implementation of the ex post regulation in the electricity sector, i.e. a regulation based on the competition law approach. It is assumed here that ex post concretization, regulation, is largely passive [Szydło 2010, p. 25], i.e. the state does not interfere ex ante in actions undertaken by enterprises. The question, however, is what ex post regulation means and what are its advantages and disadvantages. The literature shows the cases of ex post regulation, but for various sectors, i.e. the tele-

communications. The literature discussion of ex post regulation in the telecommunications sector raises questions about the relevance of telecommunication regulation to the regulation of energy networks [Block, Nold & Sidak 1981, p. 92]. However, there are already countries in the EU that have experience with this approach to regulation in this sector of the economy. Thus, there is a need to analyze the essence of ex post regulation and its types and to synthesize the advantages and disadvantages of ex post regulation in electricity markets. In the literature there is lack of synthetic studies in this field for electricity sector. Hence in this paper there was identified a research gap concerning the effects of ex post regulation in the electricity sector in European Union countries where such regulation was applied.

The aim of the article is to present the essence of ex post approach to sectoral regulation, to show the advantages and disadvantages of ex post regulation and to answer the question whether it is worth using in the electricity sector. By considering ex post regulation we do not mean the absence of regulator interference, but the control of market actors and their behavior during the regulatory period by the regulator and intervening only if regulated entities abuse market power or regulatory rules. For this article's purpose, two research tasks will serve. The first is to present what is ex post regulation and what is its essence. The second is a case study, an analysis of the experiences of countries that this model of regulation applied in the electricity sector.

The paper is structured as follows. The first part is the theoretical background concerning the essence of the economic regulation and the substance of regulation in electricity sector in Europe, advantages and disadvantages of ex post regulation and ex ante regulation, types of ex post regulation presented in the literature. The next section presents the research methods and procedure used in the article. Later the author shows research findings concerning the effects of the application of ex post regulation in the European countries that have had experience with this regulatory method. The last part of the paper is conclusions from the study conducted by the author.

## **2. Theoretical background**

The idea of state intervention in the economy is reflected in the literature from the beginning of economic thought. An approach in economic thought about the leading role of supervisory and regulatory institutions, the need to analyze formal and informal institutions in analyzing the variability of economic and social phenomena and the economic process, should be linked mainly to the

development of the new institutional economy. Its representatives emphasize that “The institutions (including institutions-organizations) are created as a result of social interaction; at the same time, institutional structures affect individuals and their preferences. Institutions are a type of social structure. Institutions are also the requirement and control of business entities” [Staniek 2007, p. 3]. Theories of public interests, theories of collective decision-making and theories of regulation have developed on this basis [Staniek 2007, p. 4]. They were the theoretical foundations of the changes that followed in the electricity sector in the European Union since 1990.

The direct impulse for changes in the European electricity sectors was increasingly underlined by the ineffectiveness of direct state interference and emphasized more the ineffectiveness of direct state interference and criticism of the approach consistent with theories of public interest. In the 1980s and 1990s, a lot of papers showed that regulation does not benefit consumers, and that the main beneficiaries of regulation are the various interest groups, that most often are companies. As noted by George Stigler, “[...] regulation is acquired by the industry and is designed and operated primary for its benefit” [1971, p. 3]. This is because individuals or interest groups always strive to achieve the benefits. By regulation it is possible to gain benefits at the expense of the rest of the population using political decisions. There are many negative effects of regulation. The main negative consequences are [Nagaj 2016b, p. 74]:

- Changes in the use of resources inside the production capacity curve and maintenance of the economy below production capacity. Rent-seeking leads to an unproductive use of resources.
- Social losses associated with quantitative restrictions that are incomparably greater than the price equivalent of certain quantitative restrictions.
- Discrepancies between private and social costs of certain activities.
- Increase in income inequalities in society because the political rent is addressed to entities with greater pressure and wealth.
- Distortion of economic parameters, which interferes with the correctness of signals in the economy and leads to inefficient allocation of resources.
- Weakness and degeneration of the institutional structures of the state and economy.
- The disappearance of justice and the increase in corruption caused by the fact that revenue is being captured by unproductive or less productive units.
- Lack of competition in the market and reduction of the innovativeness of the economy. A manufacturer who has market privileges through political decisions, and not by his own productivity and the amount of capital held, has less incentives to innovate.

