INTERNATIONAL EXPERIENCE OF PRICE REGULATION IN ELECTRICITY MARKET AND ITS RELEVANCE FOR UKRAINE

by

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Abstract

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There is a much deal of arguing among economists how the electricity market has to be regulated. After the collapse of Soviet Union (SU) Ukraine inherited the old system of electricity market structure, which has already partially restructured. This research investigates the efficiency of regional distribution companies comparing their declared costs in the winters 1999-2000 and 2000-2001 using regression analysis. The author argues that under current regulatory system there are no incentives for the distribution companies to reduce their costs through the introduction of cost-saving technologies. Privatisation of the six distribution companies has not led to significant changes in the efficiency of these companies. An international experience suggests that the implementation of price-cap regulation creates necessary and, at least in Spain, sufficient conditions for improving the performance of energy sector. The Author proposes the introduction of the new type of regulation especially for those changing the type of property rights.

TABLE OF CONTENTS

LIST OF TABLES

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GLOSSARY

NERC. National Electricity Regulatory Commission

Electricity Tariff. Price of one unit of electricity (kWh) paid by final consumers, i.e. households and industrial sectors

Oblenergo. Regional distribution company that supplies electricity.

Minenergo. Ministry of Energy and Fuel.

Chapter 1

INTRODUCTION

The issue of price regulation in the case of natural monopolies and as an example in electricity is not a new concept in economics. Economists argue whether the natural monopolies should be regulated or not. Many countries in the world deal with this problem more or less effectively. The reasons for governmental intervention are obvious and justifiable for a couple of reasons. A natural monopolist facing no competition and no regulation body can establish a price that is much higher than is socially acceptable. People as the society would be much better off with lower price and more extended coverage of the services.

In the countries with the socialist economy the price of electricity was under the permanent control of the state. These conditions certainly reduce the incentives for the monopolist to seek for the ways of reducing the costs and perform effectively. And if we add to this the issue of soft budget constraint and subsidies to poorly performing enterprises the problem would seem even greater. Reduced effectiveness, permanent non-payments to the industry due to the soft budget, low law compliance and law enforcement create a large share of the troubles for the government in transition countries. In this case the state should attain the best situation in which the society would get the maximum it can pay and the industry produce the amount it can produce. That's why the governmental regulation issue gains the additional weight in new emerging market economies.

In 1991 Ukraine declared it would follow the market economy framework. The collapse of the old system requires establishing of a new institutional framework. The government should induce the economic agents not only to

change their previous behaviour but also to enforce them to comply with the new laws. It is necessary to reconsider the ways of reasoning the state used in setting of electricity price.

The concern that my thesis will address is the problem of effective price regulation in Ukraine. I think that the methods currently employed by National Electricity Regulatory Commission (NERC) do not provide the basis for the future improvements in the electricity markets. To my mind state regulation within a market economy should not follow the methods of price regulation used in planned economies. The government cannot afford to support loss-making enterprises by the subsidies in terms of free electricity. Taking into consideration the international experience the regulatory bodies should employ the methods that would satisfy the greatest social benefits. Among the different practices used in the world Ukraine electricity industry must choose the best, which would certainly fit well into the current structure of the market, create and satisfy the condition of its further development and improvement. My thesis incorporating the international experience will propose the price cap regulation as the might-be policy for the regulatory bodies in electricity industry.

Chapter 2

THEORETICAL PART

Case of natural monopoly

Natural monopoly emerges in the case when industry has a specific cost function for a given set of products that it is sufficient to have only one producer, who produces at lower cost than two or more can do and satisfies the whole demand (subadditivity of costs)(Baumol, Bailey and Willig, 1977). This happens when the producer benefits increasing from returns of scale or scope: the case of large fixed costs but small constant or decreasing marginal costs, which are lower than average costs (Train, 1991). The "optimal" (first best) solution can only be achieved under the condition of one producer who supplies good at the marginal cost price. But facing large fixed costs and increasing returns of scale or scope the producer will incur losses and will be forced to go out of the market. So, here we can achieve only "second best solution", i.e. price equals average costs. The monopolist facing no competitors would set prices far above the marginal costs. He will provide the amount of goods according to the equality of marginal revenues and marginal costs. From the social point of view it means that too low quantity is produced. That's why there is an objective for the governmental regulation of the monopolist. There are several of methods that can be used to attain the socially desirable outcome. They can be divided into two groups: direct and indirect.

Direct Regulation

The easiest method, at least theoretical, is to subsidize the monopolist (Hirschhausen, 2000). In this case the government reimburses his loses and makes the company supply the good. It will do this until a price equals to the marginal costs. Thus, employing this policy society reaches the first best solution. But in the world of imperfect information it is highly difficult to determine which monopolist to subsidize, what his cost function is and etc. Besides, there are no incentives for the producer to reduce the costs and to produce optimally without cross subsidizing.

Another solution can include price discrimination (Hirschhausen,2000). The producers offer the good to the customers at their reservation prices or use various tariffs for different quantities (bundling). In this case the producer supply the good until his extra revenues equal extra costs. We can achieve first best solution. The only problem is that consumers loose their entire surplus and producer gets it all. It might not be equitable.

The necessary condition for the producer to stay at the market for a long time is to cover the average costs. As mentioned above the company with falling average cost cannot sell at its marginal cost in the long run. A company can discriminate taking into account a demand and an elasticity of market. The monopolist raises the prices to the largest extent at the market where the elasticity is the lowest. Such discrimination is called “Ramsey prices” or “inverse elasticity rule” (Ramsey, 1927). Increase in price from marginal cost to average cost will result in less loses in the case of inelastic demand curve than in those where demand is highly elastic (consumer with elastic demand will switch to substitutes facing higher prices of the original goods). In practice, it is very difficult to estimate the cost function, the demand curve and its elasticity. Besides, Ramsey prices do not tell anything about the equity. As a rule, people with low elasticity are those who do not have many choices but to consume the good. As an example, low-income citizen that lived in a

city can use only electricity to heat their dwellings[1]. At the same time the high-income group can easily switch between fuel and electricity as the means to heat houses. Raising the price of electricity the regulator leave no options for poor customers but to continue the usage of electricity. That is why this method can be used just as the guideline for setting prices.

The regulator body could also introduce the system of two-part tariffs (Hirschausen, 2000). Customers pay a fixed fee and then pay an additional usage price. As a rule the usage price is set according to the marginal cost and fee covers the part of the fixed costs. This principle is highly popular in the industries that face different kinds of consumers with those who use the service frequently and those who do not.

A two-part tariff gives a much more socially desirable outcome in comparison with the Ramsey prices because besides the basic fee people have to pay only marginal cost. Regulator can apply Ramsey price setting for establishing such fixed-usage fee ratio that ensures that no one is deprived from using the service. Another method enables the customer to choose the option he sees as the appropriate. He may choose between high fixed cost and low usage fee and vice versa. The consumer picks the option he likes and thus saves the regulator money for information costs. High transaction and information costs impede the development and usage of many other forms of price discrimination. Another issue is that the monopolist has to prevent the re-sales of his product by the customers who get the good at the lower price. The amount of surplus that accrues to the monopolist is the issue of debate at the political level. The government has to limit the ability of the entrepreneur to use his power.

Above-mentioned concepts of direct regulation demand that the regulator owns the full information about the demand and cost functions. In practice it

[1] Though there are also alternative ways to heat dwelling especially for those who live in rural setting and small town but I consider only those people living in big cities and unable to use another kind of heating except for electricity.

is seldom the case. That is why in practice the government or another regulatory bodies use much easier methods. As the result we cannot expect them to reflect the full social optimality.

Fully distributed costs approach is used at the enterprises, which produce many goods (Hirschausen, 2000). In this case costs are distributed according to some formula, which incorporate the index (time, distance) as the measure. This method is rather easy to employ. But it is far away from desirable because it does not consider any property of price elasticity.

