








“Analysis of the crisis resilience of utilities in the ownership of municipalities in Hungary between 2006 and 2022”

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ANALYSIS OF THE CRISIS RESILIENCE OF UTILITIES IN THE OWNERSHIP OF MUNICIPALITIES IN HUNGARY BETWEEN 2006 AND 2022

Abstract

Hungary's utility sector, encompassing district heating, water services, waste management, and public transport, has experienced notable shifts from municipal to privatized ownership and back to community control between 2006 and 2022. The purpose of this study is to assess the financial performance and crisis resilience of municipally owned utility companies in Hungary between 2006 and 2022, with a particular focus on the impact of state price regulation and the role of economic cycles. The regulation was intended to ensure service affordability but imposed significant constraints on financial flexibility and investment capacity. The study targeted a sample of Hungarian local government companies, with two distinguished periods (2006–2013 and 2014–2022), examining seven different financial indicators (formulas), e.g., EBITDA, ROA, etc., with variance analysis and correlation analyses. These revealed that while companies operated effectively during periods of economic growth, the post-2020 polycrisis, characterized by challenges such as the COVID-19 pandemic and rising energy prices, exposed vulnerabilities, especially in the district heating sector. Financial indicators, including EBITDA margin and liquidity ratios, showed mixed results, with profitability improving in certain sectors but liquidity and return on assets (ROA) declining, indicating stress on short-term solvency. The paper suggests that while price regulation maintained affordability, it limited the capacity for swift adaptation during crises. To enhance resilience, the study recommends incorporating more adaptive regulatory frameworks and investing in renewable energy and operational efficiency. These changes would help municipally owned utility companies better withstand economic fluctuations and maintain service continuity, contributing to long-term financial and service stability.

Keywords

municipal utilities, state price regulation, public service sustainability, regulatory impact

JEL Classification

H70, H76, H77, G38

INTRODUCTION

The operation and stability of public utility services, such as district heating, water supply, waste management, and public transport, are essential to social welfare and economic functionality. In Hungary, municipally owned utilities provide these critical services, directly impacting citizens' quality of life and supporting broader economic objectives, including sustainability, environmental health, and economic resilience. These utilities serve as pillars of infrastructure, ensuring accessibility to fundamental services and contributing to public health and quality of life. However, the sector has faced substantial challenges in recent decades, driven by shifts in regulatory frameworks and ownership structures, with the dual pressures of state policies and economic volatility shaping their performance and viability.

The task of balancing affordability with financial sustainability creates a complex scientific challenge for policymakers and economists alike. The introduction of state price regulation in 2013 marked a decisive turn in this balancing act, aiming to maintain service affordability for residents. However, this policy imposed significant financial constraints on municipal utilities, limiting their ability to adapt to market changes, sustain investment, and ensure financial stability. This limitation, compounded by recent global economic strains – including the COVID-19 pandemic, the ongoing energy crisis, and inflationary pressures – has highlighted an underlying tension: the resilience and adaptability of municipally owned utilities under financial and regulatory pressures.

This dynamic tension between affordability and operational sustainability in municipally owned utilities is a growing concern not only in Hungary but also globally, as many nations grapple with economic and environmental crises that strain public resources. The Hungarian experience provides a unique context to examine these issues, particularly within a post-transition economy where the roles of municipal versus private ownership are still evolving. Studying the Hungarian utility sector can thus reveal insights into how state-regulated models function under stress and how similar systems might be better equipped to withstand external pressures while still fulfilling public needs.

Understanding the economic resilience of public utilities under such constraints is scientifically valuable, as it reveals insights into the viability of adaptive governance and sustainable financial models in essential services. This study situates itself within this broader scientific problem, aiming to empirically analyze the impact of regulatory constraints on the ability of municipally owned utilities to maintain operations and recover from economic disruptions. Insights may contribute to the field of public administration and policy by shedding light on resilience and sustainability within a regulated environment, offering a foundation for developing governance models that balance regulatory requirements with adaptability and long-term stability.

1. LITERATURE REVIEW AND HYPOTHESES

Utility companies play a vital role in providing basic public services such as energy, water, and transport, which are essential for the day-to-day functioning of society. They also contribute to economic stability and sustainability goals, especially in times of crisis.

