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Analysis of Market Concentration and Profitability in the Polish Sugar Industry, 1999-2025

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Abstract:

Purpose: *The primary aim of this research is to analyse the degree of market concentration using the Herfindahl-Hirschman Index (HHI) and to evaluate the profitability of sugar production enterprises operating in Poland between 2019 and 2025. Furthermore, the study seeks to verify whether the size of a company's market share constitutes a significant factor differentiating its financial performance.*
Design/Methodology/Approach: *The empirical analysis is based on individual financial data (profit and loss accounts and balance sheets) from the four dominant entities in the Polish sugar sector: Krajowa Grupa Spożywcza, Pfeifer & Langen Polska, Südzucker Polska, and Nordzucker Polska. A panel data approach was employed to capture both cross-sectional differences and changes over time. Market concentration was measured using the HHI based on sales revenues, while profitability was assessed using the Return on Assets (ROA) indicator.*
Findings: *The study confirms that the Polish sugar market operates as an oligopoly with a moderate degree of concentration, with HHI values ranging from 1,459 to 2,286. The panel regression model indicates that market share is not a statistically significant determinant of ROA.*
Practical Implications: *The findings indicate that variations in profitability cannot be explained solely by market share, suggesting that other firm-level determinants may also be significant. Management should consider the sector's high sensitivity to international market conditions and the potential risks associated with further trade liberalisation, such as agreements with Mercosur countries.*
Originality/Value: *This research provides an up-to-date empirical assessment of the relationship between market structure and profitability in a key EU sugar-producing country. It contributes to the existing literature by demonstrating the separation between market power and financial performance in a highly regulated yet volatile agricultural commodity market.*

Keywords: *Sugar industry, market concentration, profitability, Poland*

JEL codes: *L13, L66, G30*
Paper type: *Research article.*

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1. Introduction

The sugar market in Poland is dominated by four enterprises: Krajowa Grupa Spożywcza, Pfeifer&Langen Polska, Südzucker Polska, and Nordzucker Polska. This structure is the result of long-term consolidation and ownership transformation processes that took place both before and after Poland's accession to the European Union (Kapusta, 2023; Hryszko and Szajner, 2023; Smutka *et al.,* 2018).

Following 2004, the sector became subject to the regulations of the Common Agricultural Policy and the common organisation of the sugar market, which required domestic producers to adapt to new competitive conditions (Szajner, 2014). A particularly significant development was the sugar market reform implemented by the European Union between 2006 and 2010, aimed at reducing production surpluses and improving the sector's efficiency.

The reform resulted in the closure of less profitable plants and the concentration of production in modern sugar factories. Consequently, the number of operating sugar factories in Poland decreased substantially, while production levels were maintained through improvements in technological and organisational efficiency.

This process was supported by investments from foreign sugar corporations, which acquired a significant share of domestic production assets. The restructuring process involved the modernisation of production lines, improvements in energy efficiency, and the optimisation of sugar beet supply logistics. At the same time, capital concentration increased, leading to the emergence of strong corporate groups capable of competing in the European market (Vlach *et al.,* 2025).

The abolition of the European Union's production quotas in 2017 represented another major turning point for the sector, increasing the importance of cost competitiveness and effective enterprise management (European Commission, 2017). Under the new market conditions, the ability of enterprises to generate profits and efficiently utilise available resources became particularly important (Hryszko and Szajner, 2023; Kotyza *et al.,* 2019).

Management strategies based on mergers and acquisitions, particularly those undertaken by large European groups such as Südzucker and Nordzucker, enabled companies to benefit from economies of scale. The Polish sugar industry has therefore undergone a transformation from a fragmented sector comprising more than 70 sugar factories in 2001 to only 17 sugar factories operating during the 2025/2026 sugar campaign (Hryszko and Szajner, 2023; Produkcja cukru w Polsce…, 2026).

The financial performance of sugar producers operating in the Polish market is strongly dependent on global supply and demand conditions. Increases in sugar prices on international commodity exchanges directly contribute to higher

profitability. Efficient resource utilisation is also reflected in the management of by-products, such as molasses and beet pulp, which are used in the production of animal feed, ethanol, biogas, and electricity (Hryszko and Szajner, 2023).

The aim of this study is to analyse the degree of concentration in the sugar market using the Herfindahl-Hirschman Index (HHI) and to assess the profitability of sugar-producing enterprises operating in Poland between 2019 and 2025.

In analysing the economic and financial situation of enterprises, profitability ratios play a significant role, as they enable the assessment of operational efficiency and the ability to generate profits. They constitute one of the fundamental tools for evaluating the financial condition of enterprises, as they allow the assessment of how effectively available resources are utilised in the process of achieving financial results.

