



Water Governance from the Perspective of Natural Monopoly and Regulation Theory [†]

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Abstract

Water, provided in adequate quantity and quality, is necessary for the maintenance of human life itself. But it is also, from the economic side, a commercial good that requires huge investments to be provided. The infrastructure for water provision is not easy or cheap to construct, and sources of water are relatively scarce. The necessity of water combined with investments and commercial treatment leads to different problems related to market approach. In market conditions, free competition among suppliers is assumed. Free competition leads to prices decreasing for certain goods and services. But one anomaly was noticed in theory and in practice: in some cases, prices tend to rise. Those cases are treated in theory and in practice as natural monopolies. When one supplier establishes a monopoly, the prices tend to rise again. To solve this problem, theoreticians established the theory of regulation, which aims to limit the trend of excessive price growth. This research deals with theoretical approaches to water issues.

Keywords: natural monopoly; regulation theory; Stigler–Peltzman theory; water price; water availability

1. Introduction

The topic of natural monopoly is quite difficult to understand in the free market environment. The topic has been researched for decades, and it seems to be very interesting for researchers even nowadays. To explore the challenges of natural monopoly, the theory of regulation was developed, and these two concepts seem to be inextricably intertwined. Even though the theory of natural monopoly and the theory of regulation look simple to understand, they are difficult to explain. Furthermore, the issue they deal with is almost unsolvable. This has resulted in a vast number of studies and, consequently, a vast number of references. This research was carried out with the aim of presenting some aspects of the theory of natural monopoly and the theory of regulation in terms of the water supply issue and the price of water.

The main circumstances in which a natural monopoly appears involve a market in which, due to structural reasons, only one firm finds itself able to produce a specific service or product [1].

Considering the economics of natural monopoly, four general questions appear [2]:

- The normative question deals with what the most efficient number of sellers is to supply a particular good or service (this leads to a technological or cost-based approach).



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- What conditions cause the situation where there is a single supplier (monopoly) or a very small number of suppliers (oligopoly)? This question leads to the behavioral and market equilibrium definitions of natural monopoly.
- If the industry is tending toward a monopoly, what are the potential economic performance problems that may result in terms of social costs? Another problem is how to measure those social costs.
- Will regulation mitigate potential performance problems in natural monopoly industries? How it should be designed in order to provide efficient measures?

Problems with water supply based on a significant difference in costs and tariffs could lead to the conclusion that differences in costs induce price differentials and inefficiencies in the process of supplying water [3]. Furthermore, the following assessment additionally complicates the possibility of comprehensive water price analysis: “Data on water prices and tariff structures are only partly available. The variations in water prices and price structures across and within countries and across different groups of consumers make it difficult to calculate meaningful national averages” [4].

Natural monopoly is discussed in terms of which appeared first: natural monopoly or the theory of natural monopoly. According to Di Lorenzo (1996) [5], monopolies “were created decades before the theory was formalized by intervention-minded economists, who then used the theory as an ex post rationale for government intervention.”

From the economic perspective, regulation is considered a form of government intervention in economic activity [6]. One of the classic economic assumptions about markets is that introducing regulation into a perfect competitive market generates inefficiencies, i.e., higher prices for products and services [7]. However, what is happening in cases of monopolies, especially in a case of natural monopoly? When prices under the conditions of a free market are not lower than when only one supplier is present on the market, interventions by the authorities are inevitable to keep prices acceptable for users. This means that authorities should find mechanisms of control for suppliers. Figure 1 illustrates the relationships between monopoly, regulation and water prices: monopoly tends to increase prices of water, but regulation keeps it within certain limits.

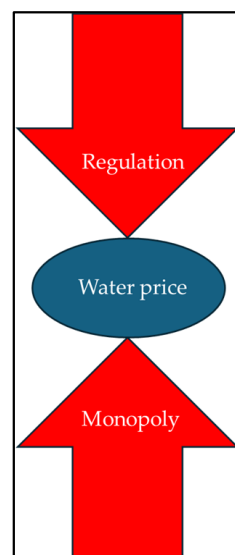


Figure 1. The relationship between natural monopoly, regulation theory and water prices.