Utility companies provide the energy supply of a country, distribute and manage energy and resources, and provide material public services to households. It is the responsibility of the country's government to decide whether public services are provided by community-owned (state or municipal) or privately owned utility companies and to what extent and in what form they regulate the prices of services. In both cases, the government has a responsibility to provide public services that are satisfactory to the population, and it can use a wide range of interventions to do so.

The utility sector is a significant branch of the national economy, as it directly affects the quality

of housing and municipal services (Farynovych et al., 2019) and the living standards of the population. However, the poor technical state of the industry can lead to a reduction in the quality of services provided and can have a negative impact on the environment (Farynovych et al., 2019). Community-owned public service companies also have a significant impact on the national economy. Their mergers can contribute to business growth and support national development (Dewi et al., 2023). The merger process of state-owned corporations is subject to legal and tax analysis to ensure compliance (Dewi et al., 2023). Municipally owned firms also face specific challenges. The utilities industry is closely linked to the concept of a green economy, which aims to increase the competitiveness of national economies. As major energy users, utilities have an interest in using a renewable, favorable energy mix (Mladenović & Arsić, 2017). Electric utilities, which include electricity generation, transmission, distribution, and trading, play a crucial role in all national economies (Borowski, 2019). The green economy is a relatively new concept, and its potential as a factor for achieving a

differentiated position in the global economy is still being explored (Mladenović & Arsić, 2017; Fedotkina et al., 2019).

Municipally owned corporations (MOCs) mainly provide infrastructure, welfare, and cultural public services, complementing other public services provided by the municipality. The accounting and governance system of MOCs is different from that of the municipalities possessing them, but the relationship between the owner municipality and the company is of paramount importance (Vakkuri et al., 2021). The fragmented ownership of municipal utilities diminishes cost efficiency, but MOCs perform better when political influence is reduced. Corporate governance is an essential factor in promoting the efficiency of MOCs (Sørensen, 2007). Grossi and Thomasson (2023) examined the role of holding companies in the governance of utility companies, which can be useful in the management and control of companies but can complicate the governance structure. The analysis suggests that politicians and public managers should consider the advantages and disadvantages of establishing holding companies.

Esposito et al. (2021) analyzed the impact of property rights on sustainable development and environmental policy in Italian MOCs. It was investigated whether multiple owners can generate better performance compared to a single owner, and whether the presence of private partners is crucial. The results suggest that multiple ownership and the presence of private partners have a positive impact on sustainable development and environmental policy in Italian MOCs.

Corporate governance factors, such as a shared vision, strategic coordination, and clear objectives, are crucial in shaping the success of MOCs. Continuous monitoring and evaluation are essential for municipally owned utilities to ensure that strategies are effectively adapted to local needs and circumstances, enabling these utilities to respond more efficiently to changing environments and customer demands (Daiser & Wirtz, 2021).

Exploring the European outlook on municipally owned corporations highlights the common challenges and successes that define these companies' role in delivering local public services. A compre-

hensive comparison of MOCs in Europe revealed the legal provisions that enable or hinder the creation of MOCs in different countries and illustrated the common trends and differences that can be observed in MOCs (Van Genugten et al., 2023).

A Dutch systematic review of municipally owned corporations found that community-owned corporations are generally more efficient in delivering local public services, such as waste collection, water services, and local transport, but they face a higher risk of early bankruptcy compared to market-based corporations (Voorn et al., 2017). The other Dutch study also dealt with the use of business techniques, including factors influencing the success of municipally owned companies. This paper provides insights into the role of business techniques, and it was found that business techniques directly support the performance of MOCs and mediate the relationship between autonomy and performance (Voorn et al., 2020).

An analysis of the experience of Swedish MOCs shows that, although companies want to improve flexibility and efficiency, their over-reliance can reduce transparency and democratic accountability (Bergh & Erlingsson, 2024).

Examining the relationship between the efficiency and quality of Polish MOCs, Jedynek and Wąsowicz (2021) found that in addition to financial performance, public needs and public perceptions of performance should be taken into account. More efficient companies achieve higher customer satisfaction.

