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FACTORS DETERMINING THE PROFITABILITY OF ENTERPRISES – INFLUENCE ASSESSMENT

The purpose of the paper is to demonstrate existence and intensity of correlation between determining factors and a state of profitability of Polish enterprises. The scope of the paper includes identifying the factors that determine enterprises profitability, creating an econometric model and conducting analysis of influence of determining factors and their intensity have on profitability of studied population of enterprises in Poland.

Keywords: *determinants, profitability, econometric models*

1. Introduction

In order to properly function and develop, an enterprise needs managers, who can well understand the economic environment that it operates in. However, this understanding is often limited to the closest environment. This is why many successes and failures come highly unexpected. They arise from the surrounding macroeconomics; we are often unaware of its forces. Therefore, its mechanisms need to be understood, its potential opportunities need to be utilized and its threats limited. Although in the literature on this subject we can find a broad range of research on internal factors, when it comes to external factors, there is no precise qualification of their influence. This is a gap in the field of science that is worth filling, or at least worth trying to investigate. In Poland, alongside economic development and integration with the global

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economy, awareness regarding the practical use of identifying the influence of factors on the profitability of domestic enterprises has been deepening. When observing Polish reality, most often we meet just awareness of certain regularities and of the influence of the environment and its factors on the results of financial instruments. This awareness has practical use, yet its narrow range causes some problems. Entrepreneurs know the concept of profitability, but they do not know how to influence its value in practice. A large percentage of bigger enterprises face this problem. It is most visible at a time of crisis. To preserve their financial condition, enterprises undertake risky steps that are supposed to be profitable, for example they buy foreign exchange options or shares in stock-listed companies. Because of limited experience and high risk, these kinds of actions most often result in worsening the financial situation of the enterprise. This is why identifying the factors determining the profitability of enterprises or applying research methodology to measure their influence in practice is still a very open subject.

2. The necessity of research on profitability and its determinants

The change of the political system in Poland which occurred in 1989 resulted in economic changes that could be observed throughout the nineties of the past century. The reason for these changes was of course the necessity of building a modern and well-developed market economy. An economy adapted to the new reality, whicch could be observed, at the very least, by the change in the public perception of enterprises. The importance of the owner (owners) of enterprises increased, as they are the ones who invest their own capital resources, which is in contrast to the previous economic model, where public property dominated. At present, the owner derives specific benefits accruing from an increase in the enterprise's capital. Therefore, he is directly interested in effective functioning of the enterprise and its market position. Beside economic responsibility, he also bears legal responsibility, which is connected to assigning him ownership, as well as the risk and the consequences of running an enterprise. A given individual or legal identity profits from and bears direct and material responsibility in the case of losses from the business activity they run [3]. For the entrepreneur, profit is compensation for costs.

During the course of time, it has been noticed that the ability to efficiently manage an economic entity is one of the main conditions for its rational functioning. *That is why managing any enterprise should concentrate on identifying and realizing set goals of the enterprise functioning* [12]. All the decisions made in the enterprise's operations will be considered through the prism of its original purpose. This purpose will motivate each and every action. The literature indicates basic goals of business

activity. These are: profit maximization, development, growth and maximization of the enterprise's value. Nowak assumes that […] *the main goal of the enterprise should be to maximize the owners' profit* [7] and as Kuder claims full satisfaction of the clients. To achieve this, analyzing the effectiveness of an economic entity is very important. Effectiveness means efficiency, proficiency and a positive outcome which, in our economic reality, is most often profit, i.e. the surplus of income over expenditure or the income expenditure ratio. To achieve this, the enterprise should make use of its assets and values in the optimum manner, applying the principle of rational economics, which was stated by Kuder: *with given expenditure to receive maximum goal realization rate or with given goal realization rate to use minimum expenditure* [6]. The running of any enterprise is dependent on achieving required economic effectiveness. The formulation of this effectiveness results from the decisions made, which means that effectiveness is crucial to an enterprise because: appropriate measurement and evaluation of effectiveness enable identifying the areas where resources are increasing the most. Appropriate measurement and evaluation of effectiveness enables one to build fair systems to assess an enterprise and, on this basis, a system of motivation [9].