The negative effects of the regulation began to apply to sectors historically monopolized and controlled by the state, such as telecommunications and electricity sector. It was argued that regulation brings more losses than benefits. For example, „[...] the theory of asymmetric information suggests that just as redistributive taxation is distortionary and therefore costly, so attempts to redistribute cost savings from utilities to consumers will produce inefficiencies and dead-weight loss. Regulatory inefficiency does not end with overpricing or inefficient supply” [Newbery 2005, p. 3]. It has been argued mainly in the European Union that some activities in the infrastructure sectors, including the electricity sector, do not operate under a natural monopoly and are subject to competition mechanisms. It was decided that it should re-orient the existing main argument for regulation, i.e. that the fact that electricity is a public good and there is the need to ensure the energy security, is not an argument for regulation of the sector. It was considered that regulation in the electricity sector should be seen in many aspects, and the safety of electricity security should be responsible for both the State and enterprises, in particular the network companies. For this reason, it was announced the need to unbundle network activity from trading activity and the need to liberalize that part of sector where competition is possible. It was found that “[...] unbundling of networks can increase competition among the producers over networks and facilitate more effective incentive regulation of them. Effective unbundling of networks can also reduce the geopolitical concerns associated with the desire of producing companies to own distribution networks in consuming countries” [Jamab & Pollitt 2008, p. 4585]. It was decided that the State guarantees the security of the electricity sector. It was agreed that the guarantee of electricity security is a function of the state which regulates through the regulatory authorities the areas of electricity sector where is the natural monopoly (network activity) and regulates the competitive electricity markets through the appropriate institutional and legal framework. In sectoral areas where there is the supervision of regulatory authorities there should be sectoral regulation, and elsewhere the target is to be free competition. A broad discussion about the purpose and substance of regulation in electricity sector in Europe was made by G. Majone [1994; 1996] who indicated that one of the main features of the regulatory changes and liberalization should be independent institutions. It happens because “[...] political sovereigns are willing to delegate important powers to independent experts in order to increase the credibility of their policy commitments” [Majone 1997, p. 139-140]. The requirement to establish independent regulatory institutions was introduced by Directive 2003/54/EC, where according to article No. 18: “National regulatory authorities should be able to fix or approve tariffs, or the methodologies underlying the calculation of the tariffs, on

the basis of a proposal by the transmission system operator or distribution system operator(s), or on the basis of a proposal agreement between these operator(s) and the users of the network. In carrying out these tasks, national regulatory authorities should ensure that transmission and distribution tariffs are non-discriminatory and cost-reflective, and should take account of the long-term, marginal, avoided network costs from distributed generation and demand-side management measures”.

Currently, all EU Member States follow harmonization of the power of the national regulator for energy and is further strengthening their independence. All this is done to help regulators enforce market mechanisms in the electricity sector and shape the behavior of the operators. Hence supervision in the form of ex ante regulation has been forced. Ultimately, all these activities are designed to further liberalize the electricity markets and create a single common and competitive electricity market in the European Union.

So far, the literature of the subject [Geradin & Sidak 2005; Newbery 2005; Department for Transport 2007], just as the European Commission, has recommended ex ante regulation in the infrastructure sectors. It was claimed that “in absence of ex ante regulation, this may lead to weak regulatory institutions, and hence the reliance on courts to resolve disputes” [Black, Harmann & Moselle 2009, p. 24]. As added D. Newbery, the liberalization experiences of gas and telecommunication sectors in USA and as sectors in Great Britain show the failure of open liberalization, functioning of sectors under competition policy and necessary of ex ante regulation [Newbery 2005, p. 7]. However, as A. Bednarska noted, “[...] for some time, we have been witnessing more and more numerous public discussions and polemics about changing the current method of ex ante regulation – adopted a reasonable regulation method of activities of enterprises” [2006, p. 7]. Therefore, models of economic regulation in the electricity market were modified, from the rate of return method or cost-of service regulation, through price cap, yardstick regulation to hybrid methods. All of them are gradually striving for an increased competitive market. The electricity sector is not yet fully ready for full liberalization and deregulation, hence the author’s response to these demands is ex post regulation.

