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THE COMPARATIVE ANALYSIS OF THE COMPANIES FROM THE TSL SECTOR OPERATING IN POLAND AND SLOVAKIA

The article presents a comparative analysis of the companies operating in Transport-Shipping-Logistics sector in Poland and Slovakia. The statistical analyses included examination of logistic companies taking into consideration the size of the company, the type of business and its character. In particular, there had been presented a characteristic of the structure of logistic companies in Poland and Slovakia in terms of the region of the business, the business branch, its legal form and the size of the company. With the use of statistical methods, on the basis of the selected financial rates the comparison of financial condition of the companies operating in the TSL sector in Poland and Slovakia in the period of 2009-2012 had been made.

For the companies operating in Slovakia, thanks to applying the taxonomic methods, comparative examinations had been made in order to isolate the accumulation of the companies similar to each other in terms of the selected rates describing their economic and financial condition. The rates characterizing the financial condition of the companies included the following groups of rates: liquidity (describing the liquidity of the companies), debt (the companies proclivity for repaying their liabilities), profitability (describing the companies proclivity for generating profits), the ability to act (describing the ability and efficiency of managing the company) and other rates describing the capital structure of companies and the effect of the financial leverage.

On the basis of the selected rates and applying the methods of multidimensional comparative statistics (the ranking method – linear ordering) with the use of generalized measure of distance GDM the examination of the ranking of the TSL sector companies operating in Slovakia in 2011 had been made. The analysis of the determined rankings allowed to distinguish the best companies in terms of their financial condition and the potential companies at risk of bankruptcy. The ranking results, as far as Slovak companies are concerned, had been referred to clusters of companies with similar financial conditions designed using taxonomic methods. The comparison of rankings within the clusters had been examined according to the size of the surveyed companies. The achieved results had been shown in the form of practical conclusions.

Keywords: TSL sector, comparative analysis, statistical analysis, taxonomic methods.

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1. INTRODUCTION

The sector associated with logistics operation is currently a very rapidly growing type of the business activity. The purpose of the article is to compare the logistics companies in Poland and Slovakia. The companies had undergone a thorough multilevel statistical analysis in terms of selected aspects of their activities in the logistics market. The essence of the analysis was to compare the structure of Polish and Slovak companies, and the next step of analysis was to extract the important diagnostic variables diversifying the companies in terms of economic and financial situation through the factor analysis method. For companies operating in Slovakia by using taxonomic methods there had been extracted the clusters of similar companies in terms of selected rates and they had been ranked using a generalized measure of distance GDM. A similar analysis had not been made as far as Polish companies are concerned, because of a very large number of surveyed companies (over 3000) and appearing therefore difficulties with the presentation of the results in this study. Multi-criteria comparative analysis of Polish companies is the subject of further investigation and the results will be presented in subsequent articles. Data for the study was taken from the Database of EMIS (Emarging Markets Information Service)[3]. To carry out the research the program of Statistica 10 PL as well as EXCEL spreadsheet had been used.

2. THE CHARACTERISTICS OF THE TSL SECTOR COMPANIES IN POLAND AND SLOVAKIA

In Poland in the TSL sector the operating activity was led by 3602 companies. The majority of the companies had their legal address in Masovian Voivodeship (21%). Every tenth company operates in Pomeranian Voivodeship (12%), Greater Poland Voivodeship (11%) and Silesian Voivodeship (10%). The smallest number of companies from TSL sector operates in Warmian-Masurian, Świętokrzyskie and Podlaskie Voivodeship (2% each).

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[3] http://www.securities.com

Fig. 1. Place of doing business of the surveyed companies in Poland
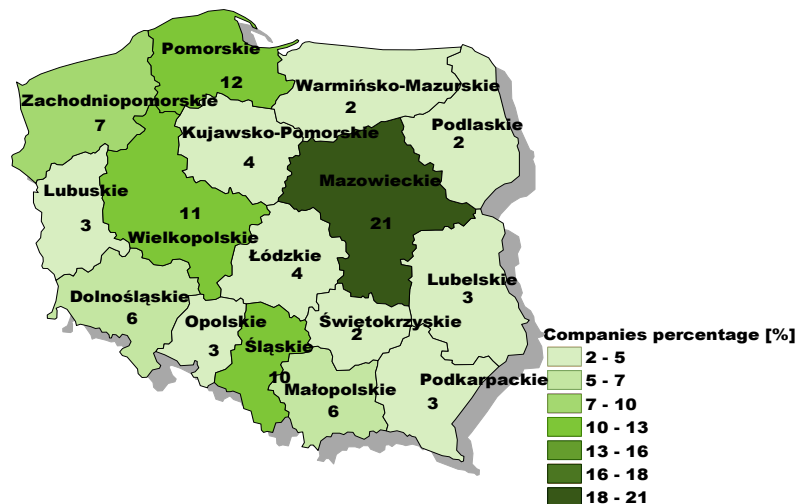
In the area of Slovakia the operating activity is led by 190 companies. The highest percentage of companies has their legal address in the Bratislava Region 36%. A large percentage also operates in the Trnava Region (13%) and in the Zilina Region (12%). The smallest percentage of TSL sector companies operates in the Presov Region (6%) and in the Trencin Region (7% each).

Fig. 2. Place of doing business of the surveyed companies in Slovakia
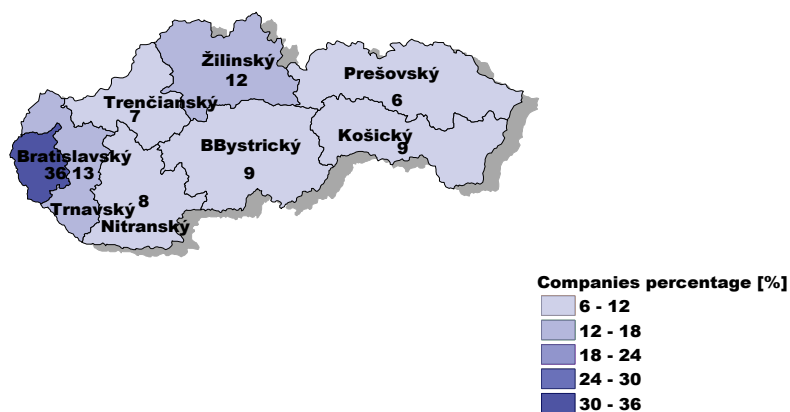
TSL sector shows a significant variation in the type of business activity in the surveyed countries $p < \alpha$ (p=0,0000). In Poland (fig. 3), the largest percentage of companies operates in the road transport of goods (54%), the second largest services are the backup services – such activity is led by every fifth company. About 12% of the surveyed companies operates in the passenger land transport.

Every third company operating in TSL sector in Slovakia (fig. 3) is engaged in the road transport of goods (35%). In the passenger land transport operates approximately 23% and 15% is engaged in warehousing and storage. A large percentage, which is about 10% are the companies dealing with courier shipping and postal services.

Companies from TSL sector in Poland and Slovakia differ in a statistically significant way because of the legal form p<α (p=0,0000). Both in Poland and Slovakia most companies operate as Limited Liability Company (fig. 4), although a higher percentage of companies is located in Poland (76%) – whereas in Slovakia 64%. Huge differences had been recorded in other categories. As a Public Limited Company in Poland operates only 5% of companies and as far as Slovakia is concerned, it concerns every third company.

Fig. 3. Branches in which the companies of TSL sector operate in Poland and Slovakia
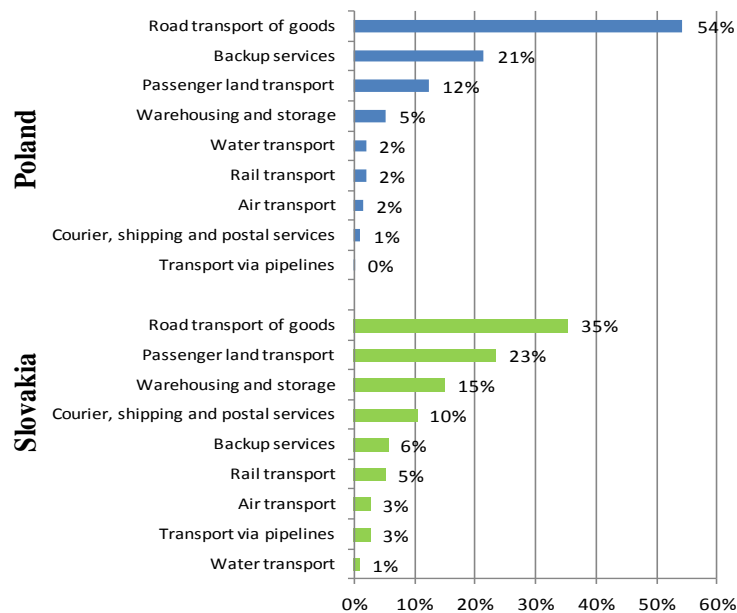
As Other non-liability limited in Poland operates every fifth company and in Slovakia it concerns only 2% of the surveyed companies. In Poland, on the stock exchange there are listed 16 companies operating in TSL sector whereas in Slovakia only two.