Building on the European overview, this study delves into the Hungarian context of government-owned enterprises, examining the unique regulatory, economic, and historical factors that shape their operation and performance within the country.

The excessive indebtedness of the Hungarian local government sector, driven by practices such as bond issuance and decentralized deficit management, created significant fiscal challenges. Between 2011 and 2014, government-led fiscal consolidation efforts, including central budget interventions, were essential to stabilize the financial landscape of municipally owned enterprises.

These measures, combined with a broader understanding of crisis management tools, were crucial for enhancing the sector's resilience and stabilizing municipal ownership of public utilities, which had positive, albeit indirect, effects on operational efficiency (Bethlendi & Lentner, 2018; Vasvári, 2020).

Corporate sustainability and regulatory compliance have emerged as critical themes in the operation of municipally owned corporations. Although research in this area often focuses on state-owned enterprises across Central Europe, studies emphasize the necessity of aligning corporate governance with sustainability practices to ensure effective service delivery and financial stability. The shift in regulatory authority from municipalities to the state, marked by Act CXXVI of 2011 and further reinforced by the 2013 Act on National Assets, transformed governance structures and centralized oversight mechanisms. This reorganization aimed to prevent financial mismanagement, yet it also introduced new challenges in aligning cost efficiency with public service obligations (Boros & Fogarassy, 2019; Vasa et al., 2020).

Hungary's unique approach to utility bill reduction in 2013, which mandated a 20-25% decrease in household utility costs through state intervention, set the country apart from others in Europe, where market-driven price regulation remains the norm. While this policy alleviated the financial burden on households, it also placed significant pressure on service providers, adversely affecting profitability and operational efficiency. Consequently, there is a recognized need for strong regulatory frameworks and rigorous internal controls to mitigate financial risks and improve performance, particularly in the face of crises like the COVID-19 pandemic (Lentner et al., 2020; Czirfusz, 2024; Van Genugten et al., 2023).

The increasing prominence of municipally owned corporations in Hungary's local public service provision since the 1990s underscores the importance of efficient governance. Research highlights persistent governance challenges, such as those identified in municipal and state-owned companies, which have led to financial instability and service quality issues. Recommendations for improving management discipline remain critical, especially as these corporations continue to navigate economic down-

turns and evolving regulatory landscapes. Insights into the performance of utility management outside Budapest reveal the complexities of balancing service delivery with financial sustainability, emphasizing the need for strategic oversight and adaptive governance practices (Ágh et al., 2021; Domokos et al., 2016; Hajnal & Kucsera, 2023).

All of the above highlights the crucial role of municipally owned utility companies in providing essential public services and contributing to economic and environmental sustainability. Studies indicate that while such companies may achieve efficiency comparable to private firms, they often face higher risks of financial instability, particularly under strict regulatory frameworks like state price control. International and Hungarian sources emphasize the challenges of balancing affordability and financial resilience, with recent research underscoring the importance of adaptive governance and effective cost management in crisis-prone environments. Additionally, the Hungarian context, marked by shifts from decentralized to centralized regulation, offers insights into the unique operational and financial challenges municipally owned utilities face.

The purpose of this study is to assess the financial performance and crisis resilience of municipally owned utility companies in Hungary between 2006 and 2022, with a particular focus on the impact of state price regulation and the role of economic cycles. This study examines the management of municipally owned and repossessed public service providers in the first years of a positive business cycle (2006 to 2019) and a post-2020 negative business cycle (2020 to 2022). The two main research hypotheses posed are as follows:

- H1: State price regulation does not adversely affect the management of the Hungarian municipally owned utility companies (district heating, water, waste management, and public transport) in a favorable economic environment but makes them inflexible in a crisis environment.*
- H2: The Resilience Index is able to detect the resilience of firms in the sectors (district heating, water, waste management, and public transport) under study.*

2. METHOD

Based on the state price regulation, two periods are distinguished, i.e., 2006–2013 and 2014–2022. The financial indicators (formulas) examined in these periods were as follows:

- EBITDA margin (EBITDA / Sales);
- Liquidity ratio (Current assets / Current liabilities);
- Current ratio ($[\text{Current asset} - \text{Stocks}] / \text{Current liabilities}$);
- ROA (PL after tax/ Total assets);
- SFperTA (Shareholders funds / Total assets);
- MCperSales (Material costs / Sales);
- FAperTA (Fixed assets / Total assets).

