

# The relation of operating costs and the economic productivity of assets according to the type and scale of activity in food enterprises

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**Abstract:** The aim of the study is to determine the relation of operating costs to revenues from operating activities and economic productivity of assets depending on the type and scale of companies' activity in the food sector. The research was carried out using the indicator of the level of operating costs to operating income, as well as the indicator of economic productivity of resources, measured by the ratio of operating result to average annual assets. The research included 175 companies of Polish food sector with revenues exceeding EUR 5 million per year from 2009 to 2017. It was found that at the operational level, the ratio of costs to revenues depended on the type of activity of the enterprise and raised with the increase in its scale. The dependence of the economic productivity of assets on the ratio of operating costs to operating income decreased along with the increase in the scale of the company's operation. It was also noted that the level of operating costs did not independently affect the size of the economic productivity of assets of food sector enterprises.

**Keywords:** economic productivity, cost efficiency, operating return on assets, resource allocation

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## 1. Introduction

While considering productivity of resources in the analysis of the efficiency of the overall level of business management, the operating cost ratio and the ratio of the productivity of resources (asset turnover) are taken into account (Wędzki, 2015). At the same time, it is believed that the level of operating costs is a factor that has a significant impact on the economics of a company. In the study by Runowski (2008) in the agricultural sector operating costs accounted for more than 97% of total costs, and 96% in the food sector in the study by Wasilewski and Stolarski (2018). Additionally, Runowski (2008) noted that the value of total income was positively correlated with the value of total assets. It is assumed that with increasing volumes of production the scale effect, manifested in a re-

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duction of manufacturing costs, occurs (Wędzki, 2015). These factors should have a positive impact on the companies' productivity. At the same time, the level of costs in income depends only to some extent on the scale of the company's operations. An increase of the production scale is assumed to be beneficial up to a certain point, regardless of the price relationships, but the determination of the optimal scale ultimately requires the consideration of product and input prices (Rutkowska, 2013). Researchers and practitioners have pointed out that the level of resource productivity, and hence economic efficiency, does not depend solely on the level of costs, but also on their structure and relationships (Koopmans, 1951; Farrell, 1957; Coelli, Rao and Battese, 1998). Considering the proportion of costs of production factors may affect the non-linearity of the relationship between the economic productivity of assets and the level of operating costs of enterprises grouped according to the criterion of the type or scale of the enterprise's activity.

Due to the scope of the article, the consideration concerns a part of the management accounting, including relations of costs and the operating return of assets. The analysis of the output of many authors, as well as empirical research with inferential statistics were used as research tools. Empirical research was carried out on the example of Polish food production companies, characterized by similar production technologies. Technical and organizational similarities are a necessary condition to compare productivity and economic efficiency (Farrell, 1957; Szudy, 2014).

The aim of the study is to determine the relationship between the level of operating costs in operating income, and the economic productivity of assets, measured by the operating return of assets, depending on the type and scale of activity of companies in the food sector in Poland.

The formulated research objective was operationalized by wording the following hypotheses:

1. The ratio of operating costs to operating income of companies with similar technologies depends on the type of activity (by raw material), and does not decrease linearly with the increase in the scale of the companies.
2. The economic productivity of companies' resources does not have a linear relationship with the level of operating costs to operating income.

The theoretical justification of the research hypotheses results from the assumption that the relation of operating costs to operating income and the economic productivity of assets are relative in nature, referring to the relation between the operating result and the value of the company's assets, as well as operating income and the costs of the resources used. The undertaken research has made it possible to discover the regularities occurring in the relationship between costs and economic productivity, depending on the specific characteristics of enterprises, such as the scale of their income and the type of activity defined by the type of raw materials and products.

