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COST OF COMPLEXITY AND THE REFORM IN THE POWER SECTOR

(AVOIDING CHAOS IN THE PATH TO AN OPTIMAL MARKET STRUCTURE)

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Rezumat. *Reforma unui sector energetic cu un singur jucător (adică un monopol natural) într-o piață a puterii a mai multor jucători aduce clienților nu numai beneficiile concurenței, ci și costurile complexității. Între cele două, un număr optim de jucători se găsește pe piață corespunzător prețului minim de putere pentru clienți. Considerând timpul ca fiind a treia dimensiune, curba optimă devine o suprafață potențială pe care evoluția entităților de piață este văzută ca oscilații de-a lungul văii prețului minim. Fiecare oscilație declanșează o explozie de preț care este în detrimentul clienților. Pentru a evita acest lucru, rolul autorității de reglementare este mai bine definit în sensul de a netezi tranziția de la monopol la piață. Exemplul evoluției sectorului energetic din SUA este relevant aici. În abordarea de mai sus, concurența pe distanțe lungi care rezultă din viitoarea deschidere a piețelor energiei electrice în Europa sau din penetrarea, în urmă cu 70 de ani, a tehnologiei de interconectare în SUA, este comparată cu concurența cu rază scurtă (locală). În cele din urmă, se stabilesc limitele de preț care garantează că (i) noii intrați pe piață nu sunt eliminați și, (ii) că piața evită oscilațiile care pot șoca drastic o economie nerezistentă. Se face un studiu de caz pentru România și se propune o metodă prin care costul complexității este evaluat pe baza raportului dintre energia tranzacționată și cea consumată, adică mai multă energie tranzacționată, înseamnă că prețul crește cu fiecare tranzacție care nu aduce energia consumatorului, ci altor comercianți. Un exemplu este prezentat pentru actuala piață deschisă din România.*

Abstract. *The reform of a one player power sector (i.e. a natural monopoly) into a multiple players' power market brings to the clients not only the benefits of competition but also the costs of complexity. In between the two, an optimal number of players is found in the market corresponding to the minimum price of power to the clients. Considering time as the third dimension, the optimum curve becomes a potential surface on which the evolution of the market entities is seen as oscillations along the valley of minimum price. Every oscillation triggers a price burst which is detrimental to the clients. To avoid this, the role of the regulator is better defined in the sense of smoothing the transition from monopoly to market. The example of the US power sector evolution is relevant here. In the above approach long range competition resulting from the future opening of power markets in Europe, or from the penetration, 70 years ago, of the interconnection technology in USA, is compared with the short range (local) competition. Finally, the price limits are determined which ensure that (i) the new entrants on the*

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market are not eliminated and, (ii) that the market avoids oscillations which may drastically shock a non-resilient economy. A case study calculation is done for Romania and a method is proposed where the cost of complexity is assessed based on the ratio of traded energy to consumed one i.e. more traded energy means that the price increases with every transaction that is not bringing the energy to the consumer but to other traders. An example Is presented for the present open market of Romania.

Keywords: *Power market, reform, optimality, chaos)*

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1. Introduction

A lot is happening these days in the power industries both in Europe (East and West) and in the United States, Australia, etc. The main trend is toward the change of the monopoly dominated national power sectors into power markets. The benefits of the competition, implemented through this change, are measured by the decrease, in the long run, of the price of energy to the clients. Alas, there is no such thing as a free lunch! That's why we try to assess here the price to pay, for the benefits of competition, that result from the costs of the increased complexity of the market. Can this cost be minimized? Is there an optimal structure of the market which results from the interplay between the benefits of competition and the costs of complexity? Bellow, we are trying to answer these questions, first by defining the behavior of the process and, second, by building conceptual tools that may allow the determination of the best strategies to face the new power market. The role of the regulator is presented in the light of these strategies.

General comments on (market - monopoly - market) cycles

From the point of view of the information, the cycle of passing from a market economy to a monopoly dominated one (the outmost extreme is a centrally planned one) and back to a market economy is showing a hysteresis effect. The pass from market to planned is done by nationalization which triggers a process of information flow from the enterprises level in the market, to the centrally planning entity. In time, no enterprise will know any longer who are the manufacturers of raw materials and who are the clients for its products, but, they will only know that raw materials are taken from a certain store house and that products are to be delivered to another specified store house. It is only the central planner who will have full, real knowledge about the market.

To reverse this process, i.e. go from planned to market, one can not, simply, reverse the nationalization action into a liberalization one. If the liberalization is done before having re-introduced all the market information back to the level of the enterprises, one will not get a market economy. The only thing obtained, is a conglomerate of disconnected enterprises and a number of market information holders, which will use the information to get rich fast. This fast enrichment comes from a high transaction cost resulting precisely from the lack of information. Situations may be encountered where there is almost a monopoly on the transaction costs established by the market information holder.

From Power Sector to Power Market

At present the power sector, in some economies, is acting as an 'economic sector' where the state is managing through the help of a natural monopoly instrument.

Any natural monopoly in power has developed, concentrating on the benefits resulted from the economy of scale. This concept has been reflected both on the supply side and on the demand one. On the supply side the nominal power of power plants has continuously increased, and the fuel, whether imported or bought from the country, was taken in bulk, which allowed negotiation of lower prices. On the demand side, the interconnection technology was extensively used to create the grid for transport and distribution, while more and more customers were connected. Also, regarding the safety of supply, black-outs, experienced in operation, have triggered measures resulting in a significant improvement of the grid resilience.

Of course, passing to a real market needs competition. Outsiders may come in, both on the supply and on the demand sides. This requires a favorable legal environment carefully thought out such that to lower risk perception. The institutionalization that follows will definitely have to create a regulator for the power market as well as a system operator to manage the power pool.

Costs of complexity versus benefits of scale

An important observation has to be made here: i.e. the fact that in a completely unbounded power generation, the benefit of scale, regarding the bulk supply of fuels, is lost. The sum of the costs of numerous smaller quantities of fuel (at higher prices) will result greater at the macro economic level, than the cost of larger quantities bought at smaller prices. Of course, this will happen unless the competition is not implemented in the fuel supply too, by, for example, diversifying the local and the foreign sources of supply. This situation is raising an important comment which has to be made regarding the costs of transition and the costs of complexity versus the benefits of scale and of competition.