For the overview of the periods, two main period distinctions were used, namely the period 2006–2013, which represents the period before the introduction of state price regulation, and the period 2014–2022, which represents the period after the introduction of state price regulation. The latter analysis period is further broken down into periods to refine the analysis:

- the period 2014–2016, the period immediately following the price regulation;
- 2017–2019, the boom period;
- the period 2020–2022, the period of polycrisis.

This study used the aggregation method to identify general trends. To explore the differences between the different periods (2006 to 2013 and 2014 to 2022), analysis of variance (ANOVA) was applied, where the independent variable was the sector, and the dependent variables were the variables describing the business entity. The first period was characterized by municipal ownership and municipal price regulation (2006–2013); the second period can be further divided into two important periods of cyclical periods of municipal ownership and state price regulation (2014–2019); while

from 2020 onwards, the period was characterized by a polycrisis, also in an official state price regulation environment. Average figures were used to explore the differences between the data.

The concept of resilience covers not only economics but also psychology, health, engineering, and infrastructure. The most widely used Oxford definition is the ability to recover quickly from adversity, so at the most basic level, resilience is the ability to withstand negative effects (Danes et al., 2009; Folke et al., 2010; Avery & Bergsteiner, 2011; Cheema-Fox et al., 2021). The Resilience Index (RI) is defined as the amount of increase in material costs that a company can handle without turning its EBITDA negative, assuming no change in turnover. In the index, assuming an external economic shock, only the cost of materials is considered as a determinant. It is expressed as follows:

$$RI = \frac{S}{C_{material}} - 1, \quad (1)$$

where RI – Resilience Index (%); S – Turnover (HUF); $C_{material}$ – Material cost (HUF).

The sectoral variance of the Resilience Index (RI) was examined by analysis of variance, while correlation analysis was performed to identify the factors (wealth, financial, profitability, and cost structure) affecting the RI.

The sample elements of the study were selected according to four main criteria:

- type of main activity;
- price regulation affects the sector;
- accounting statements submitted each year from 2006 to 2022;
- owned by a metropolitan municipality or a city government with county rights.

The study focused on municipally owned companies active in four public utility sectors (district heating, water, waste management, and public transport) with valid accounting reports for 2006–2022. These sectors were chosen due to their direct impact on quality of life and because

they have been subject to state price regulation since 2014. The analysis was limited to companies owned by the municipalities of Budapest and the 25 cities with county rights (representing 3.7 million inhabitants in 2021) to ensure adequate coverage. According to the Orbis database, there were a total of 1,063 municipally owned companies operating in Hungary in 2022. Fifty companies fully complied with the sampling criteria. Under the screening conditions presented, the sample represents almost 20% of the total population (in terms of the number of utilities), with national coverage, while it covers 95% of the firms operating in this industry in the county towns and Budapest.

Water utilities account for the largest share of the sample (36%), followed by waste management companies (30%), while public transport (9%) and district heating (8%) account for a smaller share of the sample.

3. RESULTS

Based on the analysis of the financial state of utility enterprises, significant changes can be observed between the period before (2006–2013) and after (2014–2022) price regulation in 2013. Overall, price regulation in 2013 had a mixed impact on utility businesses. To test the research hypotheses, the study used analysis of variance, and its preliminary condition was met for all variables (based on Levene's test). As shown in Table A1, the variables describing wealth-finance-income status included as dependent variables are significantly different across the sectors studied (Appendix A).

In order to evaluate the analysis of variance, it is common to use means plots, which visually present the average values of the given sectors for a given variable. Table 1 shows the values obtained.

Profitability, especially EBITDA margin, improved in almost all sectors, indicating an increase in cost efficiency. At the same time, a deterioration in liquidity ratios is observed, which may indicate a decrease in the solvency of companies in the short term. In the post-regulatory period, companies' return on assets showed mixed results: while some sectors, such as water utility, saw an increase, others, such as district heating, saw a decrease (Table 1).

