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Folia Oeconomica Stetinensia 13(21)/2, 109-119

2013

Artykuł został opracowany do udostępnienia w internecie przez Muzeum Historii Polski w ramach prac podejmowanych na rzecz zapewnienia otwartego, powszechnego i trwałego dostępu do polskiego dorobku naukowego i kulturalnego. Artykuł jest umieszczony w kolekcji cyfrowej bazhum.muzhp.pl, gromadzącej zawartość polskich czasopism humanistycznych i społecznych.

Tekst jest udostępniony do wykorzystania w ramach dozwolonego użytku.

MICROSCALE EVALUATION OF THE DIAGNOSIS STABILITY

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Received 21 October 2013, Accepted 22 December 2013

Abstract

In the paper the author makes a classification of the Construction Sector companies that are listed on the Warsaw Stock Exchange. The classification is made with a view to identify those companies whose financial standing in the years of study (2007, 2009 and 2011) was good or bad from the point of view of several selected ratios. The classification is based on the inquiry into the stability of final diagnoses of the companies' financial standing. The final diagnoses were founded on the median from partial diagnoses which had been created in the course of a two-element diagnostic process where the real values of the companies' financial indices were compared with theoretical and empirical norms.

Keywords: quantitative diagnosing, theoretical and empirical norms, classification, ratio analysis.

JEL classification: C38, G11.

Introduction

Making decisions on stock investments requires from the investor to analyze a range of data in order to assess properly the financial and economic standing of companies. A good or bad financial condition of a company, both at the time when the decision is being made and before, is a relevant ratio and helps the investor choose if they want to buy the stock or not. Investors are more willing to commit their money for companies in a good and stable financial condition rather than in these that barely survived throughout the whole observed period of time. This is why it is vital to assess the stability of a company financial standing and the information provided pursuant to this analysis can support the decision-making process.

The purpose of this paper is to classify the Construction Sector companies that are listed on the Warsaw Stock Exchange in terms of stability of their financial situation in 2007, 2009 and 2011, i.e. to identify those companies which characterized with a good or bad financial standing throughout the observed period of time. On this basis the investor can choose the companies that are worth investing in. Since the analysis of the companies' financial standing stability is a criterion for their classification, the process of diagnosing their financial condition is a starting point for further studies.

In this paper the diagnostic process has been defined according to the proposal from K. Wawrzyniak's¹ publication where a diagnosis is meant as a valuing recognition which is initially focused on identifying the actual and the desired situation and – after formulating the ultimate diagnosis – on the comparison of the both². According to the adopted definition, the most important elements of this process are the observed regularity and the normative regularity and it is the observed regularity that determines the choice of the normative regularity. The recognition of these two elements is crucial and sufficient for the diagnosis, i.e. for establishing if the observed regularity is consistent with the norm (positive diagnosis) or not (negative diagnosis). We call it a two-element diagnostic process.

In order to include into the considerations both the study aim and the essence of the two-element diagnosing process, the author presumes that the stability assessment will cover the final diagnoses of the companies' financial situation seen as a resultant of partial diagnoses. The partial diagnoses have been obtained in the two-element diagnosing process by comparing the real values of the selected financial ratios with theoretical and empirical norms that have been taken for them. Due to the type of the observed regularity (the real values of financial ratios for stock-listed companies – the structural regularity) the median value has been taken for the empirical norm³, while the theoretical norms for the chosen ratios come from the reference literature.