Costs can be distributed among a small number of parties with the main share falling on the prime user. Under such conditions all except the prime user pay only marginal costs. This principle can be applied when the regulator knows for sure that the prime user has the lowest price elasticity of demand. The Sole user concept implies that the prime user might be given the right to bear only those costs, which are really important for him. In this case he is much more involved in the decision-making process, i.e. he must determine what he need to carry out the production process. Also it enables the "sole user" to negotiate with the other parties about the terms of costs covering. By this doing he transfers some of his liabilities to the other members.

Another issue that deserves our attention is the concept of cross subsidizing (to offer one good at the lower price and to cover cost by charging more for another products (Hirschausen, 2000). There is a great deal of debate about when cross subsidization emerges. Most economists agree now that we can assume that there are no cross subsidies if the firm gets zero profit and there are no incentives to split the production. If the firm benefits from return to scope (it is cheaper to produce two or more goods together than to make them at the separate plants) it can supply the goods that might be priced less than similar goods from another producer. We can state that if the company, which has returns to scope, offers the good at a price that exceeds the marginal cost of those produced by the firm that does not, and at the same

time offers another product below the marginal cost then there is the cross subsidization. We cannot say that offering the good at a price that is below the cost of production of this good is the cross subsidizing. The firm is able to set the price of any good in the range of differences of total cost and the sum of marginal cost of separate type of production. This range emerges due to the return to scope.

Indirect Regulation

Indirect regulation includes methods that do not imply the direct intervention into the price policy employed by the producer. In this case the regulator just sets the constraints the producer faces and in such way influences the decision making process.

Rate of return regulation (ROR) aims to set the maximum profit the monopoly can obtain on its capital. The regulator does not introduce the maximum price the firm can charge the consumers (Train, 1991, Hirschausen, 2000). On the contrary the firm is free to choose the output level, input mix and the prices. But it will not be allowed to retained profit in excess of those allowed. The main task of the regulatory body is to determine the costs that are incurred by the firm in the production process and those that does not directly contribute to the production. Cost of capital and other costs are separated from each other. Then the government sets the "fair rate" of returns, which the company may earn on its capital. Averch and Johnson proved in 1962 that under rate of return regulation the regulator could not attain the socially desirable outcome (Averch, Johson, 1962). The first thing is that the firm has an incentive to increase its capital stock and thus earn more. Second, by employing more capital, the capital-labour ratio increases and this leads to inefficient mix of input usage. Third, as the result of decrease in the amount of labour the monopolist could produce less with the higher price

than before. Fourth, the firm will still continue to operate at the elastic part of the demand.

The analysis of the firm behaviour under ROR was extended others (Baumol and Klevorick, 1970; Das, 1980). Rate of return regulation will not make the firm offer such quantity of goods that will move the company at the inelastic portion. It must be added that though the firm uses an inefficient mix of inputs it will not waste them: the monopolist will employ only productive capital. Other issue that need to consider is that the regulator body has to set the "fair rate" not less than market one for that not to induce the firm to go out of the business. Letting the firm to leave the market, the government only increases social losses. An empirical study (Courville, 1974) suggests that the regulated firm overuse the capital and produce inefficiently.

The second type of regulation used is return-on-output regulation (ROO) (Train, 1991). The company is able to retain definite amount of profit on each unit it produces. As in the case of ROR regulation the company may choose the amount of inputs, output, prices. But it is not allowed to get more than the allowed share in the output. Using this form of influence on the producer the government can make it produce more than it did before. The enterprise will use the efficient mix of input and will not spend its inputs in vain. In this case there is a possibility to almost reach to the second best output level though the actual second best result will not occur. There are also a few difficulties in ROO regulation. If the firm can influence the demand curve it will surely stimulate the demand in order to increase it profit even though the expansion of the output might be undesirable from the social point of view. The firm under ROO regulation will not undertake conservation even if it generates a better social outcome.

Rate-on-sales regulation (ROS) is another option the regulatory body can apply to the monopolist (Train1991). It is often used in the cases when it is much easier to quantify the sales than real output. As in the previous cases the

producer is free to choose its output level, inputs mix as long as the allowed profits does not exceed the certain share of the revenues. The monopolist will expand its output, use efficient inputs mix and does not waste the capital only under condition that the relevant output range is on the elastic part of the demand curve. In this case reducing the allowed portion of revenues the producer can retain will lead almost to the second best solution. When the output enters the inelastic part of the demand curve the producer will not produce there because the marginal revenues are less than marginal costs. We can conclude that too little output is produced in comparison to socially desirable and the producer will use the inefficient inputs mix, i.e. waste the resources. By shrinking the allowed rate of revenues, we could make the company waste the resources. The ROS regulation is only effective on the elastic part of the demand curve.

In practice, government can also employ the return-on-cost regulation (Train, 1991). The idea is that the company can earn only a certain amount as the share of its total costs. This case has the same property as those considered above. On the elastic part of the demand the monopoly uses the efficient inputs mix and does not waste resources, expands its output. If the allowed rate is decreased the firm will increase its output. But on the inelastic part of the demand the firm earn more by producing less (its marginal revenues are less than marginal costs). The result is similar to those obtained under ROS.

As a response to the critique of ROR regulation mechanism economists have recently begun to use “price caps” method (PC) as the mean of firm regulation. The idea of this method is that the regulator sets the price also called the price cap. The regulated monopoly is free to choose a price that is not higher than the cap and as a result is the claimant for all residual profit. If the company produce various goods or services the regulatory body can establish an aggregate cap based on the basket of those products. This could be done calculating either the price index or weighted average of the prices. The firm can certainly change the price of any goods as long as the required

index or weighted average are not exceeded. These indices are subject to revision and can be adjusted by a factor X, which is known by the firm in advance. The aim of the review is to consider the costs of the firm, demand for the product and the profit conditions of the firm. The price-cap regulation stimulates the firm to produce with cost-minimizing inputs sets, to invest in cost-savings technologies and to adjust to costs changes. Under this type of regulation the firm is the claimant for all profit that was accrued due to cost-savings and the total surplus increases in comparison to the case of the firm under ROR. Besides, it was found that the costs of monitoring and administrative costs for PC were much less than for ROR (Littlechild S, Beesley M, 1992). But it might not be true in practice (Parker 1999, Liston, 1993). The regulatory body incurs costs by monitoring profit and costs due to price-cap hearings. Another advantage of PC regulation is that by setting the cap on the monopoly goods it can deter the predatory pricing of competitive goods (Liston 1993).

Though the PC regulation has merits it is not free of the disadvantages. Minimizing cost of the goods and thus attaining bigger profits the company can decrease the quality of the supplied services (Kahn, 1988). The regulator is always at a disadvantage while determining the proper X-factor for the monopolist, as there is asymmetric information between regulator and regulated (Bishop and Kay, 1988). The regulator may use the comparison between companies (if possible) and to pursue the "yardstick" regulation (Cooper, et al.). The regulator is at the risk to set too high cap and consumers will lose a significant part of their surplus. Under PC regulation there is a much bigger possibility for the regulator to be captured by rent-seeking groups, as he is not obliged to publish rates of return. A monopoly with PC regulation has the right not to provide the service for the highest cost or low-income groups unless it is specified somewhere. With PC regulation the general public loose their vote, cannot influence or reveal their preferences during the course of PC hearing. The implementation of the PC can be very difficult. No one can surely answer how the regulator has to introduce the

initial price, how to define baskets of service, how often to conduct revision of the basket and price cap, etc.

Chapter 3

LITERATURE REVIEW

Ukraine has made a great institutional reform in early 90's concerning the structure of wholesale electricity market. Now there is a great deal of debate over this sector in the economic and political environments. Certainly natural questions may arise as how to regulate the price setting for these monopolies and whether the regulator who sets up the rules of the game will secure the benefits the consumers will get. Though Ukraine has chosen the model England currently uses, it still uses the regulatory approach inherited from the previous socialist economy. To argue about the change of regulatory structure we have to consider the international experience, especially those England has obtained so far.