Ex post regulation means “[...] the control of entities and their market behavior during the regulatory period and intervening in situations when regulated entities abuse the market position or rules that have been imposed in a regulated market” [Nagaj 2016b, p. 96]. Under this regulatory approach, interventions are not continuous, remedial and do not involve the entire regulatory system, but they only concern selected elements of regulatory system and are taken only incidentally, that is, when companies have violated their market competition or

consumer interests by their decisions. Therefore, the ex post regulation usually includes only one or more of the elements of the regulatory system that are in principle subject to ex ante regulation, such as pricing and ways to apply “reasonable” costs, investment plans with medium and long-term horizons, quality of goods and services, network access and traffic instructions, rules for organizing tenders, unbundling network activity from trading. In addition “[...] the regulator uses a structural approach, does not shape the behavior of enterprises, but protects the competitive structure of the market” [Nagaj 2016b, pp. 96-97]. However, the enterprises make business decisions independently and the correction of the decision will only be made when the regulator has intervened and ordered any changes of proceedings.

In the literature, there are five types of ex post regulation. These are [Black, Harmann & Moselle 2009, p. 20]:

- ex post price review with ex ante costing approach specification,
- threshold regulation,
- obligation to negotiate,
- information disclosure,
- competition policy.

First type of ex post regulation includes mainly network companies, who distribute or transmit energy. Under this type of regime, the company is left to determine prices alone but at the end of the regulatory period the regulator considers whether the prices were reasonable. The regulator sets out an approach of how to determine prices, specify a reference cost model or principles how to determine costs in prices and considers whether to intervene in the price setting process. If the regulator decides that the company sets out its prices too high then he will order the company to modify its tariffs. The regulator’s intervention is either at the regulator’s own initiative or as a complaint from a market participant. Regulatory rigor applies in principle only to the costs and thus to prices, while freedom is given to investment plans. The only imperative for companies is the obligation to provide adequate quality of electricity services.

Threshold-based regulation consists in setting not compulsory prices or quality standards of service “threshold” by regulator. Threshold is not binding on the companies, but where a company sets prices above or quality standards under the threshold. The regulator at any time may undertake regulatory controls, but without the suspicion of a “threshold” breach he will not do it. Threshold is updated every few years. This type of regulation is to avoid the cost of maintaining permanent supervision and at the same time gaining some kind of benefit through ex ante regulation [Cowan 2007 after: Nagaj 2016b, p. 106]. Preventive threat is imposed on the market in that it may be subject to regulatory

review and the imposition of ex ante regulation. This threat of regulation is supposed to act as a substitute for administrative decisions. It is assumed here that the threat of introducing ex ante regulation provides some protection for consumers against abuse of market position by companies. This is because companies will be afraid to apply for high prices or low quality standards because with the possibility of exceeding the threshold increases the probability of regulation.

The third type of ex post regulation is obligation to negotiate. Companies must undertake negotiations with consumer organizations each time before taking decisions affecting consumers, e.g. to change prices. Sectoral regulator does not conduct surveillance of businesses here, as in the two previous types of ex post regulation, but the Antitrust Office monitors the market. There are no established ex ante regulatory rules regarding costs, investment expenditures, profit levels and regulatory thresholds. Companies operate on the basis of competition law, but with the addition that the antitrust authority regularly reviews the competition rules and the collective interests of consumers.

When there is ex post regulation with information disclosure the company has an obligation to deliver to the consumer full information about market and decision making principles. There is here no formal price threshold determination or ex ante principles on how to determine costs but companies have an obligation to deliver full information about the price processing, structure of cost and level of profits to the regulator. In addition to these informative obligations, undertakings are free decision-making, and antitrust regulator only carries out regular monitoring of the market. This type of regulation is intended to stimulate market productivity, support investment freedom, and provide market participants with access to complete information.

The last type of ex post regulation is regulation under competition policy. There is no economic regulation here, there are no regular regulatory reviews and companies are subject only to routine inspections by the antitrust authority. With regard to the electricity sector, the control of enterprises is basically only during the licensing process, when because of energy security the regulator verifies technical conditions of functioning of enterprises and level of financial stability.

### **3. Research methods and procedure**

The aim of the article is to present the essence of ex post approach to sectoral regulation, to show the advantages and disadvantages of ex post regulation and to answer the question whether it is worth using in the electricity sector. The author will present in the paper the experience of European countries which

introduced ex post regulation in the electricity sector. For this purpose, a critical analysis of the literature has been carried out, indicating the essence of ex post regulation and identifying in which EU countries it is applied to the electricity sector. The analysis indicated that such countries were Finland, Sweden and Germany. In the first two countries, ex post price review with ex ante specification of approach to costs was applied, and in Germany ex post regulation regime with obligation to negotiate with consumer associations was applied.