Among different theoretical approaches, some models could be treated as very interesting because they use mathematical models to explain specific aspects of monopoly regulation. Bearing in mind that water supply is predominantly governed by local suppli-

ers, which are under direct control of cities' or municipalities' politicians (assemblies), we could use Stigler–Peltzman's model to explain some aspects of water supply prices. Assuming that politicians often act based on what will increase their chances of maintaining their positions in office [8], disregarding scientific logic, knowledge and professionals' opinions, the Stigler–Peltzman theory seems to be an adequate base for analysis of water supply pricing. Peltzman [9] started from the presumption that the basis of the regulatory process is the transfer of wealth, which is reflected not in the form of cash but rather in the form of regulated prices. In general, there are two groups in politicians' focus: the users (buyers) of a product or service and the suppliers. If the regulator prefers the suppliers, it is possible to expect grants (in the sense of money) needed for campaigns, but then it is possible to lose support from the voting body of service users who are dissatisfied with the price of the service. In the opposite case, if the regulator prefers the users, it could cause dissatisfaction with prices on the supplier side and consequently lower grants for campaigns. When these two opposing interests are balanced, the support function is acceptable to the regulator, as any support lost from one group will be compensated for by increased support from the other group.

2. Materials and Methods

The materials for this research are based on the data for a cubic meter of water in different cities. The Stigler–Peltzman model is considered, which is mathematically formalized as follows:

$$M = n * f - (N - n) * h \quad (1)$$

where:

- M —majority;
- n —number of voters in the beneficiary group;
- f —net probability that a beneficiary will grant support;
- N —total number of potential voters;
- h —net probability that a voter who does not belong to the beneficiary group will oppose.

Changes to the function M can be calculated as follows:

$$\Delta M = \frac{\partial M}{\partial n} \Delta n + \frac{\partial M}{\partial f} \Delta f + \frac{\partial M}{\partial N} \Delta N + \frac{\partial M}{\partial h} \Delta h \quad (2)$$

Applying Formula (2) to Function (1) yields the following:

$$\frac{\partial M}{\partial n} = f + h \quad (3)$$

$$\frac{\partial M}{\partial f} = n \quad (4)$$

$$\frac{\partial M}{\partial N} = -h \quad (5)$$

$$\frac{\partial M}{\partial h} = n - N \quad (6)$$

The final form of Function (2) is as follows:

$$\Delta M = (f + h) \Delta n + n \Delta f - h \Delta N + (n - N) \Delta h \quad (7)$$

The terms Δn , Δf , ΔN and Δh represent the potential errors in regulators' calculations. The possibility of incorrect estimation of the total number of potential voters appears if some groups of voters were not included in the calculation or some groups

of voters were included but are not interested in voting even though they benefit from regulators' decisions.

3. Results and Discussion

In this research, five different scenarios were calculated and are presented here. The data were adopted in descending sequence for the number of voters in the beneficiary group. All data are given as a percentage [%]. Table 1 contains the initial data for calculating Formulas (1–7).

Table 1. Initial values for majority function calculation.

Argument	N	n	f	h	Δn	Δf	ΔN	Δh	M	ΔM
Case/Unit	%	%	%	%	%	%	%	%	%	%
1	100	90	90	20	10	10	5	5	79	14
2	100	80	80	30	10	10	5	5	58	13
3	100	70	60	50	10	10	5	5	27	11
4	100	60	70	60	10	10	5	5	18	12
5	100	50	50	50	10	10	5	5	0	10

The interval in which the majority function belongs is defined as $(M - \Delta M; M + \Delta M)$. Figure 2 shows the interval of the majority function and ΔM value.

