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Efficiency of Use Fixed Assets in the Context of Profitability – Empirical Evidence of Food Industry Enterprises in Visegrad Group

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Abstract

Efficient use of production resources in enterprises is necessary for increasing their competitiveness and the potential for their future development. In today's global world, companies are forced to invest in new technologies that are both more energy-efficient and more environmentally friendly, including in the food industry. The paper focusses on the efficiency of production factors in relation to their economic success. The aim is to find possible variants of the development of the links between capital labour ratio and labour productivity in relation to the development of profitability of returns. Empirical analysis coved 2,526 enterprises in food industry in four examined European countries (Visegrad group -V4) - Czech Republic, Hungary, Poland, Slovak Republic. The contribution of the paper is the generalization of the links between the indicators of the efficiency of production factors in the form of recommended inequalities that can be used by enterprises for economically successful development..

Keywords

Food industry, profitability, labour productivity, capital labour ratio.

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Introduction

The covid crisis, followed by the energy and security crises, caused shortages in the production factors of labour and capital, which leads to a reduction in the potential and production capacity of some firms in the food industry and may, in many cases, lead to postponement of investments. At the same time, changes in climate policy are triggering a reorientation of firms towards a low-emission economy, i.e., firms adapting to various regulatory constraints, investing in "green technologies", developing digital infrastructure, and managing resources more efficiently. The desire and need to pursue intensive growth over extensive growth is coming. Thus, assess the relationship between capital intensity and labour productivity of enterprises. The food industry today is also significantly influenced by the situation in agriculture and its shift towards organic farming and the increasing demand for organic products (Redlichová et. al, 2021). In assessing its competitiveness in the future, it is also necessary to assess the efficiency of the factors of production in relation to their economic success. The main aim of this paper is to find possible variants of the development of the links between capital labour ratio and labour productivity in relation to the development of the profitability of returns.

In the food industry, investments and innovations basis for competitiveness companies (Firlej et al., 2017). However, new technologies, which affect all areas of activity, are only a means of achieving sustainable business growth. On the one hand, companies, in any sector, are forced to invest in new technologies that are both more energy-efficient and more environmentally friendly, but on the other hand, depending on the size of the company, it is questionable whether they are making sufficient use of these investments.

The paper is structured as follows: The theory of firm productivity, profitability, and investment company policy are briefly analysed in the first part. The second part presents the data and the research methodology. The third part shows and discusses the main results of companies' profitability and fixed assets productivity analysis. The last part summarises the results.

Theoretical background

The efficient use of factors of production such as capital in account fixed assets is a prerequisite for the economic success of firms. The basic indicator that measures this efficiency of factors of production are productivity indicators. Productivity shows how efficiently the factors of production (capital, labour) are used in production. Productivity is the ratio of outputs to inputs (Coelli et al., 2005). Productivity = output/input. Productivity is an important driver for economic growth and prosperity (Fried et al., 2008) for companies. The most frequently used indicators for measuring productivity are labour productivity and capital productivity. At the enterprise level, productivity is one of the factors of growth in the competitiveness of enterprises, which means increasing the efficiency (effectiveness) with which production factors are used in production. Not only is the general capital intensity monitored, but also the capital intensity of corporate investment (Gilje and Taillard, 2016). The dynamics and level of capital intensity depend on the type of sector (Berends, 2021; Romme, 2001). The level of labour productivity and capital productivity can also be positively affected by the integration of innovation (Mura and Hajduchova, 2020) and improved management. There are two sources of productivity growth: technical progress and growth in the capital-labour (C-L) ratio (Guest, 2011), i.e., investment growth.

The size of capital investment can also be influenced by external factors (Brennan, 2021; Apostolov et al., 2006; Doytch and Narayan, 2016). An enterprise study by Bialowolski and Weziak-Bialowolska (2014) pointed out that macroeconomic factories are the driving force determining investment decisions. Among these, we can include the business cycle and the economic situation in the world or investment support policy of EU in sector (Naglova and Šimpachová Pechrová, 2019). The results of the study Bialowolski and Weziak-Bialowolska (2014) also indicate that the results are strongly tied to the organizational form, size and industry in which the firm operates, thus preventing more universal conclusions.