Specification	Profitability ratios					
	RZB1	RZOp	RZB2	RZN	ROE	ROA
1	2	3	4	5	6	7
RZB1	1.000	0.361	0.222	0.200	0.460	0.437
RZOp	0.361	1.000	0.841	0.843	0.676	0.878
RZB2	0.222	0.841	1.000	0.998	0.589	0.833
RZN	0.200	0.843	0.998	1.000	0.581	0.827
ROE	0.460	0.676	0.589	0.581	1.000	0.904
ROA	0.437	0.878	0.833	0.827	0.904	1.000
Total of absolute values in columns	2.680	4.599	4.483	4.449	4.210	4.879
Central feature: ROA; satellite features: RZOp, RZB2, RZN, ROE; isolated feature: RZB1						

1	2	3	4	5	6	7
Specification	Liquidity ratios					
	PB		PS		PG	
PB	1.000		0.803		0.675	
PS	0.803		1.000		0.805	
PG	0.675		0.805		1.000	
Total of absolute values in columns	2.478		2.608		2.480	
Central feature: PS; satellite features: PB, PG						
Specification	Activity ratios					
	Rnal	RZap	RZob	RMOB	RA	
Rnal	1.000	−0.254	0.485	0.291	0.069	
Rzap	−0.254	1.000	−0.095	0.552	0.575	
Rzob	0.485	−0.095	1.000	0.526	0.279	
RMOB	0.291	0.552	0.526	1.000	0.786	
RA	0.069	0.575	0.279	0.786	1.000	
Total of absolute values in columns	2.099	2.476	2.385	3.155	2.709	
Central feature: RMOB; satellite features: RZap, RZob, RA; isolated feature: Rnal						
Specification	Debt ratios					
	WPM	SZ	WOZ	DE		
WPM	1.000	−0.493	0.224	0.253		
SZ	−0.493	1.000	−0.369	−0.133		
WOZ	0.224	−0.369	1.000	0.153		
DE	0.253	−0.133	0.153	1.000		
Total of absolute values in columns	1.970	1.995	1.746	1.539		
Central feature: SZ; satellite feature: WPM; isolated features: WOZ, DE						

Source: own calculations on the basis of *Notoria Serwis* – version 21.20 – October 2012.

The ultimate set of diagnostic features used in the process of examining the stability of diagnoses contained the following ratios: return on assets ratio (ROA), quick ratio (PS), trading asset turnover in days (RMOB) and the debt ratio (SZ). Table 2 presents the values of the above ratios in individual companies from the Construction Sector in 2007, 2009 and 2011.

Table 2. Values of selected financial ratios in the Construction Sector companies in 2007, 2009 and 2011

Acronym (Ticker)	ROA			PS			RMOB			SZ		
	2007	2009	2011	2007	2009	2011	2007	2009	2011	2007	2009	2011
1	2	3	4	5	6	7	8	9	10	11	12	13
ABM	0.05	0.04	−0.140	1.21	0.75	0.58	158.4	157.6	146.7	0.48	0.68	0.90
AWB	0.14	0.06	0.001	0.92	1.20	0.95	137.7	121.4	147.2	0.72	0.58	0.63

