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APPLICATION OF SELECTED METHODS OF MULTIDIMENSIONAL COMPARATIVE ANALYSIS IN THE DEVELOPMENT OF RANKING LISTS OF LISTED MEDIA COMPANIES

Introduction

The application of the methods of multidimensional comparative analysis increases significantly the effectiveness of economic research that aims at the assessment of companies' financial condition. The multidimensional comparative analysis (MCA) makes it possible to analyze simultaneously at least two variables that describe every object (phenomenon) under investigation[1]. Z.Hellwig, the creator of MCA, defines it as "the methods and techniques of comparing multi-feature objects[2]. The basic objective of MCA is to develop synthetic measures that would replace numerous diagnostic features describing particular objects with a single aggregated measure. The measure in question constitutes s kind of a scalar that makes it possible to rank linearly the investigated objects[3].

The aim of the article is to apply selected methods of MCA in the development of the ranking lists of media companies that were listed in the Warsaw Stock Exchange in 2013-2015 and to investigate the congruity of the ranking and classification of the companies with the application of the selected methods. The methods were: the synthetic measure based on contra-harmonic mean and Z.Hellwig's pattern development method.

1. Research conducted with the application of MCA methods

The procedure of MCA is significantly complex due to the multiplicity of variables and objects that are subject to investigation. The scheme of conduct may vary depending on the

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[1] M. Łuniewska, *Charakterystyka metod wielowymiarowej analizy porównawczej* [in:] M. Łuniewska, W. Tarczyński (ed.), *Metody wielowymiarowej analizy porównawczej na rynku kapitałowym,* Wydawnictwo naukowe PWN, Warszawa 2006, pp. 9-10.
[2] Z. Hellwig, *Wielowymiarowa analiza porównawcza i jej zastosowanie w badaniach wielocechowych obiektów gospodarczych* [in:] W. Welfe (ed.), *Metody i modele ekonomiczno-matematyczne w doskonaleniu zarządzania gospodarką socjalistyczną,* Polskie Wydawnictwo Ekonomiczne, Warszawa 1981, p. 48.
[3] A. Figurski, *Klasyfikacja i porządkowanie wybranych mierników syntetycznych na podstawie wyników eksperymentu symulacyjnego,* Zeszyt Naukowy WSZiB w Krakowie, Kraków 2010, No. 15-16, p. 109.

complexity of the problem under investigation; however, there are some operations that are obligatory regardless of the accepted method of investigation [4].

The basic task of the investigation that applies MCA is to select a set of diagnostic features that will possibly reflect most completely the phenomena under investigation and will not have too many elements. It should be pointed out that this stage is of extreme significance as it influences the precision of the result and the final analyses[5].

The selection methods of the diagnostic features can be divided into ones that are[6]:

- statistical – using mainly the matrix of linear correlation among potential diagnostic features; these methods include Z.Hellwig's parametric method and J.Czekanowski's diagraphic method;
- non-statistical – i.e. ones that are based on the opinions of experts who apply their knowledge and experience to develop an adequate list of diagnostic features;
- mixed – i.e. two-stage methods that apply both the substantive and statistical approach.

Having specified the set of diagnostic features, one should define their character i.e. divide them into three subsets: stimulants, destimulants and nominants[7]. The determination of the character of diagnostic features is a fairly complex task as the definition and the substantive significance do not always define clearly the character of a particular feature. In such cases techniques should be applied that are either based on substantive circumstances or on statistical information[8]. The paper adopted the method based on substantive circumstances.

The selected MCA methods that are used to assess the financial condition of listed companies require that all diagnostic features should have a stimulant character. Consequently, the features that have the character of destimulant or nominant should be reduced (by means of suitable procedures) to the form of stimulants.

The next step in the MCA of multidimensional objects is to determine the significance of the features with the consideration of the substantive criterion and to transform them in the way

[4] M. Łuniewska, *Charakterystyka…,* op. cit., p. 17.

[5] A. Figurski, *Koncepcja badań w zakresie wykorzystania procedur porządkowania liniowego do oceny sytuacji finansowej przedsiębiorstw,* Zeszyt Naukowy WSZiB w Krakowie, Kraków 2008, No. 8, p. 190.