There is a great doubt about to what extent of success the electricity reform was implemented in UK and to what extent the citizens benefited from it. In particular, the analysis must be conducted not in terms of price reduction of electricity in 1990-1999 but in terms of what they would have been if there had not been any restructuring (Thomas S., 1999). He continues his analysis by comparing the price changes in each stage from generation to consumption. In order to make the privatized companies more attractive for investors Government caused real price rises in 1987 thus making the public utilities even more profitable. Besides, just after the privatization the regulatory body set rather generous formulae for distribution of electricity. So, only starting from 1995 the final consumers could see any real price reduction for electricity due to one-off price cut of 14%. In general, Thomas states, assuming 1987 prices as the benchmark, the real price reduction constituted 3% per year.

As far as supply is concerned, though the price cap formula was not so favorable there are no changes (again assuming the charges of 1987) in the charges final consumers face now after the ten years of reformation. Transmission charges were really reduced by nearly 4% per annum assuming the price level of 1987. Stickiness of prices in generation was the result of using rather expensive UK coal, which companies were obliged to buy.

According to a report published by the regulatory body, captive consumers paid 13% and 22% more than non-captive in 1995 and 1996/1997 respectively. Thomas concludes that nuclear power plants were the primary source of cheap power in those years. He points out that not only captive consumers had been giving subsidizes totaled £6bn. to nuclear power for couple of years but they were also deprived of cheap power generated by these plants. Again, by taking the prices of 1987 as a benchmark, the consumers faced only 2% reduction of their bills annually and it seems not so significant[2]. Thomas also points out that the lack of experience in setting the price-cap formulae led to very generous conditions for privatized companies. For example, the distribution price review of 1995 had to be re-opened in order to put much tougher conditions.

Bacon (1995) describes the effect of restructuring and privatizing the electricity market in United Kingdom. It clearly reveals the reader the ultimate results of such actions carried out by UK government. As the article states the government has stopped to subsidizing this sector and there is no a great decline in the prices for the consumers. The reasons for the latter can be explained by the speed of reforming that took place in this industry. Investments in new generation capacities did not bring a quick reduction in

[2] In many analyses the implicit assumption is that before privatisation there was no efficiency gain. But if we allow for this sort of efficiency exists then the reduction in prices might have existed even without restructuring as on 1998.

prices for electricity. Besides, as for the 1995 a considerably small number of generation companies dominated the market. Making the share of the greatest generator less at the time of privatization would accelerate the emergence of the competition. Another interesting issue is there is a trend for distributors to merge with each other and thus the can exploit the economies of scale. The paper also provides the overview of the usage of RPI-X price-cap pricing in UK and the problems the regulator experienced in setting up productivity indices for every distribution company. The author points out that interested groups from REC's creates its own teams that presents a lot of documentation aiming to influence the productivity factor set by the regulator for these companies. In addition, it worth mentioning that reduction in cost for generation and delivery of electricity was not passed through to final consumers as quickly as it was deemed to happen. Certainly, the value of this paper is very limited as it dates only to 1995.

On the other hand there are a lot of research that suggest price cap regulation really performs well in UK and other countries. O'Mahony conducts the comparison of the productivity in electricity, gas and telecommunication industries from 1950 to 1996 (O'Mahony, 1999). Labour and total factor productivity growth of UK electricity industry has increased significantly in comparison to other developed countries, USA and Germany, after the industry has been reformed during 90's. Though the level of total factor productivity was less than in USA it was higher than in Germany. The main finding of the research is that all industries in UK outperformed their foreign counterparts in respect to the increase in productivity growth in the period of 1989-1996 though some industries still perform worse than all USA ones and German gas sector. This clearly identifies that time of a change in a regulation and concurrent privatisations are responsible for such growth pattern across industries.

Price cap regulation together with competition and sufficient capital market pressure can lead to the increase in the efficiency of the companies not only in electricity industry. Parker and Saal conduct a research on sewerage and water industry and show that the privatisation itself did not make either industry or particular firm to operate more efficiently (Parker and Saal, 2000). On the other hand, the implementation of price-cap regulation led to the increase in total factor productivity on both aggregate and company level though with different weights. Authors argue that the increase in output prices or reduction in input prices can not explain this improvement. Though this research was conducted on the water and sewerage industry in UK and thus not directly related to electricity industry, still it clearly points out the strength of price-cap regulation.

Parker, for example, considers the electricity industry after regulatory change and privatisation ((a)Parker, 1999). He notes that the electricity companies have indeed increased their performance as the bills for electricity diminished at a rate of 2,5% and much more significant decrease for industrial consumers. The author also highlights the fact that the quality of service improved though industry employed fewer people. At the same time high profits of companies and return on investments only testify the success of the regulatory change and show the inefficiencies industry had before the reforms were performed ((b) Parker, 1999). Reforms brought benefits to consumers in terms of lower prices, higher quality and high returns on stock shareholders got just afterwards of privatisation. But as was described in earlier paper, returns to shareholders shrank especially after the price-cap review in 1995-96 and now investors seem to gain only normal rates of return on their investment in utilities (Parker, 1997). Regulators gained the information about the possible productivity growth in regulated industries and less demanding X-factor was set just because of ignorance of regulatory office and willingness of the government to make the utilities more attracted for might-be investors.

UK transformation of electricity industry included the transfer of property rights and introduction of new type of regulation. Thus, it is very difficult to judge which these two changes influence the performance of the industry more. Pablo Arocena and Catherine Waddams Price (March 2000) studied a Spanish electricity industry. These authors focus only on the regulatory change without any change in property rights. They argue that before the implementation of price cap Spanish electricity industry was subject to cost plus regulation. The authors investigate the performance of private and public electricity firms before and after the change in the regulatory design. They state that though private companies pursue only their own profit maximizing goal, under such type of regulation as cost plus they are not allowed to keep the profit from cost reduction activity and are reimbursed their cost in any case. On the contrary, public companies are expected to attach a positive weight to reduction in costs because it would lead to the burden on public budget or state budget (Waddams Price, Arocena, 2000).

The incentive mechanism changes when price-cap regulation is introduced. Private firms by reducing their costs can retain any extra profits they gain as the result of this activity. Thus, any increase in productivity will be virtually translated into higher profits, as the prices are fixed for a determined period of time. Public firms are not in general pure profit maximizers. There are many other objectives followed by the public firms in the activity. Thus, at least theoretically under price-cap the private companies will have more incentives to do much better than public ones and their efficiency would grow faster than in public sector.

The authors get very convincing results to their expectations. Public electricity companies did really outperform their private counterparts under cost plus regulatory mechanism. But the performance patterns show a significant change after the implementation of price cap. Private firms significantly improved their efficiency relative to those conditions they were before. Public

companies also amended their performance though in less extent. Empirical testing did not detect a significant increase of performance in public sector.

The authors argue that their research is an important insight into the theory of regulation and policymaking. Their results suggest that price cap regulation is more appropriate for private sector but cost plus one is better for public one (Waddams Price, Arocena, 2000).