## **2. Operating costs and the economic productivity of assets**

Costs are widely recognized as one of the most important synthetic measures characterizing the economy in an enterprise. While being a financial burden, they allow for income to be generated. They are a consequence of the use of resources for the economic activity of

the company and, in conjunction with income, have an impact on the enterprise economic productivity. In an economic context, productivity refers to the way in which resources are allocated to different competing activities, expressing the input-output relationships of a production process in monetary terms. The economic productivity of resources allows to compare the measurement of input and output values, regardless of their type (Tangen, 2005). The Profit and Loss Account (P&L), according to the Accounting Act of 29 September 1994 (PL Journal of Laws of 2018, items 395, 398, 650, 1629), provides standardized information on costs and income that can be understood by users of financial statements. Together with the data on assets and liabilities, and additional information included in the financial statements, it makes it possible to measure and compare the economic productivity of the organization. The management of a company's economic productivity in the long term is mainly related to income and cost management. Cost management consists of making and execution of decisions based on the ability to select the type of resources, determine the amount of outlays, and organize the company, processes and operations to achieve a competitive advantage and meet strategic objectives. Decisions, together with the resulting actions, generate costs, income and results (Szychta, 2012). It is assumed that the management of a company's costs and assets has a decisive impact on the level of achieved results (Nowak, 2015). It is believed that even a relatively small costs reduction can have a significant impact on profit and productivity growth in the short term. This is due to the belief that costs are entirely under the control of the management of the enterprise (Bragg, 2010). Studies of the ratio of the levels of cost of resources consumed to income of food companies in 2009–2015 indicated a trend of a slight increase in the ratio of total costs to income by 2.9 percentage points (p.p.) per year, despite the decrease in the total level of costs of materials and energy, external services and labour in income by 1.3 p.p. per year (Wasilewski and Stolarski, 2018). The research carried out by Dynowska (2012) indicated that the cost analysis, including productivity studies, plays a major role in determining the factors affecting a company's levels of cost.

Measures of a company's productivity can be defined in various ways, depending on the connection to specific income, capital, assets or total assets. Profitability ratios can be used to assess a company and the management's ability to gain profit from the resources involved in the activity (Wasilewski and Gałecka, 2010). Often, in addition to net profit, return on sales, return on assets, return on capital, and value added are used as measures of productivity (Adamczyk, 2008). Financial ratios can be used to synthetically characterize various economic aspects of the economic activity (Nowak, 2016).

Practically, managers strive for financial and economic efficiency, focusing on managing costs, achieving the highest possible volume of sales, profit or goodwill. In some types of companies, e.g. cooperatives, found in the food manufacturing sector, the profit category may be set aside and replaced by another factor, e.g. maximization of added value (Wasilewska and Wasilewski, 2016). Economic trends affect changes in levels of cost and the relationships between costs and a company's economic productivity.

Cost management is conducted in every type of business model and applied accounting model (Kalinowska, 2012). Comprehensive cost management as one of the concepts of strategic enterprise management includes activities aimed at improving the efficiency of resource use (Sobańska, 2009). Based on the analysis of the relationship between cost leadership strat-

egies and the value of a company's equity, Kosiń (2011) identifies cost inertia. It manifests itself in the autocorrelation of data related to cost. The use of the data for management purposes requires a close link between costs and other variables describing a company's activity. Combining the measurement of these variables with costs is intended to reliably demonstrate the cause and effect relationships that exist between the decisions, actions and conditions of an entity's operation and the value of costs (Łada, 2014). Such a background encourages to explore the possibility of controlling costs as an indicator of financial efficiency and productivity (Thomas and Shughard, 2013).

The cost management system should be directed at increasing the efficiency of the incurred costs. This requires the integration of measuring and calculating costs with controlling the efficiency of the company's processes. Strategic decisions typically engage the company to incur costs over the long term, influencing their level and structure (Nowak, 2006). One of the most important tasks of strategic cost analysis is to determine the dependence of total costs on the scale of operations, determining the amount of involvement of specific factors of production and sales, directly reflected in the level of total costs (Nowak, 2006). A broad comparison of costs allows for a more complete and thorough consideration of the costs of the analyzed period, to establish trends of change and to assess their regularity (Gabrusewicz, 2014). The development of costs in a company can be related to the cost policy applied in a given reporting period (Dury, 1998). At the same time Wędzki (2015) lists as internal quantitative factors affecting the financial position of companies: the value of income and costs, the level and structure of assets, the nature and structure of financing.