Fig. 4. Legal form of the surveyed companies of TSL sector in Poland and Slovakia
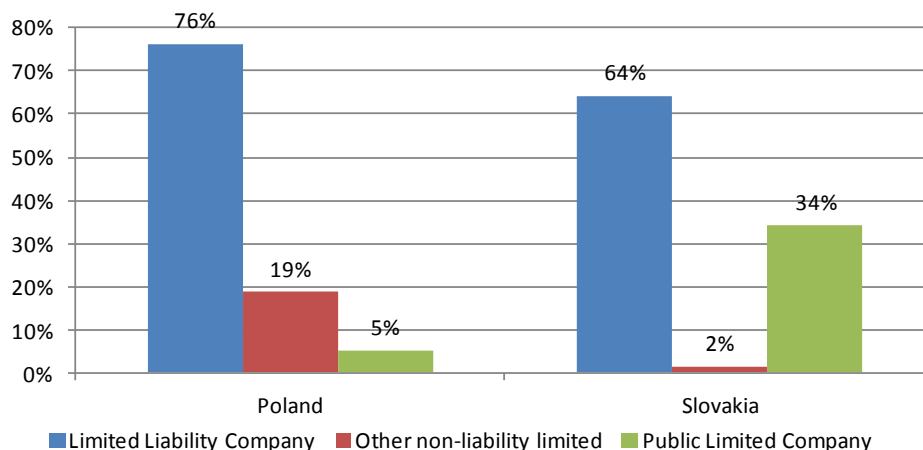
The companies had been divided into small, medium and large ones on the basis of the size of the total assets of the company balance sheet compiled at the end of the financial year. If the sum of the assets did not exceeded PLN zloty the equivalent of 10 million of Euros, the company was classified as a small one. In the case when the sum of assets was in the range from 10 to 43 million of Euros, the company was classified as a medium one. Other companies whose sum of assets exceeded 43 million of Euros was defined as a large[4] one. The structure of the size of companies is shown in figure 5.

Fig. 5. The size of the surveyed companies of TSL sector in Poland and Slovakia
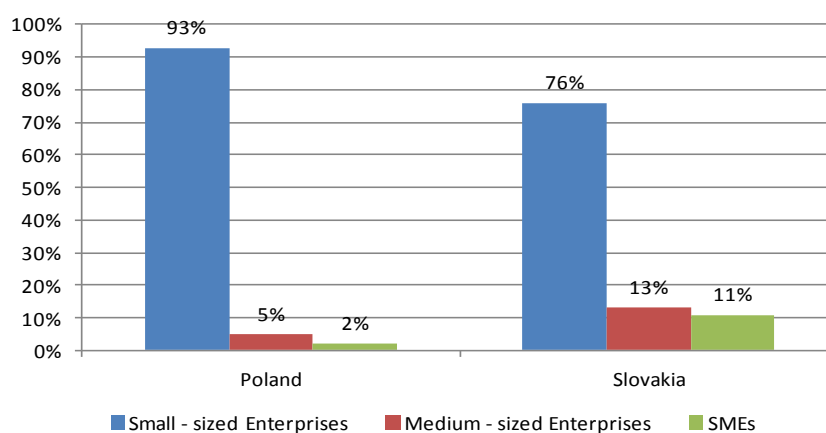
[4] Centre for Strategy & Evaluation Services, Final Report: *Evaluation of the SME Definifion*, Centre of Strategy & Evaluation Services, Sevenoaks, Kent 2012, http://ec.europa.eu/enterprise/policies/sme/files/studies/ executive-summary-evaluation-sme-definition_en.pdf, p. 35.

As far as the size is concerned, the structure of the companies also varies statistically in a significant way in the surveyed countries p>α (p=0,0000). Both in Poland and Slovakia, the largest percentage represents the small companies. However, their interest varies from 76% in Slovakia to 93% in Poland.

Table 1. Percentage distribution of the size of the surveyed companies divided into branches in which they operate in the TSL in Poland and Slovakia

	Poland			Slovakia		
	small	medium	large	small	medium	large
Road transport of goods	97%	3%	0%	93%	5%	2%
Backup services	90%	6%	3%	58%	8%	33%
Warehousing and storage	85%	13%	2%	77%	11%	11%
Water transport	90%	6%	4%	0%	0%	100%
Passenger land transport	91%	6%	3%	69%	27%	4%
Air transport	80%	14%	6%	0%	0%	0%
Courier, shipping and postal services	73%	8%	20%	73%	13%	13%
Rail transport	65%	17%	18%	63%	0%	38%
Transport via pipelines	0%	0%	100%	0%	0%	100%

There had been examined the structure of the size of the companies operating in TSL sector taking into consideration the division of the type of their activity (table 1). In Poland as well as in Slovakia, the differences are statistically significant p<α (p=0,00000).

3. THE SELECTION OF DIAGNOSTIC VARIABLES WITH THE USAGE OF FACTOR ANALYSIS

To analyze the condition of TSL sector companies, the financial data published by the company only from 2011 had been used. The number of the companies which published their reports in 2011 in Poland is 2294 and in Slovakia 43.

Table 2. Results of factor analysis – factor loadings– Varimax method - normalized (indicated loadings are > 0.7)

Variable	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6
X1 – Current liquidity ratio	0,9450	0,0698	0,0142	0,1677	0,0484	0,0387
X2 – Quick liquidity ratio	0,9464	0,0671	0,0146	0,1634	0,0458	0,0394
X4 – Liquidity ratio (foreclosure)	0,9297	0,0477	-0,035	-0,0516	-0,0054	-0,0430
X5 – Cash liquidity ratio	0,8698	0,0465	-0,039	-0,0832	-0,0126	-0,0489
X3 – Working capital / Assets liquidity ratio	0,1353	0,8414	0,0956	-0,0340	0,2839	0,1382
X12 – The debt ratio of assets	-0,075	-0,850	0,0064	0,0138	-0,4005	0,0364
X18 – Debt leverage to total assets	-0,025	-0,953	0,0361	-0,0023	0,1401	0,0523
X19 – Assets structure ratio: Equity / Total assets	0,0261	0,9535	-0,035	0,0019	-0,1417	-0,0505

X11 – Debt equity	-0,030	0,0081	0,9528	0,0169	0,0062	-0,1499
X17- Financial leverage	-0,029	0,0075	0,9529	0,0148	0,0058	-0,1771
X14 – Efficiency: Receivables turnover [days]	0,1979	0,002	0,0534	0,7821	0,0188	0,0805
X6 – Return on assets (ROA)	0,0521	-0,047	0,1370	-0,142	0,8091	0,2559
X7 – Return on equity (ROE)	-0,038	0,007	-0,245	0,0301	0,0712	0,7568
X8 - Profitability – Return on capital	-0,037	0,021	-0,176	0,0315	0,0423	0,7719
X9 – Yields: Return on sales (ROS)	-0,049	0,036	0,0165	-0,676	0,0671	0,0534
X13 – Debt ratio: Gross profit / Short-term liabilities	0,3242	0,021	0,0606	-0,406	0,2245	0,1394
X15 - Efficiency – Assets turnover [days]	-0,046	-0,211	0,1241	-0,151	-0,693	0,2436
X16 - Efficiency – Inventory turnover [days]	-0,017	0,011	0,0076	0,3862	0,0701	0,0359
X20 – Assets structure ratio: Fixed assets / Total assets	-0,162	0,076	-0,284	0,0555	0,3490	-0,4888
Variance explained	**3,6179**	**3,318**	**2,0441**	**1,4983**	**1,6101**	**1,6492**
Percentage	**0,1904**	**0,174**	**0,1076**	**0,0789**	**0,0847**	**0,0868**

The rates of profitability, efficiency, liquidity, debt and financial leverage had been the subject of analysis. Because of the variety and a large set of rates, in order to select the variables, the factor analysis had been chosen.

The factor analysis enables the elimination of data, which contains only the marginal information and of less importance for the phenomenon study, and often allows to correlate huge amounts of information in the form of a few synthetic variables.

After the analysis, seven factors had been isolated for which the proportion of explained variance was about 72%. In order to select the appropriate set of rates to characterize the financial condition of the TSL sector companies, for the created factors there had been carried out the analysis of reliability and the α-Cronbach's coefficient had been reckoned. In the case where the α-Cronbach's coefficient was high (over 70%), from the pair of variables only one had been isolated because their accuracy and the reliability of carried information was very high. If the factor consisted of only one variable, it had been automatically introduced into the study.