The interesting issue to consider is the methodology of price-cap setting and in particularly how the X-factor is determined in practice. Initially price-cap regulation was supposed to be just the temporary step, as with the expanding of competition the need for intervention would fade away (Littlechild, 1983). But in a later paper (Littlechild, 1986) he argues that because of its natural monopoly features utilities demand a long-term regulation. The natural problem with price-cap regulation arises how to accurately measure the potential level of productivity gains in the regulated industry. There are four separate regulatory offices for water and sewerage, electricity, gas and telecommunication industries (Waddams Price, 1999). Each of these offices pursues own approach in determination of the possible efficiency gains for a certain future period. Waddams Price highlights that it is highly important in the price cap review if the direct comparison can be derived within the sector. On the one hand, in the case of electricity transmission company, National Grid (NGC), is unlikely to exist. On the other one, the regulator can make comparison among regional electricity companies. It is a common practice for the regulator to seek external advice in determination of each price-cap (Waddams Price, 1999). For instance, Office of Electricity Regulation (OFFER), the electricity regulator, relied on the opinions of consultants about potential cost savings; reviewed the past performance of the company; made international comparison. In this review, the international focus was rather discarded, as the territory served by particular companies in England and Wales was much bigger of those compared. Nevertheless it was agreed that

the non-labor costs of NGC were higher (Office of Electricity Regulation, 1996). The engineering consultants studied the investment program of NGC on the subject of its capital expenditure. As for the regional companies the regulator made the within the industry comparison and set the price-cap for the local distributors. Waddams Price states that the main methodology employed by the regulatory bodies is an econometric model, which compare the operating and capital expenditures between companies. Such analysis is done on an annual basis but panel data covering several years is not used. The issue of the quality of supplied goods is also discussed while setting the price-cap as this parameter significantly affects the proposed price-cap. As a rule, efficiency of the firm is analyzed using the questionnaire technique. It allows estimating past cost savings, benchmark the costs directly related to the production, and thus enable to point out the future potential cost savings for each company. Capital expenditure is estimated as the amount capital necessary to satisfy the forecast demand for a certain good of determined quality.

Waddams Price points out that it is not a rare case that companies can outperform the constraints they face. It clearly indicates that either the constraints are too loosely set due to asymmetric information or the price-cap is very powerful method of regulation. All the studies made on the productivity show that the reforms in UK utility industries and electricity in particular resulted in significant increase of labor productivity and smaller increase in total factor productivity. The greater extent of competition is the greater efficiency companies achieved. Cost reductions are often associated with the lower share of labor employed. Waddams Price concludes (Waddams Price, 1999, p. 10): "Several European countries are reorganizing their telecoms, and energy industries…However these countries are far from identical in the characteristics of their utility sectors and in the likely impact of such reforms. …In this context it is crucial that regulators can obtain reliable

and impartial information about productivity changes which is not subject to changes by “special pleading” from interested companies”.

The international experience does suggest that introduction of price cap regulation had a significant positive effect on the performance of the electricity companies. It creates the incentives based mechanism that promotes managers to seek cheaper way to operate at the market. Ukraine would have a better position than United Kingdom had when introducing new type of regulation. Now regulators in both countries can more or less precisely estimate the “might-be” gain in efficiency, X-factor. This valuable experience could help Ukrainian regulatory body avoid problems with setting the initial price caps and measuring the X-factor for a relevant period.

Chapter 4

EMPIRICAL PART

Case of UK

For better understanding of the reforms and current structure in Ukraine, I propose to take a look at what has been done in UK in early 90's and in Ukraine in mid 90's. UK electricity industry services about the same number of citizens and operates at the country of almost the same size. The short description will show that UK and Ukraine electricity industries are almost analogical with very few exceptions.

Before the reforms, the Government owned all electricity industry in UK. It consisted of three separate electricity industries: one that covers England and Wales and two smaller covering Scotland and Northern Ireland.

Thatcher government in 1983 took a first step in deregulation of the electricity industry by adoption of the Electricity Act. The primary aim of this law was to encourage the emergence of the independent suppliers through the removal of obstacles for non-utility companies to use the national grid. But it did not lead to the expansion of the market due to the low rates of return imposed by the Central Electricity Generating Board (CEGB) and privileges that incumbent companies had in access to grid.

The full-scale restructure of the electricity market took place in July of 1989 when UK Electricity Act of 1989 was adopted. Industry was divided into four separate parts: generation, transmission, distribution and retail supply (Thomas,S., 1999). CEGB was transformed into five independent

organizations: three generation, a transmission companies and a distribution network that included twelve Regional Electricity Companies (REC's) (former Regional Area Boards). At early stages of transformation, the government remained control over the industry and the privatization had to be proceeded.

Generation

Just after the restructuring the industry comprises three generating companies (Bacon, R., 1995): National Power (46-52% of capacities installed), PowerGen (28-33%) and Nuclear Electric (15%, state-owned). National Power and PowerGen were privatized in March of 1991. Nuclear generation was remained at the government ownership till 1996. Generation was vertically unbundled from transmission and horizontally divided into several companies, entry restrictions for new generators were terminated. The only restriction imposed on power generating plants was to sell their electricity to the wholesale market, Pool, which started working on 31 March 1990. At the time of privatization 70 % of generation was represented by coal generation, which used an expensive UK coal (Thomas, 1999). Government obliged generating companies to buy coal from UK coalmines until 1993. These contracts were met by contracts with REC's. Due to increase in Pool prices in 1993 OFFER negotiated an agreement with National Power and PowerGen to reduce the market dependence on these companies. Two companies were to sell off 6000 Megawatts of their capacities, which were near 15% of their capacities and 9% of total UK generation capacity (Energy Information Administration, 1997). In order to be more independent from two major firm-generators REC's also installed nearly 5000 Mwh's in 1900-1992. The total capacities constituted about 15% of the market. As for early 90's the nuclear sector of generation has expanded tremendously, producing near 50% more output and holding 25% of the market instead of 17% (Thomas, 1999). Till 1998 10% of the electricity bills paid by the final consumers' was earmarked to cover the future cost of decomposing and

dealing with waste. However, some of these revenues were used to build the new nuclear plant, Sizewell B (Thomas, 1999).

To prevent the wave of mergers and take-over of REC's by generating companies the government constantly used its "golden share" (blocking share package) in two generating companies and twelve REC's (Energy Information Administration, 1997). The government extended the usage of "golden share" in 1996 for an indefinite period.

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Transmission

After the restructure of CEGB transmission was transferred under the ownership of National Grid Company. Government made provisions to limit REC's power over managing the grid. National Grid Company was and still is responsible for operating the wholesale market, Pool, i.e. to match demand and supply for power, to dispatch the electricity. In 1996 NGC sold its own generating capacities (two hydropower stations) to Mission Energy from USA. In December 1995 REC's sold off their share in NGC and it became an independent company with new name, National Energy Group PLC (Energy Information Administration, 1997). Transmission activity considered a natural monopoly is regulated according to price-cap regulation.

Distribution

After the reform Regional Electricity Companies provided distribution and supply activities, where deregulation applied only to the latter one. Twelve Regional Electricity Companies (REC's) obtained joint control over the national grid company and had to conduct distribution and supply activities. But in December 1995 they were compelled to divest the shares in the national grid. Price-cap regulation was adopted to regulate the distribution. At the early stage of the privatization the distribution companies were granted

very generous rates of X factors for the period of 1990-95 in order to make them more attractive for public and to stimulate the investment activity in the future. According to the law REC's have the right to hold their own generation capacities but no more than 15% of the electricity they sell. REC's are also obliged to separate their business into two parts: distribution and supply (marketing). REC's were the first part of the industry privatized in December of 1990.

Supply

Supply is considered to be the potentially competitive market (Energy Information Administration, 1997). Initially the final consumers were divided into three major groups: small, medium and large. *Small group* of customers with peak demand less than one megawatt were obliged to buy electricity from their local REC. In 1994 the requirement was lowered to 100 kilowatts and finally from 1998 it was abandoned at all. *Medium group* of consumers with peak demand of 1 to 10 MW had the choice where to buy electricity: either from REC or from independent suppliers (other REC's or generators). *Large group* customers (more than 10MW) were to negotiate the price of electricity they want to buy with suppliers. As the result of Electricity Act of 1989, which promoted competition in marketing by removing the obstacles to reach large customers, 39 second-tier suppliers emerged as for 1996. These were REC's, which provided services outside their localities, as well as subsidiaries of National Power and PowerGen. They were especially successful in getting the mid-range group of customers, expanding their share of the market from 30% in 1994/1995 to 43% in 1995/96 (Energy Information Administration, 1997). OFFER also put stringent requirements on the quality of services provided. They are related to a number of additional services for the elderly or disabled, meter reading, etc. It is too early to ponder over how successful the second-tier suppliers might be at the residential market. As the experience shows households are not eager to change the supplier frequently (Thomas, 1999).