[6] A. Figurski, *O pewnych metodach doboru cech diagnostycznych w badaniach taksonomicznych*, Zeszyt Naukowy WSZiB w Krakowie, Kraków 2004, No. 1, p. 22.

[7] The termds: stymulant, destimulant and nominant were defined, among others, in: M. Kolenda, *Taksonomia numeryczna. Klasyfikacja, porządkowanie i analiza obiektów wielocechowych,* Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, Wrocław 2006, p. 21.

[8] A. Figurski, *Koncepcja …,* op. cit., p. 192.

that they should remain their proportional impact on the final results of the investigation[9]. In the course of this stage of investigation, the following formulas are used to weight the diagnostic features[10]:

- a set of stable unit-weights: $\alpha_j = 1$;
- a set of stable weights: $\alpha_j = \frac{1}{m}$;
- a set of varied weights, based on the measures of the relative information values of features: $\alpha_j = \frac{V_j}{\sum_{j=1}^{m} V_j}$;
- a set of varied weights, based on the measures of the "unambiguousness" of features: $\alpha_j = \frac{\sum_{j=1}^{m} r_{ij}}{\sum_{j=1}^{m}\sum_{j=1}^{m} r_{ij}}$;
- a set of varied weights determined on the basis of the factor analysis results by means of the main component methods, with the correlation coefficient matrix as the starting point: $\alpha_j = \frac{w_{j1}}{\sum_{j=1}^{m}|w_{j1}|}$;

  where: m – number of variables; $j = 1, 2, \ldots, m$; v_j – coefficient of variation of the j^{th} *feature*; r_{ij} – correlation coefficient between output variables ; w_{j1} –elements of the first main component.

Before empirical data can be applied to develop synthetic variables, they have to be normalized. The purpose of the normalization is to meet two postulates without which the development of synthetic variables is not possible. They are: the postulate of additivity which consists in the reduction of particular features to a comparable form; and the postulate of uniform preference that consists in transforming destimulants into stimulants or vice versa which results in the determination of the common preference direction of the variables[11].

There are four groups of the variable normalization methods[12]:

- variable ranking,
- quotient transformations,

[9] M. Kolenda, *Taksonomia…,* op. cit., p. 44.
[10] A. Figurski, *Koncepcja …,* op. cit., p. 196.
[11] Ibidem, p. 197.
[12] Ibidem.

- standardization,
- unitarization.

The formulas of the particular methods of variable normalization are presented in a comprehensive literature on the subject[13].

Following the normalization, the values of the diagnostic features are in the range [0,1]; they are ready to be aggregated and a **synthetic measure** can be developed[14].

2. Methods of synthetic measure construction

The comparative investigations of multi-feature objects that are conducted with the application of linear ordering procedures aim at the development of synthetic measures that would enable the determination of an investigated phenomenon with the use of one aggregated measure that, consequently, gives a clear unambiguous image of a given object (phenomenon) against other objects in the set under investigation[15].

The construction methods of synthetic measures are divided into non-pattern and pattern ones[16]. The non-pattern methods consist in the determination of mean normalized values of features with the application of particular formulas, e.g. **contra-harmonic mean** which is calculated by formula[17]:

$$C_i = \frac{\sum_{j=1}^{m} {x_{ij}}^2}{\sum_{j=1}^{m} x_{ij}},$$

where: m – number of variables; $j = 1, 2, \ldots$, m; x_{ij} – normalized value of j^{th} diagnostic feature that is uniform in character.

The research conducted with the use of pattern methods is focused on dividing the population of objects into classes; for this purpose a defined pattern is used[18]. **Hellwig's pattern development method** is one of the pattern methods.