The main direction of current investment is investment to the R&D and technology area of Industry 4.0. The Rodrigues (2020) enterprises study reveals the strong influence of institutional context and argues that without strong government support, corporate investment in R&D would be at a low level. The study by Li et al. (2020) points out that another direction is the area of corporate environmental responsibility (CER). In view of the current trend in reducing energy intensity, we can also expect a strong focus on a green investment policy for companies with strong investment support from governments or the EU. According Náglová a Pechrová (2019) investments in fixed assets by subsidies causes a slight increase in production efficiency in food industry enterprises. On the other hand, also the technical efficiency of non-subsidised enterprises is higher than that of subsidised enterprises and differs statistically significantly over time, so that the effect of subsidies is negative without affecting the higher technical efficiency of enterprises. The production factor plays an important role here, whether the investment is oriented towards increasing production or improving the quality of production.

The implementation of technology investments also affects capital intensity. Deepening the level of capital (fixed assets) increases output when labour productivity increases - i.e., capital is complementary to labour. Brennan (2021) argues that a higher capital-to-labour ratio tends to imply more output per worker or hour worked. In most cases, capital deepening and productivity growth are related, but people are the carriers of investment ideas, and subsequently the investment may not prove to be sufficiently effective. Businesses, however, always consider the impact of investments on the profitability of the business when evaluating investments.

The profitability of companies shows the efficiency of the company's management. It evaluates the profitability of the enterprise, i.e., the ability of the enterprise to produce maximum output (e.g., profit) ideally with minimum inputs. A study by Khazaei (2021) found a positive relationship between indicators of competitiveness, entrepreneurship and business environment and financial performance and profitability for multinational companies. In contrast, a study of European companies by Nylund et al. (2020) indicated that innovation has a positive impact on profitability but its impact varies across sectors, with debt financing being a limiting factor. It is evident that the sector can play a significant role in assessing the profitability of firms.

The profitability of businesses in the food industry can be affected by many external factories as subsidy policy (Svobodová, et al., 2022) or new technology as Industry 4.0 (Vrchota et al., 2020). Among one of the significant factors, a study

of Bieniasz and Gołaś (2011) identified the negative impact of prolonging the cycle time of inventories, receivables and current liabilities on the profitability of firms in the food industry in Poland. However, the study by Hirsch et al. (2014) shows a large effect of firm size and industry concentration on profitability growth, while firm risk and age, as well as industry growth have a negative effect. The study by Vavrina and Lacina (2018) indicates that financial factors had a predominant positive effect on the profitability of food industry enterprises compared to nonfinancial factors during the global financial crisis between 2008 and 2012. In another relevant study, Šeligová and Koštuříková (2004) measure and evaluate the relationship between working capital and profitability of companies operating in the food industry in the Czech Republic from 2009 to 2019. The study found statistically significant relationships between, for example, return on sales and variables such as cash conversion cycle, current assets ratio, current liabilities ratio and working capital ratio. This study is added by research by Blažková and Dvouletý (2017) who tackled the problem in market concentration. The results of their study showed a positive effect of higher market concentration on the profitability of firms in the food industry. In contrast to previous studies focusing on companies' investment in the food industry, this one highlights the problem of new investment. New investments in technology are usually associated with increased capital needs, which can translate into higher debt, higher debt risk and lower profitability.

It can be assumed that efficiency in the use of capital with technological progress will become a fundamental means of increasing the competitiveness of enterprises and their profitability in the future.