In today's economy, where strong competition dominates and where all processes are highly dependent on information, the success of an enterprise requires specific measurement and management systems. To comply with the principle of rational economics, an enterprise must systematically analyze its financial result or in other words analyze profitability. When determining the profitability index of a business entity, we can use many variants of the numerator and denominator to gain more information about a company. However, we get the most data from applying the whole range of profitability indexes in three aspects [11]:

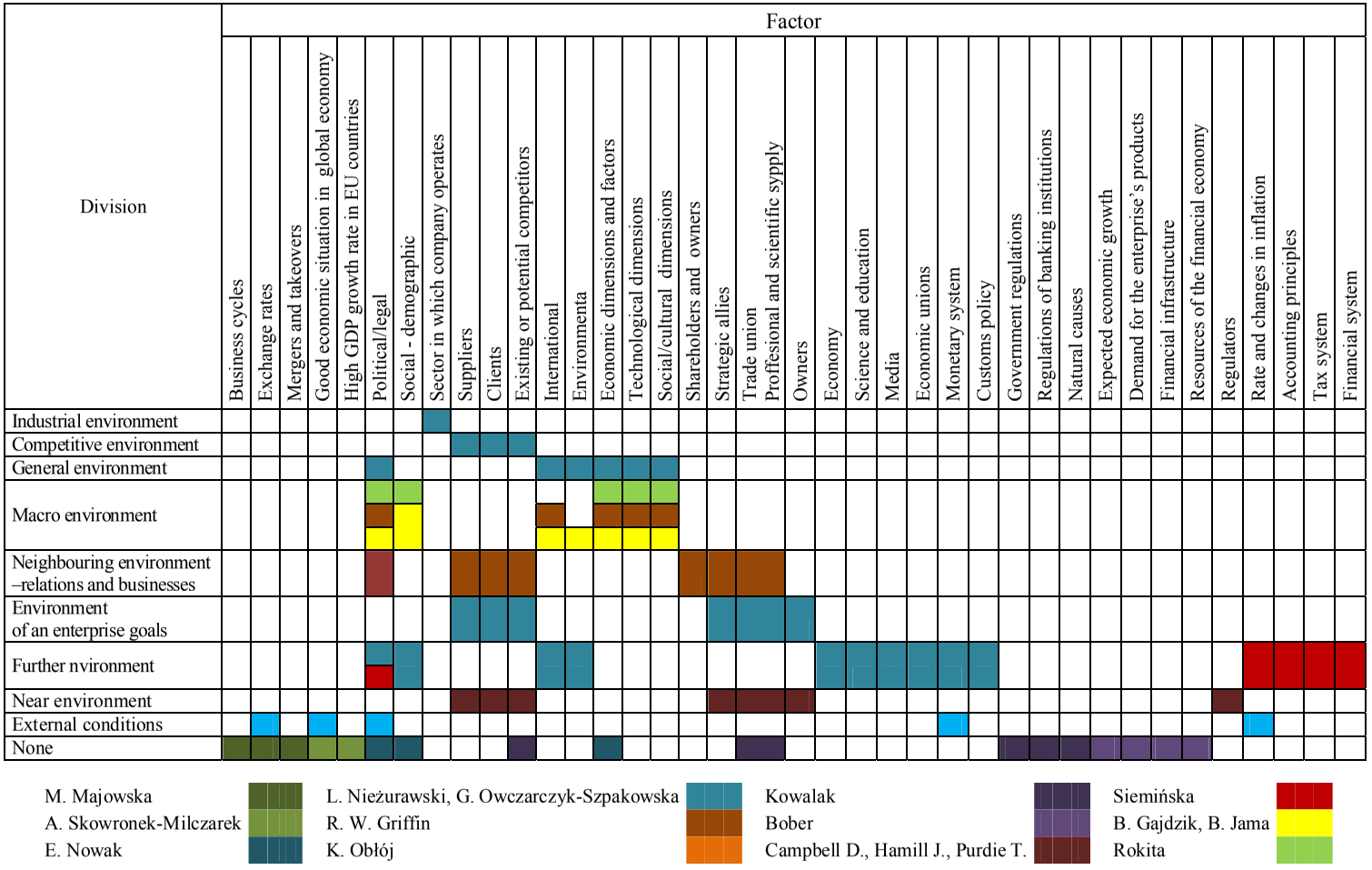
- sales profitability, defined in the literature as return on sale,
- return on assets, also known as economic return,
- return on invested capital, known also as financial profitability.

Thanks to these indexes, we can obtain a wide range of information helpful in managing an enterprise.

3. Determinants of profitability

A number of factors affect the profitability of an enterprise. Their influence varies in the short term, as well as in the long term. Recognizing these factors will be very helpful in managing a business entity. These determinants can be of a positive or negative nature. In the latter case, an important role falls to the manager of the enterprise, who must make all efforts to improve the financial results of the company.

Table 1. Exterior determinants of an enterprise's profitability



Recognizing and understanding factors that are important at the moment is a considerable challenge. The literature on this subject gives a whole list of these factors, which the authors systematized in Table 1. However, it is unacceptable when a group of managers, who in spite of recognizing these factors, fail to undertake any actions, as Kowalak states, believing that *the clouds, that came will leave on their own.* This kind of approach can, in many cases, lead to the downfall of an organization [5].