[13] Cf. A. Figurski, *Koncepcja…*, op. cit., p. 198 and M. Walesiak, *Przegląd formuł normalizacji wartości zmiennych oraz ich własności w statystycznej analizie wielowymiarowej,* „Przegląd Statystyczny" 2014, No. 4, p. 364.
[14] E. Nowak, *Analiza sprawozdań finansowych*, Polskie Wydawnictwo Ekonomiczne, Warszawa 2017, p. 77.
[15] A. Figurski, *Klasyfikacja…,* op. cit., p. 109.
[16] Ibidem.
[17] Ibidem, p. 111.
[18] Ibidem, p. 110.

The process of the construction of the measure in conducted in the following stages[19]:

- transformation of all diagnostic variables to the form of stimulants – matrix **X**;
- unification of variables through normalization – matrix **Z**;
- construction of the pattern – the object with the highest values of diagnostic variables; the process consists in the selection of the highest value (z_0) from each of the columns of matrix **Z**; as a result a pattern is developed with the best coordinates:

$$z_{01}, z_{02}, \ldots, ;\ z_{0m} = max\{z_{ij}\},$$

where: z_{ij} –value of the normalized variable;

- calculation of distance (d_i) of each object from the constructed pattern with the application of – for example – the Euclidean distance:

$$d_i = \sqrt{\frac{1}{m}\sum_{j=1}^{m}\left(z_{ij} - z_{0j}\right)^2},$$

where: $i = 1, 2, \ldots, n$ – number of objects; $j = 1, 2 \ldots, m$ – number of variables; z_{ij} – normalized value of j^{th}-variable for i^{th}-object ; z_{0j} – normalized value of j^{th} variable.

The lower value d_i of the object, the better; this means that the distance of the object from the pattern is smaller;

- normalization of the measure with formula:

$$SMR_i = 1 - \frac{d_i}{d_0},$$

where: SMR_i – symmetric development measure for i^{th} object; d_i – distance of i^{th}-object from the pattern; d_0 – norm, which result in the fact that that SMR_i accepts values in range [0,1], given by formula:

$$d_0 = \bar{d} + 2S_d\ ,$$

[19] I. Pomianek, M. Chrzanowska, P. Bórawski, *Zróżnicowanie poziomu rozwoju społeczno-gospodarczego obszarów wiejskich województwa warmińsko-mazurskiego na tle kraju według miernika Hellwiga*, Zeszyt Naukowy Ostrołęckiego Towarzystwa Naukowego, No. 27, pp. 446-447.

where: $\bar{d}$ – arithmetic mean of variable d_i; S_d – standard deviation of varaible d_i;

- division of objects to classes that differ with regard to financial situation, e.g. with the application of parameters: the first quartile, the median, the third quartile.

3. Developing ranking lists of listed media companies – the course of empirical research

The empirical research concerned a group of 15 media companies that were listed on the Warsaw Stock Exchange and which produced their financial reports in 2013-2015 in line with the international accounting standards (IAS). Thus, the companies developed a set of 45 objects to be investigated[20]. 19 financial indicators served as the set of primary diagnostic features which described company financial situation in the four basic areas: profitability, financial liquidity, company effectiveness and debt service. The indicators that are included in the set of primary diagnostic features are given in Table 1. Their structure was obtained from A.Figurski's work[21].

Table 1. Set of primary diagnostic features

I. Profitability ratios:	**III. Efficiency ratios:**
W1 – gross profit margin on sales,	W10 – receivables turnowver,
W2 – operating profit margin,	W11 – operating cycle,
W3 – gross profit margin,	W12 – payables turnover,
W4 – net profit margin,	W13 –cycle cash conversion,
W5 – return on equity ROE,	W14 – current asset turnover,
W6 – return on assets ROA.	W15 – asset turnover.
II. Financial liquidity ratios:	**IV. Debt ratios:**
W7 – current liquidity ratio,	W16 – asset coverage ratio,
W8 – quick liquidity ratio,	W17 – debt ratio,
W9 – cash flow ratio	W18 – debt service ratio,
	W19 – debt/EBITDA.

Source: A. Figurski, *Syntetyczne mierniki permutacyjne jako narzędzie do oceny sytuacji finansowej przedsiębiorstw, Doctor's thesis*, University of Economics in Krakow, Kraków 2011, pp. 40-49.