1	2	3	4	5	6	7	8	9	10	11	12	13
BPM	0.09	0.003	0.04	1.45	1.17	1.07	179.4	164.8	189.6	0.49	0.39	0.54
BDX	0.01	0.050	0.06	0.89	0.73	0.74	218.7	308.8	240.2	0.77	0.82	0.84
BDL	0.14	0.040	0.09	2.11	3.59	2.27	148.3	367.2	216.6	0.48	0.33	0.46
ELB	0.10	0.120	0.06	1.20	1.91	1.39	147.8	176.2	190.4	0.67	0.39	0.50
ELT	0.09	0.080	0.07	4.31	4.52	2.50	378.3	335.9	206.8	0.24	0.22	0.36
EKP	-0.10	-0.170	-0.15	0.68	1.19	2.88	241.4	553.5	bd	0.99	0.26	0.14
ENP	0.01	0.100	0.04	1.36	1.53	1.86	111.7	117.5	206.7	0.65	0.59	0.52
EPL	0.02	0.030	0.03	4.24	3.03	1.83	274.8	226.4	245.2	0.23	0.38	0.49
EPD	0.06	-0.030	-0.05	1.15	1.19	0.57	223.3	397.8	224.6	0.53	0.64	0.76
ERB	0.07	0.070	-0.03	1.38	1.26	1.24	241.7	194.3	152.7	0.57	0.61	0.70
HRS	0.08	0.010	0.03	6.26	0.22	0.63	536.7	134.3	141.9	0.15	0.85	0.47
HBP	0.07	0.070	0.01	0.92	1.19	1.16	288.5	261.6	276.1	1.01	0.73	0.73
INK	0.11	0.110	0.07	0.79	1.32	1.45	237.4	190.5	193.7	0.53	0.43	0.44
ITK	0.02	-0.004	-0.19	0.67	1.12	0.56	231.3	317.2	231.9	0.73	0.66	0.85
ITB	0.08	0.130	0.06	0.77	0.63	0.79	140.5	175.6	323.8	0.72	0.77	0.63
MRB	0.07	0.050	0.04	0.68	0.82	0.82	165.8	353.0	261.4	0.85	0.73	0.56
MSX	0.07	-0.090	-0.55	1.27	1.36	0.60	219.3	384.8	173.9	0.45	0.37	0.45
MSP	0.17	0.180	-0.09	2.89	2.56	2.02	176.6	178.4	227.1	0.32	0.39	0.40
MSW	0.05	0.080	-0.06	1.22	1.31	1.05	154.0	147.6	159.3	0.66	0.63	0.77
MSZ	0.15	0.060	0.04	1.23	0.99	0.99	110.8	126.3	151.3	0.46	0.58	0.60
NVA	0.09	0.090	0.05	5.20	2.16	1.56	381.7	146.5	129.7	0.17	0.25	0.38
PBG	0.05	0.050	0.03	1.31	1.51	1.06	394.3	419.5	412.0	0.65	0.60	0.65
PBO	-0.02	0.060	0.06	0.65	1.15	0.96	91.7	215.9	235.1	0.90	0.77	0.64
PMG	0.07	-0.050	0.14	0.93	0.83	2.61	131.6	198.0	432.8	0.87	0.54	0.39
PQA	0.05	-0.080	0.04	1.73	1.19	1.07	320.5	149.3	162.3	0.44	0.52	0.58
PXM	0.04	0.040	0.02	1.16	1.09	0.89	175.1	173.7	205.5	0.62	0.64	0.66
PRM	0.06	0.002	0.02	1.28	1.28	1.37	224.3	183.8	245.9	0.53	0.38	0.42
PJP	0.09	0.004	0.01	2.15	1.43	1.39	209.0	261.3	199.6	0.21	0.24	0.29
RES	0.05	-0.150	-0.36	1.07	1.48	1.07	114.0	177.6	132.8	0.65	0.46	0.75
TSG	0.07	0.080	0.07	1.27	1.31	2.26	235.3	229.0	209.2	0.73	0.62	0.34
TRK	0.06	0.120	0.06	0.99	1.91	0.90	202.2	196.9	179.7	0.70	0.37	0.71
ULM	0.13	-0.010	0.10	1.14	0.78	1.09	169.0	193.3	151.6	0.39	0.53	0.40
UNI	0.08	0.070	0.04	0.88	0.74	1.09	107.6	186.2	160.1	0.89	0.60	0.70
WAX	0.15	0.150	0.09	2.09	3.68	3.58	160.9	279.2	205.8	0.41	0.35	0.42
ZUE	0.25	0.050	0.05	1.34	1.50	1.37	136.2	91.4	198.5	0.61	0.68	0.56

Source: *Notoria Serwis* – version 21.20 – October 2012.

2. Stability of final diagnoses of the financial situation in the companies observed in 2007, 2009 and 2011

The process of evaluating final diagnoses over time started from identifying the normative regularity being the ground for interim diagnoses based on the values of individual ratios. For the PS and SZ ratios, being nominants, the normative values were adopted within the range of target values found in the reference literature (theoretical norms). For the ROA ratio, regarded

as a stimulant, and the RMOB, regarded as a destimulant, the author proposes an empirical norm at the median level which, in both cases, allows to evaluate positively a half of the companies.