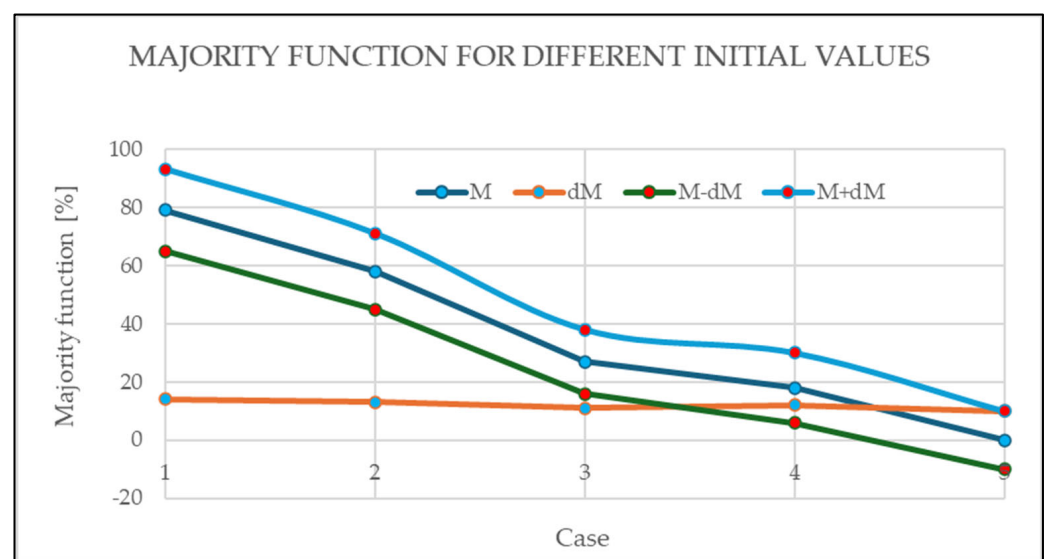


Figure 2. Majority function for different cases.

According to the results obtained by applying Formulas (1–7), it is obvious that errors in initial assumptions could result in significant differences in majority functions. Bearing in mind that regulation of water supply is only one part of full regulatory activities, Formula (1) should be redefined, and the total number of potential voters N as well as the number of voters in the beneficiary group n should be defined as the numbers of voters who are affected by water prices, while the probabilities f and h are the variables under investigation. The analyzed cases show that only in the case of a high number of voters in the beneficiary group and with a high probability that they will vote can they provide more than 50% of the votes for the regulator.

This research is limited due to being based on only the simplest case of the Stigler–Peltzman model, as it aims to highlight the importance of the topic. However, the original Stigler–Peltzman model does not include an analysis of potential errors in Formula (1),

which have been analyzed in this research. Further investigations should include a higher number of parameters and a more complex approach to the Stigler–Peltzman model.

4. Conclusions

In this research, the authors have considered the simplest formula in the Stigler–Peltzman model, highlighting the fact that regulators are always trying to regulate natural monopolies with the aim of reaching their main goal: keeping their position in office. This aim is driven by the balance of water prices, which should lead to support from both users and suppliers of water. The research is limited to the simplest equation of the Stigler–Peltzman model but includes an analysis of the influence of potential errors that regulators could make when estimating the total number of potential voters, number of voters from beneficiary groups and probabilities for voters from beneficiary and opposition groups. In order to obtain the necessary number of votes (over 50%), the regulator must receive a high number of votes from the beneficiary group and estimate the number of voters and probabilities with high accuracy. Further investigation should be based on real prices of water and more complex formulas of the Stigler–Peltzman model.

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References

1. Mosca, M. On the Origins of the Concept of Natural Monopoly. Università di Lecce Department of Economics Working Paper, 2006; (92/45). Available online: <https://ssrn.com/abstract=975461> (accessed on 9 June 2026).
2. Joskow, P.L. Regulation of natural monopoly. *Handb. Law Econ.* **2007**, *2*, 1227–1348. [CrossRef]
3. Nauges, C.; Van den Berg, C. *How “Natural” Are Natural Monopolies in the Water Supply and Sewerage Sector?: Case Studies from Developing and Transition Economies*; World Bank Publications: Washington, DC, USA, 2007; Volume 4137.
4. Environment at a Glance 2015 OECD INDICATORS. Available online: https://www.oecd.org/content/dam/oecd/en/publications/reports/2015/10/environment-at-a-glance-2015_g1g554f7/9789264235199-en.pdf (accessed on 1 March 2026).
5. Di Lorenzo, T.J. The Myth of Natural Monopoly. *Rev. Austrian Econ.* **1996**, *9*, 43–58. [CrossRef]
6. Moosa, I.A. Definition and Theories of Regulation. In *Good Regulation, Bad Regulation: The Anatomy of Financial Regulation*; Palgrave Macmillan: London, UK, 2015; pp. 1–15.
7. Joskow, P.L.; Noll, R.G. Regulation in theory and practice: An overview. *Stud. Public Regul.* **1981**, 1–78.
8. Ovin, R.; Nestorović, Ž.; Geršak, T. Can economic policy be praised for its environmental policy in the field of transportation? *Mednar. Inov. Posl. J. Innov. Bus. Manag.* **2023**, *15*, 1–6. [CrossRef]
9. Peltzman, S. Toward a more general theory of regulation. *J. Law Econ.* **1976**, *19*, 211–240. [CrossRef]

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