[20] Financial reports that serve as the source of the financial data of companies under investigation were obtained from the Notoria service through the Emis base.

[21] A. Figurski, *Syntetyczne mierniki permutacyjne jako narzędzie do oceny sytuacji finansowej przedsiębiorstw, Doctor's thesis*, University of Economics in Krakow, Kraków 2011, pp. 40-49.

The final set of diagnostic features was determined with the use of the following two statistical methods: Hellwig's parametric method and J.Czekanowski's diagraphic method. Table 2 presents the algorithms of the methods used.

Table 2. Algorithms of Z.Hellwig's parametric and J.Czekanowski's diagraphic methods

Z.Hellwig's parametric method	**J.Czekanowski's diagraphic method**
1. Development of linear correlation matrix between potential diagnostic features. 2. Determination of the value of parameter r* which is the basis for the classification of potential features into the so called system and isolated features. 3. Determination of the value of parameter Rl which is the sum of the elements of each column (each verse) of the correlation matrix of features R . 4. Determination of the first central feature; i.e. the feature that corresponds to the column with the highest value of R1. 5. In the column of correlation matrix R that was determined in step 4, elements that meet inequality $\mid r_{ij} \mid \geq r^*$ must be distinguished. The verses that correspond to these elements constitute features satellite to the central feature. 6. From correlation matrix R, columns and verses should be crossed out that were distinguished in step 5 of the algorithm; thus a reduced correlation matric R* is obtained . 7. The procedures of steps 3-6 of the algorithm should be repeated until the set of features is finished.	1. Development of a distance matrix between potential diagnostic features with the application of Euclidean metrics. 2. Development of the Czekanowskis's matrix by means of changing the order of the features in the distance matrix so that the smallest values in the matrix should be placed along the main diagonal of the matrix. 3. Development of the Czekanowski's diagram: the elements of the matrix with similar values should be assigned the same or similar color. The groups of objects of the same color that are represented by squares along the main diagonal constitute the groups of similar features.

Source: A. Figurski, *Syntetyczne mierniki permutacyjne jako narzędzie oceny sytuacji finansowej przedsiębiorstw,* Doctor thesis, University of Economics in Krakow, Kraków 2011, p. 61; M. Kolenda, M. Kolenda, *Taksonomia numeryczna. Klasyfikacja, porządkowanie i analiza obiektów wielocechowych,* Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, Wrocław 2006, p. 75.

The final set of diagnostic features is constituted by 8 features that are selected with the application of the above methods. The set and the determination of the character of the diagnostic features that was based on the substantive interpretation is given in Table 3.

Table 3. Set of diagnostic features and determination of their character

No.	**Diagnostic feature**	**Substantive interpretation**
Company profitability indicators		
1.	**W2** – operating profit margin	stimulant
2.	**W5** - ROE	stimulant
Company financial liquidity indicators		

3.	**W8** – quick liquidity ration	nominant
Company efficiency ratios		
4.	**W12** – payables turnover	nominant
5.	**W14** – current asset turnover	destimulant
Company debt ratios		
6.	**W17** – debt ratio	nominant
7.	**W18** – debt service ratio	stimulant
8.	**W19** - debt/EBITDA	destimulant

Source: Authors' research.

Another step in the research, in line with MCA, is to transform the character of diagnostic features into stimulants. The transformation formulas for destimulants and nominants are given in Table 4. In order to transform the character of diagnostic features, K.Kolenda's computer program *Taksonomia numeryczna* was used (attached to M.Kolenda's work[22]).

The procedure of the character unification of the diagnostic features cannot be conducted arbitrarily; this should be done in the way that the linear correlation matrix that is developed between the features should not have significantly negative values of correlation coefficients off-diagonal (in the paper the accepted threshold value of the correlation coefficient was $|r| \geq 0{,}3$). The existing insignificant number of positive values of correlation coefficients is acceptable; this informs that financial indicators duplicate some part of the information on the financial situation of the companies under investigation[23].