In the literature we find many types of external factors influencing the profitability of an enterprise. Table 1 presents an assemblage of the factors existing in the literature. They include:

Political-legal environment. Political factors are those that derive from the fact that an enterprise functions in a given country. This environment consists of various kinds of state institutions that regulate the business activity of an enterprise, its relations with the state and other enterprises. The problems that private enterprises face when they enter a market where monopolists are still present are the simplest example of this.

Economic environment. The literature defines economic environment as the milieu that *comprises the basic macroeconomic values characterizing the economy in which an enterprise runs, institutions operating in given economy, together with specific legal system, technologies etc*. [10].

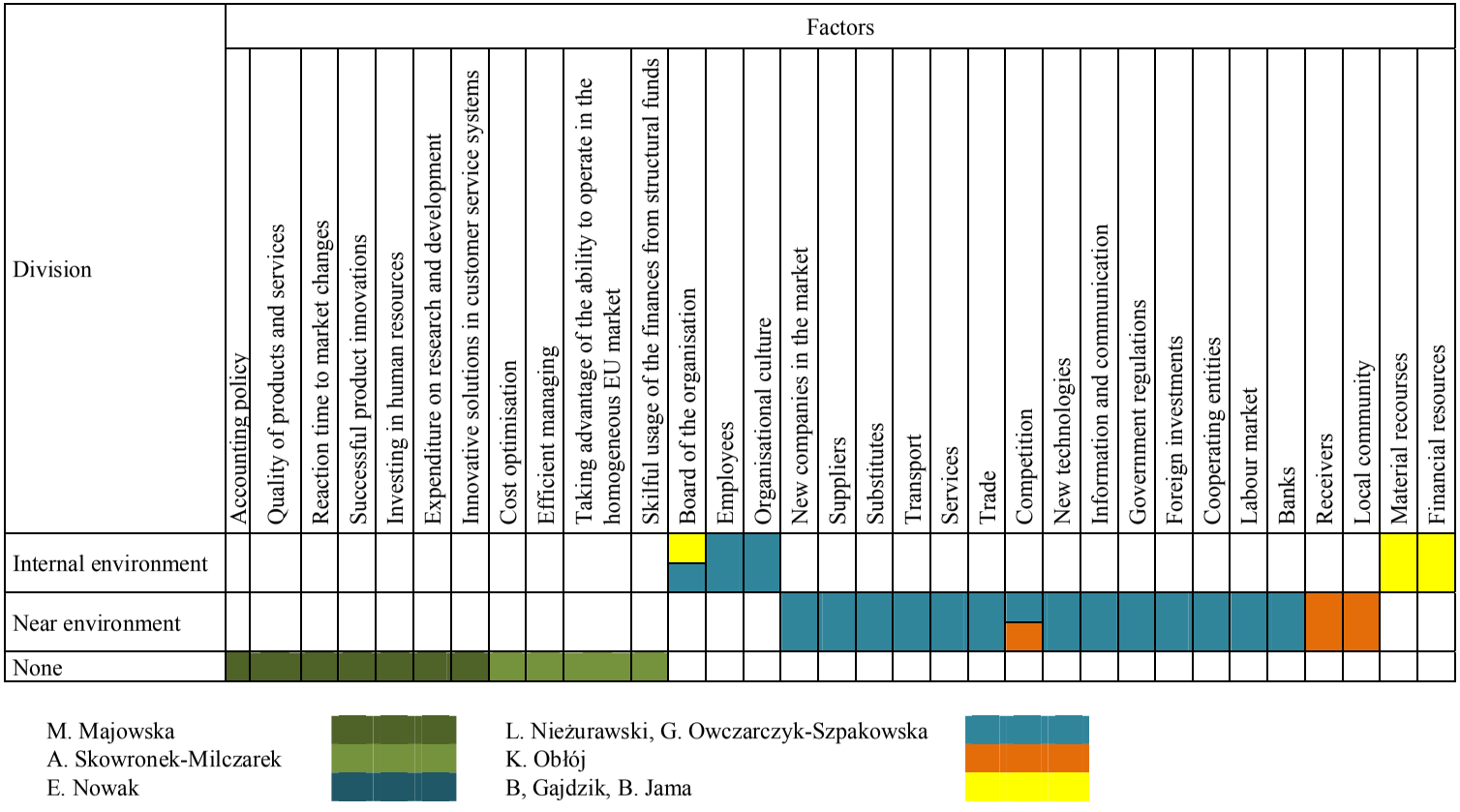
Tide of the market. The tide of the market determines an enterprise's profitability to a high degree. It is subject to periodic, cyclical fluctuations. It is expressed by the macroeconomic ratio defined as gross domestic product (GDP). Bień [1] defines GDP as *the value of goods and services produced in a given time which are intended for final consumption and for investment, adjusted for import/export balance.*

Unemployment. In connection with the increasing range of new technologies, industrialization or with "informatization", more and more often we are facing resignation from human work in favor of machines, devices or computers. This results in a phenomenon defined as *unemployment, which means a surplus of people available for work over the number of work posts.*

Social-cultural environment. These are the norms and cultural values of the country in which a business operates. These factors are demography, its tendencies and modes of consumption. Forecasts from the Central Statistical Office (GUS) are quite alarming.