Because literature analysis has indicated that the goal of ex post regulation is to prevent the violation of competition in the market, and the subject of regulation is price processing and quality standards, so these areas will be examined in the article. Two research methods will be used: a three case study of each country and a comparison of changes in price and quality of services. This will help determine what were the advantages and disadvantages of ex post regulation in the analyzed electricity markets.

The research period will cover the period 2000-2016, except that due to availability of data for prices the research period is 2000-2016, and for service quality 2002-2014. For Finland, two research periods will be distinguished. The first was until 2005, when regulatory oversight was absent and the second was after 2005 when ex post price review with ex ante specification of approach to costs was used. For Sweden, two periods will be distinguished: until 2011, when ex post price review with ex ante costing approach specification was used and from 2012 when ex ante regulation was applied. For Germany, however, two periods have been distinguished: 2000-2004, when ex post regulation under competition policy with obligation to negotiate has been applied and the period since 2005 since ex ante regulation is used.

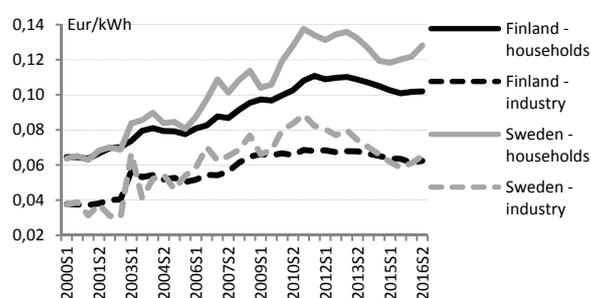
Two research periods were compared, whether in the area of pricing and quality of services there were some advantages or disadvantages and how the analyzed countries compared to other EU countries.

#### **4. Research findings and discussion**

The countries most often referred to as examples of ex post regulation are the Scandinavian countries. The first country to be analyzed is Finland, which launched the liberalization process in 1995. This was done by implementing in 1995-1998 the possibility of using the TPA rule (Third Party Access rule) by the final consumers and the unbundling of the network activity from other electricity activities. As a result, supply and generation have been subject to competition mechanisms, and to network companies ex post regulation with ex ante costing

approach specification was used. The liberalization of electricity sales resulted in the price of the supply being fully liberalized from the control of the regulator and the companies were left to be free to decide on the level of capacity reserves. This resulted in a reduction in investment in generating capacity and to a certain extent in power grids [Amundsen, Bergman & Fehr 2006, p. 150 after: Szablewski 2012, p. 79]. Moreover, in a situation, restrictions on the production of energy, large changes in electricity prices began to appear (Figure 1). The same was in Sweden, where a large part of electricity production is based on water energy.

**Figure 1.** Electricity prices (without taxes and levies) for end-users in Finland and Sweden in 2000-2016



Note: S1 means first half of the year, S2 means second half of the year.

Source: Calculations based on Eurostat data [2017a, 2017b].

The second element of regulation in the electricity sector in Finland was network activity, which until 2004 was deprived of supervision by the regulator and since 2005 was covered by ex post regulation with ex ante costing approach specification. Finnish Energy Market Authority (EMA) does not approve tariffs and charges, but began conducting annual ex post reviews of return rates achieved by companies. The regulator determined the ex ante methodology for setting tariffs, and in cases of suspected disturbance of competition or suspicion of the rate of return on tariffs applied by the companies with the proposed methodology, the regulator made a regulatory review. When the controller stated inconsistency, he issued an administrative decision to change the tariffs. The decisions could be appealed by the companies to the court, but they remained in force until they were changed by the court [EMA 2003, p. 32]. The functioning of this type of regulation showed that the price expectations of enterprises for network fees have increased, which has led the regulator to have to dampen companies' price expectations. Proof of such practices is that when companies appealed against these decisions, the court upheld them in most cases [EMA

2007, p. 25; Nagaj 2016b, pp. 187-188]. Another drawback was the need to conduct many regulatory annual reviews by the regulator.