### 3. Testing methods

The empirical research was conducted on the financial data of 175 companies in the Polish food production sector publishing financial statements in the National Court Register. The research objects were deliberately selected due to: their similar technologies and organization of raw material processing according to the Polish Classification of Activities (PKD), the markets on which they have operated and the way in which the results were presented in the comparative variant of the profit and loss account (P&L). These companies accounted for around 50% of all companies in the PKD classes 10.11; 10.12; 10.13 and 10.51, which have maintained continuity in the publication of financial data for the period 2009–2017. This number of years is considered to be the optimal period for research using cross-sectional and tidal data, as the phenomenon of "data ageing" is avoided (Dańska-Borsiak, 2011). The financial data for the period 2009–2017 enable the measurement of cost effectiveness based on the dynamic relationship of the operating profitability of assets with the operating cost level indicator.

In the PKD class 10.51, cooperative dairy companies were selected and grouped, which, despite the technical and organizational similarity of the way raw materials are processed, have a different business purpose function than commercial companies. Profit is not the main objective of dairy cooperatives (Ganc and Wasilewski, 2018). The study determined the impact of this difference on economic productivity and cost relations.

Among the source data, data from abnormal observations deviating from existing regularities were identified using GRETL<sup>1</sup> statistical software, following the methodology presented by Hamulczuk and Stańko (2013). Indicated incorrect data were characterized as distortions of accounting entries in the profit and loss accounts and the balance sheet. The source data were transformed into cost and result indicators, respectively. Based on the indicators, 1,575 balanced micro panels of cross-time data were created, following the methodology outlined by Baltagi (2013). Indicators, expressed in percentages, have been used in order to provide a uniform way of researching economic productivity, represented by the operating return of assets and the connected cost relationships, according to the type of activity and scale of companies measured by the value of their operating income, which is the sum of sales revenue and other operating income.

For the purposes of the research, companies were grouped according to two criteria, i.e. type of activity (PKD classes) and value of income. Grouping by scale of activity, measured by value of income, was carried out using the quartiles method, where a  $q$ -quantile in a population is such a number  $xq$  that  $q \times 100\%$  of the elements of this population have a value of the studied feature not greater than  $xq$ , where  $q$  ( $0 < q < 1$ ). The grouping and names of the groups of companies are presented in Table 1. Particular groups of companies according to types of activity (PKD classes) have been marked with abbreviated names connected with their characteristic types of raw materials and products.

Table 1. List of researched companies according to grouping criteria

No.	Grouping criterion		Company groups				
1.	PKD classes	Scope of PKD	10.11; 10.12; 10.13; 10.51	10.11	PKD 10.12	PKD 10.13	PKD 10.51
		Name	<i>Food sector</i>	<i>Red meat</i>	<i>White meat</i>	<i>Meat and vegetables</i>	<i>Milk</i>
		Number of objects	175	55	40	34	46
2.	Total revenues	The scope of PLN million	19÷3089	19÷55	56÷94	95÷215	216÷3089
		Name	<i>Food sector</i>	<i>Smallest</i>	<i>Average</i>	<i>Above-average</i>	<i>Biggest</i>
		Number of objects	175	44	44	43	44

Source: Authors' own elaboration.

The research included an analysis of the relationship between the economic performance of the enterprise and the relationship between the level of operating costs and operating revenues. The economic result was represented by operating return on assets (OROA), which was taken as the response variable. The size of OROA was calculated according to the following formula:

<sup>1</sup> Open source (free) GRETL (GNU Regression Econometric and Time-series Library) software of advanced numerical econometric methods, available at [www.gretl.sourceforge.net](http://www.gretl.sourceforge.net).

$$OROA = \frac{\text{Operating result} \times 100}{\text{Average annual assets}^2} (\%) \quad (1)$$

The operating return on assets informs about the efficiency of the management of the company's operations, including the costs of consumption of various types of resources available to the company's managers. OROA is an indicator that is easy to understand and analyze. The operating cost level index was chosen as the response variable, which expresses the ratio of operating costs to operating income, denoted by X1 and determined by the formula:

$$X1 = \frac{\text{Operating costs} \times 100}{\text{Operating income}} (\%) \quad (2)$$

Analyses were conducted on mean values from descriptive statistics of panel data (cross-sectional and tidal) of financial indicators of researched companies. Descriptive statistics were obtained using GRETL statistical software.