EBITDA margin increased in almost all sectors, indicating that companies' profitability improved. For example, it increased from 10.49% to 15.20% for district heating and from 15.28% to 19.55% for water utility. By contrast, liquidity and current ratios declined, suggesting a deterioration in short-term solvency; e.g., district heating liquidity fell from 1.45 to 0.80. The ROA indicator, which measures the efficiency of devices, shows mixed results: district heating supply shows a decrease (from 5.23% to 3.85%), while water purification shows an increase (from 5.86% to 7.05%). The SF/TA (equity ratio) and FA/TA (fixed asset ratio) ratios remained relatively stable, indicating that the capital structure and asset base of companies did not change significantly between the two periods (Table 1).

For a more detailed analysis, the post-price regulation period in this study is divided into three phases: 2014–2016, i.e., the phase of introduction,

Table 1. Average value of variables describing the wealth-financial-income situation of sectors 2006–2013 and 2014–2022

Source: Orbis database.

| | Sector name | EBITDA margin (%) | Liquidity ratio | Current ratio | ROA (%) | SF / TA (%) | MC / S (%) | FA / TA (%) |
|-----------|-------------|-------------------|-----------------|---------------|---------|-------------|------------|-------------|
| 2006–2013 | DH | 10.49 | 1.45 | 1.32 | 5.23 | 40.74 | 56.18 | 77 |
| | WM | 6.83 | 0.48 | 0.38 | 1.85 | 27.44 | 33.45 | 75.1 |
| | WT | 15.28 | 2.91 | 2.78 | 5.86 | 52.62 | 24.05 | 55.39 |
| | PT | 11.17 | 2.51 | 2.32 | 3.98 | 46.87 | 27.77 | 55 |
| 2014–2022 | DH | 15.2 | 0.8 | 0.7 | 1.85 | 41.25 | 44.97 | 70.14 |
| | WM | 4.71 | 1.41 | 1.12 | 0.41 | 30.52 | 17.65 | 54.06 |
| | WT | 3.97 | 1.56 | 1.52 | 1.27 | 35.61 | 16.28 | 46.2 |
| | PT | 5.99 | 1.01 | 0.87 | 0.71 | 30.3 | 21.13 | 60.73 |

Note: DH – district heating; WM – waste management; WT – water utility; PT – public transport. *N* = 50.

Table 2. Average value of variables describing the wealth-financial-income situation of sectors during the different periods between 2014–2022

Source: Orbis database.

| | Sector name | EBITDA margin (%) | Liquidity ratio | Current ratio | ROA (%) | SF / TA (%) | MC / S (%) | FA / TA (%) |
|-------------------------------------|-------------|-------------------|-----------------|---------------|---------|-------------|------------|-------------|
| 2014–2016 After price regulation | DH | 12.63 | 0.84 | 0.64 | 0.36 | 41.64 | 47.81 | 69.35 |
| | WM | −0.46 | 1.91 | 1.2 | −1.79 | 31.19 | 16.58 | 70.54 |
| | WT | 2.69 | 1.49 | 1.4 | 0.02 | 34.48 | 21.09 | 55.12 |
| | PT | 2.62 | 0.71 | 0.63 | 1.21 | 27.28 | 28.6 | 65.74 |
| 2017–2019 Economic growth | DH | 18.19 | 0.77 | 0.72 | 2.62 | 39.64 | 45.94 | 69.89 |
| | WM | 5.42 | 1.6 | 1.54 | 2.94 | 32.9 | 13.22 | 33.24 |
| | WT | 4.98 | 1.41 | 1.3 | 0.9 | 36.2 | 15.17 | 55.54 |
| | PT | 9.5 | 0.95 | 0.82 | 1.22 | 28.43 | 18.97 | 63.72 |
| 2020–2022 Polycrisis | DH | 14.85 | 0.81 | 0.73 | 2.27 | 40.52 | 41.15 | 71.18 |
| | WM | 4.21 | 1.87 | 1.81 | 3.05 | 36.06 | 12.56 | 27.89 |
| | WT | 5.69 | 1.31 | 1.22 | 0.75 | 35.2 | 15.68 | 52.73 |
| | PT | 8.91 | 0.91 | 0.67 | 1.01 | 27.67 | 23.16 | 58.38 |

Note: DH – district heating; WM – waste management; WT – water utility; PT – public transport. $N = 50$.

followed by 2017–2019, the business cycle of highest economic growth, and 2020–2022, which is the period of the polycrisis (COVID-19, armed conflicts, etc.). Table 2 compares the trends in average values with the period before the price regulation and with the previous periods.