Table 3. The values of Cronbach's α-factor for the developed factors

Diagnostic variable	α-Cronbach
X1 – Current liquidity ratio	
X2 – Quick liquidity ratio	0,95
X4 – Liquidity ratio (foreclosure)	
X5 – Cash liquidity ratio	
X3 – Working capital to Assets liquidity ratio	
X12 – The debt ratio of assets	-0,94
X18 – Debt leverage to assets	
X19 – Assets structure ratio: Equity to Total Assets	
X11 – Debt equity	0,99

X17- Financial leverage	
X7 – Return on equity (ROE)	0,73
X8 - Profitability – Return on capital	

Table 4. The final set of variables adopted to study the financial condition of companies operating in the TSL in Poland and Slovakia

Diagnostic variable	Financial ratios	Group of financial ratios
X1	Current liquidity ratio	Liquidity
X6	Return on assets (ROA)	Profitability
X7	Return on equity (ROE)	
X14	Receivables turnover [days]	Efficiency
X17	Financial leverage	Leverage
X18	Debt leverage to total assets	Debts

For the first and the second factor there was a need of additional correlation analysis because they contained the four variables. The most representative feature for the first factor was the current ratio (X_1) – the high value of the correlation coefficient with all variables and for the second the debt leverage to total assets (X_{18}). From the third factor the financial leverage (X_{17}) and from the sixth the return on equity – ROE (X_7). The final set of diagnostic variables has the form presented in Table 4.

For the selected diagnostic variables the basic descriptive statistics were calculated, with the division of the country in which the surveyed companies operate (table 5).

Table 5. Basic descriptive statistics of selected diagnostic variables

P – Poland, S – Slovakia	Mean	Min	Max	Standard deviation	Coefficient of Variation (V_z)	Kurtosis
X1 - Current liquidity ratio (P)	310,8	0,0	20828,6	942,0	303,1	185,1
X1 - Current liquidity ratio (S) +	191,5	12,2	1400,0	218,5	114,1	22,7
X6 - Return on assets (ROA) (P) +	2,4	-900,0	1050,0	48,3	1984,6	185,2
X6 - Return on assets (ROA) (S)	2,3	-37,3	33,3	12,2	533,4	4,2
X7 - Return on equity (ROE) (P) +	24,2	-7963,6	6900,0	404,1	1666,6	212,0
X7 - Return on equity (ROE) (S)	10,3	-100	133,3	38,9	378,9	3,8
X14 - Receivables turnover [days] (P) +	122,9	0,0	28461,2	803,5	653,7	788,2
X14 - Receivables turnover [days] (S)	57,9	0,0	129,6	26,3	45,4	0,4
X17- Financial leverage (P)	419,8	-52790	53589,0	3456,0	823,2	146,7
X17- Financial leverage (S) +	339,1	-544,1	1505,8	319,4	94,2	5,9
X18 - Debt leverage to total assets (P)	75,4	0,5	6250,0	169,3	224,7	794,6
X18 - Debt leverage to total assets (S) +	59,8	2,0	100,0	24,0	40,1	-0,1

Current Ratio – states how many times the current assets cover the current liabilities. The optimum value of the ratio is in the range of 150% - 220%.[5] The high value which is greater than 2 may indicate an excessive freezing of capital in current assets. If the ratio is too low, it may indicate some problems connected with the repayment of current liabilities. For Polish companies the average value of this ratio was very high, (approximately about 311 %), which indicates an excessive freezing of capital in current assets. For Slovak companies, the ratio has the optimal size (191%). The situation improves median which for both Polish and Slovak companies is at the level of about 133%. Larger differences in the size of current ratio is observed in Polish companies as it is evidenced by the larger standard deviation (942%) and the coefficient of variation (303%).

Return on assets ROA which is the rate of return on assets, is a measure of profit attributable to total assets. It informs about the possibility to achieve profits and efficiency as far as the management of property is concerned. The higher the rate, the better for the company because it indicates a higher level of financial condition of a company. It also presents the return of all assets of the company in relation to the earned profits. The rate indicates how many cents of net profit is generated by a single penny of invested assets. For the companies operating in Poland ROE assumes higher values. The higher are both the average (2,4) as well as the median (3,9). However, as to the Slovak companies we can observe a greater uniformity of profitability, lower values are in the case of the standard deviation (12) and the coefficient of variation (533).

Return on equity ROE – the return on equity – meaning how much of the profit the company was able to save from the contributed equity. The higher the rate, the more favorable the situation of the company is. The higher efficiency of equity implies the possibility of gaining a higher financial surplus (higher dividends). This indicates to what extent the company multiplies the resources entrusted by the owners which is a measure of shareholders profits. The rate shows how much profit was obtained from contributed equity.[6] Companies operating in Poland have on average a higher return on equity (24), the higher is also the median (14). The differentiation in the size of the surveyed rate is also higher.

Efficiency – receivables turnover [days] - informs about the efficiency of receivables to generate revenue. It shows how many times over the year the company reconstructed its receivables, or how many turnover cycles of receivables took place during the financial year. There is no reference value of this rate but its size should be as large as possible. The increase in the number of cycles (the rate) from year to year provides a better management of receivables. The decrease in the value of the rate (the decrease in rotation cycle) reduces the company's ability to settle its liabilities on time because its liquidity falls as well. The rate obtains larger values for companies operating in Poland (about 123 days), however the medians both for Polish and Slovak companies are at a similar level (about 58 days). In the case of companies operating in Slovakia, there is a less variation in the turnover rate, as the standard deviation (130 days) and the coefficient of variation (45%) are less than in Poland.

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[5] M. Sierpińska, D. Wędzki, *Zarządzanie płynnością finansową w przedsiębiorstwie*, Wydawnictwo PWN, Warszawa 1997.

[6] J. C., Ritchie, *Analiza fundamentalna*, WIG PRESS, Warszawa 1997, p. 214 -215.

The rate of financial leverage – the higher its value, the greater degree of making use of foreign capital and the greater risk of burdening the activity. The average value of financial leverage indicates that Polish companies are more often make use of the foreign capital (420 to 339), but taking into account the value of the median, it turns out that more companies in Slovakia have a higher level of financial leverage (277 to 200). Much greater diversity of financial leverage is observed within the operating area of Polish companies.

Debt leverage to total assets i.e., the rate of debt – it shows in the easiest way the degree of financing the companies from the foreign sources without the distinction of their origin. It can be assumed that the proper level of this rate should be between 0,57 a 0,67.[7] On the basis of the average value, the optimal level takes the rates of the companies operating in Slovakia. The medians of the two rates take the optimal values, but the greater variation had been observed in companies operating in Poland.

Fig. 6. Chart of medium-sized diagnostic features adopted to study the condition of the companies operating in the TSL sector in Poland and Slovakia
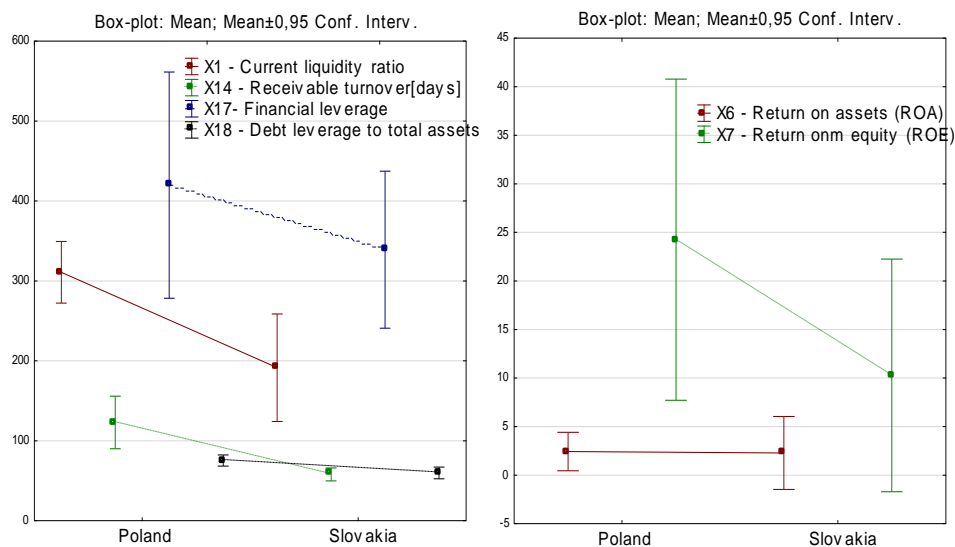
4. THE COMPARATIVE ANALYSIS OF THE CONDITION OF THE COMPANIES OPERATING IN THE TSL SECTOR IN POLAND AND SLOVAKIA