In the case of sugar producers, the analysis of profitability indicators is particularly valuable, as it enables the evaluation of both the effectiveness of operating activities and the outcomes of restructuring processes undertaken within the sector. The level of profitability achieved by sugar enterprises is determined not only by their internal operational efficiency and ability to optimise costs, but also by external factors, including regulatory changes, market concentration, competitive conditions, and supply and demand developments on the global sugar market.

Consequently, the analysis of profitability indicators enables a comprehensive assessment of the impact of both managerial decisions and market conditions on the financial performance of enterprises operating in the sugar sector.

2. Literature Review

The global sugar market is regarded as one of the most distorted commodity markets due to extensive government intervention in the form of tariffs, import quotas, subsidies, and price support schemes. As a result, a substantial proportion of global sugar production takes place under protected or subsidised pricing conditions, leading to artificially depressed prices on the world market (Hudson, 2019).

Consequently, most sugar-producing countries employ mechanisms designed to protect domestic producers from low world prices, which frequently fail to cover production costs (Chmielewski, 2021; Trejo-Pech *et al.,* 2023; Chmielewski and Szajner, 2025). The importance of such mechanisms is particularly evident in regions characterised by relatively high production costs, where producers' competitiveness depends not only on operational efficiency but also on the prevailing trade and regulatory framework.

In the sugar industry, economies of scale play a crucial role in determining firms' ability to remain competitive and financially viable (Xie *et al.,* 2024). The sector is

highly capital-intensive. Investments in areas such as the modernisation of energy systems, improvements in juice purification processes, and the automation of logistics require substantial financial resources and are economically justified only when production volumes reach a sufficiently large scale.

The findings of Maitahet *et al.* (2024) indicate that sugar supply in the European Union market is determined by the level of sugar production, opening stock levels, raw sugar imports, and sugar beet yields per hectare. Furthermore, their econometric model demonstrates that sugar prices are primarily influenced by their values in the previous period, as well as by changes in economic policy (Maitahet *et al.,* 2024).

Surjanto and Ariefianto (2024) drew upon the concept of rent-seeking behaviour. Using a panel dataset comprising 158 firms from 44 countries over the period 2013-2022, they demonstrated that, within the sugar industry, higher profitability is not always the result of superior operational efficiency but often reflects firms' ability to benefit from government intervention and exert influence over policy-making processes.

The authors identified a positive relationship between cost inefficiency, inefficient asset utilisation, and profitability, a finding that contradicts the traditional assumptions of the theory of the firm. This suggests that firms operating in highly protected markets may maintain high profit margins despite relatively high operating costs and lower levels of resource-use efficiency.

Under such conditions, non-market activities - including lobbying efforts aimed at preserving protective tariffs, subsidies, and preferential regulations - become an important source of competitive advantage.

The study further indicates that larger firms tend to achieve higher profitability, which may stem from their greater capacity to influence economic policy. At the same time, the authors emphasise that high-quality public institutions and effective governance mechanisms constrain rent-seeking behaviour by promoting transparency and increasing the importance of operational efficiency as a source of competitive advantage.

In the long run, however, rent seeking results in inefficient resource allocation, reduced innovation, and diminished competitiveness across the sector. The findings therefore suggest that assessments of profitability in the sugar industry should take into account not only financial indicators and operational efficiency but also the institutional and regulatory environment, which may substantially influence firms' economic performance.

Vlach (2025) formulated the following conclusions regarding profitability and growth dynamics among sugar producers in Central and Eastern Europe:

- Operating profitability (measured, inter alia, by EBITDA) and efficient working capital management are essential for maintaining financial stability.
- Firm size is a key determinant of financial stability owing to economies of scale and strong market positioning. However, large size does not automatically translate into growth potential. Major producers such as Südzucker AG (Germany) and Agrana Zucker GmbH (Austria) exhibit high levels of stability, yet their growth trajectories are constrained by market maturity.
- Smaller firms, such as Pfeifer&Langen Polska S.A., demonstrate greater flexibility and adaptability, enabling them to achieve stronger growth performance and respond more effectively to changing market conditions than larger organisations.
- Poland and the Czech Republic are perceived as dynamic and competitive markets characterised by strong financial fundamentals and considerable growth potential.
- Germany and Austria represent mature markets where strategic priorities focus on consolidation, profitability maintenance, and operational efficiency, with limited opportunities for further expansion.