On the one hand they indicate a decrease in the population, and on the other, aging of the population. Forecasts say that in 2030, the Polish population will be just over 35 mln., of which 42% will be over 65, which, as one can guess, will have a considerable influence on the profitability of enterprises.

Table 2. Internal determinants of an enterprise's profitability (source: own work)



Technical-technological environment. This covers the knowledge of how to transform a natural good into a final product, as well as all the means and skills for realizing this goal. Analyzing this environment gives us information about new inventions and innovative technologies. It is a very important factor, because it can decide about the success or failure of an enterprise. Implementing new technology is important so as not to be left behind the competition. Usually new technologies cause a decrease in costs or shortening of the technological process. Failing to follow in its direction can quickly cause a decrease in profitability or even completely exclude an enterprise from the market. *External factors create the framework for macroeconomic policy* [8].

A large amount of research on factors influencing profitability that are dependent on the enterprise itself have been published (Table 2). As a result many opinions and indications of various determinants emerge. Further factors of the neighbouring environment indicated by Kopertyńska are: sufficient capital recourses, access to the buyers' market, accessibility of resources and materials. [4]

Taussig and Baker were pioneers in the research on salary levels. They introduced the famous relationship between the effectiveness of an organization and the salaries of the employees in high positions. This relationship was so surprising that many researchers followed up their research. In the course of time, the function of such research was modified. At the beginning, researchers treated the managers' salaries as a means of enabling discussion about the role of the board (for instance analyzing whether the board pays too high salaries to the managers)[*]. After modification, this research was used as a tool to control effectiveness. In spite of using similar sources of data and identical statistical methods, the results of this research are ambiguous. Some confirmed the association between effectiveness and salary, others quite the contrary, and there were also some ambiguous results.

4. Factors determining the profitablity of enterprises – influence assessment

The data used for our research into profitability and its determinants came from three sources: the website of the Central Statistical Office (GUS), Table 8 in the Appendix, Concise Statistical Yearbooks of Poland, Table 3, and the database from the document *Poland – macroeconomic indicators. Annual economic measurement instruments*, provided by the Institute of Financial Management, which includes 2254

*Zajac E.L., *CEO selection, succession, compensation, and firm performance. A theoretical integration and empirical analysis*, Strategic Management Journal, 1990, 11 (3), 217–230. [after] Majowska M., *W kierunku definiowania efektywności organizacyjnej*, Zeszyty Naukowe Uniwersytetu Szczecińskiego, *Finanse, rynki finansowe, ubezpieczenia*, nr 14, Szczecin, 2008.

enterprises over a period of 10 years. The data were incomplete for some enterprises. After selection, 535 enterprises remained.

Table 3. External factors selected from the Concise Statistical Yearbooks of Poland

Symbol	Specification	Unit
x_{41}	unemployed aged 15 and older	quantity
x_{42}	unemployment rate	%
x_{43}	registered unemployed persons	quantity
x_{44}	unemployed previously not employed	
x_{45}	unemployed previous employment terminated by the company	
x_{46}	unemployed possessing benefit rights	
x_{47}	unemployment benefits	PLN
x_{48}	average monthly income for 1 person in a household (available income)	
x_{49}	average monthly wages and salaries	
x_{50}	average monthly expenditure for 1 person in a household	
x_{51}	inventions and utility models – applications	items
x_{52}	inventions and utility models – patents granted	
x_{53}	import dynamics	previous year = 100
x_{54}	export dynamics	
x_{55}	domestic demand	per capita
x_{56}	gross domestic product (current prices)	
x_{57}	foreign debt	(mil USD) gross
x_{58}	gross domestic income (current prices)	mln. PLN
x_{59}	total money supply	
x_{60}	total industrial production sold	previous year = 100
x_{61}	indices of agricultural output	
x_{62}	obligatory encumbrances on the gross financial result of enterprises	mln. PLN
x_{63}	including income tax from enterprises	
x_{64}	the net financial result	
x_{65}	indices of construction and assembly production	previous year = 100
x_{66}	current assets of enterprises	mln. PLN
x_{67}	total value of the stocks of enterprises	
x_{68}	short-term dues and claims	
x_{69}	short-term dues and claims from deliveries and services	
x_{70}	short-term investments (monetary means)	
x_{71}	short-term liabilities of enterprises	
x_{72}	credits and loans	

Source: Authors' work based on the Central Statistic Office data.