Creating a market for power leads to having a large number of players in competition. This is bringing the advantage of competition to the newly defined 'market clients', coming from the former 'sector customers'. At the same time, there is a loss in the benefits of scale, which is felt at the macro economic level (e.g. in the impact of the total cost of fuel on the country’s balance of payments). This loss comes from the increased complexity of the market and can, thus, be associated to a measure of the cost of complexity. As shown bellow, other mechanisms add up to this cost.

Going to the extremes we may see that the greater the number of market players, the greater the competition will be, lowering the price to the clients. But, the greater the market complexity, the higher the complexity cost (by e.g. loss of scale benefits, transaction costs and / or other mechanisms) which tends to increase the price to the clients (the increase could be direct or indirect through the macro economic influences).

Since two opposite trends have been identified for the price to the client, we may define an optimum price corresponding to a market complexity where competition benefits are balanced by the cost of complexity (measured by e.g. the loss of scale benefits).

A qualitative behavior of the process is shown in Figure 1. below.

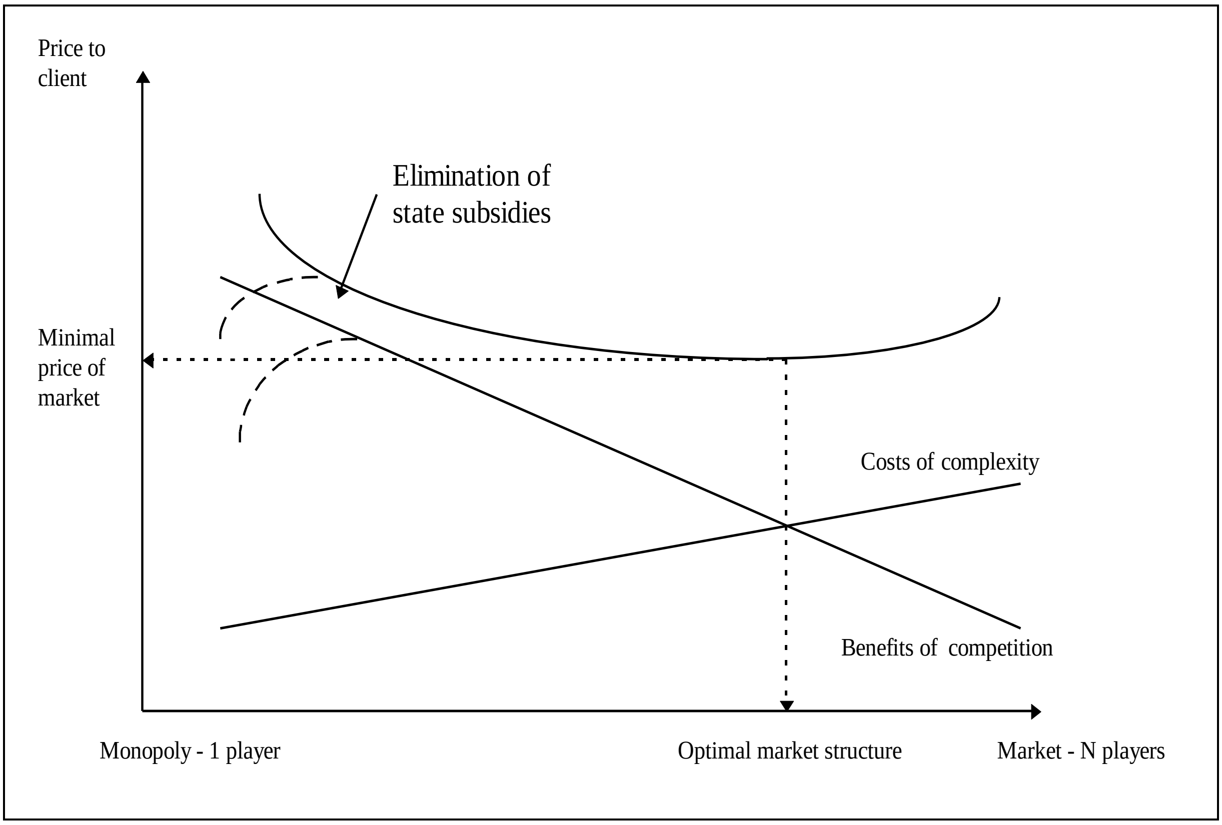

Fig. 1. Minimal price to the client optimization of the market structure

As more players are penetrating the market the costs of complexity accumulates. The processes that generate the cost of complexity are, in a non-exhaustive list, the following (the estimated figures are given for the case of Romania, based on mentioned international sources) :

1 The loss of scale benefits for the fuel supply - we think that due to the size of the coal mines, or of the oil tankers, or oil fields, the quantity of fuel delivered is covering the fuel storage capacity of one power plant. So the loss of scale benefits for the fuel supply may not be substantial in the price of fuel if the size of the generation entity is suitably chosen. Diversification of fuel sources may also contribute positively. We may assume an increase of e.g.5$/toe.

2 The need for an information network which has to be set in place at the level of each player in the market as well as for the whole market - The costs of this information system are substantial and we may notice that the lack of such a system in the market is liable to produce looses which may add to the cost. Let us consider a minimum for such costs of the order of 150 M$US.

3 Along with the information there is a need for more metering. Setting up manufacturing facilities and installation and maintenance capabilities for that equipment adds other costs. This situation, though, is creating jobs which may help to absorb the redundant personnel from the power entities, reducing the social conversion costs. The estimation here should amount to 350 M$US (i.e.7Mconsumers x 50$/meter).