Table 3 shows the character of the examined ratios and their theoretical and empirical normative regularity.

Table 3. Selected financial ratios and their normative values⁷

No.	Ratio	Feature character, normative value
1.	return on assets (ROA)	Stimulant – the higher the ratio. the better. Empirical norm (median) in the years: 2007 – 0.071; 2009 – 0.052; 2011 – 0.037
2.	Quick ratio (PS)	Nominant – [1.0–1.3]
3.	trading asset turnover in days (RMOB)	Destimulant – the lower the ratio. the better. Empirical norm (median) in the years: 2007 – 179.4; 2009 – 193.3; 2011 – 202.6
4.	Debt (SZ)	Nominant – [0.57–0.67]

Source: own study. The values of medians were calculated on the basis of data in table 2.

Information from Table 3 was used in the process of diagnosing the monitored companies' financial situation from the point of view of the selected ratios in 2007, 2009 and 2011. The process was conducted in the following steps:

1. Two-variant interim diagnoses (dc_{ij}) were formulated basing on the real ratio values in the monitored companies according to the rule:

- for the nominants with a known range of normative values

$$dc_{ij} = \begin{cases} 1 & \text{for } x_{ij} \in \langle_d x_{wj}; g x_{wj} \rangle \\ 0 & \text{for } x_{ij} <_d x_{wj} \cup x_{ij} >_g x_{wj} \end{cases} \quad (1)$$

- for the stimulant

$$dc_{ij} = \begin{cases} 1 & \text{for } x_{ij} \geq Q_{2j} \\ 0 & \text{for } x_{ij} < Q_{2j} \end{cases} \quad (2)$$

- for the destimulant

$$dc_{ij} = \begin{cases} 1 & \text{for } x_{ij} \leq Q_{2j} \\ 0 & \text{for } x_{ij} > Q_{2j} \end{cases} \quad (3)$$

2. Three-variant final diagnoses (dk_i) were formulated according to the rule:

$$dk_i = \text{mediana}\{dc_{ij}\} \quad (4)$$

where:

- x_{ij} – value of the j th ratio in the i th company, i.e. the observed regularity;
- d^x_{wj}, g^x_{wj} – bottom and upper limit of the range of the normative values;
- Q_{2j} – the median value determined for the j th ratio;
- dc_{ij} – the two-variant interim diagnosis for the i th company in reference to the j th ratio:
 - $dc_{ij} = 1$ – a positive diagnosis (the value of the j th ratio in the i th company consistent with the adopted norm),
 - $dc_{ij} = 0$ – a negative diagnosis (the value of the j th ratio in the i th company inconsistent with the adopted norm);
- dk_i – the three-variant final diagnosis for i th company was formulated basing on the even number of partial diagnoses⁸:
 - $dk_i = 1$ – a positive diagnosis (over a half of the ratios is consistent with the adopted norm),
 - $dk_i = 0,5$ – an inconclusive diagnosis (the number of the ratios consistent and inconsistent with the norm is the same),
 - $dk_i = 0$ – a negative diagnosis (over a half of the ratios is inconsistent with the adopted norm);
- $j = 1, 2, \dots, k$;
- k – the number of ratios;
- $i = 1, 2, \dots, n$;
- n – the number of companies.

Table 4 contains the two-variant interim diagnoses (formulas 1–3) and the three-variant final diagnoses (formula 4) for the monitored companies in 2007, 2009 and 2011.