Hryszko and Szajner (2023) argue that fluctuations in global supply and demand conditions constitute the primary factor determining changes in the financial performance of sugar industry enterprises in Poland. These fluctuations significantly influence sugar prices and, consequently, firms' financial results. By contrast, domestic factors play a relatively limited role, and their impact on the overall condition of the sector is considerably weaker than that of international determinants.

As a result, industry profitability is highly dependent on cyclical changes in the global sugar market, leading to periodic fluctuations in corporate financial performance. The global sugar market is characterised by pronounced cyclical fluctuations, largely resulting from the nature of sugar cane production. The cultivation of sugar cane, the dominant raw material in global sugar production, responds to price changes with a time lag.

Consequently, production decisions taken during periods of high prices lead to increased supply only after a certain period. This creates recurring cycles of oversupply, which depress prices, followed by periods of shortage that contribute to price increases. Climatic factors, including droughts and floods, further affect price volatility by influencing harvest volumes in key producing regions.

As a result, the global sugar market exhibits relatively short cyclical patterns, estimated at approximately two to three years, generating considerable price volatility and market uncertainty (Szajner, 2019). These developments directly affect domestic markets, including the Polish sugar sector, whose financial performance is strongly dependent on global sugar prices. On the world market, sugar is frequently traded at prices below production costs.

This phenomenon results from extensive subsidies provided by numerous countries, which significantly depress world market prices and threaten the profitability of producers operating under market-based conditions (Surjanto and Ariefianto, 2025).

An important factor shaping the future development prospects of the European sugar sector is the ongoing liberalisation of international trade. As noted by Chmielewski and Szajner (2025), the substantial production and export potential of Mercosur countries may significantly increase competitive pressure on European producers.

Greater access for sugar from this region to the European Union market may lead to increased supply, lower prices, and reduced profitability for firms operating under higher production costs. Consequently, maintaining the competitiveness of the European sugar industry will increasingly depend on improvements in production efficiency, cost reduction, and firms' ability to adapt to changing market conditions.

The literature review indicates that the functioning of the sugar sector is determined by a wide range of interrelated factors, encompassing market, regulatory, and institutional conditions. At the same time, the existing literature highlights the need for empirical verification of the extent to which these relationships are present in the Polish sugar market.

Accordingly, the following research hypotheses were formulated concerning market concentration, changes in profitability, and the role of market share as a determinant of firms' financial performance:

H1: The Polish sugar market in the period 2019-2025 was characterised by a high degree of market concentration.
H2: Market share constituted a significant factor differentiating firms' return on assets.
H3: The return on assets of sugar-producing enterprises exhibited significant changes over time, reflecting evolving market conditions in both the domestic and global sugar markets.

3. Research Methodology

Firm-level data used in this study relate to four companies operating in the Polish sugar market and engaged in sugar production: Krajowa Grupa Spożywcza, Pfeifer&Langen Polska, Südzucker Polska, and Nordzucker Polska. The empirical analysis is based on individual financial data obtained from the annual financial statements of these companies for the period 2019-2025, collected from publicly available financial reporting repositories.

These data include income statements and balance sheets, thereby enabling the construction of profitability indicators. A panel data approach was employed to capture both cross-sectional differences between firms and changes over time within

individual enterprises. Panel data methods are widely used because they allow researchers to analyse both inter-firm heterogeneity and temporal variation simultaneously.

To determine the market structure and the degree of market concentration, data on the sales revenues of the analysed companies were utilised. Based on these figures, market shares were calculated for each year covered by the study as the ratio of an individual company's sales revenue to the total sales revenue of all firms included in the sample.

The resulting market shares were subsequently used to calculate the Herfindahl-Hirschman Index (HHI), one of the most commonly applied measures of market concentration. The HHI is a standard concentration measure based on the sum of squared market shares and is widely used in competition and market structure analyses (Peleckis, 2022):

$$HHI = \sum_{i=1}^{n} (s_i)^2 \tag{1}$$

The higher the value of the index, the greater the degree of market concentration. The HHI ranges from close to 0 (in a highly competitive market) to 10,000 (in the case of a pure monopoly) (U.S. Department of Justice and Federal Trade Commission, 2010).

The analysis was based on the Return on Assets (ROA) ratio, which was used as a measure of firms' profitability (Ross *et al.,* 2022):

$$ROA_{it} = \frac{Net\ Income_{it}}{Total\ Assets_{it}} \tag{2}$$

where ROA_{it} denotes the return on assets of firm i in year t, $NetIncome_{it}$ represents the net income of firm i in year t, and $TotalAssets_{it}$ refers the total assets of firm i in year t.