In the case of the profitability on turnover of Polish enterprises (Table 6), we can notice a significant and very strong positive correlation with some of the studied factors, for example: youth education in total (0.90), the net financial result for all enterprises (0.96), investment outlays on machinery, technical equipment and tools (0.90).

A very strong negative correlation is characteristic of the cost level indicator in all enterprises (–0.99). The critical value for this correlation for $n = 9$ calculated from the formula

$$r^* = \sqrt{\frac{\frac{t^2_{\alpha, S}}{n-2}}{1+\frac{t^2_{\alpha, S}}{n-2}}}$$

is 0.6664. These selected factors form a basis to build an econometric model describing the profitability on turnover of Polish enterprises.

The first stage of creating econometric models was to determine the purpose of the research. This is to determine which factors influence the profitability indices studied. The data was selected based on the literature, and subsequently using correlations, input data was selected for the model. We assume a linear model of the following form:

$$y_i = \sum_{j=0}^{k} a_j X_{ij} + \varepsilon_i$$

The next stage was to estimate the structural parameters, which was carried out using the Gretl software by the method of least squares. Because of the large number of factors and, at the same time, the relatively small number of years, at this stage several probable econometric models have been selected.

In the case of the profitability on turnover of Polish enterprises, the models suggested are given below. They all explain variation in profitability at a significance level of $\alpha = 0.05$.

- Model 1

$$y = 10824.76 - 0.25924x_1 - 11.4913x_8 - 42.688x_9 - 1.54825x_{11} - 24.955x_{13} + 3.54\times10^{-6}x_{20}$$

- Model 2

$$y = 11258.49 - 0.27525x_1 - 8.57086x_8 - 37.9335x_9 - 0.90931x_{11} - 26.6974x_{13} + 2.7\times10^{-5}x_{36}$$

- Model 3

$$y = 10925.72 - 0.26509x_1 - 9.7725x_8 - 39.5849x_9 - 1.01198x_{11} - 25.9911x_{13} + 1.67\times10^{-5}x_{36} + 1.39\times10^{-5}x_{67}$$

- Model 4

$$y = 10774.94 - 0.26295x_1 - 8.54521x_8 - 36.9436x_9 - 0.90139x_{11} - 25.8863x_{13} + 2.52\times10^{-5}x_{36} + 3.47\times10^{-6}x64$$

- Model 5

$$y = 11116.643 - 0.266175x_1 - 11.80505x_8 - 43.77216x_9 - 1.622046x_{11} - 25.62702x_{13} + 3.854\times10^{-6}x_{22}$$

- Model 6

$$y = 5040.725 - 0.13256x_1 + 0.462391x_8 + 0.364081x_{11} - 15.8811x_{13} + 3.46\times10^{-5}x_{68}$$

The models studied were considered according to an assumed model of action. Statistical testing of these models was carried out in accordance to standard procedures for building econometric models. To assure the transparency of the regression results, they are given in Table 9 in the Appendix.

The correlation and determination coefficients inform us that the created models explain the variability of the profitability studied to a high degree. Almost all of them explain as much as 99% of the variation. Only for the last model, the correlation coefficient is 0.90, which shows a good match to the empirical data (Table 4). The correlation coefficient was calculated from the following formula:

$$\varphi^2 = \frac{\sum_{t=1}^{n} e_t^2}{\sum_{t=1}^{n} (y_t - \bar{y})^2}$$

Table 4. Values for calculating the correlation coefficient

Y average	*Et*	Et^2	$(y - y_{śr})^2$	φ^2
2.6222222	0.019389	0.0003759	3.6949383	0.0001964
	–0.00452	2.043×10^{-5}	8.5393827	
	0.004643	2.156×10^{-5}	7.9649383	
	–0.04674	0.002185	0.8504938	
	–0.02379	0.000566	4.742716	
	0.044962	0.0020216	1.632716	
	0.033865	0.0011468	4.3171605	
	–0.03275	0.0010723	5.6538272	
	0.004943	2.444×10^{-5}	0.4593827	
	Sum	0.0074342	37.855556	

Source: authors' work

Based on this value, the coefficient of determination was calculated from the formula $R^2 = \varphi^2$. For each model, the condition of coincidence was used to eliminate some factors. The condition of coincidence is:

$$\operatorname{sign}\left(r\left(x_j, y\right)\right) = \operatorname{sign}\left(a_j\right)$$

where: sign($r(x_j, y)$) is the sign of the correlation coefficient between the exogenous variable x_j and the endogenous variable y; sign(a_j) is the sign of the coefficient a_j in the econometric model with variable x_j (Tables 5, 6).