Table 4. Partial and final diagnoses for the listed companies from the Construction Sector observed in 2007, 2009 and 2011

Acronym	2007					2009					2011				
	ROA	PS	RMOB	SZ	dk_i	ROA	PS	RMOB	SZ	dk_i	ROA	PS	RMOB	SZ	dk_i
ABM	0	1	1	0	0.5	0	0	1	0	0	0	0	1	0	0
AWB	1	0	1	0	0.5	1	1	1	1	1	0	0	1	1	0.5
BPM	1	0	1	0	0.5	0	1	1	0	0.5	1	1	1	0	1
BDX	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
BDL	1	0	1	0	0.5	0	0	0	0	0	1	0	0	0	0
ELB	1	1	1	0	1	1	0	1	0	0.5	1	0	1	0	0.5
ELT	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0
EKP	0	0	0	0	0	0	1	0	0	0	0	0	bd	0	0

ENP	0	0	1	1	0.5	1	0	1	1	1	0	0	0	0	0
EPL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EPD	0	1	0	0	0	0	1	0	1	0.5	0	0	0	0	0
ERB	0	0	0	1	0	1	1	0	1	1	0	1	1	0	0.5
HRS	1	0	0	0	0	0	0	1	0	0	0	0	1	0	0
HBP	1	0	0	0	0	1	1	0	0	0.5	0	1	0	0	0
INK	1	0	0	0	0	1	0	1	0	0.5	1	0	1	0	0.5
ITK	0	0	0	0	0	0	1	0	1	0.5	0	0	0	0	0
ITB	1	0	1	0	0.5	1	0	1	0	0.5	1	0	0	1	0.5
MRB	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
MSX	1	1	0	0	0.5	0	0	0	0	0	0	0	1	0	0
MSP	1	0	1	0	0.5	1	0	1	0	0.5	0	0	0	0	0
MSW	0	1	1	1	1	1	0	1	1	1	0	1	1	0	0.5
MSZ	1	1	1	0	1	1	0	1	1	1	1	0	1	1	1
NVA	1	0	0	0	0	1	0	1	0	0.5	1	0	1	0	0.5
PBG	0	0	0	1	0	1	0	0	1	0.5	0	1	0	1	0.5
PBO	0	0	1	0	0	1	1	0	0	0.5	1	0	0	1	0.5
PMG	1	0	1	0	0.5	0	0	0	0	0	1	0	0	0	0
PQA	0	0	0	0	0	0	1	1	0	0.5	1	1	1	1	1
PXM	0	1	1	1	1	0	1	1	1	1	0	0	0	1	0
PRM	0	1	0	0	0	0	1	1	0	0.5	0	0	0	0	0
PJP	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0
RES	0	1	1	1	1	0	0	1	0	0	0	1	1	0	0.5
TSG	0	1	0	0	0	1	0	0	1	0.5	1	0	0	0	0
TRK	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0.5
ULM	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1
UNI	1	0	1	0	0.5	1	0	1	1	1	1	1	1	0	1
WAX	1	0	1	0	0.5	1	0	0	0	0	1	0	0	0	0
ZUE	1	0	1	1	1	1	0	1	0	0.5	1	0	1	0	0.5

Source: own calculations based on Tables 2–3.

3. Classification of the Construction Sector companies in terms of stability of their final diagnoses

Basing on the final diagnoses of financial standing in individual companies in 2007, 2009 and 2011, the author classified them according to the following assumptions:

- the higher the sum calculated from the values of final annual diagnoses, the better the financial situation of the company and the higher its position in the ranking, which means that a given company falls into the group of companies with a very good or good financial standing,
- in every group of companies their position in the ranking depends on the value of the final diagnosis in 2011, ahead of the values of the diagnosis in 2009 followed by 2007. A higher final diagnosis in the most recent years means that the company's financial

situation improved throughout the observation period, hence the company is worth investing, even if it belongs to the group of companies in a worse financial situation.

The observed companies' classification and the characteristics of their financial standing are presented in Table 5.