Wholesale market- The England and Wales Power Pool

To secure uninterrupted power the government created the wholesale market for electricity, Pool, which started working on 31 March 1990. The Poll is neither a buyer nor a seller of electricity. It is organized to equalize the demand with supply. All generating companies with capacities exceeding 100 MW are required to sell all electricity produced to this market, managed by the National Grid Company. All big generators and suppliers signed the pooling and settlement agreement (Maclaine, 1999). Energy Settlements and Information Services (ESIS), which is a subsidiary of NGC conducts all settlements.

Generating companies bid to supply the power in half-hour slots for the next twenty-hour hours (Bacon, 1995). At 10a.m. ESIS receives the bids from generating companies for every half hour of the next day. The system administrator has to forecasts the demand as well as to calculate the minimum amount of capacity to meet the forecasted demand for the following day. Among the bids only the least expensive are chosen up to the point when forecasted demand is satisfied for every half hour (Maclaine, 1999).

Case of Ukraine

After the break down of the USSR in 1991 Ukraine inherited a huge electricity industry in state ownership. Generating capacities of the industry totaled near 54.5 GW. The overall economic decline in Ukraine resulted in a dramatic reduction of the electricity generated from 279 TWh in 1991 to 172 TWh in 1998 (Opitz, Hirschhausen, 2000). Since then the amount power generated keeps more or less stable. Most of the electricity industry is concentrated within a small number of power companies that provide base load to the economy. At the same time there is a lack of peak load generating stations. The biggest share in the capacities installed is represented by the 44 thermal

power stations (near 67%), followed by 6 nuclear and 7 hydropower stations (24% and 9% respectively) (Opitz, Hirschhausen, 2000).

Ukraine holds a well-developed transportation and distribution network throughout the country (about 1 mln km with 22 thsd km of 220-750 thsd voltage lines), which in theory would enable Ukraine to introduce competition in inter-regional generation(Opitz, Hirschhausen, 2000). Though the capacities of that sector of economy were and remain far larger than Ukraine needs, the state of the industry in 1991 needed urgent changes.

The aim of restructuring was to introduce competition in generation and distribution of the electricity and, therefore, to lower prices and increase the welfare of the citizens. Facing the competition companies acting at the market will try to reduce their cost via efficiency and supply cheap energy. Therefore there is no need for overall regulation but what left for regulation in this case is the electricity network, which is regulated by Regulator. Another goal probably pursued by the reformers, while unbundling the industry, was to make the process of monitoring costs more transparent.

At that time Minenergo (Ministry of Energy) had direct control over eight vertically integrated regional companies, a hydro generation association, a national dispatch center and central staff. Nuclear power generation was subordinated to the Goskomatom (Ryding, 1998). In 1993, the World Bank Group issued the Energy Sector Review in which it outlined the focus of the future restructuring. It was agreed that Bank's reform would concentrate on non-nuclear sector. The World Bank provided a necessary financial assistance aimed not on the expansion of the capacities but on the improvement of the capital assets. The emphasis was made to make the companies more independent in the financial and operational activities and to promote competition within the industry. The negotiation between the World Bank Group and Ukrainian government resulted in acceptation of the proposed

scheme. After a long debate within the government Cabinet of Ministers and the President issued the Presidential decree № 244/94 in May 1994 and confirmed the industry structure with decree № 282/95. The main features of this restructuring are (Ryding, 1998) (See figure1):

- ✓ The wholesale market (Energorynok, which conduct purchasing operation from Generators and selling to suppliers) was created from the National and Regional Dispatch Centers. Along with other restructuring the Regional Dispatch Centers were transferred to the National Dispatch Center in May 1995. They subordinate to Ministry of Fuel and Energy;

- ✓ 4 corporative companies such as Donbasenergo (five plants, 7.77 GW), Dniproenergo (three plants, 8.4 GW), Tsentrenergo (three stations, 7.8 GW) and Zakhidenergo (three plants, 4.68 GW) were created; on the basis of eight Dnipro and three Dnister stations two companies were established; Energoatom Company absorbs all nuclear power stations;

- ✓ Restrictions to supply electricity by independent suppliers were eleminated;

- ✓ The National Electricity Company incorporated high voltage operations of the 8 regional distribution companies;

- ✓ Out of 8 regional utilities 27 local distribution companies[3] (oblenergos) (25 servicing regions and extra 2 covering Kyiv and Sevastopol) were created in 1995. They are now, as the direct result of

[3] Currently 12 regional companies are currently privatized; 2 companies are partly privatized and the rest is still public; Initially all companies was the property of the state

the reformation, responsible for low voltage network, electricity supply and serving the operations of small district heat and power plants;

- ✓ A regulation body (the National Electricity Regulatory Commission) was established in December 1994. The National Electricity Regulatory Commission (NERC) regulates activities concerning issuing and monitoring of the license for production of electricity, transmission via high voltage lines, low voltage distribution, tariff and non-tariff supply. NERC also is to foster competition, protect customers, monitor the performance of electricity market, set the prices for high and low-voltage operators, margins for tariff suppliers.

It should be mentioned that only thermal power generating companies are allowed to compete in terms of prices at the wholesale market; not nuclear power stations. The share of Energoatom supply at the electricity industry constituted about 45% (approximately 77 billions kWh) in 1999. As a result of non-payment problem Energoatom sold near 50% (about 75% of total electricity supply sold at non-regulated prices) of its generated electricity at the non-regulated price, which is significantly lower of those regulated. Though it is formally forbidden by legislature to offer electricity at non-regulated prices it is done mainly as an exception to enterprises that are able to pay for this. Prices exceed the marginal cost of energy production but cover only 66%-85% of total cost. The Pool model of electricity market started operations in Ukraine on 10th of April 1996 after the thermal generation and grid companies along with local distribution companies signed the Energomarket Members Agreement on 21st of March 1996. The current structure of the Ukrainian Electricity industry is depicted in Figure 1 in the appendix.

Price setting methodologies

The description would not be complete without describing what type of regulation, if any, the regulatory body uses and how it set prices in the electricity industry. In 1998 NERC introduced a new methodology for setting tariffs and envisaged tariffs for consumers depending on the voltage level and group of consumption. It regulates the tariffs on a cost-plus basis and only thermal plants are allowed to compete with each other. NECR saw this step as the necessary and temporary measure until the structure of tariffs for four different classes of voltage levels would have been elaborated and implemented (NERC, 1998).

The Regulatory body uses the following formulas to calculate tariffs in the electricity industry. The retail price formula for the first class, highest one, (34-154 kW) is the following (NERC, 1998):

$$P_{i1}^{P} = \frac{P^{av}}{(1 - C_{p1}^{m})} * C_c + T_1^t + T_i^d$$

The retail price for second class, lowest, (0,4-10 kW) of voltage level is calculated in the following way (NERC, 1998):

$$P_{i2}^{P} = \frac{P^{av}}{(1 - C_{p1}^{m}) * (1 - C_{p2}^{m})} * C_c + T_2^t + T_i^d \text{, where}$$

P_{ij}^{p} – retail price for j voltage level

P^{av} - average price of electricity bought at the wholesale market and from non-members of the electricity market weighted by the amount of electricity bought from these sources plus/minus deviation between real and forecasted data for tariff calculation.

T_j^t - tariff for electricity transmission according to voltage levels.