The data in Table 2 show that while district heating has achieved significant financial improvements, other sectors, such as water utility, continued to face challenges in the period 2014–2019.

Based on EBITDA margin ratios, the district heating sector experienced significant growth: it increased from 12.63% in 2014–2016 to 18.19% in 2017–2019. This suggests that companies have been able to manage costs and increase profits more efficiently. In contrast, EBITDA margin in the waste management sector remained negative at −0.46%, indicating that the sector continued to make losses during this period. Liquidity ratios and current ratios indicate companies' ability to cover short-term liabilities. In district heating, the liquidity ratio decreased but remained relatively stable (from 0.84 to 0.77), while in the water utility and waste management sectors, it was higher, indicating that these sectors were able to pay better in the short term (Table 2).

The change in ROA indicators shows mixed results: ROA for district heating increased from 0.36% to 2.62%, while in the waste management sector, it was negative (−1.79%), showing poor asset use efficiency. The equity ratio in district heating

decreased slightly (from 41.64% to 39.64%), but remains high, indicating a stable capital structure. In contrast, it is lower in the waste management sector, indicating greater dependence on external funding. In the case of district heating, the share of working capital decreased slightly but remained high (from 47.81% to 45.94%), meaning that the sector has sufficient working capital to sustain operations. In contrast, waste management is low (16.58%), showing weaker short-term financial flexibility (Table 2).

The stability of the fixed asset ratio (e.g., around 69% in district heating) indicates that these companies rely heavily on physical assets, which is important in the long run but reduces the proportion of liquid assets. This high asset value may represent flexibility constraints as physical assets are less easily mobilized in emergency situations or unexpected market changes.

According to the data, the period 2017–2019 was the most successful for utility companies, especially in the district heating sector. During this period, the EBITDA margin increased significantly to 18.19%, indicating an improvement in profitability. In addition, ROA increased to 2.62%, reflecting efficient asset use.

Although liquidity ratios declined slightly over this period (e.g., the liquidity ratio was 0.77), this did not affect financial success as improvements in profitability and asset use were more significant factors (Table 2).

Table 3. Variance analysis of the Resilience Index

Source: Orbis database.

| ANOVA | | | | | |
|---------------------|----------------|----|-------------|-------|-------|
| Source of variation | Sum of Squares | df | Mean square | F | Sig. |
| Between Groups | 4648.151 | 3 | 1549.384 | 0.923 | 0.437 |
| Within Groups | 77231.504 | 46 | 1678.946 | | – |
| Total | 81879.655 | 49 | – | | |

Since at the time of finalizing this paper, the data for the 2023 financial statements were not available, the principle used to calculate the Resilience Index was that, provided that revenues do not increase significantly, how much is the increase in material costs that the company can tolerate without generating losses, i.e., EBITDA = 0. This tolerance range was examined from a sectoral aspect by means of variance analysis. The cost of materials was chosen as a baseline because it is considered an exogenous factor, with utilities having greater flexibility to respond to labor needs and wages.

The analysis of variance found no significant difference in the resilience of the sectors in the study (Table 3). Nevertheless, the average was visualized using a means plot.

It is clear that district heating is the most sensitive to material costs, as a total material cost increase of 4.285% would already put the sector in the negative range, which is alarmingly low, especially in light of the energy crisis in 2022. The waste management sector has a higher tolerance than district heating, at almost 25%, while the water utilities sector and public transport have the highest tolerance. Consequently, the district heating sector has been very adversely affected by the energy price increases that hit Hungary hard in the aftermath of the war between Russia and Ukraine (Figure 1).

In the context of the Resilience Index, a correlation analysis was also carried out for the last available year (2022) in order to identify the variables that can help establish a statistical relationship.