Table 5. Classification of listed companies from the Construction Sector due to stability of their 2007, 2009 and 2011 final diagnoses

Group no.	Company name	Acronym	Sum of dk_i	2007	2009	2011	Characteristics of the group of companies
I	MOST_ZAB	MSZ	3	1	1	1	Very good and stable financial situation
	UNIBEP	UNI	2.5	0.5	1	1	
	MOST_WWA	MSW	2.5	1	1	0.5	
II	BIPROMET	BPM	2	0.5	0.5	1	Good but not quite stable financial situation
	ULMA	ULM	2	1	0	1	
	AWBUD	AWB	2	0.5	1	0.5	
	ELBUDOWA	ELB	2	1	0.5	0.5	
	ZUE	ZUE	2	1	0.5	0.5	
	POLIMEX	PXM	2	1	1	0	
III	POLAQUA	PQA	1.5	0	0.5	1	Rather good but not quite stable financial situation
	ERBUD	ERB	1.5	0	1	0.5	
	INTERLUB	ITB	1.5	0.5	0.5	0.5	
	RESBUD	RES	1.5	1	0	0.5	
	ENERGOAP	ENP	1.5	0.5	1	0	
IV	INSTAL_K	INK	1	0	0.5	0.5	Bad but quite stable financial situation
	PANOVA	NVA	1	0	0.5	0.5	
	PBG	PBG	1	0	0.5	0.5	
	PBOANIOL	PBO	1	0	0.5	0.5	
	MOST_PK	MSP	1	0.5	0.5	0	
V	TRAKCJA	TRK	0.5	0	0	0.5	Very bad and stable financial situation
	ENMONTDPD	EPD	0.5	0	0.5	0	
	HYDROWLO	HBP	0.5	0	0.5	0	
	INTAKUS	ITK	0.5	0	0.5	0	
	PROCHEM	PRM	0.5	0	0.5	0	
	TESGAS	TSG	0.5	0	0.5	0	
	ABMSOLID	ABM	0.5	0.5	0	0	
	BUDOPOL	BDL	0.5	0.5	0	0	
	MOST_EXP	MSX	0.5	0.5	0	0	
	PEMUG	PMG	0.5	0.5	0	0	
	WADEX	WAX	0.5	0.5	0	0	
	BUDIMEX	BDX	0	0	0	0	
	ELEKTROT	ELT	0	0	0	0	
	ELKOP	EKP	0	0	0	0	
	ENERGOPL	EPL	0	0	0	0	
	HERKULES	HRS	0	0	0	0	
	MIRBUD	MRB	0	0	0	0	
	PROJPRZM	PJP	0	0	0	0	

Source: established by the author on the basis of Table 4.

Conclusions

The study shows that information about stability of the companies' financial situation over time can greatly support the investor's decision making process. On that basis we can rank companies, thus finding out which are worth investing or not.

As far as the Construction Sector companies are concerned, the most attractive are these which belong to the first group, i.e. MOST_ZAB, UNIBEP and MOST_WWA. However, we should be rather cautious about the latter one since in 2011 its financial standing worsened.

Despite a good or quite good but unstable financial standing of the companies in the second and the third group, two of them are still worth recommendation (BIPROMET, POLAQUA) because their situation improved period to period. Another interesting company is ULMA, whose financial situation improved in 2011. In the case of the remaining companies in these two groups the decision is not easy to make due to their unstable final diagnoses.

In the companies of the fourth group their financial standing is not quite advantageous, but because of their stable diagnoses in the two latest periods of observation four companies (INSTAL_K, PANOVA, PBG, PBOANIOL) are worth consideration.

The least attractive for investors are the companies from the last group. Their financial standing was bad or very bad throughout the whole period of observation. Only TRAKCJA slightly improved its financial situation in 2011, but this signal is too weak to make the company attractive for investors.

All in all, it should be noted that the final ranking of companies depends first of all on the choice of financial ratios and on empirical norms adopted in the diagnosing process. Therefore every investor should decide for themselves which ratios are the most relevant for them when evaluating the company's financial standing and how high the empirical norms should be⁹. The best solution would be to replace empirical norms with theoretical (constant) ones. Unfortunately, such norms have not been established for every ratio.