The research considered the specificity of the analyzed economic phenomena, which, in addition to correlation, also include autocorrelation of all variables. It was significant that panel data were analyzed. The essence of the study was to search for the degree of dependence of cost efficiency according to the criterion of economic productiveness of assets in relation to the type and scale of operations of the surveyed enterprises. In order to select a method for the measurement of cost and economic productivity relationships and interpretation of their results, the statistical characteristics of the empirical data collected were examined. The Lagrange multiplier test showed non-linearity in the regression of the panel data studied, while the Durbin-Watson statistic confirmed the autocorrelation of the variables. Residual heteroscedasticity was identified by White's test. This ruled out the possibility of using classical correlation methods of measuring the relation between the operating cost index and the operating profitability index. Due to the nature of empirical data and the selection of pre-determined variables correlated with each other, for the needs of research and inference, the method of zero-order partial correlation was chosen (total correlation) (Balicki, 2013). Cost relationships with economic productivity were measured by the analyses of correlation conducted in GRETL software. In the study of the total correlation of panel variables there are very low coefficients of determination  $R^2$  (Górecki, 2010). Hence, the statistical significance of the total correlation coefficients, in the case of a low coefficient of determination  $R^2$ , was tested and confirmed by the Fisher-Snedecor statistics (F).

#### 4. Results and their analysis

The dynamic relationships of the operating cost level indicators with the operating return on assets ratio of the researched companies were examined. Table 2 presents the average values of the operating cost level index (X1) and the operating return on assets index (OROA), as well as the correlation of these indicators in food companies grouped by type of activity in the years 2009–2017. The average value of the ratio of the level of operating costs to operating income of researched companies in the years 2009–2017 was 98.6%. The lowest level of operating cost ratio (96.3%) was recorded in the group of meat and vegetable processing companies, while the

highest (101.9%) in the group of dairy industry companies. Groups of red meat and white meat processing companies had similar values, at 97.9% and 97.8%, respectively.

The average operating return on assets (OROA) recorded among the researched companies was 8.3%. The highest level, with average of 11.1%, achieved the red meat processing group of companies. In the meat and vegetable processing group, this parameter amounts to an average of 10%. Despite the fact that in this group of companies the level of operating costs was the lowest, the value of the highest indicator of operating return of assets among the researched companies was not obtained. This may have been influenced by the different average annual asset value, in favour of meat and vegetable processing companies.

Table 2. Total correlation coefficient of the ratios of operating costs to operating income (%) and operating return on assets (%) of food industry companies grouped by activity (PKD class) (average figures)

Variable	Grouping of companies by type of processing				
	<i>Red meat</i>	<i>White meat</i>	<i>Meat and vegetables</i>	<i>Milk</i>	<i>Total</i>
<b>Operating cost index (X1)</b>	97.9	97.8	96.3	101.9	98.6
<b>Operating return on assets ratio (OROA)</b>	11.1	8.9	10.0	3.2**)	8.3
<b>Correlation X1 with operating return on assets (OROA)</b>	-0.32	-0.63	-0.73	-0.22	-0.44
<i>p</i>	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Sample size<sup>*)</sup> (n)</b>	495	360	306	414	1575

\*) Sample size—the product of the number of measurements from each year of the research and the objects in the group (balanced micro panels).

\*\*\*) OROA adjusted by contributions of cooperative members (milk suppliers) to the members' fund.

Legend: if  $p < 0.05$  is a statistically significant coefficient, the assumed significance level and the H0 hypothesis verification condition:  $\alpha = 0.05$ .

Source: Authors' own elaboration.