4 Creating and maintaining a market mechanism, e.g. a power pool, as well as a regulatory agency represents costs which have got to also be sustained. We will discuss later, in more detail, the issue of regulation. The initial costs could be cca.40 M$US and cca.5 M$US/year. So, over a 10 years period a total of cca.90M$ (source: RENEL - Power Sector Reform Target Structure proposal)

5 The professional relocation of the personnel sacked from the previous Monopoly as well as the training of the remaining ones in order to increase their competitiveness are bringing more costs into the picture. The order of magnitude could be roughly 300 M$US (considering 30000 persons laid off at a cost of cca.10000 $US/person).

6 Finally we mention here the transaction cost. It usually results from the increasing number of intermediaries doing the retail wheeling in the market. For the moment we will consider this cost as a variable, to assess later, depending on the number of market entities.

Where are the benefits which may compensate for these costs, i.e. the benefits of competition ? They are coming from the following trends:

1. The increase of efficiency stemming from a better organization and management of the market players; we estimate it to generate a price decrease of cca.10%, (source: UK Electricity Association- 1994; O.Chisari et.al. 1997).

2. The increase of the technological efficiency resulting from the implementation of modem technologies; The assessed value based on the British, and Argentinean data is cca.30% decrease in the toe/GWh (see sources at point 1 above).

3. The competitiveness effect of the market on the supply side; is estimated to reduce prices of electricity by cca.10%. (same sources)

4. The use of the scale benefits by the users which are joining in order to increase the scale of the demand, thus, lowering the price. May bring another cca.10% reduction. (same sources as above plus K.Conger - APPA 1996).

Two other topics should be mentioned here: the security of supply and the need for guarantees by the state which will foster the flowing in of capitals to the power sector.

A good example of the influence that the government's energy investments guarantees policy, has, on the speed of the reform, is the Nuclear Power Plant at Temelin in Czech Republic. This case evolved as follows: CEZ - the Power company of the country was in a process of spinning off its generation. At the same time the Czech Government decided to finalize the NPP Temelin project. A foreign company came in with a good offer but, which required the state guarantee. The Czech Government did not wanted to give that guarantee (in order not to increase its already big foreign debt) and asked CEZ to provide it. At this moment the downsizing of the company stopped because CEZ had to have enough revenues to be able to cover the required guarantee. So, the generation which was taken away amounted to merely 20% of the total. The process may continue after the Temelin plant will be finished, (Source Pro-Democratia Foundation, 1997).

A conclusion of the story above is that, the creation of a market of power, with several smaller players, is only possible if the government, or any designated entity, assumes the costs of guarantees for investments in power projects. If this is not happening, then, either the size of the power companies must be big enough to sustain guarantees, or, the size of the new power projects (e.g. power plants), built into that economy, will be downsized. Guarantee responsibilities represents an increased cost to the government, but it buys out the future existence of the power system' operational capability.

The other important topic we wanted to mention was the safety of supply. From fuel abundance into the market, coming from diversified sources, to the availability of power at any time, through to the existence of a continuous distribution service and appropriate maintenance, this involves various economic layers working in inter-correlation.

We may identify the :

1. Physical layer of the technologies used to convert energy;
2. Information layer of the data related to the system operation, finance, etc.;
3. Commercial layer of the actions ensuring the inter-relations among the parties involved (generators, operators, clients, etc.);
4. Financial layer of the fluxes of money serving, among other, to maintain the working capability of the physical layer, etc..

It is important to notice here the fact that , the nominal operation of the power system is influenced by the processes within each layer, while, the safety of supply depends strongly on the inter-correlation among the layers.

Considering the four layers one may define the safety of supply in relation to each of them. Thus:

- at the physical layer the main parameter to consider is the reliability of the technologies used - it is the only remedy against low frequency high consequence events like a total black-out;
- at the information layer it is the timelines of the data allowing fast quality decisions. The interplay of information with technology may better help to avoid the low frequency high consequence events.

Moving toward the commercial and the financial layers we enter the field of high frequency low consequence events. The protection against these can be achieved through:

- contract design to minimize risk (this also depends on the market structure) at the commercial level and,
- on the set up of a sound insurance policy for covering and distributing risk. A captive insurance company may generate some more financial resources which could be used for direct investments or/and guarantees.

Determining the optimal structure of the market.

We will consider now the optimum resulting from the two opposing trends described above.

In the graph bellow there was assumed that the power sector will be segregated into 30 entities including generation, transport, distribution. We did not considered the ownership of these entities but, they may include e.g. a state owned nuclear power generator, Independent Power Producers, Public Utilities, etc. the same variation being possible on the distribution side, including the brokers.

The important thing to notice here, related to the costs of complexity, is that, with the exception of the transaction cost, which depends on the number of entities in the market, all the others costs vary slightly with the number of players and may be considered as initial costs required by the setting up of the market. The dependence of the variable costs of complexity with the number of entities is assumed to be linear, i.e. 1% of power price increase for every new entity coming to the market. This is a very rough approximation and in Appendix 1 a more detailed discussion is made on this topic. The same comments may be made for the benefits where we considered that the competition is lowering the price by 1.5% for each new entrant into the market.

The data are presented in Figure 2. below:

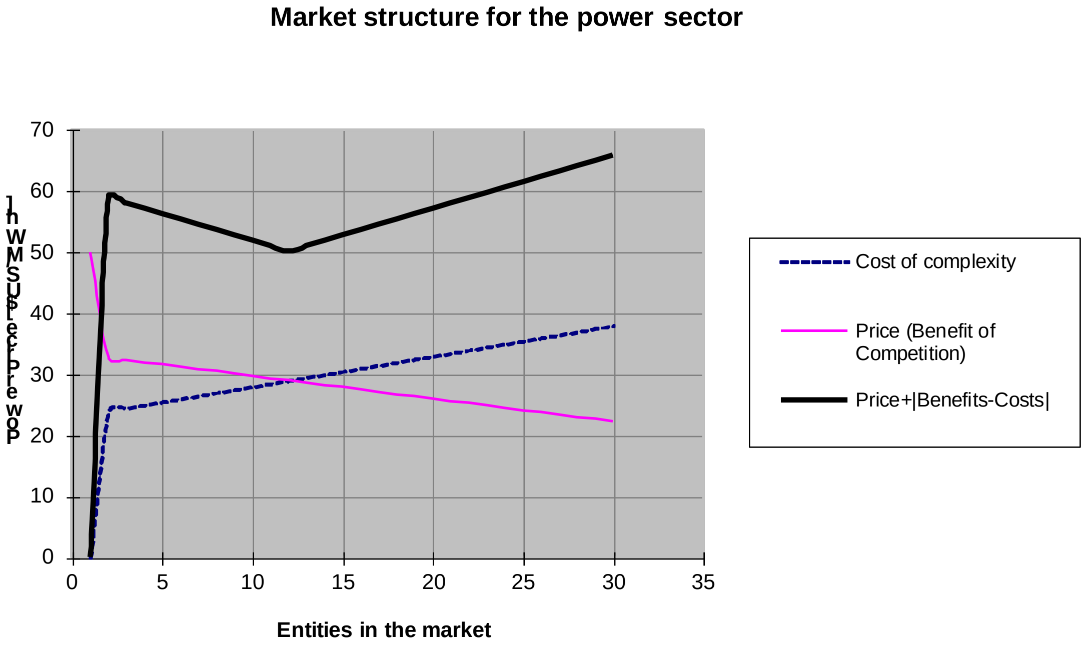

Fig.2. Market structure for the power sector

One may see that with the assumptions made above the optimal number of entities in the market is 12. Of course a sensitivity analysis could be done in order to see how this optimum varies with the different components of the costs and of the benefits, but, this being straight forward we will, instead, make some considerations on the time evolution of the market concentrating on the aspect of regulation.

Time evolution of the market entities

Let us look at Figure 1, to which we add a third dimension i.e. time. The optimum curve becomes a surface having a valley of optimum. In this representation the time evolution of the number of the entities in the market which could increase by new entrants or decrease (e.g. by merging, buy-out, etc.) is seen as a curve oscillating on the two sides of the optimum valley, eventually converging to it. If we project this curve on the two planes respectively describing the time evolution of the number of enterprises and the one of the price, we see that each change in the number of entities is leading only to the increase of the price over the optimal value. These price shocks can only be detrimental to the clients. To mitigate them, a new special entity is needed in the market i.e. the regulator. Considering this approach, the role of the regulator becomes better defined in relation to the market evolution. The regulator must speed up the convergence time to the market optimum by diminishing the number of oscillations of the market entities' number. He should also ensure a smoother penetration of the new comers. By doing this, the number of price shocks to the market is diminished, with a beneficial effect to the economy as a whole.

Figure 3. Is presented below.

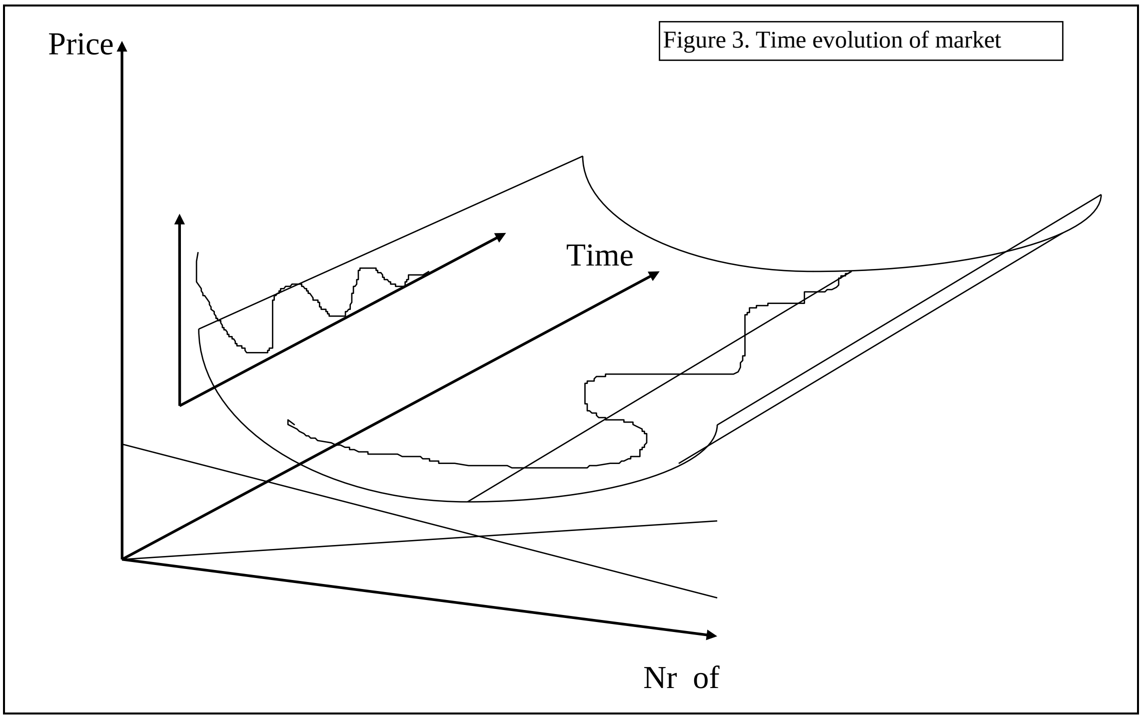

Fig. 3. Time evolution of market

One other behavior that is resulting from the interpretation above is concerning the case of the border's elimination in the European Union. This is creating more competition which leads to reducing the local markets power costs to the clients, without actually increasing too much the cost of local complexity. This leads to a displacement of the minimum in the price-entities surface toward the left i.e. toward fewer entities in the market. This shows that the expected effect of the overall European grid opening will be a merging of power entities in the local markets. The same effect in the USA is given by the interconnection technology penetration, which lead the private power entities to merge, being exposed to more fierce, long range, competition, while the local entities did not merged to the same level, being confined to service mainly their local areas, without being interested in long range competition.

To substantiate the above statement, we give bellow the evolution of the number of entities, in the United States Power sector, along the years. The occurrence of regulation and of the interconnection technology, has had a strong damping effect on the public utilities oscillation and lead to the smooth penetration of the late-comers rural power cooperatives.