It had been examined whether there are the differences in the level of selected rates in the division on the country in which the companies operate, the type of business they run

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[7] M. Sierpińska, T. Jachna, *Ocena przedsiębiorstwa według standardów światowych,* Wydawnictwo PWN, Warszawa 2004.
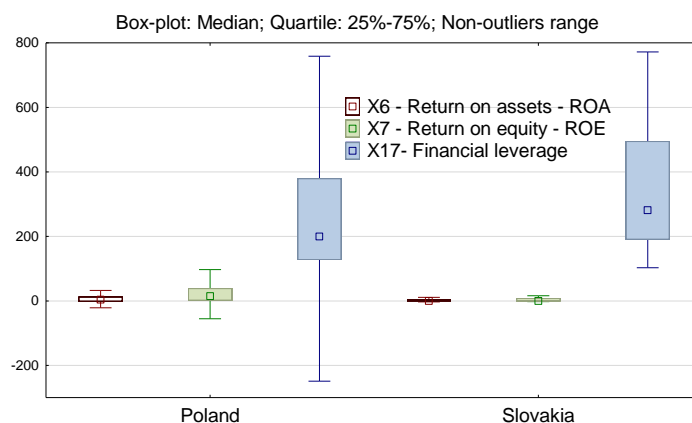
and the size of the individual companies from TSL sector[8]. To identify the differences nonparametric tests of U Mann – Whitney and ANOVA Kruskal – Wallis had been used. The tests were conducted at a significance level α=0,05.

Table 6. Results of the U-Mann-Whitney and ANOVA Kruskal–Wallis tests, selected indicators by country of establishment, type of activity and the size of the company

Variables	Financial ratios	Country	Type of activity	Company size
X1	Current liquidity ratio	0,7060	0,0000***	0,6300
X6	Return on assets (ROA)	0,0144*	0,0000***	0,1879
X7	Return on equity (ROE)	0,0004***	0,0000***	0,0008***
X14	Receivables turnover [days]	0,6372	0,0000***	0,6750
X17	Financial leverage	0,0348*	0,0016**	0,1328
X18	Debt leverage to total assets	0,8639	0,0001*	0,0000***

Analyses show that the country, in which the surveyed companies operate, differentiate the level of ROA (p<α) p=0,0144, ROE p<α (p=0,0004), and the financial leverage p<α (p=0,0348). The differences in these rates had been statistically significant. The median of ROA rate in Poland was higher and amounted about 4, whereas in Slovakia it was at the level of 0. The higher the rate, the better financial condition of the company. The ROE rate also assumes higher values in the case of companies operating in Poland (Me_P=14,3, Me_S=0,0). The median of financial leverage is higher among the companies operating in Slovakia. In Poland there is a wide variation in the level of financial leverage in the surveyed companies.

Fig. 7. Box-plot of indicators which significant differentiate surveyed companies

The branch in which the individual companies of the TSL sector operate has a significant impact on the level of all surveyed rates. The current ratio assumes the optimal values in the courier, shipping and postal services, and the smallest is in the passenger

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[8] R. Szostek, *Metodologia badań statystycznych*, Zeszyty Naukowe Politechniki Rzeszowskiej nr 272, Zarządzanie i Marketing, z. 17(4), Rzeszów 2010, pp. 149-157.

land transport. The return on assets, equity and the efficiency receivables turnover are the highest in the courier, shipping and postal services and the smallest in the passenger land transport.

Fig. 8. Return on equity by type of business in the TSL sector companies
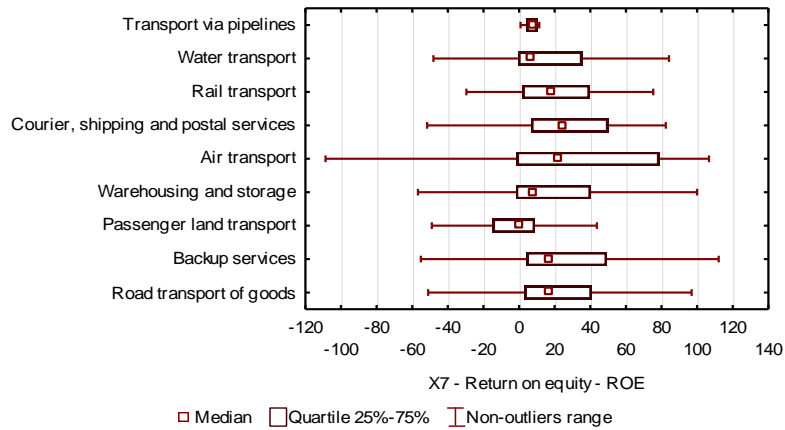
The most frequently the foreign capital is used by the companies operating in the road transport of goods and the least frequently the ones operating in air transport. The size of the company varies the results of two rates: the return on equity and the debt leverage to total assets.

Fig. 9. Return on equity and leverage ratio of debt to assets by company size
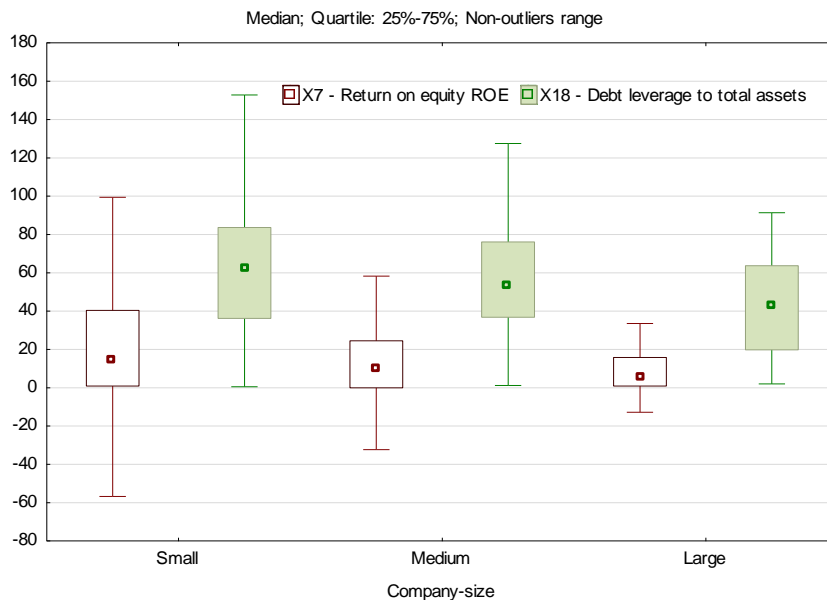
The rates behave similarly in both cases. The greatest difference in the two rates is present in small companies and the largest companies are the most uniform. It had been

examined whether there are some statistically significant differences in the size of the achieved rates in Polish and Slovak companies in various branches. The test showed three statistically important differences.

Table 7. Results of the U Mann - Whitney test. Comparison of indicators in Poland and Slovakia in particular sectors of activity

	X1	X6	X7	X14	X17	X18
Road transport of goods	0,1889	0,0508	0,0157*	0,3183	0,1431	0,6816
Warehousing and storage	0,7544	0,9878	0,8907	0,9331	0,0176*	0,2555
Passenger land transport	0,1968	0,4942	0,9572	0,0097**	0,1385	0,1604
Courier, shipping and postal services	0,9793	0,551	0,7755	0,6223	0,5169	0,7361
Rail transport	0,6676	0,2157	0,1498	0,1976	0,9798	0,8596

In the group of companies operating in road transport of goods there had been noted the differences in the level of ROE p<α (p=0,0157). For companies operating in Poland the median is about 17 and for Slovak companies at the level of 0. In the branch of warehousing and storage the differences occurred in the financial leverage p<α (p=0,0176). The median adopted higher values for the companies operating in Slovakia (280) – in Poland (186). The final difference appeared in the passenger land transport branch p<α (p=0,0097) in the level of efficiency - receivable turnover [days]. In this case, the median takes greater values for the companies operating in Slovakia. Other rates were at the similar levels in the surveyed branches in Poland and Slovakia.