T_i^d - tariff for electricity distribution by local network for different groups of consumers

C_{p1}^m - coefficient of technological costs for transmission to first voltage level,

C_{p2}^m - coefficient of technological costs for transmission to second voltage level; C_{p1}^m and C_{p2}^m follow the distribution (0;1)

C_c - correction coefficient for technological loses of electricity, which is calculated and submitted by local distribution companies to NERC for approval;

All of these variables are in turn also calculated employing formulas that are more elaborate. Nevertheless, for time being it is reasonable just to consider the formula for average price, which is calculated as (NERC, 1998):

$$p^{av} = \frac{\sum (P_i^w * Q_i^w) + (\sum P^n * Q^n)}{\sum Q_i^w + \sum Q^n}, \text{ where}$$

P_i^w - price of electricity at the wholesale market at period;

Q_i^w - quantity of electricity bought at the wholesale market at period;

P^n - price of the electricity bought from non-members of wholesale market

Q^n - quantity of electricity bought from non-members of wholesale market

As one can expect from the formula selling prices differ for each area depending on transportation cost and losses in electric lines. Transport tariffs along with tariffs for final customers are established by NERC and the facts of cross-subsidization between groups of final consumers are not rare in favor of private household.

NERC uses the following formula to set the tariffs for nuclear electricity supply:

T= AC+AP+D+TX, where

T- tariff per kWh
AC- accounting cost
AP- accounting profit
D- deductions made to build new reactors at Khelmytsk and Rivne nuclear power stations.
TX- taxes
Current mechanism for price setting is depicted in Figure 2.

The issue of accounting profit needs more discussion. The regulatory body sets the officially determined rate (as allowed profit), which is included into tariff but not set as a percentage. Rather the regulatory body calculates the amount of future costs aimed to finance future developments in the sector. Current total costs of nuclear power generation without deduction for industry development and those that includes all capital costs constitute 1.8 UScts and 2,3 UScts (2 UScts) per kWh respectively in 1997 (1998). This cost did not include deductions to social funds and taxes payment to road fund (in foreign countries payments to these funds are done mainly through the taxes and are not the items of the costs). International comparison indicated that the costs of production and fuel did not exceed the level of cost incurred by foreign nuclear power plants in 1998 (Opitz, 2000). Costs of nuclear power generation are highly dependable upon the exchange rate. Nuclear fuel, repayments and depreciation are calculated in US dollar because these kinds of service Ukraine has to import from Russia. Nevertheless Ukraine can compete with other countries in this type of electricity and its competitiveness

will depend on exchange rate and costs of closing the existing reactors from 2003-2005.

Due to long established tradition significant part of the final consumers in the country pay for the electricity at the lower tariffs than other and costs to cover these differences are not provided by the state budget. There are particularly 3 main groups of consumers such as households, agriculture producers and coalmines. Former two groups receive electricity at the tariff established rather in administrative way and for the latter one NERC itself set the price ceiling. NERC calculates and includes indirect subsidies to these groups in the price at which it bought the electricity at the wholesale market. The issue of such price setting mechanism in post-socialist countries has been widely discussed in transition literature by other researchers (Kennedy, 1999; Stern and Davis 1998; Freund and Wallich, 1997).

Chapter 5

DATA AND METHODOLOGY

In order to suggest the introduction of price cap regulation for Ukrainian electricity industry we have to estimate performance of the electricity distribution companies through the years.

For the analysis of the companies' performance researchers use panel or cross-sectional data. I will follow the common practice. Though there are 27 local electricity companies in Ukraine, I use the panel data from companies' budget expenditures for only 25 regional electricity distribution firms. The reason is that two companies, namely Poltavaobleenergo and Sumyoblenergo stop providing Ministry of Fuel and Energy with their budget expenditure for every month starting from January 2000. My analysis of the efficiency covers two periods: December 1999- February 2000 and December 2000- February 2001. I use this time period because of mainly two reasons. First, Ukraine has a significant overall economic growth and its industrial output reached remarkable figure in the year of 2000. Second, the reforms conducted by the government in energy sector had positively influenced the overall situation in the industry. Thus, one can expect that facing the economic revival regional distribution companies would improve their performance also.

The main sources of data were the databases of the two institutions: UEPLAC and National Electricity Regulatory Commission. In general, data on industrial production, inflation and fluctuations of nominal wages are monitored very precisely and thus it enables us to employ these databases in my thesis. As it was mentioned above, the regional electricity companies are required to submit their expenditure to NERC on a monthly basis for full reimbursement of their costs.

The information available allows me to study the magnitude and the direction of changes and differences, if any, in the activity of the electricity companies.

Taking into consideration the theoretical predictions and empirical results, my main hypothesizes, which I expect to reject, are:

$\mathbf{H_0^1}$: Under cost plus regulation there is no significant difference in the performance of public and private distribution companies;

$\mathbf{H_0^2}$: Under cost plus regulation there is no gain in efficiency from year to year.

There are many ways to estimate the efficiency of a particular industry or a firm. The most frequently used are costs, profit and labor productivity approaches.

After reviewing Ukrainian electricity industry I suggest to employ the method, which uses the costs as a measure of relative performance. Labor productivity approach cannot be carried out because there is no available information about the number of employees per a distribution companies. Profit based method may give us distorted results because distribution companies used to use barter and non-monetary payments in their economic operations. Besides, as it was mentioned above, regional distribution companies sell electricity to final consumers for different prices and the share of particular customer in the total consumption is not known. Thus, we cannot rely on the figures provided by these companies

The issue of non-payment and arrears in electricity industry is often discussed as the probable detriments on the way to enhance performance of the companies. This concern is only partially applicable in relation to the whole

industry. To understand this problem we have to distinguish between distribution-supply and generation companies while talking about non-payments, because this mainly relates to latter ones. The regional distribution companies get money first for electricity from final consumers, households and industrial sectors. It was a common practice when private electricity distribution companies bought electricity at the wholesale market but did not pay for it. The same but certainly in less degree is applicable to the public companies. It was socially not justified to cut off those regional monopolies as they supply electricity for whole regions. They took electricity and got paid for it, even if only partly, by final consumers. Those payments covered more than that distribution companies incurred as the costs. Though this practice was very significantly reduced (by requiring transferring all revenues to a special account) regional distribution companies are the first to be reimbursed their costs. This description clearly identifies that the distribution companies were and are not the "losers"; rather the generation companies are.

Cost based approach can be applied to estimate the performance of the distribution companies. Under cost plus regulation the companies had very incentives to declare the cost they really incurred because every amount will be reimbursed later.

To evaluate the performance of the distribution companies I will use the following lin-log regression model.

$$\ln Y_i = á_0 + á_1 * \ln C_i + á_2 * \ln W_i + á_3 * \ln IPO_i + á_4 * D_{public} + á_5 * D_{private} + á_6 D_{years}$$

Y_i - amount of effective output for a distribution company[4], kWh;

C_i – total costs of production with the exception of payroll costs per a distribution company, UAH;

[4] Hereby I use the amount they actually sold to final consumers. This amount is free of technical losses.

W_i – total payroll costs per a distribution company; UAH;

$D_{private,}$ - dummy for privately owned companies;

D_{public} – dummy for public companies;

IPO_i – regional industrial production, UAH;

D_t – dummy for years;

I assume that such a specification of the model would allow me to estimate the relative performance of private and partly privatized companies in comparison to their public counterparts and also to see if there is any change throughout the time. I include payrolls and other total cost in the model because it is clear that these parameters have a direct effect on the amount of sale. The inclusion of these two parameters in logarithmic form is due to the reason that costs of these companies do not increase in linear way and thus logarithm should control for this. I expect these two coefficients near them to be positive.

According to the theory coefficient on dummy for private firms has to be negative (Waddams Price, 2000). At the same time, I cannot predict the sign of the coefficient on dummy for public companies. If they turn out to be insignificant it will clearly suggest that there are no difference in the performance of the companies. I don't include dummy for the number of years companies are in a private hands as they were privatized in 1998 almost simultaneously. In last month six distribution companies were privatized. Though there are thirteen private companies in Ukraine currently my data analyses the performance of seven private firms, which were privatized in 1998.