Table 4. Correlation analysis between the variables and the Resilience Index

Source: SPSS output.

| Resilience Index | CoE / Sales (%) 2022 | FA / TA (%) 2022 | SF / TA (%) 2022 | MC / Sales (%) 2022 | ROA (%) 2022 | Liquidity ratio 2022 | Current ratio 2022 | EBITDA margin (%) 2022 |
|---------------------|----------------------|------------------|------------------|---------------------|--------------|----------------------|--------------------|------------------------|
| Pearson Correlation | -0.349* | -0.288* | 0.215 | -0.477** | -0.145 | -0.017 | 0.044 | -0.314* |
| Sig. (2-tailed) | 0.013 | 0.042 | 0.134 | 0.000 | 0.315 | 0.908 | 0.760 | 0.026 |

Note: * significance below 0.05%; ** significance below 0.01. N = 50.

Source: SPSS output.

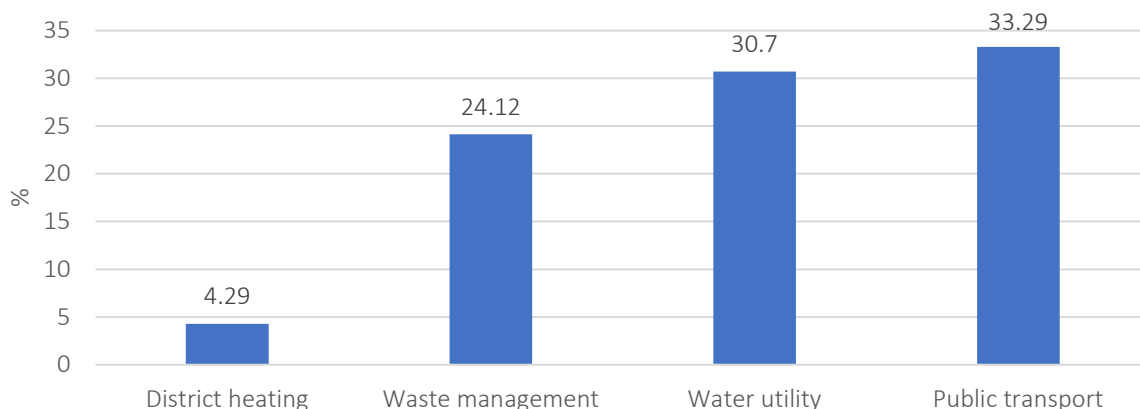
**Figure 1.** Visualization of the average value of the sectors surveyed using a means plot

Table 5. Decision on hypotheses

| Hypothesis | Decision |
|---|----------|
| H1: State price regulation does not adversely affect the management of the Hungarian municipally owned utility companies (district heating, water, waste management, and public transport) in a favorable economic environment but makes them inflexible in a crisis environment. | Accepted |
| H2: The Resilience Index is able to detect the resilience of firms in the sectors (district heating, water, waste management, and public transport) under study. | Accepted |

From the correlation analysis, this study found relationships with four variables, but the strength of the relationships is weaker than medium, with a negative sign in all aspects. The strongest relationship, which is even weaker than the medium, is with the ratio of material costs to sales, followed by the ratio of personnel costs to sales, and finally, the EBITDA margin. A negative relationship is also observed with the ratio of fixed assets (Table 4).

The result implies that the higher the cost ratio, the lower the resilience of the corporation, while the negative relationship with the EBITDA margin is a surprising development. The negative relationship with the fixed asset ratio is due to the fact that firms with a higher asset ratio have a higher expense ratio, which typically includes a higher proportion of fixed costs.

4. DISCUSSION

Based on the literature review (e.g., Voorn et al., 2017), municipal-owned enterprises may sometimes be more efficient in providing public services than market actors. At the same time, the probability of early bankruptcy is higher for these companies. The findings of this study confirm this claim, as the management performance of decentralized, municipally owned utility companies varied over the period 2006–2013, and performance generally deteriorated with the introduction of centralized price regulation (Table 5). Mitigating the restrictive effects of state price regulation, for example, by introducing market-based approaches, could help improve the financial stability of companies. As a result, firms could become more resilient to economic shocks, leading to increased resilience.