The white meat processing group of companies achieved an OROA of 8.9%. The operating return of assets in the group of white meat processing companies was lower by 2.2 p.p. than the operating return of assets in the group of red meat processing companies, with a difference in the average level of operating costs of only 0.1 p.p. In this case, the difference in the value of the operating return on assets ratio may also have been influenced by the significant differentiation in the average annual value of assets. The lowest average value of the operating return on assets ratio (3.2%) was obtained in the group of dairy industry companies. This ratio was positive, despite recording a ratio of operating costs to operating income amounting to 101.9%. The positive value of the operating return of assets in the group of dairy industry companies, despite the index of the level of oppressive costs, is the result of the method of accounting for payments made by cooperative members to the members' fund. These payments, as deductions from the cooperative members' due remuneration for the milk delivered, create an additional cash surplus, supplementing the profit of the cooperative (Wa-

silewski and Dworniak, 2007). These contributions adjust the value of the OROA, and thus increase the ratio.

In companies grouped by type of activity, a negative linear dependence of the operating return of assets on the value of the level of operating costs index was found. The higher the value of the ratio of the level of operating costs to operating income, the lower the absolute value of its correlation coefficient with the operating return on assets ratio. It can be assumed that the obtained average values of the operating return of assets indicator in the groups of companies processing meat and vegetables, red meat and white meat were influenced by the average annual state of assets the managers of companies from these groups had at their disposal.

The data on the correlation of the ratio of the level of operating costs in operating income with the ratio of the operating return on assets are characterized by a great diversity of values, depending on the type of activity of the company. All of the obtained correlation coefficients were negative. The results of the cost relationship studies indicate, different in each group of companies, dependence of the operating return of assets on the share of operating costs in operating income, proportionally to the value of the correlation coefficient. The highest negative correlation of  $-0.73$  was recorded in the group of meat and vegetable processing companies. A correlation level of  $-0.63$  was obtained in the white meat processing group. A significantly lower value of negative correlation was observed in the red meat processing group ( $-0.32$ ) and the lowest—in the dairy industry group ( $-0.22$ ). Across all of the groups of researched companies, the average correlation coefficient amounted to  $-0.44$ . This means that in the food sector, a reduction in the ratio of operating costs to operating income by an average of 1 p.p. will increase the operating return on assets by only 0.44 p.p. The obtained correlation coefficients indicate that the economic efficiency of resource used by companies varies depending on the type of activity. In the period in question, assets were used the least efficiently in the group of dairy industry companies. In this group, a reduction of the share of operating costs in operating income by an average of 1 p.p. allowed for obtaining of an increase in the operating return on assets of only 0.22 p.p. on average. Correspondingly, in the group of red meat processing companies, a reduction of the share of operating costs in operating income by 1 p.p. on average increased the operating return of assets by 0.32 p.p., in the white meat processing group by 0.63 p.p., and in the meat and vegetable processing group by 0.73 p.p. Hence, the group of meat and vegetable processing companies was characterized by the strongest relationship between the operating cost ratio and the operating return on assets. This demonstrates the best use of assets to create an operating result and the waste-free management taking place in the group of meat and vegetable processing companies.

Table 3 presents data showing the average values of the level of operating costs (X1), the indicators of operating return on assets (OROA) and the linear correlation of these indicators in companies of the food sector, grouped by scale of activity, in the years 2009–2017. The average value of the operating costs ratio in the sector was 98.6%. As the scale of a company's operations increased, the ratio of the level of operating costs to operating income increased as well, from the lowest average value recorded in the group of companies with the smallest income, where the ratio was 97.6%, through 98.9% in the group of companies with average income to the highest value of the ratio (99.5%), found in the group of companies with above-average income.



Table 3. Total correlation coefficient of the ratio of operating costs to operating income (%) and operating return on assets (%) of food industry companies grouped by the value of revenues (PLN million) (average figures)

Variable	Grouping of companies by value of revenues				
	<i>Smallest</i>	<i>Average</i>	<i>Above-average</i>	<i>Biggest</i>	<i>Food sector</i>
<b>Level of operating costs (X1)</b>	97.6	98.9	99.5	98.4	98.6
<b>Operating return on assets ratio</b>	9.1	9.5	7.7	6.9	8.3
<b>Correlation of X1 and operating return on assets</b>	-0.8	-0.45	-0.1	-0.43	-0.44
<i>p</i>	0.0000	0.0000	0.0000	0.0000	0.0000
<b>Sample number</b>	396	396	387	396	1575

Legend: if  $p < 0.05$  is a statistically significant coefficient, the assumed significance level and the H0 hypothesis verification condition:  $\alpha = 0.05$ .