Materials and methods

The paper is focused on the efficiency of using fixed assets in the context of profitability. Efficiency of use fixed assets is measured through the index Turnover fixed assets (FAT = Operating revenues/ (Tangible and intangible assets) and takes into account possible variations in the development of links between indicators capital labour ratio (c.l.ratio = (tangible and intangible assets)/ costs of employees) and labour productivity (LP = Operating revenues/Costs of employees).

Furthermore, the objective is to assess the relationship with the development of the profitability of revenues (ROS = Operating profit/Operating revenues). Empirical analysis covered 2,526 companies in food industry in four examined European countries (Visegrad countries) – Czech Republic, Hungary, Poland, Slovak Republic. Data were taken from the European company database for the years 2020 and 2019. The analysis considers other aspects such as the effect of the factor of the country of establishment of enterprises, the effect of the factor of the size of enterprises, through ANOVA analysis.

The analytical part is based on the linkages between the indicators:

$$FAT = \frac{Operating\ revenues}{(Tangible+Intangible\ assets)} = \\ = \frac{Operating\ revenues}{Costs\ of\ employees} / \frac{(Tangible+Intangible\ assetss)}{Costs\ of\ employees} \quad (1)$$

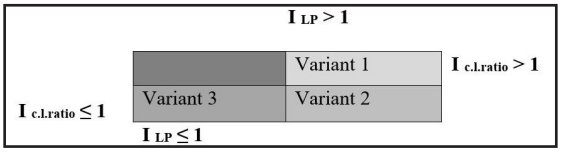
$$FAT = LP / c.l.ratio$$

The same relationships hold for the indices of these indicators:

$$i_{FAT} = i_{LP} / i_{c.l.ratio} \quad (2)$$

Enterprises are divided according to I FAT into two groups. The first group includes enterprises preferring investment activities in which tangible and Intangible assets grow faster than their revenues (I FAT < 1). The second group includes enterprises more economical in terms of investment activities. These enterprises are more oriented towards higher utilisation of Tangible and Intangible assets and thus their revenues grow faster than Tangible and Intangible assets (I FAT > 1).

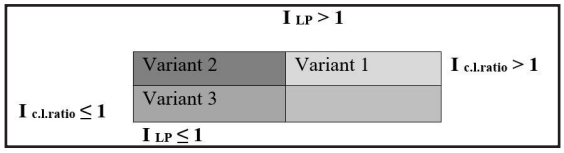
The level and dynamics of all indicators for both groups of enterprises. Based on the relationships between the indicators, three variants of development were defined for each group (Novotná, 2022). For enterprises having I FAT < 1, Variant 1 can occur, which means simultaneous growth of both indicators (the LP and c.l.ratio indices are higher than 1 year on year), respectively Variant 2, in which capital intensity grows and labour productivity decreases at the same time, respectively Variant 3, in which both indicators under study decrease (Figure 1).



Source: Authors˘ calculation (Novotná, 2022)

Figure 1: Efficiency of use fixed assets (I FAT < 1).

Companies which having I FAT > 1, there can be Variant 1, which means simultaneous growth of both indicators (LP and c.l.ratio indices), respectively Variant 2, in which labour productivity grows while capital intensity decreases or does not change, respectively Variant 3, in which both observed indicators decrease (Figure 2).



Source: Authors' calculation (Novotná, 2022)

Figure 2: Efficiency of use fixed assets (I FAT>1).

Subsequently, the relationship between the development of indicators of efficiency of production factors and the development of profitability of revenues after the division of enterprises into groups was analysed.

Results and discussion

The analysis covered 2,526 enterprises from the V4 countries whose main activity is classified in Section 10 of the standardised NACE classification, which is the food industry, in 2020 and 2019. The indices of the observed efficiency of production factors, indices of selected absolute indicators including the Return on Sale index (Figure 3).