Table 5. Signs of the coefficient a_j

Variable	Coefficient
const	10824.76253
x_1	–0.259236256
x_8	–11.49130841
x_9	–42.68804759
x_{11}	–1.548254524
x_{13}	–24.95499803
x_{20}	3.54358×10^{-6}

Source: authors' work

Table 6. Correlation with profitability on turnover in the model for Polish enterprises

Variable	y	x_1	x_8	x_9	x_{11}	x_{13}	x_{20}
y	1						
x_1	–0.8858	1					
x_8	–0.8378	0.982531	1				
x_9	0.839921	–0.98671	–0.99828	1			
x_{11}	0.903889	–0.962	–0.95085	0.95194	1		
x_{13}	0.809863	–0.98028	–0.98043	0.977174	0.921443	1	
x_{20}	0.738861	–0.89288	–0.91885	0.902921	0.8546	0.948087	1

Source: authors' work.

$$\operatorname{sign}(r(x_1, y)) = \operatorname{sign}(a_1), \quad \operatorname{sign}(r(x_8, y)) = \operatorname{sign}(a_8), \quad \operatorname{sign}(r(x_9, y)) = \operatorname{sign}(a_9)$$

$$\operatorname{sign}(r(x_{11}, y)) = \operatorname{sign}(a_{11}), \quad \operatorname{sign}(r(x_{13}, y)) = \operatorname{sign}(a_{13}), \quad \operatorname{sign}(r(x_{20}, y)) = \operatorname{sign}(a_{20})$$

Accordance of the coefficient signs and the coefficient in the econometric model does not occur for the variables x_9, x_{11}, and x_{13}. Once these variables had been excluded, one more model estimation using the OLS method, was carried out.

The next step was to check whether the proportion of the variability of profitability explained by a model is significant. First, the significance of the regression coefficients in the model was tested. The null hypothesis assumed that the regression coefficients in the model are all equal to zero and this hypothesis was tested by means of Snedecor's F statistic with $n - k - 1$ degrees of freedom in the numerator and k degrees of freedom in the denominator.

$$H_0 = \sum_{j=1}^{n} \alpha_j^2 = 0$$

$$H_1 = \sum_{j=1}^{n} \alpha_j^2 \neq 0$$

$$F = \frac{R^2}{1-R^2} \frac{n-k-1}{k}$$

The realization of this test statistic for model 1 was $F = 7.405801$. The corresponding critical value (for the F distribution) is 6.99 at the assumed significance level $\alpha = 0.05$. The hypothesis regarding the insignificance of the regression coefficients is thus rejected. Model 3 did not make it through this stage. The next calculation was made to establish whether the individual regression coefficients are significant. The method of examining the significance (at a significance level of $\alpha = 0.05$) of an exogenous variable in determining profitability inolves comparing the value of the realization of Student's t distribution statistics with the appropriate critical value for $(n-k-1)$ degrees of freedom. In this case, this value is $t^* = 2.571$.

$$|t(\alpha_0)| > t^*, \qquad |t(\alpha_1)| > t^*, \qquad |t(\alpha_8)| > t^*, \qquad |t(\alpha_{20})| > t^*$$

Table 7. Significance tests for the model of profitability on turnover for Polish enterprises

Name of the test	Significance of regression coefficients system	Significance of individual regression coefficients
Critical values	$F^* = 5.593$	$t^* = 2.365$
Calculated values	$F = 54.53$	$t\alpha 0 = 1.077$
		$t\alpha 1 = 7.385$
Condition	$F > F^*$	$\|t\alpha 0\| < t^*$
		$\|t\alpha 1\| > t^*$
Test fulfillment	yes	yes

Source: authors' work.

Among the models presented, only model 4 indicated the significance of one of the factors. This is why only this model was submitted to further verification. According to the principles of building an econometric model, another test of this model was started which now has the following form:

$$y = 0.426254 + 5.12 \times 10^{-5} x_{64}$$

This model explains 89% of the variability of the profitability on turnover of Polish enterprises. The condition of coincidence has been fulfilled. The results of the significance tests verifying the variability explained by the model are presented in Table 7. The results of the test show that the net financial result is very significant associated with the profitability on turnover.

5. Conclusions

Recognizing and skillful evaluation of the factors influencing an enterprise makes it easier for managers to react to situations that a business entity faces. A problem posed in this way was submitted to in-depth analysis from the point of view of identifying a wide spectrum of factors determining profitability. Based on this, an analysis of the influence of determining factors was conducted on a given sample of Polish enterprises. The following conclusions were made:

- In the cases of the unemployment rate and business cycle, there were some difficulties in evaluating their influence on profitability, which could mean that they are of a non-linear character.
- Econometric models enabled selecting external factors that show a linear impact on the profitability of enterprises.
- The created econometric models showed that the following influence the sales profitability of Polish enterprises: total population, youth education, graduates of higher education institutions. However, the procedure for creating econometric models showed their low significance.
- It has been observed that throughout most of the study period it was noticeable that there are opposing influences of the studied factors on the operating profitability of invested capital (sample of 535 enterprises).