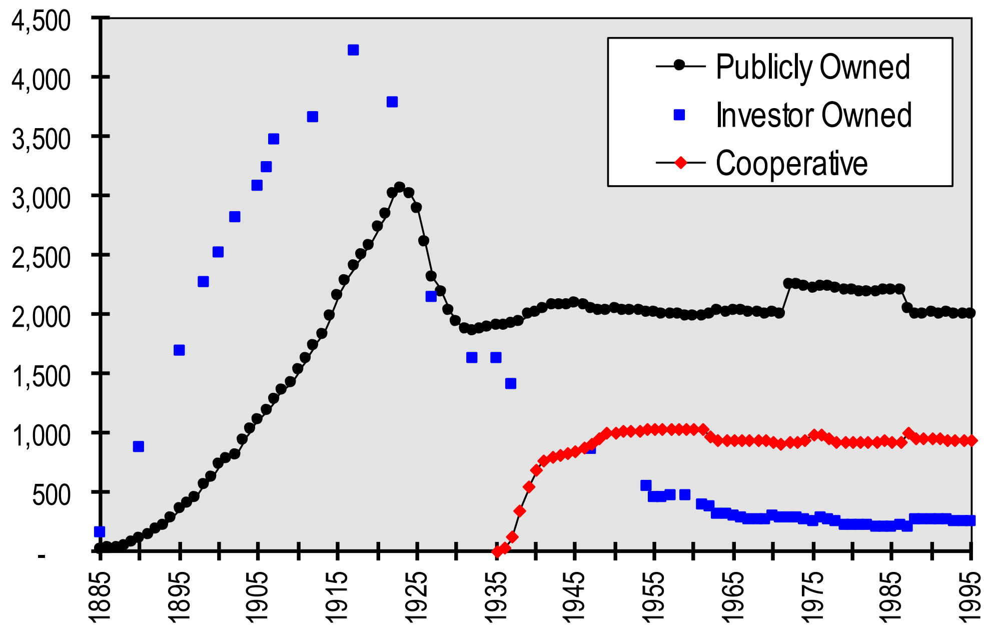

Fig. 4. Evolution of the power market in the USA, Source APPA-1996

One observation to make here, relates to the fact that, by contrast to the USA at the end of the 19-th century, the power sectors of today's Europe are not starting from nothing. The companies are not forming themselves as the new technology penetrates but, the existing natural monopolies in power are segregating and the whole market is restructuring. What are the limits of the speed of penetration of the private power companies on a monopoly dominated market ? Based on the argument of the economic resilience (capability of an economy to absorb shocks and still operate) there are, presently, two approaches:

- the small step approach, which tries to minimize the shock by distributing it in time. The possible criticism of this approach is that, by taking small steps, one may never reach the new better structure in a finite amount of time. The risk of privates' extinction is very big in this case.
- the sudden change approach, which tries to minimize the shock by reducing it to only one - even if relatively big - instead of having to suffer several smaller, successive ones. The critics here are related to the capability of a weak economy to resist this first shock without being severely damaged. One shock could be beneficial if it would take the market directly to the optimal structure. If this is not the case, the market will tend to its optimal structure inducing, thus, subsequent shocks which add up to the first.

a third way out is the situation where the penetration may be smooth enough, through the limited involvement of a regulator. This may be done through the identification, and use, of the non-linearity in the market behavior.

Numerical data - the Romanian case

Since enough time has passed from the moment the power market was set up n Romania and started functioning liberalized, we will analyze the data of this market and its dynamics in the framework described above. The main goal is to identify the potential basins of optimality and the associated optimal price. Moreover, the cost of complexity will be assessed based on the ratio of traded energy and consumed energy. This ratio can be considered a good measure for the increased price of energy because it compares the transacted energy, that may change hands several time from the producer to the consumer, with the consumed energy that reflects only the relation producer-consumer and not the market 'history' of the energy. Also a comment will be done on the level of competition in the market for the period under scrutiny.

Annex 1 gives the basic data that have been gathered from the site of OPCOM the market operator of the country. It ranges from 2007 - the year the market was liberalized - to 2018.

The data is showing a dynamic that has two basins of behavior. This suggests that there is competition both in the incipient phase of the market and in the following phase when the number of players is reaching high values.

The figure 5 and 7 (respectively for PZU and PCCB) presents the dynamic of the price that has a first minimum when the number of participants has smaller values and a second minimum when this number reaches larger values. In both basins of behavior, shown in figures 6 and 8 respectively for PZU and PCCB, the same pattern of behavior is encountered in both types of markets with different minimal prices.

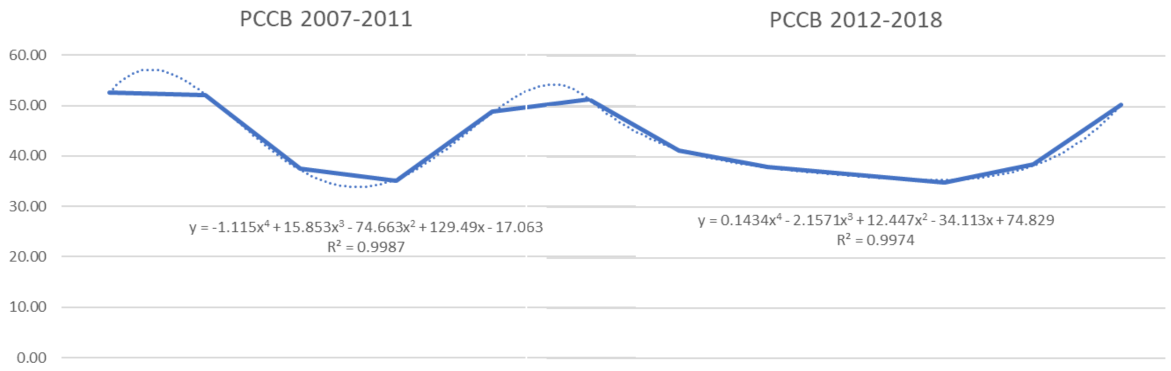

Fig. 5. The basins of behavior for the PCCB market.