Based on the dynamics of the indicators for the monitored companies in the food industry, it can be concluded that in 2020 compared to 2019, there is a growth in the cost of employees and fixed assets. Although revenues increased at the same time, their growth was lower compared to the previous items, which meant an overall decrease in labour productivity and capital intensity. The operating result in food processing enterprises also declined, which affected the decline in the profitability of revenues.

$$1 > I_{c.l.ratio} > I_{LP} > I_{ROS}$$

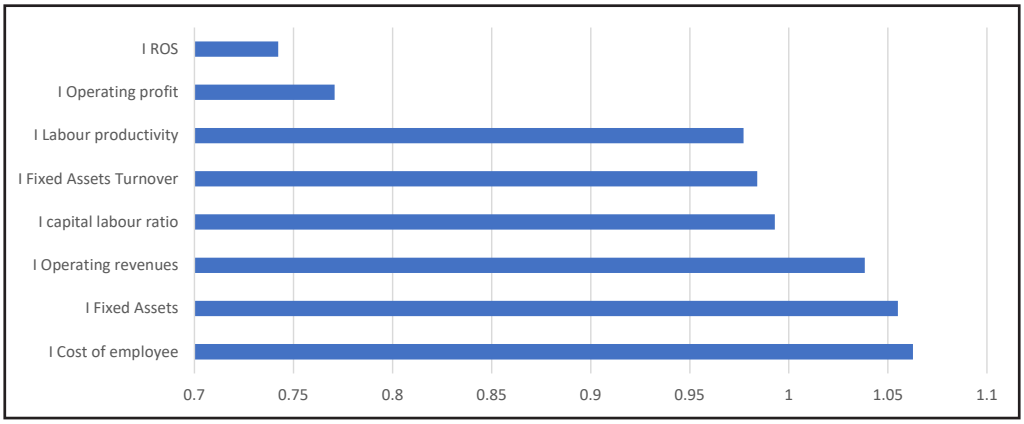
$$I_{costs\ of\ employees} > I_{Fixed\ Assets} > I_{Operating\ revenues} > 1 > I_{Operating\ profit}$$

The development of the dynamics of the indicators shows an unfavourable development, as the growth of costs per employee and the growth of fixed assets exceeds the growth of operating income, leading to a decline in the economic result and to a decreasing profitability of the food industry companies.

The ANOVA analysis (Figure 4) showed that the Turnover Fixed Assets index for food industry enterprises is not affected by either the factor of enterprise size or the location of the enterprise in a V4 country. The effect of both factors is statistically insignificant ($p > 0.05$).

In the more detailed analysis of the efficiency of the use of fixed assets, attention was focused in more detail on individual enterprises, which were subsequently classified into groups (see methodology). Figure 5 illustrates the division of enterprises into two groups and then variants (see methodology), further broken down by enterprise size (LE - large enterprises, SMEs - small and medium enterprises, see EU methodology).

It is clear from Figure 5 that enterprises with an increasing asset turnover rate are slightly predominant (absolute frequency is 1500 enterprises, i.e., 59.4% of all surveyed enterprises). The largest part of these enterprises is classified to variant 3, followed by variant 2. Variant 3 prevails for SMEs, variant 2 for large enterprises (LE).



Source: Own calculations

Figure 3: Development of selected economic indicators in food industry enterprises (index 2020/2019).