A similar system of regulation was applied in Sweden, but with the difference that for the whole 2000-2011 period ex post regulation with ex ante costing approach specification was used. In addition, regulatory reviews could be conducted either at the request of consumers challenging pricing or investment decisions, and at the initiative of the regulators. The practice of using ex post regulation indicated that electricity companies often complained about the administrative decisions of the regulator to the court, and that the court proceedings lasted a very long time. In 2003-2007 there were as many as 50-75 regulatory reviews and at each case network companies were ordered to refund substantial amounts to consumers [Black, Harmann & Moselle 2009, p. 35]. Due to the length of the court cases, consumers often gave up their appeals and disputes were finally resolved out of court. It was often criticized. A. Kaijser and P. Högselius pointed out that these changes resulted in increased electricity prices in Sweden, they were much higher than in 1996, i.e. at the beginning of the liberalization process [2007 after: Gustafsson, Lundmark & Nilsson 2007, p. 1). For this reason, in 2012, ex post regulation was abolished and replaced by ex ante regulation.

Meanwhile, in Germany until 2004, the electricity sector was based on competition law with the obligation on companies to negotiate with consumer associations. The changes began in 1998 when the liberalization process began. The initial effect was a fall in electricity prices, but since 2002 prices have started to rise steadily. However, no price fluctuations were recorded, and there was a permanent slow growth in prices. It should be added, however, that this was not a consequence of market pressure, but was caused by tax and environmental charges imposed by the State. The primary negative consequence of ex post regulation was, however, the consolidation processes in the sector and market dominance by 4 vertically integrated entities. The change took place only later, that is after 2005, when ex post regulation was imposed by the European Commission. It was imposed on companies mandatory unbundling of network activities from trading. As a result, the number of changed suppliers has increased from 1.47 million in 2007 to 3.51 million and only 2.1% of enterprises and 36.7% of households were serviced by incumbent suppliers under unchanged contracts [Bundesnetzagentur & Bundeskartellamt 2014, p. 123, 126].

Analyzing the effects of ex post regulation one should focus on two aspects highlighted by the literature: electricity prices and quality of services.

**Table 1.** Average annual change of electricity prices without taxes and levies (in euro) for final consumer in the UE Member States (in %)

Country	Households	Industrial consumers	Households	Industrial consumers
	2000-2004		2005-2016	
Belgium	-0.57	-0.25	3.92	1.59
Bulgaria	5.14	0.00	3.60	5.50
Czech Republic	9.02	1.26	4.59	3.25
Denmark	6.02	6.27	0.75	0.06
Germany	-0.25	-1.67	0.65	0.70
Estonia	7.96	0.50	4.36	3.99
Ireland	5.82	3.52	4.92	2.95
Greece	0.00	1.60	5.53	2.78
Spain	-0.64	-2.92	6.08	5.12
France	-0.50	-1.23	1.69	1.69
Croatia	n.d.	n.d.	3.13	3.34
Italy	-2.20	5.56	0.02	0.18
Cyprus	1.36	-1.54	3.09	3.25
Latvia	19.30	-11.14	5.25	7.70
Lithuania	0.00	8.10	3.60	3.08
Luxembourg	2.57	-0.98	0.72	0.82
Hungary	7.00	7.19	0.45	0.32
Malta	1.40	-1.17	5.45	6.93
Netherlands	4.92	6.88	1.13	-1.69
Austria	0.04	-6.30	1.85	1.99
Poland	2.68	1.38	3.02	4.21
Portugal	1.33	1.15	-0.48	2.76
Romania	n.d.	27.76	1.05	1.79
Slovenia	0.00	-4.13	2.20	1.95
Slovakia	2.05	2.05	1.50	3.61
Finland	4.21	6.28	2.11	1.56
Sweden	6.10	9.14	3.59	1.49
United Kingdom	-3.50	-2.41	4.82	5.27