The optimal price for each basin is given below, as determined from the regression presented in the figure:

PCCB 2007-2011

3.6

33.83 Euro/MWh

PCCB 2012-2018

4.9

35.41 Euro/MWh

It is important to notice that the participants in this market do not have all the minimal price. Those whose prices are further above the minimal values are actually helping the producers although the competition is acting undisturbed in the market.

As the number of participants increases the new optimum is settled on a somewhat larger price value than in the first basin. Here it should be mentioned that the larger volatility of PZU induces a greater difference between the minimal prices of the two basins of behavior than in the PCCB where the volatility is smaller. Actually this second market type is the one seek by financial institutions due to its higher predictability.

The basins of behavior are presented in the figure 6 and 7 below.

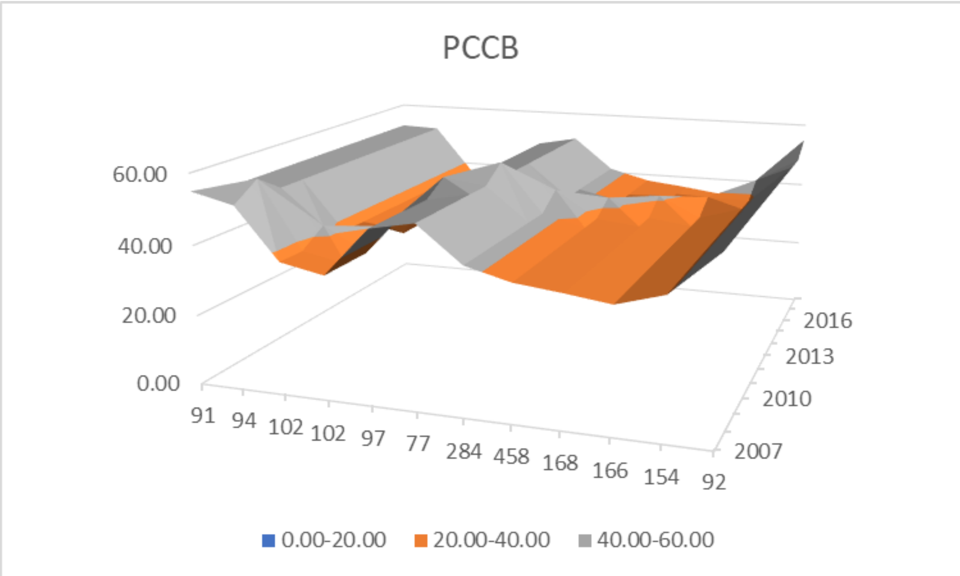

Fig. 6. The basins of behavior in PCCB competition

The trajectory of the price was slightly enhanced to be visible in a better way.

The same type of analysis is shown for PZU respectively in figures 7 and 8.

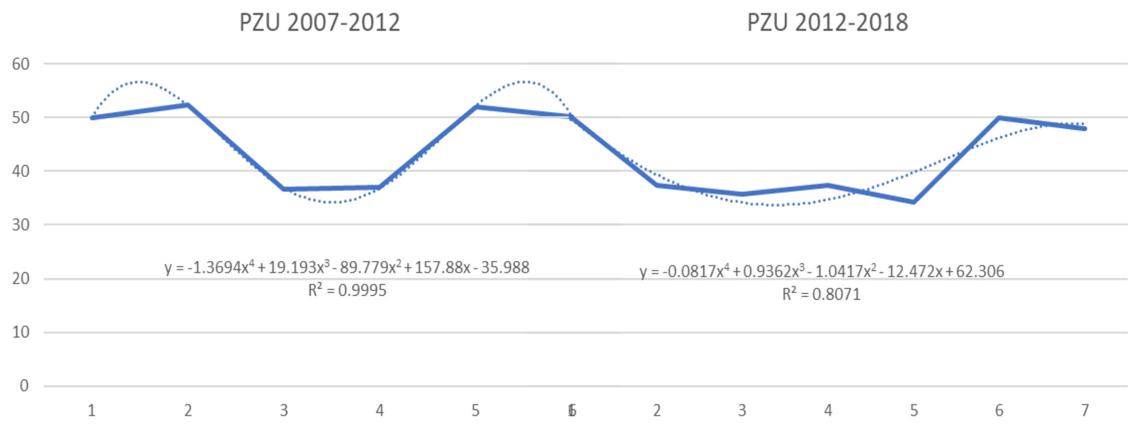

Fig. 7. The basins of behavior in the PZU market dynamic.

The theoretical minimum prices are the ones presented below. It should be noticed that these prices are slightly larger than the ones in the PCCB in the first period while they are greater in the second period. on one side this shows that the predictability of PCCB is larger than the one of PZU that has a larger volatility, while on another side, the diminishing of the portion of the market covered by the PCCB due to the increase of PZU, and the larger number of participants in PCCB leads to a greater price than the one In PZU. This is proof that the competition works i.e. a smaller offer for a larger request increases the price.

The two theoretical optimal prices are given below.