Fig. 10. Box-plot. Efficiency ratio-receivables turnover of companies operating in land passenger transport in Poland and Slovakia in 2011
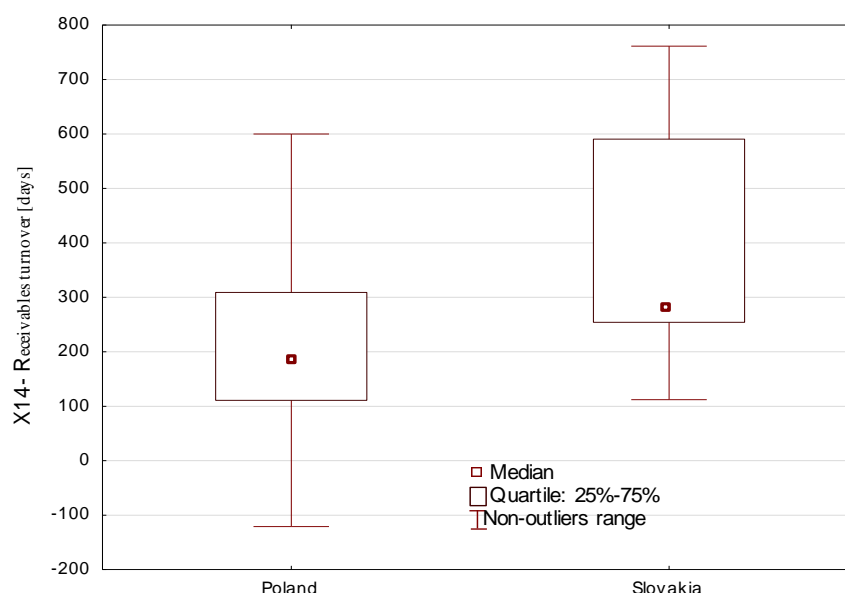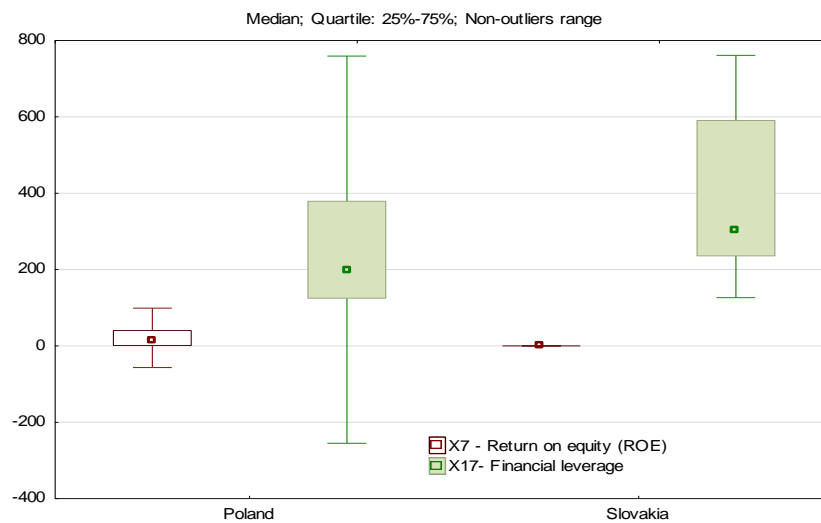
It had been examined whether the size of the company affects the level of received rates in Poland and Slovakia. The most varied are the rates in small companies. The differences were observed in the case of X_7 – the return on equity ROE $p<\alpha$ (p=0,0287) and X_{17} – the financial leverage $p<\alpha$ (p=0,0116).

Table 8. Test Results of U Mann – Whitney. Comparison of indicators in Poland and Slovakia by the size of the company

	X1	X6	X7	X14	X17	X18
small	0,1675	0,0886	0,0287*	0,7363	0,0116*	0,2054
medium	0,7899	0,1527	0,0612	0,4707	0,1528	0,1350
large	0,2368	0,7948	0,3347	0,4968	0,0950	0,3021

In small companies, the return on equity ROE assumes higher values in Poland (23) to 13 and the median is also higher in Poland (15) to 0. The financial leverage reaches the higher values in Slovak companies on average 419 to 408 and in the case of median 305 to 200.

Fig. 11. Box-plot of indicators showing differences in small companies operating in Poland and Slovakia

Medium and large companies operating in Poland and Slovakia do not show significant differences in the levels of surveyed rates. It had been examined whether there are the differences in the levels of the rates for companies operating in Poland and Slovakia in terms of the type of activity and the size of the company.

Table 9. The results of ANOVA Kruskal – Wallis test, selected indexes by type of activity and the size of the company calculated separately for companies operating in Poland and Slovakia

Variables	Financial ratios	Poland		Slovakia	
		Type of activity[1]	Company size	Type of activity[2]	Company size
X1	Current liquidity ratio	0,0000***	0,4450	0,3155	0,2811
X6	Return on assets (ROA)	0,0000***	0,3462	0,0320*	0,7416
X7	Return on equity (ROE)	0,0000***	0,0067**	0,0542	0,7607
X14	Receivables turnover	0,0000***	0,5830	0,1321	0,7909
X17	Financial leverage	0,0016**	0,1875	0,2173	0,0122*
X18	Debt leverage to total assets	0,0007***	0,0000***	0,1833	0,0026**

1) *In the group of Polish companies in the analysis the companies in the group transport via pipelines (3 companies) were omitted*
2) *In Slovakia there were omitted companies in the group of pipeline transport, water transport and transportation support services (no companies in the industry or only one company in the group)*

In the group of companies doing the business activity in **Poland**, the branch has a significant influence on the level of all surveyed rates so on the overall financial condition of the companies operating in TSL sector.

The current ratio assumes the highest values in the companies operating in air transport (1379) and the lowest in the case of companies operating in the passenger land transport (210) where there is the highest diversity of results ($\sigma=3018$). The highest median is in the transport via pipelines (526) and the smallest in the passenger land transport (99).

The return on assets reaches the highest values in the air transport (18) and the smallest concerns the passenger land transport (-8). The differentiation is the highest in the branch of backup services (61) and the most similar results of ROA rate are in the branch of the transport via pipelines (4). The highest values of median are observed in the courier, shipping and postal services (10) and the smallest in the passenger land transport (-0,6).

Fig. 12. Graph of average values of ROA of companies operating in the sector TSL by activity in Poland
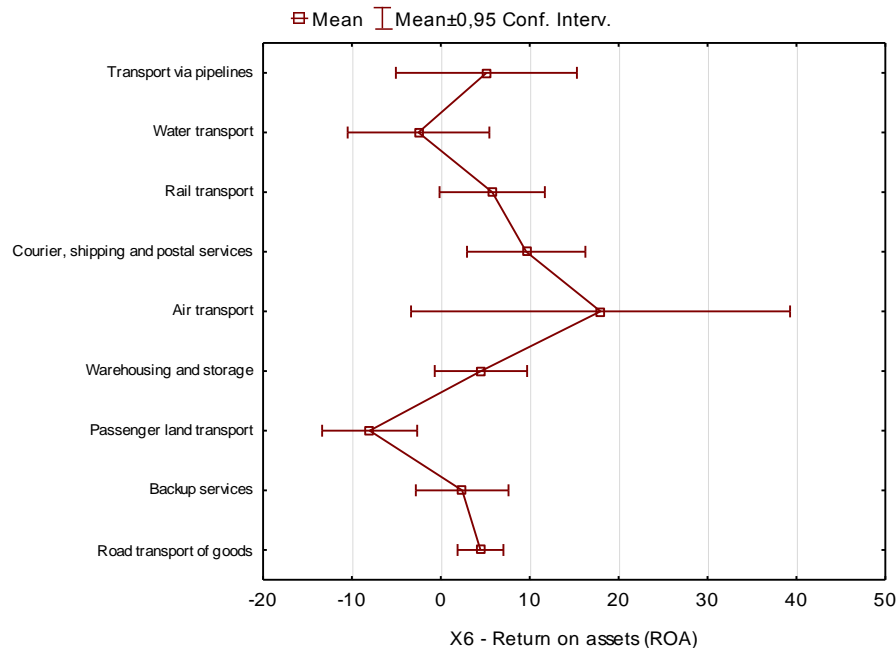
The return on equity ROE on average, had the higher level in the air transport (214) and the smallest was observed in the passenger land transport (-39). The most diversified branch as far as the return on equity is concerned, is the air transport ($\sigma=1025$) and the most uniform one is the transport via pipelines ($\sigma=7$). The median reaches the highest values in the courier, shipping and postal services (25) and the lowest in the passenger land transport (0,5).

The efficiency – receivable turnover [days] rate is the highest in the warehousing and storage branch (193) and the lowest in the transport via pipeline (31). The greatest diversity presents the companies from the road transport of goods branch (976) and the lowest the transport via pipeline (10). The greatest values of median concern the companies from the branch of the courier, shipping and postal services (64) and the smallest ones are in the passenger land transport (21).