Notes

¹ See Wawrzyniak (2007).

² This proposal refers to the definition of econometric diagnosis by J. Hozer (1989). According to the author diagnosing is a process consisting of the following elements: the observed regularity, the normative regularity (a norm), the deviation, and the tolerance of the deviation.

³ For quartiles playing the role of empirical norms used in the classification of stock-listed companies see Wawrzyniak (2013).

- ⁴ Data bought by Katedra Zastosowań Matematyki w Ekonomii Zachodniopomorskiego Uniwersytetu Technologicznego w Szczecinie.
- ⁵ *Notoria Serwis* publishes information about 21 financial ratios but the author decided not to take into consideration three of them: working capital ratio, operation cycle (the sum of receivable and inventory turnovers) and the cash conversion cycle (the difference between the operation cycle and the receivable turnover). The abandoned ratios are absolute values and in comparative analysis their cognitive value is limited. Moreover, they replicate directly information conveyed by other ratios in individual groups.
- ⁶ See Nowak (1990), pp. 28–31.
- ⁷ Values of theoretical norms for the PS and SZ ratios are taken from: Sierpińska, Jachna (1995), pp. 81, 89; Hozer et al. (1997), pp. 69–72; Łuniewska, Tarczyński (2006), pp. 46–49.
- ⁸ For the uneven number of partial diagnoses the final diagnosis has only two variants 0 and 1. The 0 value means a negative diagnosis (over a half of the ratios is inconsistent with the norm), while 1 means a positive diagnosis (over a half of the ratios is consistent with the norm).
- ⁹ When making partial diagnoses apart from the empirical norm at the level of the median the author also used the first quartile (a soft norm) and the third quartile (a hard norm). It turned out that in the case of the first quartile the number of companies in the first (best) group grew to 7, while in the fifth (worst) group fell to 7. In the case of the third quartile, no company fell into the first group, whereas the number of companies in the fifth group increased to 26.

References

- Hozer, J. (1989). Funkcja diagnostyczna modeli ekonometrycznych, *Wiomości Statystyczne* nr 2, 13–15.
- Hozer, J., Tarczyński, W., Gazińska, M., Wawrzyniak, K. & Batóg, J. (1997). *Metody ilościowe w analizie finansowej przedsiębiorstwa*, Warszawa: Główny Urząd Statystyczny.
- Łuniewska, M. & Tarczyński, W. (2006). *Metody wielowymiarowej analizy porównawczej na rynku kapitałowym*, Warszawa: Wydawnictwo Naukowe PWN.
- Nowak, E. (1990). *Metody taksonomiczne w klasyfikacji obiektów społeczno-gospodarczych*, Warszawa: PWE.
- Sierpińska, M. & Jachna, T. (1995). *Ocena przedsiębiorstwa według standardów światowych*, Warszawa: PWN.
- Wawrzyniak, K. (2007). *Diagnozowanie ilościowe procesów i obiektów gospodarczych – podstawowe pojęcia*. In: J. Hozer (Ed.) *Metody ilościowe w ekonomii*, Zeszyty Naukowe Uniwersytetu Szczecińskiego nr 450, Prace Katedry Ekonometrii i Statystyki nr 17, Szczecin: Wydawnictwo Uniwersytetu Szczecińskiego, 647–659.
- Wawrzyniak, K. (2013). *Parametry struktury jako narzędzia klasyfikacji obiektów w mikroskali*. In: J. Hozer, B. Bieszk-Stolorz (Eds.) *Metody ilościowe w ekonomii*, Studia i Prace Wydziału Nauk Ekonomicznych i Zarządzania nr 31, Szczecin: Wydawnictwo Uniwersytetu Szczecińskiego, 345–359.