Table 4. Formulas of transformation of destimulants and nominants into stimulants

Character of diagnostic feature	Symbol and name of diagnostic feature	Formula of transformation of diagnostic feature into stimulant
destimulants	W14 – current asset turnover ratio	$z_i = \frac{\min X}{x_i}$,
	W19 –debt/EBITDA ratio	$z_i = -1 \times x_i$,

[22] M. Kolenda, *Taksonomia…,* op. cit.
[23] A. Figurski, *Syntetyczne…,* op. cit., p. 118.

nominants	W8 – quick liquidity ratio	$z_i = f(x) = \begin{cases} -\lvert x - c_1\rvert \times p_1 & for\ x \in (-\infty,\ c_1) \\ 0 & for\ x \in \langle c_1,\ c_2\rangle \\ -\lvert x - c_2\rvert \times p_2 & for\ x \in (c_2, +\infty) \end{cases}$ $c_1 = 0.9$; $c_2 = 1$; $p_1 = 3$; $p_2 = 0.25$;
	W12 – payables turnover ratio	$z_i = f(x) = \begin{cases} 1 - \left(\frac{c_1 - x_i}{c_1 - a}\right)^{p_1} & for\ x \in (-\infty,\ c_1) \\ 1 & for\ x \in \langle c_1,\ c_2\rangle \\ 1 - \left(\frac{x_i - c_2}{b - c_2}\right)^{p_2} & for\ x \in (c_2, +\infty) \end{cases}$, $c_1 = 7$; $c_2 = 14$; $p_1 = 1$; $p_2 = 1$
	W17 – debt ratio	$z_i = f(x) = \begin{cases} 1 - \left(\frac{c_1 - x_i}{c_1 - a}\right)^{p_1} & for\ x \in (-\infty,\ c_1) \\ 1 & for\ x \in \langle c_1,\ c_2\rangle \\ 1 - \left(\frac{x_i - c_2}{b - c_2}\right)^{p_2} & for\ x \in (c_2, +\infty) \end{cases}$, $c_1 = 57$; $c_2 = 67$; $p_1 = 1$; $p_2 = 1$
z_i – value x_i transformed into a stimulant; $\bar{x}$ – arithmetic mean; x_i – value of feature X that is a destimulant; min X – minimal value of feature X; c_1 i c_2 – parameters determining the range of the most desired nominant values; a i b – zeros of function $f(x)$ – parameters determining the range of the so called acceptable values of the nominant; p_1 i p_2 – parameters responsible for function $f(x)$ type.		

Source: M. Kolenda, *Taksonomia numeryczna. Klasyfikacja, porządkowanie i analiza obiektów wielocechowych,* Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, Wrocław 2006, p. 22-26.

After the formulas given in Table 4 were used, a linear correlation matrix was obtained which is presented in Table 5 ($|r| \geq 0{,}3$).

Table 5. Correlation matrix between features that have the properties of stimulants

	W2	**W5**	**W8**	**W12**	**W14**	**W17**	**W18**	**W19**
W2	1.00	0.49	0.49			0.40		
W5	0.49	1.00						
W8	0.49		1.00			0.34		
W12				1.00				
W14					1.00		0.40	
W17	0.40		0.34			1.00		
W18					0.40		1.00	
W19								1.00

Source: Authors' research.

The next step in line with the MCA procedure is to weight and to normalize the features. In order to determine the weights of diagnostic features, a system of weights was accepted that is based on the measures of the "unambiguity" of particular features and also a system of weights that is based on the measures of the relative information value of features. Having analyzed the results given in Table 6, one can notice that different weight values were assigned to the indicators depending on the accepted feature weighting system (Spearman's rank correlation ratio equals –0.45). In such cases, in order to ensure a reliable selection of diagnostic features, a system of constant unit weights should be used in comparative research[24]. Consequently, such system of weights will be used here.

Table 6. Values of weights of diagnostic features determined proportionally to correlation coefficient Weight 1 and proportionately to variation coefficient – Weight 2

Indicator	Weight 1	Rank by Weight 1	Weight 2	Rank by Weight 2
W18	0.0986	1	0.0147	5
W19	0.1119	2	0.0173	8
W14	0.1143	3	0.0458	7
W5	0.1251	4	0.0985	4
W12	0.1333	5	0.1070	2
W17	0.1341	6	0.1136	1
W8	0.1401	7	0.1314	3
W2	0.1425	8	0.4715	6

Source:Authors' research.