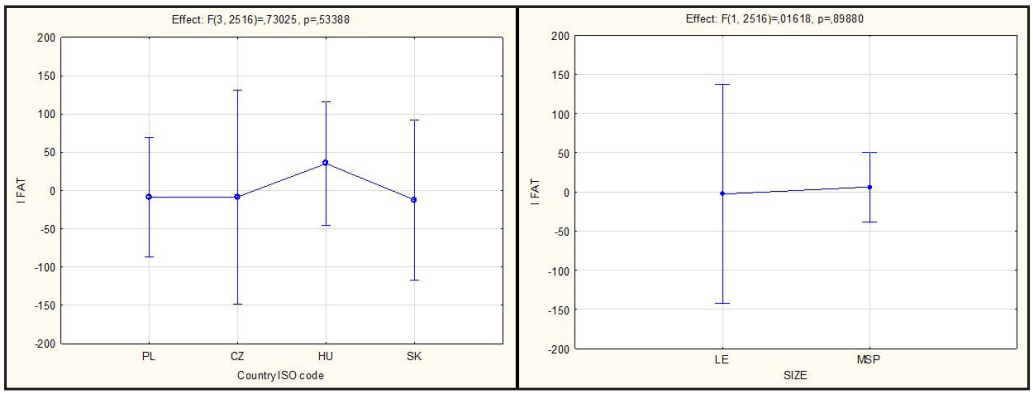


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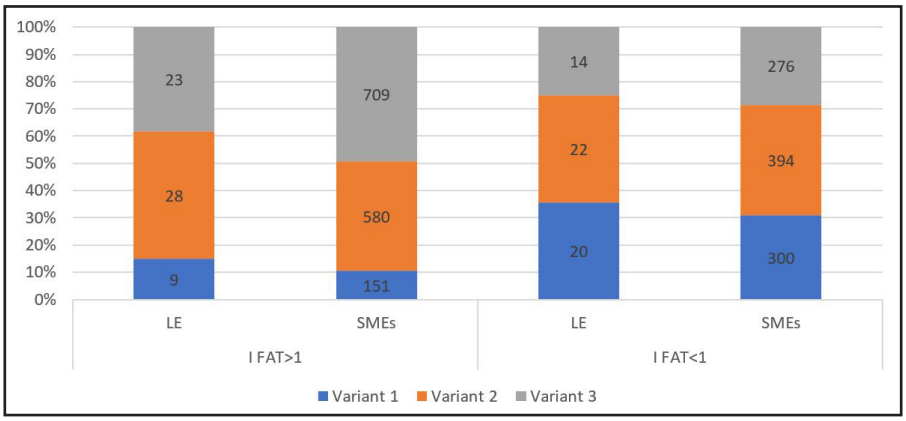
Figure 4: The ANOVA result for Turnover Fixed Assets index – size and location factor.



Source: Own calculations

Figure 5: Numbers of enterprises by intensity of investment assets, by size in %.

For enterprises using more fixed assets (I FAT < 1), variant 2 prevails for both SMEs and LE, followed by variant 1 again for both SMEs and LE. In a more detailed analysis of the economic success of both groups of enterprises in all variants of development, the level and dynamics of indicators assessing the efficiency of production factors and the level and dynamics of the profitability of sales indicator were monitored (Table 1 and 2).

For those firms with higher year-on-year fixed asset utilisation (I FAT<1), Variant 1 (Table 1) is the most successful, especially in terms of return on sales. The ROS level is clearly the highest despite a slight year-on-year decline. The level and dynamics of labour productivity in this variant are also developing positively. The c.l.ratio also increases in this variant, i.e. costs of employees grow more slowly than fixed assets. The most frequent variant (Variant 2) reaches about half the level of ROS, while at the same time its year-on-year decline is observed. Labour productivity also declines. Variant 3 is the least economically successful, with a year-on-year decline in all the indicators monitored.

Table 2 illustrates the economic performance of a group of companies characterised by higher revenue growth compared to fixed asset growth. The most represented is Variant 3, where the return on revenues has fallen sharply year-on-year, by more than 50%. The second most frequent variant in this group is Variant 2, in which ROS increases, although it does not reach the same level as for firms in the first group in Variant 1 (Table 1). The highest level and dynamics of labour productivity, the c.l. ratio, can be observed in the least numerous Variant 1. In this variant, although enterprises reach a lower level of ROS, but with a positive dynamic (annual growth of about 30%).