PZU 2007-2012

3.6

34.30 Euro/MWh

PZU 2012-2018

3.8

34.20 Euro/MWh

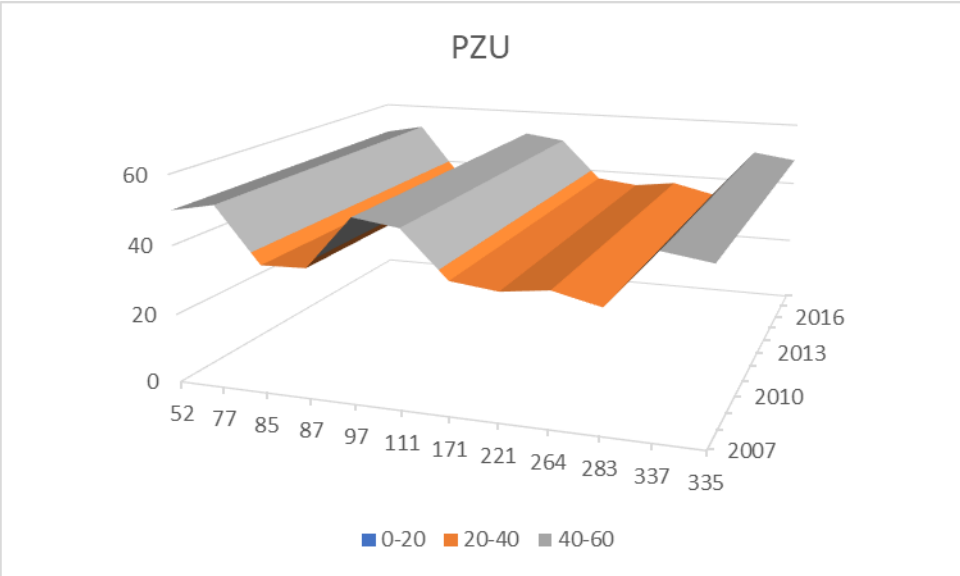

Fig. 8. The basins of behavior of the PZU power market.

Here too there is a passage from one basin to the next as the number of participants increases in the market. The difference between the optimal prices between the two basins is smaller because the volatility in this market is larger without being too dependent on the number of participants. Notice that both periods show the existence of competition in the market. This is a good sign of market open behavior.

Finally, the analysis of the market dynamic done above shows several important things. first that there is competition in the market without any tendency of jeopardizing the penetration of the market by more new participants; second, that there are two basins of behavior with specific optimal prices. On this line one may state that the larger the price of energy of a given participant, the better the chance for a given producer to finance its operations and investments. This applies mainly to the PCCB market where the contracts are medium to long term that favors loan guarantees.

Conclusions

The important conclusions resulted from the approach developed above are underlining:

a. the fact that the benefits of competition are balanced by the costs of the increased complexity of the market. There exists an optimal number of players in the market giving a minimum price to the clients. As the number of players Increases a new optimum may show up having the minimum price larger than the one before due to the volatility of the market.

b. the process of privatizing monopolies, especially in economies whose structures are rapidly changing, may lead to complex dynamic regimes ("chaotic") uncontrollable by the policy makers;

c. in the Romanian case the competition was not jeopardized in either of the two basins of behavior leading to the occurrence of the expected minima.

d. there are cost of complexity of the market that can be assessed based on the amount of energy traded versus the one consumed. In the case presented these costs may reach an average of 30% from the total price.

e. the existence of an optimal market structure (number of entities for a minimum price to the clients) and of an optimal time path (giving a minimum shock to the economy) may create a basis for the design of a power market and of its regulatory frame before a natural monopoly is broken as well as after the market is becoming fully operational. This possibility shows that the one-large-step approach is the best, provided the path trajectory, from monopoly to market, and the target structure of the market, are the optimal ones. Thus, subsequent shocks are eliminated and the path is smooth.

APPENDIX 1.

Romania - Power Market dynamics

A first example of assessing the cost of complexity may be drawn from the table below showing the various types of power markets in Romania in the years 2008, 2009 and 2010. The estimation of the cost of complexity is based on the quantities of energy consumed and respectively traded in the market. In 2007 the market was liberalized and it may be seen that the next years show an increase of the traded energy compared with the consumed one. This implies an increase of the cost of complexity i.e. more traders in the market, hence a price increase that may be as high as 66%.

TRANSACTIONS ON THE WHOLESALE MARKET	2008	2009	2010
1. BILATERAL CONTRACTS' MARKET			
traded volume (GWh)	**63848**	**64921**	**79165**
% from internal consumption (%)	116.9	130.0	152.2
average price (lei/MWh)	148.39	*161.37*	*161.62*
1.1. Sales on regulated contracts			
traded volume (GWh)	**29104**	**30334**	**28942**
% from internal consumption (%)	53.3	60.8	55.6
average price (lei/MWh)	158.15	*164.44*	*166.35*
1.2. Sales on negociated contracts*			
traded volume (GWh)	**34745**	**34587*** **	**50223*** **
% from internal consumption (%)	63.6	69.3	**96.5**
average price (lei/MWh)	146.07	*158.68*	**158.89**
2. EXPORT			
traded volume** (GWh)	**5366**	**3154**	**3854**
% from internal consumption (%)	9.8	6.3	**7.4**
average price (lei/MWh)	191.22	170.23	**170.90**
3. CENTRALISED MARKETS OF CONTRACTS			
traded volume (GWh)	**8770**	**6329**	**4386**
% from internal consumption (%)	16.1	12.7	8.4
average price (lei/MWh)	177.04	192.54	157.01
4. DAY AHEAD MARKET			
traded volume (GWh)	**5208**	**6347**	**8696**
% from internal consumption (%)	9.53	12.71	16.7
average price (lei/MWh)	*188.53*	*144.77*	*153.09*
5. BALANCING MARKET			
traded volume (GWh)	**3546**	**3206**	**2965**
% from internal consumption (%)	6.5	6.4	5.7
upward volume (GWh)	**2198**	**1272**	**1410**
average negative imbalance price(lei/MWh)	278.12	243.05	237.41
downward volume (GWh)	**1348**	**1934**	**1555**
average positive imbalance price (lei/MWh)	66.54	74.17	40.25
INTERNAL CONSUMPTION (includes distribution and transmission losses) (GWh)	**54627**	**49923**	**52027**

Note:

* *Electricity supply contracts for final customers and export contracts are not included*

** *Export volumes represent the quantities for which TSO applies the injection component of transmission tariff, which in some cases are different to those reported as traded by participants; in 2008 the average price was calculated based on 94% from the total volume, corresponding to quantities for which the participants have also reported the prices (all values included the injection component, most of them also included the extraction component, system services and market administration tariffs, capacity interconnection value)*

*** *Volumes traded on negotiated contracts do not include the quantities resulted from the processing contracts, as this activity is not subject of ANRE regulations and not comprised within the market participants' reports*

Source: ANRE, REPORT ON RESULTS OF MONITORING THE ROMANIAN ELECTRICITY MARKET DECEMBER 2010

Let us now make a more extended analysis considering the data of price and market participants In the period 2007-2018 as presented In the table below for the PZU (day ahead market) and PCCB (bilateral contracts market). These two types of markets are the ones where