The normalization of diagnostic features was conducted with the application of unitarization that is given by formula:

$$z_{ij} = \frac{x_{ij} - x_{min}}{x_{max} - x_{min}},$$

where: x_{max} – maximum value of feature j; x_{min} – minimum value of feature j.

On the basis of the data obtained, two synthetic measures: SMR_i – Z.Hellwig's development measure and C_i – contra-harmonic mean were determined to be applied to classify and rank the companies with regard to their financial situation in accordance to the classification criteria given in Table 7.

[24] Ibidem, p. 116.

Table 7. Classification criteria of listed companies with regard to their financial condition

Assessment of company's financial situation	Criterion applied	Group
Very good	$\mathbf{M_i > Q_3}$	I
good	$\mathbf{M_e < M_i \leq Q_3}$	II
weak	$\mathbf{Q_1 < M_i \leq Me}$	III
Very weak	$\mathbf{M_i \leq Q_1}$	IV
where: Q_1, Me, Q_3 – values of the first quartile, the median and the third quartile for variables M_i, . M_i – measure C_i or SMR_i.		

Source: A. Figurski, *Syntetyczne mierniki permutacyjne jako narzędzie oceny sytuacji finansowej przedsiębiorstwa,* Doctor's thesis, Kraków 2011, p. 127.

The ranking lists of the listed media companies that were developed with the use of Z.Hellwig's development measure and the non-pattern measure - the contra-harmonic mean are presented in Table 8. The values of the above synthetic measures are presented in the dynamic approach, i.e. as an arithmetic mean of the measures in all the periods under investigation (2013-2015).

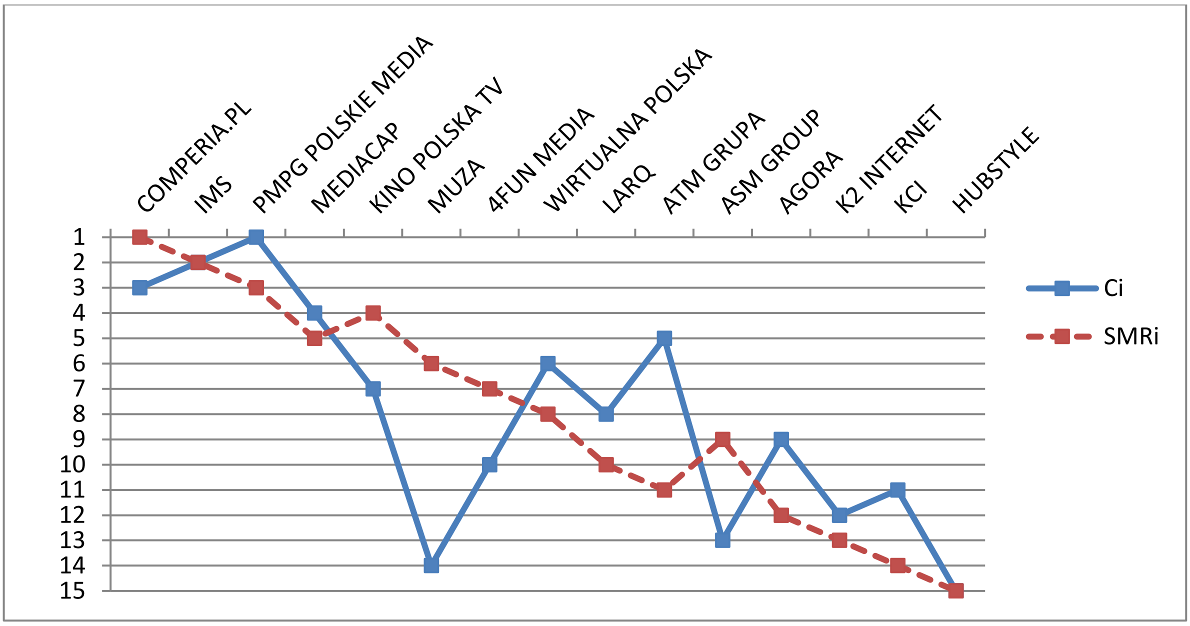
The analysis of the ranking list in Table 8 shows that the congruity of classifications occurred only in two items. They are: the IMS S.A company, which according to the both selected measures was ranked second in the group of companies in a very good financial situation and the Habstyle S.A company, which was ranked last (the 15th) among companies in a very weak financial situation. The ranking of companies is given in Graph 1.