***I FAT* < 1**	**Indicator (EUR)**	**Average value in**		**Index**
		2020	**2019**	
Variant 1 (320 companies)	Return on Sales -ROS	0.0625	0.0673	0.9294
	Labour productivity - LP	12.2811	11.8175	1.0392
	The capital labour ratio - c.l. ratio	3.3024	2.4853	1.3288
	Fixed assets Turnover - FAT	3.7188	4.7550	0.7821
Variant 2 (416 companies)	Return on Sales - ROS	0.0317	0.0451	0.7012
	Labour productivity - LP	11.6059	12.5182	0.9271
	The capital labour ratio - c.l. ratio	3.0773	2.6880	1.1448
	Fixed assets Turnover - FAT	3.7715	4.6570	0.8098
Variant 3 (290 companies)	Return on Sales - ROS	0.0174	0.0398	0.4363
	Labour productivity - LP	10.2326	12.4325	0.8231
	The capital labour ratio - c.l. ratio	3.0859	3.4272	0.9004
	Fixed assets Turnover - FAT	3.3159	3.6276	0.9141

Source: 'authors' calculation

Table 2: Indicators by individual variants (I FAT>1).

***I FAT* > 1**	**Indicator (EUR)**	**Average value in**		**Index**
		2020	**2019**	
Variant 1 (160 companies)	Return on Sales -ROS	0.0262	0.0201	1.3045
	Labour productivity - LP	14.5458	12.3099	1.1816
	The capital labour ratio - c.l. ratio	3.529	3.2466	1.087
	Fixed assets Turnover - FAT	4.1218	3.7916	1.0871
Variant 2 (608 companies)	Return on Sales - ROS	0.0372	0.0305	1.2182
	Labour productivity - LP	11.809	10.9057	1.0828
	The capital labour ratio - c.l. ratio	2.7226	2.9960	0.9087
	Fixed assets Turnover - FAT	4.3374	3.64	1.1916
Variant 3 (732 companies)	Return on Sales - ROS	0.0386	0.0788	0.49
	Labour productivity - LP	8.8342	9.6386	0.9165
	The capital labour ratio - c.l. ratio	2.3673	2.8721	0.8242
	Fixed assets Turnover - FAT	3.7318	3.356	1.112

Source: 'authors' calculation

Table 2: Indicators by individual variants (I FAT>1).

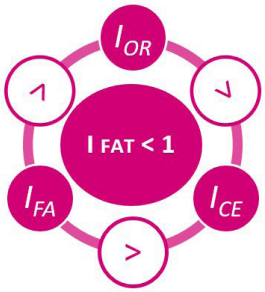
Conclusion

The enterprises in the food industry in the V4 countries play an important role not only in the aspect of production, i.e., GDP creation but also in terms of employment or foreign trade (Kowalska et al., 2021). Enterprises in the V4 countries are examined together as one large group. This is due to many common features, such as geographical location, their history (transition from a centralised economy to a market-oriented economy at the same time), which indicate the same starting point for the business cycle in all V4 countries. Another reason for examining the firms as a whole is the ANOVA test analyses performed, which confirm non-significant changes in the analysed firm characteristics depending on the V4 country.

Enterprises have to follow their profitability on the one hand and on the other hand invest in the future to increase their international competitiveness. The present study in food enterprises in the V4 countries puts these two aspects in combination. On average, enterprises in the food industry in the V4 countries experienced unfavourable developments in 2020 compared to 2019. There has been a decline in both the profitability of revenues and the efficiency of using fixed assets. However, when analysing groups of enterprises in more detail, it is possible to draw conclusions regarding the dynamics

of the monitored indicators. Based on a deeper analysis of capital intensity, labour productivity and related indicators, including the profitability of revenues, it can be concluded that for enterprises engaged in the food industry, the economically advantageous variant (with respect to the profitability of revenues) always appears to be variant 1. From the empirical evidence of enterprises in the food industry, it can be stated and confirmed that enterprises, regardless of size and country, achieve the best economic results if they observe the relationships between the dynamics of the indicators of operating revenues (OR), costs of employees (CE) and fixed assets (FA).