At the end, it is necessary to stress the diversity and complexity of the problems that are the subject of this article. Despite the attempt to explain the subject thoroughly, not every issue has been presented. In the face of such a complex problem, this paper should be treated as an entry point for further discussion. In the authors' opinion, research has not explained the determinants of profitability, their identification or evaluation of their influence. However, this is a very important aspect of enterprise management.

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Appendix

In the Appendix, Table 8 (External factors used in this study) and Table 9 (Report from testing the model of turnover profitability for Polish enterprises) are presented. The data was included to assure the transparency of the regression results.

Table 8. External factors used in this study

Symbol	Table	Specification	Unit
1	2	3	4
x_{10}	prices	price indices of foods and services	prev. year = 100
x_{11}	education, science, and information society	youth education[a, b] in total	%
x_{12}		early school leavers[c, d] in total	%
x_{13}		graduates of higher education institutions[e] in the fields of life science, technical and computer science in total	per 1000 inhabitants
x_{14}		public expenditure on education in relation to GDP	%
x_{15}		expenditure for R&D activities in relation to GDP	%
x_{16}		computers	% of all enterprises
x_{17}		internet access	% of all enterprises
x_{18}		broadband internet	% of all enterprises
x_{19}	finances of non-financial enterprises[a]	revenue from total activities of enterprises in general	mln. PLN
x_{20}		including revenue from sales of products, foods and materials	mln. PLN
x_{21}		costs of obtaining revenue from total activity of enterprises in general	mln. PLN
x_{22}	(the data include economic entities keeping accounting ledgers, employing more than 9 persons. Data do not include banks, insurance companies, brokerage house and offices, investment, pension societies, national investment funds, higher education institutions, independent public health care institutions, cultural institutions with legal entity, private farms in agriculture)	including the cost of sold products, foods and materials	mln. PLN
x_{23}		the net financial result of enterprises in total	mln. PLN
x_{24}		cost level indicator in enterprises in total	%
x_{25}		the net turnover profitability rate in enterprises in general	%
x_{26}		long-term liabilities of enterprises in total (for end of the year)	mln. PLN
x_{27}		short-term liabilities in enterprises in total (for end of the year)	mln. PLN
x_{28}		non-returnable funds from the european union and other sources[f]	mln. PLN
x_{29}		state budget expenditure in total	mln. PLN
x_{30}		allocations and subsidies in total	mln. PLN
x_{31}	investments	investment outlays in total (current prices)	mln. PLN
x_{32}		on machinery, technical equipment and tools	prev. year = 100
x_1	population	population in total (for 31.12)	thousands
x_2		annual increase	thousands
		population in	
x_3		pre-working age (0–17 years old)	%
x_4		working age (18–59/64 years old)	%
x_5		mobile age (18-44 years old)	%

Table 8 continued

1	2	3	4
x_6		non-mobile age (45–59/64 years old)	%
x_7		post-working age (60/65 years and older)	%
x_8		0–14 years old (children)	%
x_9		65 years and older	%
x_{33}		official NBP exchange rate: 100 USD	PLN
x_{34}		100 EUR	PLN
x_{35}		Consumption in total (current prices)	mln. PLN
x_{36}		including individual consumption expenditure in household sector	mln. PLN
x_{37}	labour market	employed in the national economy (at the end of the period)[g]	thousands
x_{38}		average age of professional deactivation[h]	%
x_{39}	environment	municipal waste deposited on waste dumps	kg/inhabitant
x_{40}		participation of energy from renewable sources in electricity consumption	%

[a]Share of persons aged 20–24, with at least basic vocational education, in the total population, in the same age group.
[b]Data obtained from the Eurostat website on 14th January 2010.
[c]Data obtained from the Eurostat website on 14th January 2010.
[d]Share of persons aged 18-24 with lower secondary education at most, and who are not participating in education or training in the same age group.
[e]Preliminary data.
[f]In the years: 2004,2005,2006 –payments to the state budget from the European Union.
[g]Data since 2000 including professional soldiers in extended mandatory military service, in 2002 in two dimensions: considering employed persons in private farms in agriculture on the basis of the results of the Agricultural Census 1996 (numerator) and Population and Housing Census 2002, as well as the Agricultural Census 2002(denominator).
[h]Data from the Eurostat website from the 14th January 2010.
Source: own work on the basis of Central Statistical Office (GUS) data.