As to the financial leverage rate, its values are the greatest in the branch of warehousing and storage (705) and these companies represent the highest diversity in the level of rates (4454). The lowest values of the financial leverage rate are in the air transport (-353) and the most uniform group is the branch of the transport via pipelines (11). The median of the financial leverage has the highest values in the case of road transport of goods (215) and the lowest in the air transport (115).

Air transport is characterized by the highest average of the debt leverage to total assets (130) and it this branch there is also the highest diversity of results (273). The lowest values of debt leverage to total assets was recorded in the transport via pipeline branch (16) where there is also the smallest diversity in the level of debt leverage to total assets

(12). The median is the highest in the air transport (65) and the smallest level was recorded for the transport via pipeline (15).

The size of the company in Poland has an influence on the level of two rates: X_7 – the return on equity (p=0,0076), and X_{18} – the debt leverage to total assets (p=0,0000).

Fig. 13. Level of profitability and leverage ratio of debt to assets by company size among companies operating in Poland
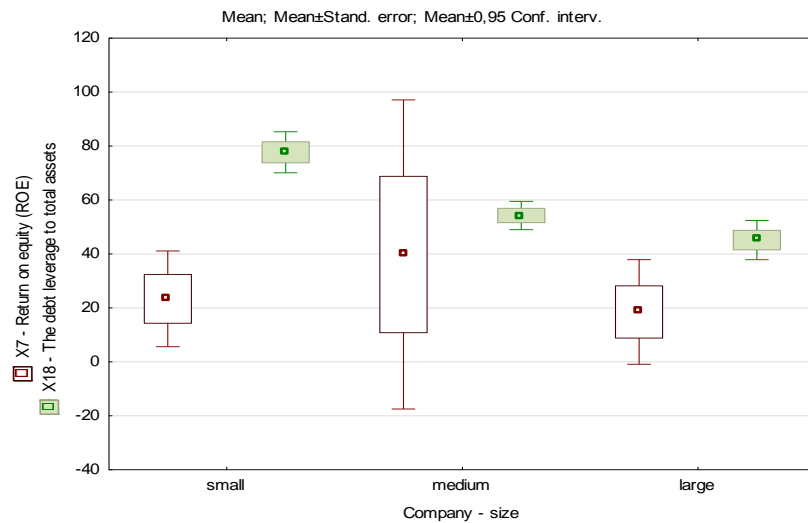

The greatest return on equity rate is characteristic for the companies of the medium size. In this group there is also the greatest diversity in the level of profitability. The smallest level of the return on equity rate is observed in large companies.

As far as Polish companies are concerned, the larger the company, the smallest value of debt leverage to total assets.
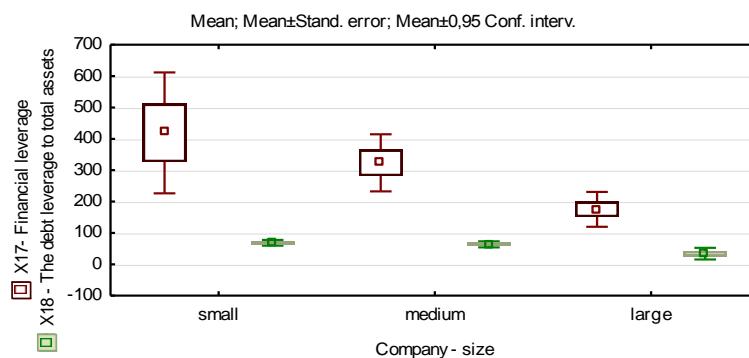
For companies operating in Slovakia only one difference concerning the level of surveyed rates had been identified, in terms of the type of branch in which they operate. It is the return on assets ROA, $p<\alpha$ (p=0,0320). In Slovakia, the highest profitability concerns the companies operating in the branch of the courier, shipping and postal services (16%) and the smallest one is observed in the backup services (-37%). (Both the median and the average were at the same level).

Fig. 14. Average value of ROA by the branch in which the companies operate in Slovakia
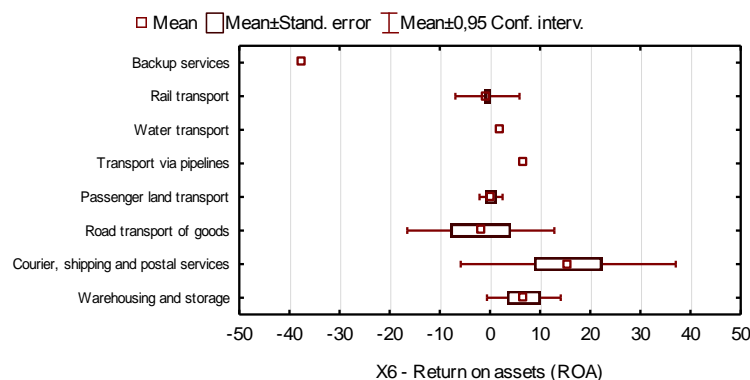
The company size in Slovakia differentiates the level of two rates: X_{17} – the financial leverage p<α (p=0,0122) and X_{18} – the debt leverage to total assets, p<α (p=0,0026). The larger the company, the smaller values of the financial leverage and the debt leverage to total assets.

Fig. 15. The values of leverage and the leverage of debt to assets by company sizes enterprises in Slovakia

5. THE TAXONOMIC ANALYSIS OF THE COMPANIES OF THE TSL SECTOR IN SLOVAKIA

To make a detailed analysis of the companies operating in the TSL sector selected methods of Multidimensional Comparative Analysis were used. They allow to carry out the grouping of the surveyed companies in terms of selected economic – financial rates. Presentation of the idea of such analysis is possible thanks to the small number of companies operating in Slovakia, which published their financial results for the year 2011. A similar analysis can be made for the companies operating in Poland although the presentation of the results would be difficult.

One of the advantages of the classification being made thanks to the procedures of taxonomic methods is first of all the ability to achieve the homogeneous objects of the analysis, in which it is easier to extract the systematical factors and the cause and effect

relationships are clearly outlined. Secondly, an important advantage is associated with the classification of the cognitive presumptions (reducing the large amount of information into a few main categories, which significantly simplifies the application process) and economic presumptions (limiting discussion to analyzing typical trend phenomena or facts with a relatively small deformation of test results)[9]. To extract the accumulation of companies operating in the TSL sector and achieving similar financial results Ward method had been used.

The results of taxonomic analysis were compared with the results of ranking prepared using the generalized distance measure GDM[10]. The analyses had been made for 43 companies operating in the TSL sector in Slovakia in 2011. The companies had been characterized with the use of six rates which had been selected at the beginning of the study.

For the purposes of the ranking the following characteristics of diagnostic variables had been established: the rate X_1 – current ratio, interpreted as a nominant (the nominal value 120%) and measured on a quotient scale, the rate X_6 – return on assets ROA, interpreted as a stimulant and measured on an interval scale, the rate X_7 – return on equity ROE, interpreted as a stimulant and measured on an interval scale, the rate X_{14} – efficiency – receivable turnover [in days], interpreted as a destimulant and measured on a quotient scale, the rate X_{17} – financial leverage, interpreted as a nominant (the nominal value 100%) and measured on an interval scale, the rate X_{18} – debt leverage to total assets, interpreted as a destimulant and measured on a quotient scale.

Nominants measured on a quotient scale were converted to stimulants according to

quotient formula: $x_{ij} = \dfrac{\min\left\{nom_j; x_{ij}^N\right\}}{\max\left\{nom_j; x_{ij}^N\right\}}$, where: x_{ij}^N - the value of the j - nominant

observed in the i - object, nom_j - the nominal level of j - variable. Nominants measured on an ordinal scale were transformed according to the differential formula: $x_{ij} = -\left|x_{ij}^N - nom_j\right|$. The standardization had been used as a method of normalization of diagnostic variables. The pattern object was always the object in the form of the upper pole development of the best values of diagnostic variables (maximum for stimulant and minimum for destimulant). Two variants of ranking had been used, the first with the equal weights for the variables ($w_j = 1$) and the second with the variable weights calculated

depending on the value of the coefficient of variation: $w_j = m \cdot \dfrac{V_j}{\sum\limits_{j=1}^{m} V_j}$, where: m – the

[9] T. Grabiński., *Metody aksonometrii*, Wydawnictwo Akademii Ekonomicznej w Krakowie, Kraków 1992, p.11-12

[10] M. Walesiak, *Uogólniona miara odległości GDM w statystycznej analizie wielowymiarowej z wykorzystaniem programu R*, Wydawnictwo UE we Wrocławiu, Wrocław 2011, p. 73-78.