S o u r c e: Authors' own elaboration.

Subsequently, the share of operating costs in operating income decreased to 98.4% in the group of companies with the highest income. The results indicate that there is no positive influence of the scale effect on the reduction of the level of operating costs in operating income. The analysis of the cost indicators changes in relation to the scale of activity of the researched companies pointed to the increase in the level of the operating cost index as the value of the grouping criterion increased. It was possible that companies with the smallest income achieved a relatively low ratio of operating costs to total operating income, thanks to their ability to use a targeting strategy<sup>2</sup>, including their own distribution on local markets (Wasilewski and Stolarski, 2018).

Trends in shaping of the level of the operating return on assets ratio in individual groups of companies according to the criterion of the income value can be assumed to be uniform, taking into account that these ratios in groups of companies with the smallest and average income slightly differed in value (9.1% and 9.5%, respectively), being larger than the operating return on assets ratios in the remaining groups of companies, according to this grouping criterion. The level of the OROA decreased linearly from the highest value in the group of companies with average income (9.5%), through the group with above-average income (7.7%) to the lowest average value (6.9%) in the group of companies with the highest income. The average value of the operating return on assets for the food sector was 8.3%. The group with the highest income had the lowest level of the operating return on assets ratio, despite the fact that this group had an operating cost ratio similar to the average of all of the researched companies. This may indicate a less economically efficient use of available resources in this group of companies. The fact that companies in the group with the highest average income have the highest average operating return on assets indicates that the managers of these companies

<sup>2</sup> A targeting strategy refers to matching multiple types of products and services to local markets and/or narrow customer segments defined by their specific benefits, increasing customer value.

have taken advantage of the opportunity to adapt products and distribution to local markets and obtain higher margins. Misiólek (2013) and Gorzelany-Dziadkowiec (2013) pointed to this strategy of operations and its favourable impact on economic results. The lower average values of the OROA in the group of companies with above-average and highest income may have been caused by the existence of price competition in these groups and the need to cooperate with corporate retail chains, which impose stock and prices on their suppliers. Misiólek (2013) highlighted the significant reduction in margins resulting from the practices of commercial corporations. When considering scale economy in relation to the economic results of the company, the research showed that there was no tendency for the volume of operating return on assets to be stimulated by the increase in the volume of operating income.

In the case of the correlation study of the indicator of the level of operating costs in operating income with the indicator of operating return of assets of companies grouped according to the criterion of income value, a linear negative dependence of this correlation on the grouping criterion was observed. A linear negative dependence was also observed between the absolute value of the correlation coefficient and the level of the ratio of operating costs to operating income. As the scale of the company's operations increased, the dependence of the operating return of assets on the ratio of operating costs to operating income decreased, despite the fact that the value of this ratio increased according to the grouping criterion. In the group of companies with the highest income, the correlation coefficient was close to the average of all of the researched companies. It amounted to, respectively,  $-0.43$ , with an average in the food sector of  $-0.44$ . In terms of value, the highest negative correlation coefficient of  $-0.8$  was noted in the group of companies with the smallest income and the lowest—in the group of companies with above-average income ( $-0.1$ ). The obtained values of the correlation coefficients of the level of operating costs in operating income with the operating return of assets ratios of companies, grouped according to the scale of their activity, indicate that the decrease of the ratio of level of operating costs in operating income by 1 p.p. on average in the group of companies with the smallest income makes it possible to increase the operating return of assets by 0.8 p.p. on average. This means that by reducing the level of operating costs in operating income from an average value of 97.6% to 96.6% it was possible to obtain the operating return of assets from 9.1% to 9.9% on average. The obtained values of correlation coefficients indicate that the operating return on assets is the least dependent on the relation between the level of operating costs and operating income in the group of companies with above-average income, despite the fact that this group is characterized by the highest ratio of operating costs to operating income. This demonstrates the excessive value of assets used to generate operating income and operating result.