Consum final energetic	35569	37501	38774	38859	40965	40949	41775	37606	41317	42714	42384	40627	41909	43027	43258	44699	45566
Legenda: ':' - date lipsa; 'c' - date confidentiale; 9999,00 - normal - date definitive; 9999,00 - ingrosat subliniat - date semidefinitive; 9999,00 - ingrosat - date revizuite; 9999,00 - subliniat - date provizorii																	
Preţ mediu ponderat [EURO/MWh]						49.91	52.4	36.69	37.08	52.07	50.23	37.31	35.76	37.4	34.27	49.92	47.97
Volum total tranzacţionat [MWh]						5043193	5207616	6346571	8696191	8869002	10718236	16345887	21496271	22496040	25809568	24715882	25540832
Volum mediu tranzacţionat [MWh/h]						576	593	724	993	1013	1220	1866	2454	2568	2938	2821	2687
Cotă de piaţă din consumul net realizat în anul 2007 [%]						9.4	9.56	12.67	16.56	16.37	19.88	31.27	41.31	42.2	47.01	43.78	41.37
Valoarea tranzacţiilor [lei]						832926909	1004028867	985946835	1359326157	1962177723	2395865164	2697980818	3416403362	3742151907	3974713504	5627491308	5225231890
Valoarea tranzacţiilor [EURO]						251683353	272844957	232869539	322478398	461873344	538421206	609930037	768746968	841381295	884509761	1233712055	1129195000
Participanti PZU inreg						99	87	98	106	123	129	248	242	314	337	380	374
Participanti PZU activi						52	77	85	87	97	111	171	221	264	283	337	335
en.tranz/cons						1.31	1.30	1.33	1.27	1.27	1.27	1.29	1.24	1.24	1.27	1.26	1.35
cost de complexitate						11.82	12.21	9.15	7.91	11.02	10.74	8.31	6.96	7.21	7.27	10.39	12.57
pret de baza						38.09	40.19	27.54	29.17	41.05	39.49	29.00	28.80	30.19	27.00	39.53	35.40
Participanti PCCB activi						91.00	94.00	102.00	102.00	97.00	77.00	284.00	458.00	168.00	166.00	154.00	92.00
Pret mediu ponderat Euro/MWh						52.54	52.05	37.55	35.05	48.77	51.20	41.26	37.97	36.55	34.85	38.60	50.39
Energie tranzactionata MWh						6507638.00	8612019.00	4836466.00	3874480.00	5557220.00	7872825.00	21688671.00	33589464.41	7950562.00	21350361.00	25037801.00	24658710.00
cota PCCB %						12.13	15.81	22.50	7.78	8.60	14.60	41.50	64.98	14.91	38.89	44.35	43.33
en.tranz/cons					Medie 200	1.31	1.30	1.57	1.21	1.51	1.27	1.29	1.23	1.24	1.27	1.26	1.25
cost de complexitate				cost cpl Eu	10.05	12.44	12.13	13.63	5.97	16.53	10.96	9.19	7.19	7.06	7.39	8.04	10.04
pret de baza				cost baza	33.02	40.10	39.92	23.92	29.08	32.24	40.24	32.07	30.78	29.49	27.46	30.56	40.35
				%cost cpl	0.31	0.31	0.30	0.57	0.21	0.51	0.27	0.29	0.23	0.24	0.27	0.26	0.25

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COST OF COMPLEXITY AND THE REFORM IN THE POWER SECTOR (AVOIDING CHAOS IN THE PATH TO AN OPTIMAL MARKET STRUCTURE)

Ionuț PURICA[1],

Rezumat. *Reforma unui sector energetic cu un singur jucător (adică un monopol natural) într-o piață a puterii a mai multor jucători aduce clienților nu numai beneficiile concurenței, ci și costurile complexității. Între cele două, un număr optim de jucători se găsește pe piață corespunzător prețului minim de putere pentru clienți. Considerând timpul ca fiind a treia dimensiune, curba optimă devine o suprafață potențială pe care evoluția entităților de piață este văzută ca oscilații de-a lungul văii prețului minim. Fiecare oscilație declanșează o explozie de preț care este în detrimentul clienților. Pentru a evita acest lucru, rolul autorității de reglementare este mai bine definit în sensul de a netezi tranziția de la monopol la piață. Exemplul evoluției sectorului energetic din SUA este relevant aici. În abordarea de mai sus, concurența pe distanțe lungi care rezultă din viitoarea deschidere a piețelor energiei electrice în Europa sau din penetrarea, în urmă cu 70 de ani, a tehnologiei de interconectare în SUA, este comparată cu concurența cu rază scurtă (locală). În cele din urmă, se stabilesc limitele de preț care garantează că (i) noii intrați pe piață nu sunt eliminați și, (ii) că piața evită oscilațiile care pot șoca drastic o economie nerezistentă. Se face un studiu de caz pentru România și se propune o metodă prin care costul complexității este evaluat pe baza raportului dintre energia tranzacționată și cea consumată, adică mai multă energie tranzacționată, înseamnă că prețul crește cu fiecare tranzacție care nu aduce energia consumatorului, ci altor comercianți. Un exemplu este prezentat pentru actuala piață deschisă din România.*

Abstract. *The reform of a one player power sector (i.e. a natural monopoly) into a multiple players' power market brings to the clients not only the benefits of competition but also the costs of complexity. In between the two, an optimal number of players is found in the market corresponding to the minimum price of power to the clients. Considering time as the third dimension, the optimum curve becomes a potential surface on which the evolution of the market entities is seen as oscillations along the valley of minimum price. Every oscillation triggers a price burst which is detrimental to the clients. To avoid this, the role of the regulator is better defined in the sense of smoothing the transition from monopoly to market. The example of the US power sector evolution is relevant here. In the above approach long range competition resulting from the future opening of power markets in Europe, or from the penetration, 70 years ago, of the interconnection technology in USA, is compared with the short range (local) competition. Finally, the price limits are determined which ensure that (i) the new entrants on the*

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