As Ukrainian distribution companies sell electricity to industrial and household sector, I take the level of industrial production in a particular region to control for demand or income. The more industrial sector produces the more electricity it uses. So, it is clear that the coefficient must be positively correlated with the amount of electricity sold by a particular company. I don't use the number of household users because of several reasons. Firstly, the number of people living in a particular region does not change greatly from month to month, even during the year. Secondly, there is no statistical data about the short-term fluctuation of population in regions for 1999-2001. Thirdly, on theoretical grounds, the more people live in the territorial unit the more electricity is consumed. But Ukraine has net negative growth of population since 1997 but amount of electricity increases during the year of 2000. So, inclusion of variable to control for demand from households would have negative sign and probably would be insignificant. I assume the intercept of every distribution company will reflect the amount of electricity consumed by households.

I include dummy for years to control for time for which I run the regression. I choose winter 1999-2000 as the benchmark setting dummy to zero and one for winter of 2000-2001. Based on theoretical predictions and previous empirical studies, this coefficient has to be insignificant to suggest that there is no efficiency gain from year to year, that is the coefficients near payroll costs and other total costs are the same

Regional distribution companies differ greatly in size, as the territorial units are also different. As these companies supply the electricity to those regions the number of final consumers in that part of Ukraine determines their size. That is why distribution companies are very heterogeneous. Taking into account this fact among companies I also suggest employing fixed effect model to control for this issue. To determine whether the random or fixed

effect model to employ I perform Hausman specification test, which suggest s using fix effect model (see Table 2).

To substantiate the analyses I perform a test that determines whether there is a structural changes in the model, i.e. whether the coefficients of two models differs. Researchers very often use test known as Chow test suggests by Gregory Chow (Chow, 1960). For this I split my sample into two parts: first part is the panel data for winter 1999-2000 and the second is 2000-2001. And then running the model specified above for every year I test the null hypothesis that there is structural stability that is there are no statistically significant differences in the coefficients for two years. Results of the test are summarized in Table. 3.

RESULTS

The results of regression are summarized in the Table 1:

Table 1. Regression results

Fixed-effects (within) regression

R-sq: within = 0.1665; between = 0.8344; overall = 0.76; F (4,121)= 6.04

lnY	Coefficient	Std. Error	t	P>|t|
lnC	0.0642	.02903	2.211	0.029
lnW	0.1710	0.08	2.119	0.036
lnIPO	0.105921	.05574	1.90	0.060
D_{public}	(dropped)			
$D_{private}$	(dropped)			
D_{time}	0.0567	0.0389	1.459	0.147
Constant	13.7567	1.4737	9.368	0.0000

F test that all u_i=0: F (24,121) = 13.05 Prob > F = 0.0000

Chow test: F (4, 118) = 1.43 Prob > F = 0.2294

As can be easily seen coefficients responsible for industrial production, wage bills and other total costs are significant and signs on these coefficients are such as expected: wages bill, other total costs and industrial production output positively affect the quantity of electricity supplied by distribution companies. The F-statistics, which can be regarded as the specification test, suggests that coefficients are not zero simultaneously,

Coefficients for dummies responsible for types of ownership turned out to be insignificant even at 10% significance level. Thus, it suggests we cannot reject the null hypothesis that there is no significant difference in the performance of the companies due to the type of ownership. It is obvious that the econometric analysis generated the results that go against my expectation. Though it might seem odd, it is not in reality. It clearly indicates that National Electricity Regulatory Commission carries out the activity that restricts the ability of companies to overstate their expenditure within reasonable bounds at the cost of higher prices for electricity. To my mind, NERC has good information about the regional and other specific characteristics of local distribution companies, which might account for discrepancies in the cost patterns among companies, as the privatization has happened recently. There were no large shifts in the production capabilities of the privatized companies, which can account for a change in costs.

On the other hand, the dummy for years turned out to be insignificant even at 10% level. Thus, we cannot reject the idea that there is no gain in efficiency, i.e. reduction in costs, in any type of companies. This result suggests that there is lack of incentives for companies to seek for the cheaper way to supply electricity to the final consumers. The result also shows that contrary to the expectations of the Government and economic revival in the year of 2000 the companies have not improved their performance from 2000 to 2001 years.

Chow test also suggests that we cannot reject the hypothesis that there is structural stability of models in two years even at 10%. That indicates that the relationship between dependent and independent variables has not changed and thus coefficients near all variables are statistically the same. So, there are no performance changes during the year of 2000.

It is worth mentioning that the coefficient near total cost though positive seems to be very small in magnitude. This is very odd fact, which needs more

detailed explanations. In my model I estimate the performance of the oblenergos during period, which constitutes the end and the beginning of the fiscal year. The period during December and January is characterized by the expenditures that are significantly higher than average ones over the year. The reasons are as following: it is a common practice for the firms to pay taxes in December and to buy materials and other necessary equipments at the beginning of the year, in early January. In contrast, total costs in February are much lower than those in the previous two months in my data set. That is why we can observe relatively stable amount of electricity consumption and large increases in fluctuations in total cost. Thus, increases in total costs are not associated with large increase of electricity delivered, i.e. coefficient near total costs is small in magnitude.

I want also to point out that this pattern in total costs fluctuations should not constitute the big problem for the estimation of performance changes. The research considers two similar periods of the year and that is why we cannot expect changes in the behavior of the firms. We should take the coefficient near total cost with some reservation, but general conclusions do not change.

Chapter 6

CONCLUSIONS

This research aims to show that Ukrainian electricity industry needs the introduction of price-cap regulation, as it will probably enhance the willingness to improve performance. Econometric analysis suggests that we cannot reject the hypothesis that there is no significant difference in performance among companies due to the type of ownership. Though results about relative performance of the companies turned out to be contrary to those predicted by the theory, there is indeed no gain in efficiency in any of ownership types. Second zero hypotheses cannot be rejected and that suggests there is no change in relative performance.

Empirical results do suggest that the managers of companies irrespective to their type of ownership lack the incentive mechanism that would make them seek the reduction in cost. As it was mentioned above, cost-plus regulation mechanism is aimed to reimburse the costs of production without any reservations and stimulation for the managers to reduce their costs.

Results of research have important policymaking implications. Electricity and any other industries are currently being restructuring fundamentally with great changes in ownership, market structure and regulatory design. Taking into account endeavourers of the state to let electricity be privatized, the government should also switch from current cost based to more powerful and incentive based regulatory regime.

Price-cap regulation enhanced the efficiency of electricity distribution companies in UK. At the same time current regulation in Ukraine has not led

to significant increase in efficiency. So, I would recommend that Ukrainian regulatory commission try price-cap regulation, at least on a trial basis. If this does not lead to improvement in efficiency in the long run, the researcher has to look for a better model for Ukrainian regulatory policy in electricity industry.