Profitability indicators were calculated on an individual company-year basis, which enabled an analysis of both cross-sectional differences between firms and changes in profitability over time.

To examine whether market share influences firms' profitability, panel data regression models were estimated using observations for four firms over the period 2019-2025. The analysis employed three alternative specifications: pooled ordinary least squares (Pooled OLS), fixed effects (FE), and random effects (RE) models. The general panel data specification is expressed as follows:

$$ROA_{it} = \alpha + \beta MarketShare_{it} + u_i + \lambda_t + \varepsilon_{it} \tag{3}$$

where ROA_{it} denotes the return on assets of firm i in year t,
α is the intercept,
$MarketShare_{it}$ represents the market share of firm i in year t.

The parameter β measures the marginal effect of market share on ROA and constitutes the principal coefficient of interest. The term u_i captures unobserved firm-specific effects that are constant over time, such as managerial practices, organisational culture, or other time-invariant characteristics. The term λ_t represents time-specific effects that are common to all firms, such as macroeconomic conditions or regulatory change affecting the industry each year. Finally, ε_{it} is the idiosyncratic error term, reflecting random shocks and other unobserved factors that vary across both firms and time.

4. Research Results and Discussion

Sugar production in the European Union reaches approximately 15-16 million tonnes per year. Poland is one of the key sugar producers in the European Union, ranking third after France and Germany (Sugar market observatory, 2026). The annual sugar output in Poland averages between 2.0 and 2.5 million tonnes, while domestic sugar demand is estimated at approximately 1.7 million tonnes per year. The surplus production is directed towards export markets (Kapusta, 2023; Polish sugar…, 2026).

Based on the market shares presented in Table 1, it can be concluded that the Polish sugar market in the period 2019-2025 was characterised by a moderate level of concentration and a clear dominance of a single enterprise. The market leader, Krajowa Grupa Spożywcza, accounted for around 40% of the domestic sugar market.

Table 1. *Market shares of firms (2019-2025).*

	2019	2020	2021	2022	2023	2024	2025
Südzucker Polska	20.4%	16.8%	15.5%	13.7%	12.9%	17.0%	18.6%
Nordzucker Polska	11.6%	10.7%	10.0%	9.6%	8.9%	12.3%	13.3%
Pfeifer&Langen Polska	29.8%	32.2%	32.6%	32.1%	30.3%	27.6%	25.5%
Krajowa Grupa Spożywcza	38.2%	40.3%	41.9%	44.6%	47.7%	43.1%	42.6%

Source: *Author's calculations.*

During the analysed period, only minor changes in market shares were observed. The values of the Herfindahl-Hirschman Index (HHI) ranged from 1,620 to 2,286 (Table 2). The results obtained confirm the oligopolistic nature of the sugar industry in Poland, where sugar production is concentrated among four enterprises: Krajowa Grupa Spożywcza, Pfeifer&Langen Polska, Südzucker Polska, and Nordzucker Polska.

The observed fluctuations in HHI values reflect changes in the market shares of individual producers; however, they do not indicate a significant change in the market structure, which remained concentrated throughout the analysed period.

Table 2. *Herfindahl-Hirschman Index (2019-2025).*

	2019	2020	2021	2022	2023	2024	2025
HHI	1.459 competitive market	1.620 moderately concentrated market	1.754 moderately concentrated market	1.992 moderately concentrated market	2.286 moderately concentrated market	1.854 moderately concentrated market	1.814 moderately concentrated market

Source: *Author's calculations.*

The research conducted enabled the positive verification of all formulated research hypotheses. Hypothesis H1 was partially confirmed, as the analysis of concentration indicators demonstrated that the Polish sugar market in the period 2019-2025 was characterised by a moderate level of concentration (U.S. Department of Justice and Federal Trade Commission, 2010). This finding is consistent with the specific characteristics of the domestic sugar sector, in which production activities are carried out by a limited number of large enterprises controlling a substantial share of the market.

The Return on Assets (ROA) indicators were calculated individually for each company and for each year covered by the study (Table 3), enabling an assessment of the differentiation in financial performance among enterprises operating in the Polish sugar market. The obtained values of the indicators demonstrate the ability of sugar sector enterprises to maintain positive profitability over an extended period despite changing market conditions.

The analysis of the calculated profitability indicators reveals differences in financial performance among the examined enterprises. The highest average ROA over the analysed period (8.2%) was recorded by Pfeifer&Langen Polska, which may support the conclusions of Vlach (2025) regarding the greater flexibility and adaptive capacity of smaller entities compared with the largest market players in the European Union (such as Südzucker, Tereos, and Nordzucker).