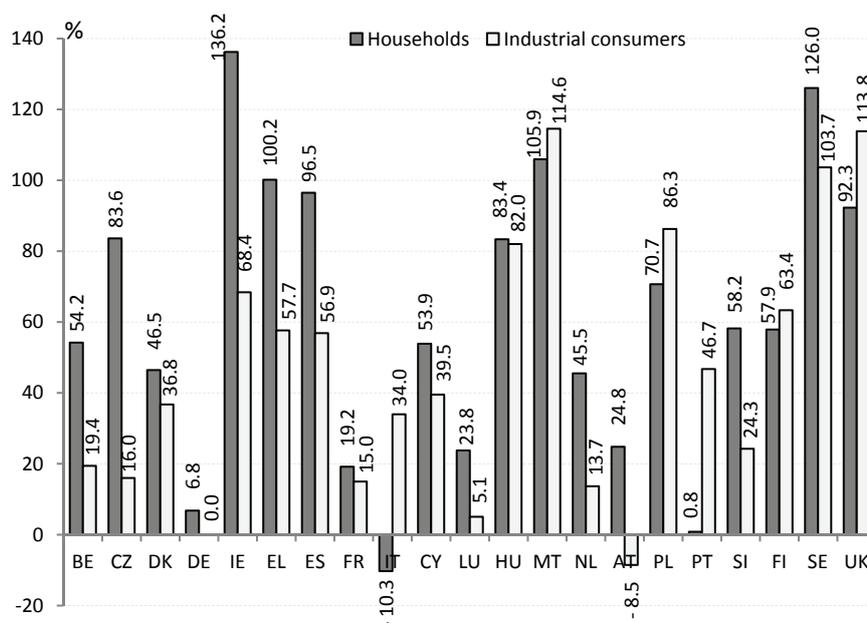
Source: Calculations based on Eurostat data [2017a, 2017b].

An analysis of the average annual price changes indicated that ex post regulation influenced faster price increases (Table 1). In most countries where ex ante regulation was used, prices increased faster in 2005-2016 than in 2000-2004. In the analyzed countries where ex post regulation was applied, faster annual average price increases were observed in 2000-2004 than in 2005-2016, except for Germany where the variations in price movements were small. In Germany, however, the reason for this was investment in the development of generation infrastructure [Bundesnetzagentur & Bundeskartellamt 2012, pp. 130-138; Nagaj 2016a, pp. 15-17, 2016b, pp. 195-197]. This analysis provides the conclusion that ex post regulation has encouraged businesses to raise prices in the short term.

Figure 2 shows the change in electricity prices for end-users in 2000-2016. This analysis allows us to determine whether ex post regulation has positively influenced the price level in the long run. Retail prices of electricity without

taxes and levies were subjected to a study to bypass climate change-related factors and show only the impact of market factors.

**Figure 2.** Change of electricity prices without taxes and levies (in national currency) for final consumers in 2000-2016 (in percentage points)

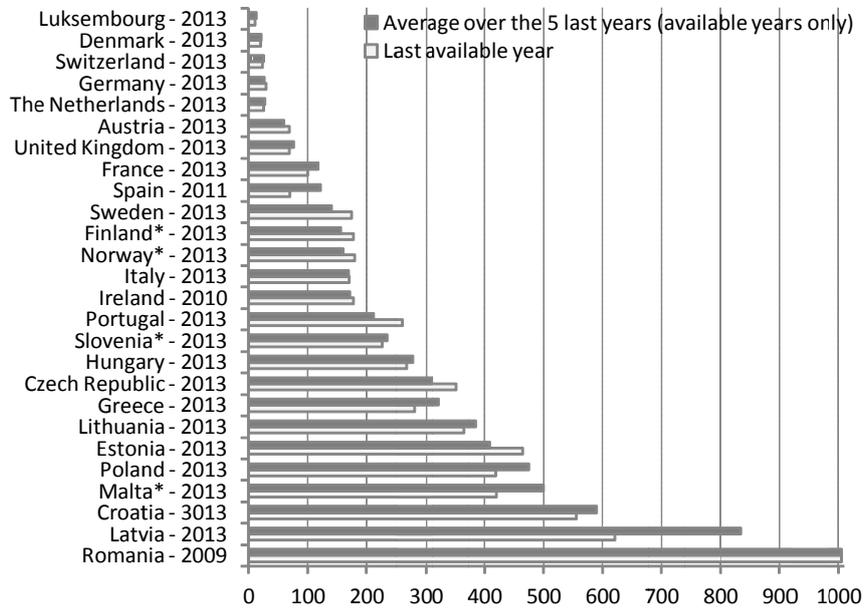


Source: Calculations based on Eurostat data [2017a, 2017b].

The analysis of price developments in the long term did not indicate unequivocally whether ex post regulation affects the tendency of companies to raise prices. It is worth noting that while the price changes in Germany was one of the lowest and at the same time the ex post regulation lasted the shortest, Sweden's prices increased the most in the long run, and even growth was higher than in Finland, where ex post regulation lasted the longest. It should also be noted that in Finland, where ex post regulation is still partially used (in conjunction with ex ante regulation), prices for households have increased in the long run to a lesser extent than for businesses (as compared to other EU countries is unique).

