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DOES NATURAL MONOPOLY EXIST IN ELECTRICITY INDUSTRY?

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Introduction

Many theories have been proposed to explain what a natural monopoly is in fact and what fields should be deemed as appropriate occasions to this consideration. Although the literature covers a wide variety of theories related to the scope of natural monopoly, this review will use several of them to examine the existence of natural monopoly in the electricity distribution industry thoroughly. This issue really needs a focused investigation, because there are sufficiently more debates and perspectives on this topic. This review will not explore the descriptive statistics of electricity distributing firms or their influences on the community. It will represent several theoretical approaches and studies of famous scholars who support or contradict to the stated issue. In this review we will try to analyse findings of the research conducted using academic articles of J.Tomain, R.Stevenson, F.Felder, P.Joscow, D.Gegax and K.Nowotny, K.Salvanes and S.Tyotta, N.Primeaux, W.Baumol, F.Frantz, whose contributions on the economics are truly extensive. Finally, we will try to reach a conclusion by means of all aforementioned resources.

The Pareto inefficiency theory

The first theory which is going to be explored is Pareto inefficiency. According to J.Tomain (2002) in his article *The Persistence of Natural Monopoly*, electricity industry was considered as “natural monopoly” in early 19th century. In his argument, it was clearly proved by giving many different reasons and critical views of scholars about the existence of natural monopoly in electrical industry. First, he states that the costs of supplying electricity by a single firm will be lower than by many firms, as short run average cost curve is downward sloping and is located above short run marginal cost curve but long run average cost curve is flatter because of large fixed costs. Additionally, Tomain points out that ‘...electricity utilities require large front-end capital investments, these investments formed entry barriers for new firms...’ (Tomain, 2002). Joscow states that in most situation of market, even in monopolistic market, firms make their profit by adjusting price to the marginal cost. However, natural monopoly is an exception in this scenario which sometimes is referred as Pareto inefficiency. In fact, the pricing system is the main



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problem which has been caused by large fixed costs. The construction of generation and transmission systems of electricity requires large amount of funding, while distribution of electricity incurs a small marginal cost. If producers operate under the condition of price equals marginal cost in natural monopoly, it leads to loss. Whereas, the company covers its costs when price equals to average cost which leads to insufficient amount of output (2005). According to ideas aforementioned before, the authors have summarized that, the factors of downward sloping average cost, large fixed cost and small marginal cost in the case of electrical industry are considered to be a natural monopoly.

According to opponents' views on the theory of existence of natural monopoly, Primeaux (1987) in his article "*Direct Electric Utility Competition: The Natural Monopoly Myth*" mentions his objectives '... to inform the uninformed that direct competition has existed and does exist in the electric utility industry...'. Primeaux claims that in monopolistic market electricity suppliers are expected to set a price unfairly unless the market is competitive (cited in Stevenson, 1987). Moreover, Grossman and Cole by their article "*The End Of Natural Monopoly: Deregulation And Competition In The Electric Power Industry*" contradict to the ideas of declining average cost and argue that curve of the average cost does not allow industry to be natural monopoly. Instead, natural monopoly may happen due to several other factors. In addition to this, they comment that many economists mistakenly consider that economies of scale occurs due to decreasing average cost, while in fact, it results from high fixed cost (2003). On the other hand, Tomain (2002) states, the natural monopoly existed in electricity industry till the mid of the last century and it began gradually switching to more competitive market. He gives some empirical evidences how electricity industry exits from monopolistic market step by step. Due to crisis in 1965, technological and financial advancement slowed considerably which politically led to an increase in regulation costs. Firstly, the price for electricity was raised by dint of inflation in that crisis period. Then high elasticity of demand for electricity caused consumers to switch to other best alternatives such as solar panels and wood stoves. These political and economic inconstant conditions created public concerns which eventually triggered National Energy Act (PURPA)¹ about

¹ Public Utility Regulatory Policies Act



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transferring from traditional rate² to market-based rate³. Given these points, the scholars have concluded that the idea of natural monopoly is dependent not only on the shape of declining average cost but on the other economic factors as well and summarized that the concept of natural monopoly, which existed in electricity industry for the last two centuries, has started losing its validity after the crisis in 1965.

Minimum efficiency scale

One more concept of natural monopoly is clearly explained by the theory of Minimum Economies of Scale, which is explained by Mansfield, that a firm is a monopolist when economies of scale reach a minimum at an output rate that satisfies the whole market at a profitable price (1970). Salvanes and Tyotta (1998), in their article, represented the major findings consisting principal approaches and models about natural monopoly deliberated by prominent economists. Research shows that Evans and Heckman have made a notable contribution to the testing of specified fundamental question. They analyzed the procedure of electricity distribution in Norway in terms of cost structure indicating a natural monopoly. Their test is based on the translog cost model which reveals an estimated cost function with negative marginal cost. Behind the hypothesis they state that for the specific output arrangement it is required to have data on the costs of both specific and hypothetical output combinations. Indeed, the results of Evans and Heckman can be limited by the fact that hypothetical output combinations do not meet particular requirements of proper cost function. Thus, they create the test region which is consistent to all requirements by restricting the existing data set. In this way they developed the proposed method and reached a conclusion of ‘... natural monopoly locally (in the consistency region) is a necessary and sufficient condition for global natural monopoly’. Salvanes and Tyotta emphasize that they strongly agree with the points of Baumol et al. (1988) and define an electricity distribution industry as natural monopoly if the firms have a subadditive cost function. They state that ‘the cost function is subadditive for a given output vector if it is less costly to have one firm produce the output vector than to have the same vector produced by two or more

² Natural monopoly

³ Competitive market



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hypothetical firms'. (Salvanes and Tyotta, 1998) Furthermore, Gegax and Nowotny (1993) followed William Baumol's views and described that observations comprehensively in their article named "Competition and electric utility industry: an evaluation". According to this article, the subadditivity condition subsequently causes the issue of economics of scale to happen. A firm shows economies of scale when it has a decreasing long-run average cost function. Whilst, it is true to confirm that the production process showing a subadditive economies of scale at that output level can be fully subadditive even though it has an increasing average cost function. Hence, they have concluded that the firm exhibiting decreasing average cost is considered as a strong natural monopoly, whereas the firm showing increasing average cost following subadditive costs too is called a weak natural monopoly (Gegax and Nowotny, 1993).