In both types of grouping of companies, both by type and scale of the conducted activity, no positive linear correlation was observed between operating return of assets and the ratio of the level of operating costs to operating income. Analysis of the results obtained in the research concerning the relationships indicates that the level of operating costs does not independently affect the operating return on assets. The greater the ratio of operating costs to operating income, the lower the strength of the dependence between the operating return on assets and the value of this ratio. In addition, among companies grouped according to the criterion of the type of raw material used, at similar values of operating cost indices in the

groups of companies processing red meat and white meat (97.9% and 97.8%, respectively), the operating return on assets was obtained at the level of 11.1% and 8.9%, respectively. At the same time, the correlation between the operating return on assets and the ratio of the level of operating costs to operating income was found to be two times lower, with values of  $-0.32$  and  $-0.63$ , respectively. In companies grouped by revenue value, it was observed that in the group with the smallest and average income, having small differences in the size of the operating return on assets ratios, i.e. 9.1% and 9.5%, respectively, the correlation coefficients of the operating return on assets ratios with the ratios of the level of operating costs in operating income were substantially different, amounting to  $-0.8$  and  $-0.45$ , respectively. The results obtained indicate the existence of additional factors influencing the operating return on assets, apart from the value of the ratio of the level of operating costs to operating income.

## 5. Summary

On the basis of the study of the relationship between the level of operating costs and the economic productivity of assets depending on the type and scale of activity of companies in the food sector, the following conclusions were drawn:

1. The average economic productivity of assets, determined by the operating profitability of companies in the food sector, depended on the ratio of the level of operating costs to operating income only in 44% (correlation  $-0.44$ ).
2. In companies grouped by type of activity, it was noted that the smaller the ratio of the level of operating costs to operating income, the greater the linear dependence of the operating return on assets on this ratio. This indicates the best match between the average annual value of assets and the generated value of operating income is present in companies with the largest average absolute values of the correlation coefficient module.
3. Companies with similar production technologies (*red meat*, *white meat*) had comparable levels of operating costs in income, and different operating returns on assets. This indicates a significant difference in proportions of average annual operating results to assets, despite similar levels of operating costs in operating income.
4. In companies grouped by scale of operations, there was a linear increase in the average level of operating costs along with the expand of the scale of operations. This may indicate that the costs of coordinating activities increase along with the increase of the scale of the company's operations or reduced resource allocation efficiency. It was stated that the economic productivity of assets decreased as the scale of income increased.
5. The economic productivity of assets was characterized by a negative linear correlation with the indicator of the ratio of operating costs to operating income, decreasing with the increase of this indicator, depending on the type and scale of activity of food companies.

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## Rodzaj i skala działalności a relacje produktywności ekonomicznej aktywów z poziomem kosztów operacyjnych przedsiębiorstw sektora spożywczego

**Abstrakt:** Celem opracowania jest określenie relacji kosztów operacyjnych do przychodów z działalności operacyjnej oraz produktywności ekonomicznej aktywów w zależności od rodzaju i skali działalności przedsiębiorstw sektora spożywczego. Badania przeprowadzono z wykorzystaniem wskaźnika relacji poziomu

kosztów operacyjnych do przychodów z działalności operacyjnej oraz wskaźnika produktywności ekonomicznej zasobów, określonego relacją wyniku operacyjnego do średniorocznego stanu aktywów. Badaniami objęto 175 przedsiębiorstw polskiego sektora spożywczego o przychodach powyżej 5 milionów euro rocz-

nie w latach 2009–2017. Stwierdzono, że na poziomie operacyjnym relacja kosztów do przychodów zależała od rodzaju działalności przedsiębiorstwa i zwiększała się wraz ze wzrostem jej skali. Zależność produktywności ekonomicznej aktywów od relacji kosztów operacyjnych do przychodów z działalności operacyjnej

zmniejszała się wraz ze wzrostem skali funkcjonowania przedsiębiorstwa. Odnotowano także, że poziom kosztów operacyjnych nie wpływał samodzielnie na wielkość produktywności ekonomicznej aktywów przedsiębiorstw sektora spożywczego.

**Słowa kluczowe:** produktywność ekonomiczna, efektywność kosztowa, rentowność operacyjna aktywów, alokacja zasobów

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