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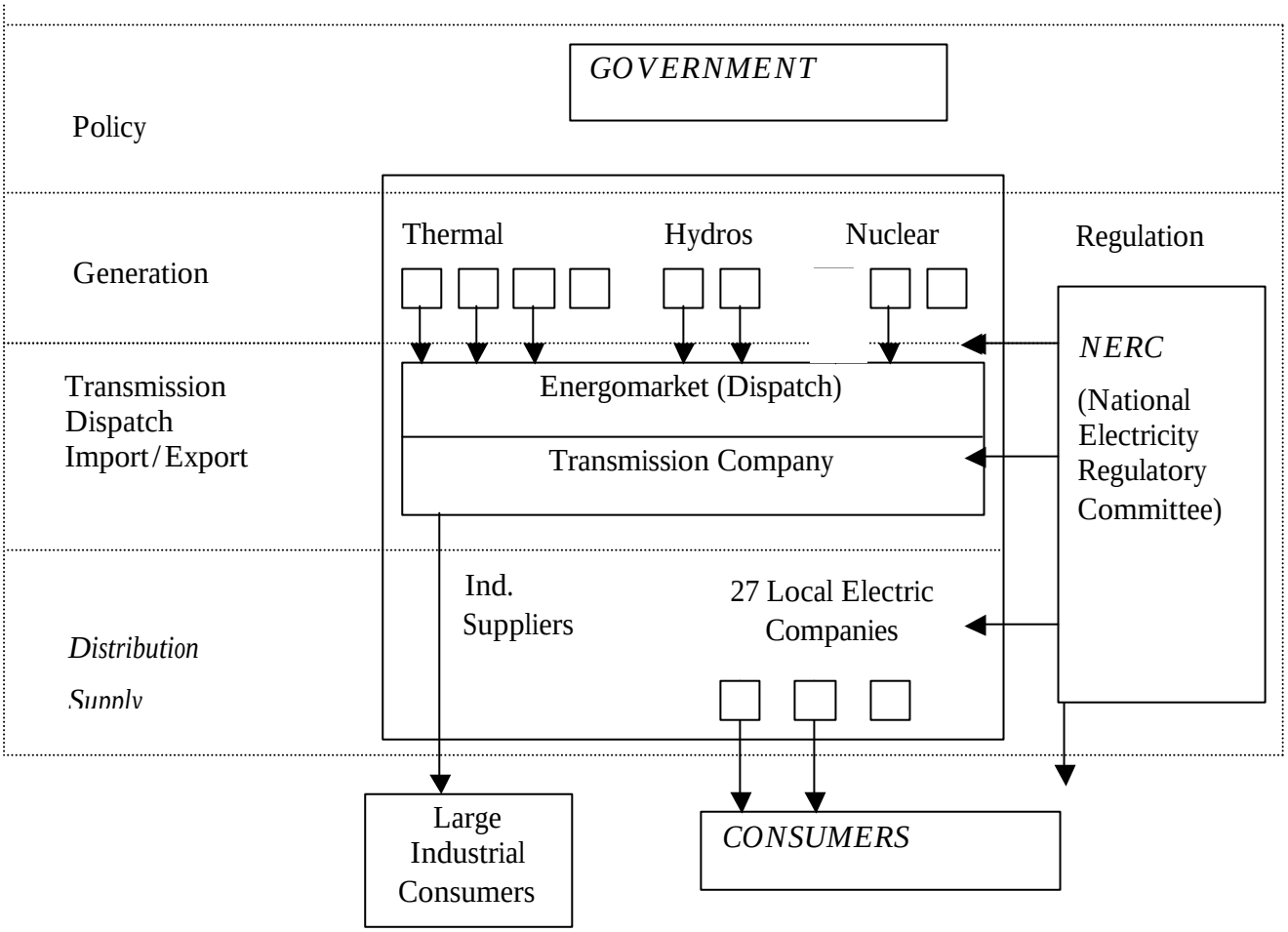
APPENDIX

Figure1. Structure of Ukrainian Electricity Industry.



Source: Wolcott, D.R.

Figure 2. Structure of the tariffs and price setting.

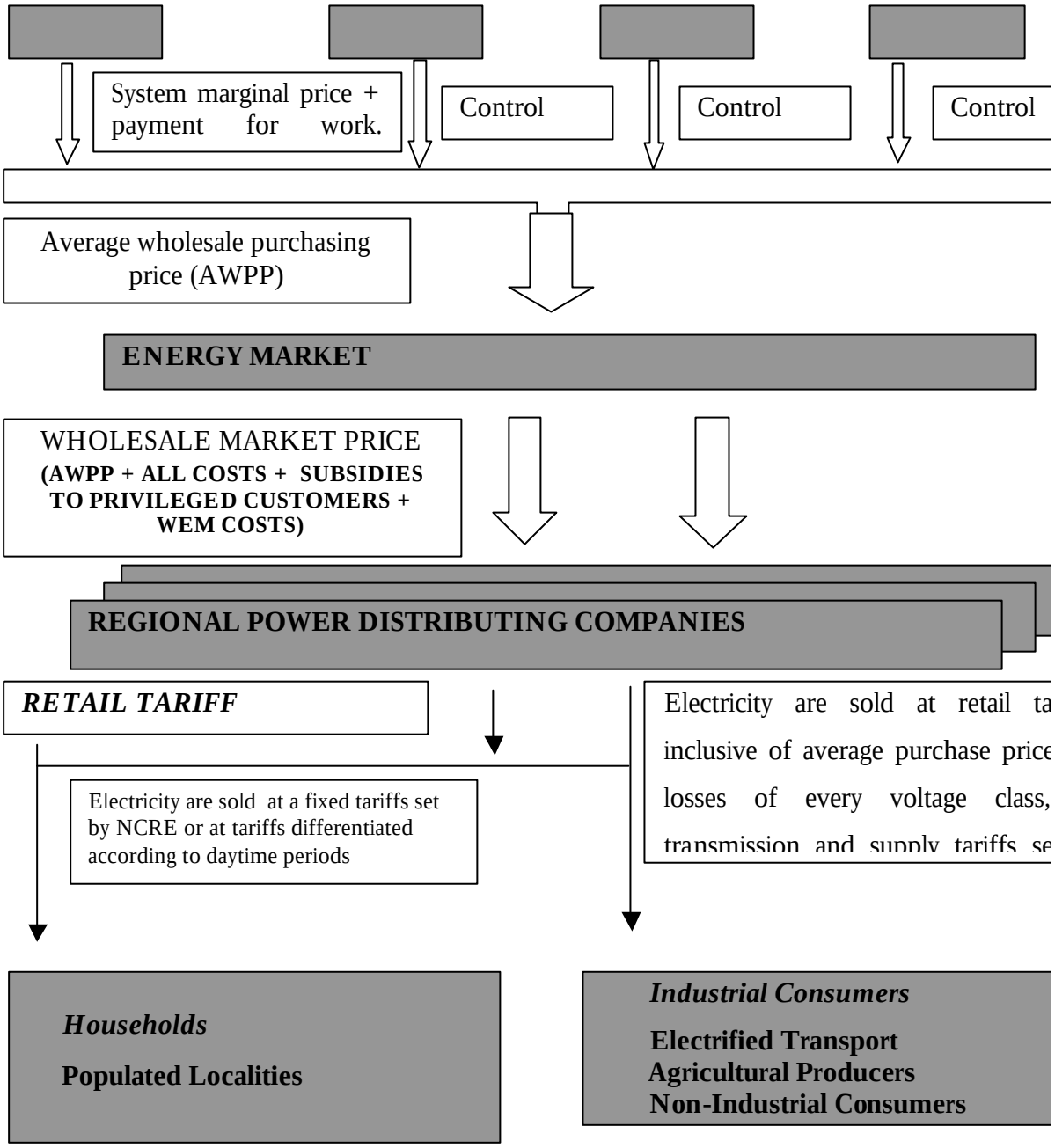


Table 2. Hausman specification test

lnY	Fixed effects	Random effects	Difference
LnC	0.0625	0.06343	-0.000833
LnW	0.1754	0.32749	-0.15209
LnIPO	0.10507	0.33061	-.225537
D_{time}	0.016374	0.02129	0.004923

Test: Ho: difference in coefficients not systematic

chi2(4) = (b-B)'[S^(-1)](b-B), S = (S_fe - S_re)

= **27.94**

Prob>chi2 = 0.0000

Table 3. Regression results

Chow test for structural stability

lnY	Coefficient	Std. Error	t	P>|t|
lnC	0.03489	0.01352	2.581	0.011
lnW	0.2224	0.0638	3.48	0.001
lnIPO	0.0802449	0.0356	2.254	0.026
Public	(Dropped)			
Private	(Dropped)			
D_{time}	0.0077271	0.3009	0.026	0.98
G2*lnC	0.037628	0.02451	1.535	0.127
G2*lnW	-0.0162497	0.0352	-0.461	0.646
G2*lnIPO	-0.0163032	0.0228011	-0.715	0.476
Constant	14.0424	0.9591	14.640	0.0000

F test that all u_i=0: F (24,118) = 56.18 Prob > F = 0.0000

F (3, 117) = 1.43 Prob > F = 0.2294