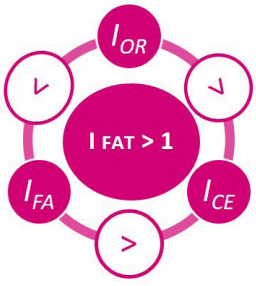
The economically successful variant for food processing enterprises that invest more (investment growth rate exceeds operating revenues) is based on compliance with these relationships (Figure 6), corresponding to variant 1.



Source: Authors´ calculation

Figure 7: Relationships between selected indicators (I FAT>1).

In this situation, the growth rate of capital intensity is higher than the growth rate of labour productivity I_(c.l.ratio)>I_LP>1, but the level of profitability of revenues is well above the average ROS of food firms. The economically successful variant for food enterprises that make more use of existing fixed assets (i.e., the growth rate of revenues exceeds the growth rate of fixed assets) is again based on these relationships (Figure 7).



Source: Authors˜ calculation

Figure 7: Relationships between selected indicators (I FAT>1).

In this presented situation, labour productivity growth companies exceed capital intensity growth $I_{LP} > I_{c.l.ratio} > 1$. Both successful variants 1 imply increasing dynamics of these indicators (c.l.ratio, LP). The findings of empirical research (Vukšiće 2016) conducted in Croatian industry also show that higher capital intensity growth contributes significantly to stronger labour productivity growth. Smejkal et al. (2022) highlight high the importance of the corporate investment strategy. The effects of increasing fixed assets (increasing capital intensity) according to the study of Grozdic et al. (2020) may be negatively affected in the profitability of firms in the year of realized investment. The positive effect on the profitability of enterprises will only be seen in the year following the investment. The structure of fixed asset investment plays a crucial role in respect of the contribution of investment to increased profitability. The type of fixed asset (investment) is an important factor in assessing the impact of an investment on the performance of a company. Greater benefit for company can be expected for investment in machinery, while for investment in buildings or large technological investments the effects will be more delayed. According to a study by Campbell (2012), the biggest profit benefits from investment in technology are 3 years after the investment is made. The authors also recommend taking into account the structure and type of investment to assess the impact of investments on profitability. The paper no considers the time lag of the investment, but focused on the relationships between the trend of indicators in relation to profitability. The results of the paper can be a useful tool not only for businesses themselves, but also for policy makers within subsidy policy and other institutions.

Among the limitations of the above analysis, the focus on a single industry and the short period analysed can be considered. The further research will focus on the differences in the relationships between economic efficiency (productivity) indicators and economic success indicators of enterprises in different sectors. The contribution of the paper is the generalization of the links between the indicators of factor efficiency in the form of recommended inequalities that can be used by companies for economically successful development.

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Appendix

Variable (EUR)	Year	Average	Median	Minimum	Maximum	Standard deviation
Operating revenue	2020	10 846 176	909 149	9596	1 220 804 031	51 818 916
	2019	10 446 538	869 382	3	1 764 247 902	56 226 935
Costs of employees	2020	987 654	151 770	91	74 451 763	3 719 660
	2019	929 489	140 190	68	122 084 842	4 023 052
Fixed assets	2020	3 396 089	180 980	39	677 001 320	22 437 440
	2019	3 239 698	173 517	90	679 726 601	21 925 271
ROS	2020	-0.008	0.025	-12.25	0.877	0.436
	2019	-0.04	0.028	-20.279	0.904	0.865
Resource productivity	2020	3.85	1.626	0.514	189.408	13.041
	2019	4.401	1.575	0.128	446	21.517
Capital labor ratio	2020	9.292	1.099	0	6976	157.564
	2019	7.296	1.177	-0.096	7101	143.194
FAT	2020	43.952	5.609	0.004	7727.25	260.135
	2019	42.678	5.547	0	6143.571	255.694
Labour productivity	2020	15.014	5.25	0.156	8119.433	165.281
	2019	23.46	5.392	0.003	15851.235	364.821

Source: Authors´calculation

Table 3: Descriptive statistics of the data set.