number of variables, V_j - the values of the coefficient of variation for the j - variable,

$$w_j \in [0;m]; \sum_{j=1}^{m} w_j = m \ .$$

The distance of particular objects from the model had been determined according to the formula[11]:

$$d_{iw} = \frac{1}{2} - \frac{\sum_{j=1}^{m} w_j a_{iwj} b_{wij} + \sum_{j=1}^{m} \sum_{\substack{l=1 \\ l \neq i,k}}^{n} w_j a_{ilj} b_{wlj}}{2\left[\sum_{j=1}^{m} \sum_{l=1}^{n} w_j a_{ilj}^2 \cdot \sum_{j=1}^{m} \sum_{l=1}^{n} w_j b_{wlj}^2\right]^{\frac{1}{2}}} \tag{1}$$
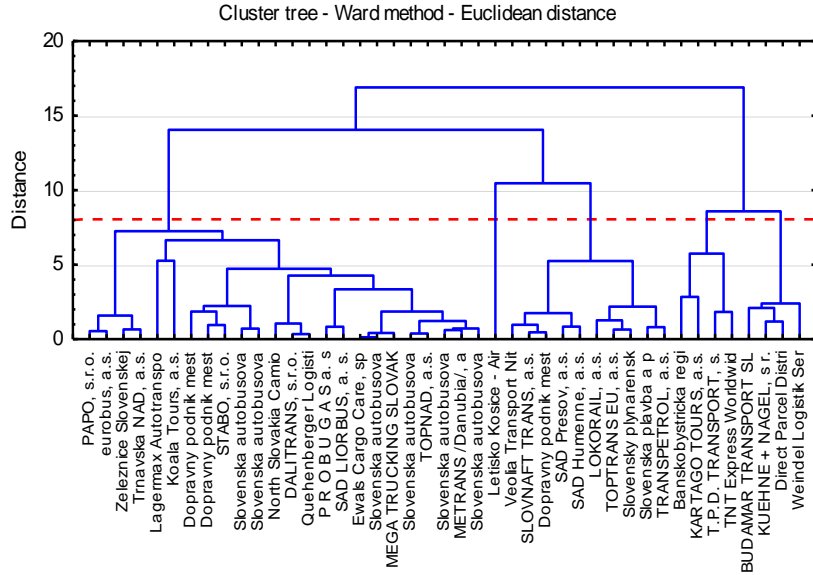
where:

d_{iw} - a measure of the distance GDM of the i – object of the pattern w, $p=w,l$; $r=i,l$; $i,l=1,...,n$ – number of the object, w – number of the object pattern $j=1,...,m$ – the number of variable, w_j – weight of j - variable,

$$a_{ipj} = x_{ij} - x_{pj} \quad \text{for} \ \ p = w,l; \tag{2}$$
$$b_{wrj} = x_{wj} - x_{rj} \quad \text{for} \ \ r = i,l;$$

$x_{ij} (x_{lj})$ - i (l) observation of j - variable.

Fig. 16. Cluster Tree - Euclidean distance - the method of Ward

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[11] op.cit. p.78

The companies had been ordered in accordance with increasing values of the distance measurement, the smaller the distance value of GDM from the ideal object (pattern) the surveyed company has, the better it was considered to be (at a higher position) in the ranking. The final ranking of companies was calculated as the average of the rankings assigned in both variants (for similar and different weights of diagnostic variables).

The results of taxonomic grouping of the TSL companies from Slovakia are shown in Figure 16 and the results of the ranking in Table 10.

Table 10. Ranking results and the grouping of companies operating in the TSL in Slovakia

	Company size	Average ranking	Grouping
Weindel Logistik Service SR, spol. s.r.o.	small	1	a
Direct Parcel Distribution SK, s.r.o.	small	2	a
KUEHNE + NAGEL, s r.o.	small	3	a
BUDAMAR TRANSPORT SLOVAKIA, a.s.	medium	4	a
TRANSPETROL, a.s.	**large**	**5**	**c**
Slovensky plynarensky priemysel, a.s.	**large**	**6**	**c**
Slovenska autobusova doprava Michalovce, akciova spolocnost	medium	7	e
SAD Humenne, a.s.	**small**	**8**	**c**
TNT Express Worldwide, spol. s.r.o.	medium	9	b
Slovenska autobusova doprava Zilina , akciova spolocnost	large	10	e
SAD Presov, a.s.	**medium**	**11**	**c**
TOPTRANS EU, a.s.	**large**	**12**	**c**
METRANS /Danubia/, a.s.	large	13	e
T.P.D. TRANSPORT, s.r.o.	small	14	b
Slovenska plavba a pristavy, a.s.	**large**	**15**	**c**
Dopravny podnik mesta Presov, akciova spolocnost	**medium**	**16**	**c**
KARTAGO TOURS, a.s.	small	17	b
Veolia Transport Nitra, a.s.	**medium**	**18**	**c**
SLOVNAFT TRANS, a.s.	**small**	**19**	**c**
Slovenska autobusova doprava Dunajska Streda, akciova spolocnost	medium	20	e
Slovenska autobusova doprava Nove Zamky, akciova spolocnost	medium	21	e
TOPNAD, a.s.	small	22	e
MEGA TRUCKING SLOVAKIA, s.r.o.	small	23	e
LOKORAIL, a.s.	**small**	**24**	**c**
STABO, s.r.o.	small	25	e
Slovenska autobusova doprava Lucenec, akciova spolocnost	medium	26	e
Slovenska autobusova doprava Trnava, akciova spolocnost;	medium	27	e
Ewals Cargo Care, spol. s.r.o.	small	28	e

Koala Tours, a.s.	small	29	e
Trnavska NAD, a.s.	small	30	e
Zeleznice Slovenskej republiky, Bratislava v skratenej forme ZSR	large	31	e
SAD LIORBUS, a. s.	medium	32	e
eurobus, a.s.	large	33	e
P R O B U G A S a. s.	medium	34	e
Quehenberger Logistics SVK, a.s.	small	35	e
PAPO, s.r.o.	small	36	e
DALITRANS, s.r.o.	small	37	e
Dopravny podnik mesta Kosice, akciova spolocnost	medium	38	e
North Slovakia Camion, s.r.o.	small	39	e
Dopravny podnik mesta Ziliny, s.r.o.	small	40	e
Banskobystricka regionalna sprava ciest, a.s.	small	41	b
Letisko Kosice - Airport Kosice, a.s.	large	42	d
Lagermax Autotransport Slovakia, spol. s.r.o.	small	43	e

As a result of examination, five clusters were established bringing the companies similar to each other together in terms of the level of the performance of six rates. The accumulation was labeled as a, b, c, d, e (see tab. 10). To identify which group of companies is characterized by high profitability and has good results and general condition, the group mean method had been used. It aims to identify diagnostic features dominant in the group. For a matrix of the figures, the arithmetic mean of the surveyed rates were calculated marked by $\overline{W_i}$. Then, there was the calculation of arithmetic mean of the surveyed rates in the achieved accumulation which were marked as $\overline{w_i}$ The rate of

the structure of each accumulation is the quotient $\dfrac{\overline{w_i}}{\overline{W_i}}$. The maximum value of the

structure rate indicates the dominance of a given feature in the achieved group. The average level of phenomenon has the value of 1. The values more than 1 are the rates of the values larger than the average and less than 1 are the rates for which the level in particular groups is smaller than the average.[12]

Figure 17 presents the levels of the six surveyed rates in the achieved accumulations.

The graph shows that the highest rates of profitability is characteristic for the **accumulation (a).** This is the group consisting of four companies, two of them operate in the branch of warehousing and storage. The majority of them were the small companies operating around Bratislava. The rates of the financial leverage and the debt leverage to total assets take small values which means that companies from his accumulation are not

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[12] K. Chudy – Laskowska., M. Wierzbińska, *Zróżnicowanie województw pod względem infrastruktury transportowej w Polsce – wyniki badań,* Zeszyty Naukowe Wydziału Zarządzania. Ekonomia i Nauki Humanistyczne, z. 18, Rzeszów 2011

exposed to the high risk in their business. In the ranking, the companies from the first accumulation are at the top of the list.