However, designed experiments show that theory of Minimum Economies of Scale is not applicable to the practice. Coursey, et al designed four experiments with a single seller and several buyers, using Plato computer system to create auction between them. Seller knew that he was the only one seller, he could change the price and his costs were artificially made to exhibit economies of scale. But participants of three out of four experiments chase prices at the level of perfect competition, not the monopoly one (1984). The conclusion of the experiment: 'It is simply not true that monopoly pricing is a "natural" result of a market, especially in electricity industry, merely because firms in the market exhibit decreasing costs and demand is sufficient to support no more than a single firm' (Coursey et al, 1984).

Baumol et al demonstrates that cost advantage indicates natural monopoly, but it is not enough for natural monopoly to be sustainable. Cost advantage gives a chance to single firm to produce all given vectors of outputs more cheaply than if production would be divided between several firms. Such advantage can be explained as subadditive cost function, which is presented this way:

$C(y_i) > C(y) = C(y_i)$, where $C(y)$ - cost function, $y_i = y$, $y_i \neq 0$, k - output vectors, $k > 1$.

If monopolistic production is at least as expensive as production made by several firms, then there is no vector of prices which is able to prevent entry into industry. Strict subadditivity is not sufficient to prevent monopolistic market from entries (1977).

One more economist reckons theory does not illustrate the reality. Primeaux, cited in Stevenson, has made a huge analysis of a data about costs and sales of monopolies and duopolies in electric industry taken from Federal Power Commission for the



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period 1964-1968 (1977). Although monopolists exhibit economies of scale, duopolists have smaller long-run costs till the point of $Q=222$ million kwh, and at the average level of output duopolists' costs are 10.75 percent smaller than monopolists' costs. Even without economies of scale duopolists had lower long-run costs, and Primeaux cited in Stevenson notes "... economies of scale as an attribute for natural monopoly are rather unimportant, even if they do exist." (1977).

Conclusion

The review has raised the issue of whether the concept of a natural monopoly is appropriate to apply in electricity industry. After conducting some analysis of research papers, it can be summarized that findings of Tomain and Primeaux have contributed significantly to the understanding and development of theory of natural monopoly in electric-power industry. According to the findings of Tomain, it can be concluded that, although natural monopoly existed in the electricity industry till the middle of XX century, it began gradually disappearing and transforming to the competitive market. In fact, one of the most persuasive argument was given by Primeaux. His huge investigation and analysis of data gives the review a deep understanding that natural monopoly no longer exists in electricity industry. Moreover, his contradictions to Minimum Economies of Scale lead to development of economic theory, especially to the theory of natural monopoly.

List of References

1. Baumol, W., Bailey, E. and Willig, R. (1977). Weak Invisible Hand Theorems on the Sustainability of Multiproduct Natural Monopoly. *American Economic Association*, [online] 67(3). Available at: <http://www.jstor.org/stable/1831405> [Accessed 3 Nov. 2016].
2. Coursey, D., Isaac, R. and Smith, V. (1984). Natural Monopoly and Contested Markets: Some Experimental Results. *The Journal of Law and Economics*, [online] 27(1). Available at: <http://www.jstor.org/stable/725154> [Accessed 3 Nov. 2016].
3. Felder, F. (2004). The End of a Natural Monopoly: Deregulation and Competition in the Electric Power Industry by Peter Z. Grossman and Daniel H. Cole. *International Association for Energy Economics*, [online] 25(4). Available at: <http://www.jstor.org/stable/41323362> [Accessed 3 Nov. 2016].
4. Gegax, D. and Nowotny, K. (1993). Competition and the Electric Utility Industry: An Evaluation. *Yale Journal on Regulation*, [online] 10(1). Available at: <http://digitalcommons.law.yale.edu/yjreg/vol10/iss1/4> [Accessed 3 Nov. 2016].



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2016].

5. Joscow, P. (2005). REGULATION OF NATURAL MONOPOLIES. *Center for Energy and Environmental Policy Research*. [online] Available at: <http://ceepr.mit.edu/files/papers/2005-008.pdf> [Accessed 3 Nov. 2016].
6. Salvanes, K. and Tjotta, S. (1998). A Test for Natural Monopoly with Application to Norwegian Electricity Distribution. Springer, [online] 13(6). Available at: <http://www.jstor.org/stable/41798834> [Accessed 3 Nov. 2016].
7. Stevenson, R. and Primeaux, W. (1987). Direct Electric Utility Competition: The Natural Monopoly Myth. *Land Economics*, [online] 63(3). Available at: <http://www.jstor.org/stable/3146842> [Accessed 3 Nov. 2016].
8. Tomain, J. (2002). The Persistence of Natural Monopoly. *American Bar Association*, [online] 16(4). Available at: <http://www.jstor.org/stable/40924211> [Accessed 3 Nov. 2016].



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