The second element as indicated in the literature, was the threat from the use of ex post regulation to the level of investment and the quality of electricity services. For this purpose, a comparison was made of the quality of electricity services in the countries listed below (Figure 3), as measured by the average annual interruption time for consumers connected to distribution networks (Figure 3) as well as planned long interruptions in minutes lost per year (Figure 4).

**Figure 3.** The 5-year average interruption time for customers connected to distribution networks in 2009-2013 and the SAIDI for last available year in the EU Member States, Switzerland and Norway

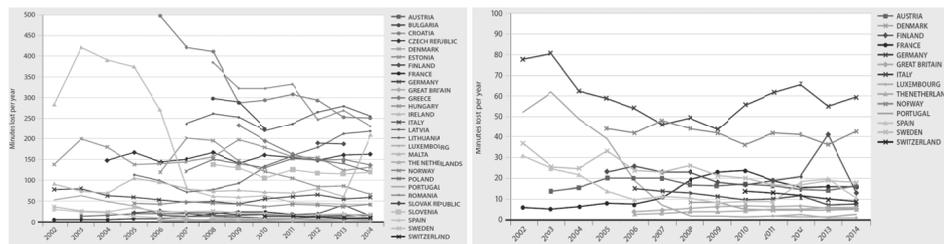


\* Harmonized total SAIDI – all interruptions considered. Non-harmonized SAIDI – interruptions which originate from incidents on LV networks not taken into account, or average annual interruption time taking into account MV customers and weighted by average consumption. Likely underestimated compared to harmonized total SAIDI, by about 5%-20%.

Note: SAIDI means System Average Interruption Duration Index. It measures average annual interruption time for customers connected to distribution networks.

Source: CEER [2015, p. 10].

**Figure 4.** Planned long interruptions in minutes lost per year in 2002-2014



Note: Left panel – all countries; right panel – only countries not exceeding 100 minutes.

Source: CEER [2016, p. 43].

Analysis of the quality of service indicated that Germany, Sweden and Finland belong to the group of countries with the highest quality of electricity service in the EU. The electricity interruptions time in Germany, Finland and Sweden is low compared to other EU countries. Moreover, the analysis of the length of electricity interruptions in 2002-2014 indicated that the quality of electricity services was not deteriorating (Figure 4). The results of the study have not confirmed concerns about the negative impact of the use of ex post regulation for the level of investment and the quality of electricity grids.

## **5. Conclusions**

The research contribution of the paper is a synthetic presentation of the essence of ex post regulation and its types applied in the electricity sectors and an analysis of the experience of the EU countries that have applied the approach to regulation in the electricity sector. The key advantages of ex post regulation include the freedom of decision-making businesses, the ability to react quickly to changes in the economy, improving the cost efficiency of enterprises and low cost of regulatory reviews.

Analysis of the experience of Germany, Finland and Sweden indicated, same as Block, Nold & Sidak [1981], that in the short term ex post regulation affects large fluctuations in electricity prices for final consumers, and in the initial period after its introduction affects the rapid rise in prices. However, the study showed that in the long term there was no impact of ex post regulation on price increases. Moreover, contrary to the fears reported in the literature, the ex post regulation does not adversely affect the quality of electricity service which confirms the thesis presented by Ph. Aghion & R. Griffith [2007].

The main disadvantages of this method of regulation include the tendency of companies to over-estimate bills for consumers and the need to shift regulatory risk to consumers. The result is the need to assert the rights of consumers in court. The experience of Finland and Sweden also pointed to the excessive length of court settlement of disputes. One solution to this problem seems to be either using the threat of regulation [Block, Nold & Sidak 1981] or shortening of the period for dealing with disputes or introduction of the practice of settlement of disputes to the benefit of consumers in dispute with the company. In the case of a regulator's administrative decision, that is during the period from the administrative decision of the regulator until the court decides to change the decision.

The research gap has been investigated, which was to examine the main effects of ex post regulation in the electricity sector in the European Union coun-

tries where this regulation was applied. The main research implications are that ex post regulation should be applied over a long period, there also should be a high level of competition in the market and a well-functioning court system or fast-paced complaints handling procedure. However, there are still many unknowns. Besides main research limitation is a small amount of data on the functioning of ex post regulation in the electricity markets. Hence, proposals for further research are being evaluated on this method of regulation in other markets and countries outside the European Union, comparing the long-term effects of ex post of regulation and ex ante regulation.

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