Table 3. *ROA values (2019-2025)*

	2019	2020	2021	2022	2023	2024	2025	Mean
Südzucker Polska	-2.8%	2.3%	1.1%	4.7%	10.0%	9.0%	-0.1%	3.5%
Nordzucker Polska	3.2%	3.2%	5.6%	6.8%	2.6%	3.0%	-2.9%	3.1%
Pfeifer&Langen Polska	6.1%	8.6%	8.8%	11.7%	14.2%	8.6%	-0.6%	8.2%
Krajowa Grupa Spożywcza	-0.5%	3.4%	2.7%	6.1%	6.7%	2.9%	-4.9%	2.3%

Source: *Author's calculations.*

To determine the most appropriate panel data specification, Pooled OLS, Fixed Effects (FE), and Random Effects (RE) models were estimated (Table 4). The F-test

for individual effects failed to reject the null hypothesis of common intercepts across entities (p=0.065), indicating that the FE model does not provide a significant improvement over the pooled specification. The Breusch-Pagan Lagrange Multiplier test likewise failed to reject the null hypothesis of no random effects (p=0.200).

In addition, the Hausman test showed no systematic differences between the FE and RE estimators (p=0.788). Consequently, the Pooled OLS model was considered the most appropriate specification. The estimated coefficient for the variable MarketShare was not statistically significant, suggesting that it has no significant impact on ROA (p=0.792). Therefore, hypothesis H2 was not supported.

Table 4. *Estimation results of panel data models*

	Model 1 (Pooled OLS)		Model 2 (FE)		Model 3 (RE)	
	coefficient	p-value	coefficient	p-value	coefficient	p-value
const	0.038	0.063	0.016	0.854	0.036	0.293
MarketShare	0.019	0.792	0.108	0.754	0.027	0.820

Source: *Authors' calculations.*

The financial condition of enterprises operating in the sugar industry in Poland is characterised by considerable variability over time. Hypothesis H3 was confirmed. The analysis of profitability indicators revealed significant changes in their levels during the period 2019-2025, reflecting the impact of changing market conditions, including fluctuations in sugar prices, production costs, supply and demand conditions, and developments occurring in both the domestic and global sugar markets.

The results presented in Table 3 confirm the observations of Hryszko and Szajner (2023) and Maitah *et al.* (2024). Domestic production has consistently exceeded internal demand, generating surpluses that are directed towards foreign markets, primarily within the European Union.

This export surplus means that the financial performance of sugar producers in Poland is significantly dependent on conditions prevailing in global markets, including international sugar prices and export competition. The decline in profitability in 2025 can be interpreted because of deteriorating market conditions in the sugar sector. Since 2024, the global sugar market has experienced a noticeable decline in prices, resulting from increased supply and a persistent production surplus.

5. Conclusions

The Polish sugar market has an oligopolistic structure, dominated by four entities: Krajowa Grupa Spożywcza, Pfeifer&Langen Polska, Südzucker Polska, and Nordzucker Polska. The market is characterised by a moderate level of

concentration, with a clear dominance of the market leader, Krajowa Grupa Spożywcza, whose market share exceeded 40%.

The analysis of panel data models demonstrated that market share size is not a statistically significant determinant of the level of return on assets among the analysed enterprises. This suggests that, under the conditions of the Polish oligopoly, other factors, such as operational efficiency, cost management, and external market conditions, play a more important role in generating profits than the scale of market share itself.

The sugar sector in Poland demonstrates a strong dependence on cyclical fluctuations in global sugar prices and supply-demand relationships. The year 2025 brought a significant deterioration in the financial performance of all analysed companies, which was directly associated with increased global supply and declining sugar prices on international commodity markets. Despite overall market volatility, enterprises demonstrated the ability to maintain positive profitability over the long term.

Poland remains one of the key sugar producers in the European Union, generating export surpluses. However, progressing trade liberalisation (e.g., agreements with Mercosur countries) and the high capital intensity of the sector require further improvements in production efficiency and cost optimisation.

Unequal environmental and social standards may significantly affect competition in the European Union sugar market. Producers operating in countries with less stringent environmental regulations or labour standards may incur lower production costs, giving them a competitive advantage over enterprises operating under more demanding regulatory frameworks. Such differences may contribute to distortions of fair competition within the EU Single Market.

The future condition of the sugar sector will be determined not only by strategic decisions made by individual enterprises, but also by the direction of EU regulatory policy, the degree of harmonisation of environmental and social standards, and the industry's ability to adapt to changing competitive conditions and global price fluctuations.

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