Table 8. Ranking list of the listed media companies obtained with the application of contra-harmonic mean - C_i oraz Z.Hellwig's development measure − SMR_i

C_i				SMR_i			
Company rank	**Company**	$\bar{x}$	**Group**	**Company rank**	**Company**	$\bar{x}$	**Group**
1	PMPG POLSKIE MEDIA	0.778		1	COMPERIA.PL	0.450	
2	IMS	0.770	I	2	IMS	0.431	I
3	COMPERIA.PL	0.768		3	PMPG POLSKIE MEDIA	0.407	
4	MEDIACAP	0.749	**Q3**	4	KINO POLSKA TV	0.370	**Q3**
5	ATM GRUPA	0.725		5	MEDIACAP	0.369	
6	WIRTUALNA POLSKA	0.724	II	6	MUZA	0.367	II
7	KINO POLSKA TV	0.724		7	4FUN MEDIA	0.343	
8	LARQ	0.719	**Me**	8	WIRTUALNA POLSKA	0.333	**Me**
9	AGORA	0.718	III	9	ASM GROUP	0.329	III
10	4FUN MEDIA	0.717		10	LARQ	0.329	
11	KCI	0.701		11	ATM GRUPA	0.311	
12	K2 INTERNET	0.695	**Q1**	12	AGORA	0.309	**Q1**
13	ASM GROUP	0.693	IV	13	K2 INTERNET	0.266	IV
14	MUZA	0.687		14	KCI	0.206	
15	HUBSTYLE	0.652		15	HUBSTYLE	0.145	

Source: Authors' research with the application of K.Kolenda's computer program *Taksonomia numeryczna* and Microsoft Excel spreadsheet.

Graph 1. Ranking of companies based on the application of the contra-harmonic mean and Z.Hellwig's development measure



Source: Authors' research

Graph 1 shows that the most significant disproportions in the classification occurred in the cases of the MUZA S.A company (difference of 8 positions) and ATM GRUPA S.A (6 positions). As regards other companies, the differences amount to four positions. The results show clearly that the choice of a synthetic measure to assess company's financial condition affects the final results of the investigation, which is confirmed by the value of Spearman's rank correlation coefficient (0.7) given by formula:

$$r_s = 1 - \frac{6\sum_{i=1}^{n} d_i^2}{n\,(n^2-1)}\,.$$

where: d_i – difference between i^{th} rank for X and i^{th} rank for Y; n – size of population.

Conclusions

The paper presents the classification and ranking of listed media companies with regard to their financial situation which were conducted with the use of Z.Hellwig's pattern development measure and non-pattern synthetic measure based on contra-harmonic mean. The analysis of the results shows that the ranking positions of particular companies differ depending on the accepted synthetic measure.

The above results show the necessity to conduct further research aiming at the determination of factors that result in the differences in the ranking positions. Moreover, further investigation should be carried out to show ranking lists that are developed with the use of a different normalization method of diagnostic features, a different system of weights or a different synthetic measure. These issues will be the subject of further research of the Authors.

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Abstract

The article presents key steps of multidimensional comparative analysis and the methodology of developing synthetic measures. Moreover, with the application of Z.Hellwig's pattern development method and the non-pattern measure based on contra-harmonic mean, a classification and ranking of listed media companies was conducted with regard to their financial condition in 2013-2015. The ranking lists obtained were analyzed with regard to the congruity of the classifications and ordering with the application of the two selected methods.