Table 9. Report from testing the model of turnover profitability for Polish enterprises

Model	Symbol	Correlation convergence	Coefficient of determination	As a result of the coincidence test I eliminated the following variables	New form of the model containing the variables	Correlation convergence	Coefficient of determination	Significance of the regression model	Significance of the individual regression coefficients		Conclusion
1	2	3	4	5	6	7	8	9	10		11
1	x_1	0.000196384	0.999803616	x_9 x_{11} x_{13}	x_1 x_8 x_{20}	0.183706	0.816294004	$F = 7.41$	$t\alpha 0 = 1.735686038$ $t\alpha 1 = -1.71643103$ $t\alpha 2 = 0.705669147$ $t\alpha 3 = -0.17367067$		model insignificant
	x_8							***F**** = 6.99	***t**** = 2.571**		
	x_9								$\lvert t\alpha 0\rvert < t^*$	statement unfulfilled	
	x_{11}							***F* > *F****	$\lvert t\alpha 1\rvert < t^*$		
	x_{13}								$\lvert t\alpha 2\rvert < t^*$		
	x_{20}							statement fulfilled	$\lvert t\alpha 3\rvert < t^*$		
2	x_1	9.07E–05	0.999909319	x_9 x_{11} x_{13}	x_1 x_8 x_{36}	0.176193753	0.823806247	$F = 7.792617$	$t\alpha 0 = 1.48432483$ $t\alpha 1 = -1.45448213$ $t\alpha 2 = 0.295506624$ $t\alpha 3 = -0.49459964$		model insignificant
	x_8							***F**** = 6.99	***t**** = 2.571**		
	x_9							***F* > *F****	$\lvert t\alpha 0\rvert < t^*$	statement unfulfilled	
	x_{11}								$\lvert t\alpha 1\rvert < t^*$		
	x_{13}								$\lvert t\alpha 2\rvert < t^*$		
	x_{36}							statement fulfilled	$\lvert t\alpha 3\rvert < t^*$		

Table 9 continued

1	2	3	4	5	6	7	8	9	10	11
3	x_1 x_8 x_9 x_{11} x_{13} x_{36} x_{67}	0.000000292	0.999999708	x_9 x_{11} x_{13}	x_1 x_8 x_{36} x_{67}	0.154131834	0.845868166	F = 5.487952 F^* = 6.42 $F > F^*$ statement unfulfilled		model insignificant
4	x_1 x_8 x_9 x_{11} x_{13} x_{36} x_{64}	0.000000035	0.999999965	x_9 x_{11} x_{13}	x_1 x_8 x_{36} x_{64}	0.05804954	0.94195046	F = 16.22667 F^* = 6.42 $F > F^*$ statement fulfilled	$t\alpha0 = -1.14866878$ $t\alpha1 = 1.161249949$ $t\alpha2 = -1.59388261$ $t\alpha3 = -1.94578144$ $t\alpha4 = 2.853230334$ $t^* = 2.776$ $\lvert t\alpha0\rvert < t^*$ $\lvert t\alpha1\rvert < t^*$ $\lvert t\alpha2\rvert > t^*$ $\lvert t\alpha3\rvert < t^*$ $\lvert t\alpha4\rvert > t^*$ statement for $\lvert t\alpha4\rvert > t^*$ fulfilled	one significant regression coefficient
5	x_1 x_8 x_9 x_{11} x_{13} x_{22}	0.000145017	0.999854983	x_9 x_{11} x_{13}	x_1 x_8 x_{22}	0.1825386	0.817461376	F = 7.463821 F^* = 6.99 $F > F^*$ statement fulfilled	$t\alpha0 = 1.71959365$ $t\alpha1 = -1.69936114$ $t\alpha2 = 0.666415791$ $t\alpha3 = -0.24966065$ $t^* = 2.571$ $\lvert t\alpha0\rvert < t^*$ $\lvert t\alpha1\rvert < t^*$ $\lvert t\alpha2\rvert < t^*$ $\lvert t\alpha3\rvert < t^*$ statement unfulfilled	model insignificant

Table 9 continued

1	2	3	4	5	6	7	8	9	10		11
6	x_1 x_8 x_{11} x_{13} x_{36} x_{68}	0.09396619	0.90603381	x_8 x_{13}	x_1 x_{11} x_{68}	0.1611362	0.83886376	$F = 8.676548$ $\boldsymbol{F^* = 6.99}$ $\boldsymbol{F > F^*}$ statement fulfilled	$t\alpha0 = 0.575012241$ $t\alpha1 = -0.70349921$ $t\alpha2 = 0.874072537$ $t\alpha3 = -0.75364406$ $\boldsymbol{t^* = 2.571}$ $\lvert t\alpha0\rvert < t^*$ $\lvert t\alpha1\rvert < t^*$ $\lvert t\alpha2\rvert < t^*$ $\lvert t\alpha3\rvert < t^*$	statement unfulfilled	model insignificant

Source: author's work.