Van Genugten et al. (2023) suggest that price regulation may sometimes limit firms' profitability

and financial flexibility. In the case of Hungarian utility companies, financial stability has actually deteriorated after the introduction of state price regulation (2013), as the paper finds. Indicators (e.g., EBITDA margin and ROA) declined during the period under price regulation, especially in the post-2020 polycrisis period, indicating the limitations presented in the literature. Increasing transparency and financial discipline, as well as enhancing corporate autonomy, could facilitate more efficient operations. Reducing over-centralization can lead to decisions better adapted to local needs, which can contribute to improving adaptability to economic cycles.

Boros and Fogarassy (2019) and Voorn et al. (2022) suggest that efficient cost management and rapid adaptability are necessary for the sustainability of utilities. The analysis of the Resilience Index presented in this paper confirms that the crisis resilience of sectors varied significantly and that crisis management capabilities were not adequate in all sectors. District heating and water utilities had higher resilience, while waste management had low indicators, which foreshadows the problems in the sector, as reflected in the literature. The role of utilities in the green economy could be key in the future, especially by increasing the use of renewable energy sources. Integrating sustainability goals could improve long-term competitiveness and reduce the negative effects of economic shocks.

Based on Vakkuri et al. (2021) and Esposito et al. (2021), the efficiency of municipally owned utility companies is highly dependent on corporate governance mechanisms and ownership structure. The results of the study suggest that the functioning of Hungarian utility companies has often been hampered by excessive centralization and lack of transparency. Ownership control and financial discipline should be strengthened, especially in crises.

CONCLUSION

The purpose of this study was to assess the financial performance and crisis resilience of municipally owned utility companies in Hungary between 2006 and 2022, with a particular focus on the impact of state price regulation and the role of economic cycles.

The findings indicate that the introduction of state price regulation in 2013 significantly impacted the operation of these utility companies. While the regulation aimed to ensure the affordability of public services, it simultaneously reduced the companies' financial flexibility and constrained their investment capacity.

The financial data show that the companies' performance improved during the favorable macroeconomic environment, especially between 2017 and 2019, supported by central budget subsidies and increased household demand. In contrast, in the post-2020 period, marked by multiple crises (such as the COVID-19 pandemic and rising energy costs), EBITDA margins and liquidity ratios deteriorated, particularly in the district heating sector, which proved highly sensitive to energy price increases.

These findings suggest that maintaining state-controlled price regulation is effective only in a stable and favorable macroeconomic environment. In times of crisis, however, it poses considerable challenges, especially for municipally owned companies, given their limited financial resources. This study highlights the need to increase flexibility in the regulatory environment to enhance the resilience of the utility sector. This could include incorporating market-based approaches, enabling companies to adapt more swiftly to economic shocks and shifts in the energy market.

This study proved that Hungarian price regulation among utility companies works well only in times of economic prosperity. In contrast, in times of crisis the state has less resources to support enterprises, making the management system inflexible, and therefore the first hypothesis is accepted. The second hypothesis was also accepted, as the index proved that the sector most affected was district heating.

Additionally, this study proposes that to ensure the sustainability of public services, a regulatory and support structure is required that allows utility companies to achieve financial stability, particularly in crises. This could involve promoting greater use of renewable energy sources and enhancing energy efficiency, which would improve the companies' long-term competitiveness and crisis resilience.

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APPENDIX A

Table A1. Summary of the analysis of variance of the variables under study for the period before and after price regulation

Source: SPSS output.

| Variable | 2006–2013 | | 2014–2022 | |
|--|-----------|------|-----------|------|
| | F | Sig. | F | Sig. |
| EBITDA margin | 6.262 | 0 | 4.874 | 0 |
| Liquidity ratio | 5.098 | 0 | 8.705 | 0 |
| Current ratio | 6.092 | 0 | 6.949 | 0 |
| ROA | 6.346 | 0 | 7.144 | 0 |
| Shareholder Funds (SF) / Total Assets (TA) | 7.109 | 0 | 6.821 | 0 |
| Material Cost (MC) / Sales (S) | 12.066 | 0 | 5.535 | 0 |
| Fixed Assets (FA) / Total Assets (TA) | 6.329 | 0 | 6.948 | 0 |