Fig. 17. Radar chart - the average values of diagnostic variables in the clusters
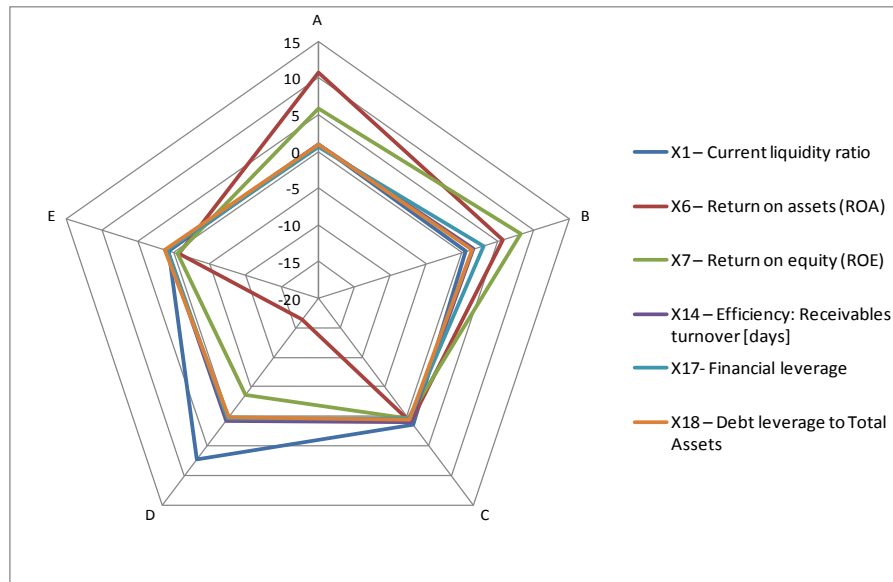
The second **accumulation (b)** are the further four companies. The profitability of the companies is at a high level but the current ratio reaches a very low level and the financial leverage and the debt leverage to total assets are vey high, which may indicate a low stability of the surveyed companies. The majority of them are the small companies operating in the branch of warehousing and storage. Three of them are in the top half of the ranking while one of them takes the third place from the end.

The third **accumulation (c)** is the second one in terms of the size and includes 10 companies. The rates are moderate, profitability is small but positive, it is characterized by the correct liquidity and low values of leverage rates, which may indicate the established position in the market and can prove the stability in the conduct of activities and a good condition. In this group there were in majority the medium and large companies usually operating in the passenger land transport.

The fourth **accumulation (d)** is one company. From the graph can be read that the rates ROA and ROE are at a very low level and their values are negative. The company made loss in running a business. The current ratio has a high value which reflects the excessive freezing in capital in current assets. It is a big company and in the ranking takes the next to last position.

The last **accumulation (e)** is the most numerous and it includes 24 objects. The liquidity rate in this group is very low, the return on assets is negative as well the return on equity (the companies make loss), moreover, the financial leverage and the debt leverage to total assets are at a quite high level and therefore the companies are at risk in their business. The majority of these companies are the small and the medium ones operating in the passenger land transport and the road transport of goods. They take place in the second half of the ranking.

6. CONCLUSIONS

The analysis of the TSL sector companies operating in Poland and Slovakia allows to provide a number of important conclusions.

The largest proportion of the companies from the TSL sector have their legal addresses in the metropolitan regions.

- TSL sector companies show a great diversity in terms of:
    - **running a business** – the largest percentage are the companies operating in the branch of the road transport of goods (Poland 54%, Slovakia 35%),
    - **the legal form** – the most companies operate as Limited Liability Company (in Poland 76%, in Slovakia 64%), a significant difference appears in other forms. Every third company in Slovakia operates as Public Limited Company, whereas in Polish conditions there is only 5% of such companies,
    - **the size** – the largest percentage of companies are the small ones however, in Slovakia there are more medium and large companies.

The comparative analysis showed that:

- Polish companies have better return on assets ROA, return on equity ROE and efficiency measured by the rotation of liabilities,
- Slovak companies have better current ratio and values of the financial leverage and the debt leverage to total assets rates.

   Taking into account all the surveyed companies it was also stated that:

- **The country** in which the TSL sector operate has an influence on: the return on assets and the return on equity as well as the financial leverage. In Polish companies, the profitability is higher and the companies are less risky in their actions.
- **The type of activity** has an influence on the level of all surveyed rates. The best results obtain the companies operating in the courier, shipping and postal services. The worst results are achieved by the companies operating in the passenger land transport and the road transport of goods.
- **The size of the company** has an influence on the two rates: ROE and the debt leverage to total assets. The larger the company, the lower profitability and smaller values of the debt leverage to total assets.

It had been examined whether there are the differences in the size of the achieved values of rates in particular **branches** in the division of the companies operating in Poland and in Slovakia. The differences appeared in the rate of ROE between the companies in the group of the road transport of goods. The higher profitability is observed in the case of Polish companies. In the branch of warehousing and storage the differences appeared in the financial leverage. Slovak companies quite often make use of the foreign capital. In the passenger land transport the differences were present in the level of efficiency rate, the companies in Slovakia are more effective.

In small companies the differences occurred in the two rates: the profitability ROE and the financial leverage. The larger the company, the lower return on equity and lower value of the debt leverage to total assets.

The comparison of the financial condition of Polish and Slovak companies gave the following results.

In terms of **the branch**

- The differences were observed in the group of companies operating in the road transport of goods and concerns the rate of ROE – Polish companies have higher profitability.
- The companies operating in the branch of warehousing and storage have a different financial leverage – Slovak companies more often make use of the foreign capital.
- The companies operating in the branch of the passenger land transport have a different rate of the efficiency – receivables turnover – in this respect Slovak companies are much better.

In terms of **the size of the company**

- The differences in the rates were observed only in small companies. The medium and large ones achieve similar levels of the surveyed rates. In small companies the differences were identified in the case of ROE rate (Polish companies have a better condition) and the financial leverage (Slovak companies more often make use of the foreign capital).

For **Polish** companies

- All the rates differ in terms of the business activity (belonging to the branch).
- The size of the company has an influence on the return on assets ROE and the debt leverage to total assets.

For **Slovak** companies

- The differences in the surveyed rates appeared only in the case of the return on assets ROA.
- The size of the company has an influence on the financial leverage rate as well as the debt leverage to total assets.

The taxonomic analysis made for the companies operating in Slovakia showed that they can be divided into five accumulations (clusters). The best results are achieved in the case of four companies from the accumulation „a". These are also the companies that occupy the highest position in the ranking. They have a high profitability and do not show a high risk of default of repayment of their financial liabilities.

The worst rates presents the accumulation „d", it is one big company characterized by a negative profitability and high risk in action.

There was also created the most numerous group including 24 companies, which represent the average level of condition mainly consisting of small and medium companies.

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ANALIZA PORÓWNAWCZA FIRM Z SEKTORA TSL DZIAŁAJĄCYCH W POLSCE I NA SŁOWACJI

W artykule przedstawiono analizę porównawczą firm działających w sektorze Transport – Spedycja – Logistyka w Polsce i na Słowacji. Przeprowadzone analizy statystyczne obejmowały badanie firm logistycznych ze względu na wielkość przedsiębiorstwa, rodzaj prowadzonej działalności oraz jej charakter. W szczególności scharakteryzowano strukturę firm logistycznych w Polsce i na Słowacji ze względu na region prowadzonej działalności, branżę prowadzonej działalności, formę prawną prowadzonej działalności oraz wielkość przedsiębiorstwa. Z wykorzystaniem metod statystycznych, na podstawie wybranych wskaźników finansowych porównano kondycję finansową firm sektora TSL w Polsce i na Słowacji w latach 2009-2012.

Dla firm działających na Słowacji, za pomocą metod taksonomicznych przeprowadzono badania porównawcze mające na celu wyodrębnienie skupień firm podobnych do siebie pod względem wybranych wskaźników opisujących ich kondycję ekonomiczno – finansową. Wskaźniki charakteryzujące kondycję finansową przedsiębiorstw obejmowały następujące grupy wskaźników: płynności (opisujące płynność finansową przedsiębiorstw), zadłużenia (skłonność przedsiębiorstw do spłaty swoich zobowiązań), zyskowności (opisujące skłonność przedsiębiorstw do generowania zysków), sprawności działania (opisujące sprawność i efektywność zarządzania firmą) oraz pozostałe wskaźniki opisujące strukturę kapitałową przedsiębiorstw oraz efekt dźwigni finansowej.

Na podstawie wybranych wskaźników wykorzystując metody wielowymiarowej statystyki porównawczej (metodę rankingu – porządkowania liniowego) z wykorzystaniem uogólnionej miary odległości GDM przeprowadzono badanie rankingu firm sektora TSL działających na terenie Słowacji w 2011 roku. Analiza wyznaczonych rankingów umożliwiła wyodrębnienie firm najlepszych pod względem ich kondycji finansowej oraz potencjalnych firm zagrożonych ryzykiem upadłości. Wyniki rankingu do firm Słowackich odniesiono do wyznaczonych metodami taksonomicznymi klastrów firm o podobnej kondycji finansowej. Porównanie rankingów w obrębie klastrów zbadano w zależności od wielkości analizowanych przedsiębiorstw. Uzyskane wyniki przedstawiono w formie wniosków praktycznych.

Słowa kluczowe: sektor TSL, analiza porównawcza, analiza statystyczna, metody taksonomiczne.