RELATIONSHIP BETWEEN SIZE AND PROFITABILITY OF POLISH TRANSPORTATION COMPANIES

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Abstract

There is an ongoing debate in the literature on the relationship between the size of the firm and the profitability. Some researchers postulate that relationship is positive, which stems primarily form the economies of scale. Other researchers claim the opposite, i.e. the analysed relationship is negative which results form, inter alia, bureaucratization, which is typical for larger firms. Given the relationships between the size and the profitability of the firms might differ among various industries and regions and due to inconsistencies of results presented in the literature by other researches, in this study only one industry in one region is being analysed. The aim of this paper is to study the relationship between the size and the profitability of 3.000 road transportation companies registered in Poland in period $2013 - 2017$. Poland has been selected for the study, because Polish road transportation fleet is the largest in European Union. This paper uses moving quartiles, Spearman rho and Kendall tau-b coefficients to analyse studied relationships. The results of this study indicate statistically significant and negative relationship between the size and the profitability of road transportation companies. Identified negative relationship is strong if the size is measured with total of assets, and weaker, but yet statistically significant if the size is measured with sales. This finding is of particular value for decision makers. The main limitations of this study are: analysed period, which comprise only the time of economic growth; and the region, as we analyse only road transportation companies registered in Poland. These both limitations are a good indication for further research, which ones carried out could allow for global conclusions regarding road transportation industry.

Key words: road transportation, size, profitability, performance

1. INTRODUCTION

Both size and profitability of companies have been since long subjects of many studies. This is primarily because nearly all companies are interested in profitability and growth or size. The majority of papers study independently either the size or the growth (Baum et al., 2001; Massey et al., 2006; Masurel & Montfort, 2006; Mazzucato & Parris, 2015; Megaravalli & Sampagnaro, 2019) or the profitability of companies (McGahan & Porter, 2002; Bowman & Helfat, 2001; Abu-Tapanjeh, 2006; Yoo & Kim, 2015) along with their determinants. Despite significant number of papers on either the size or the profitability of companies, insufficient attention has been paid to the mutual relation between the size and the profitability of companies (Singla, 2011; Nunes et al., 2009; Tyagi & Nauriyal, 2017). Furthermore, the results on mutual relationship between the size and the profitability of companies are frequently at contradictory or least inconsistent. Several scholars postulate the relationship between the size and the profitability of the firm is negative (Dhawan, 2001; Goddard et al., 2005), whereas other scholars claim the opposite (Nunes et al., 2009; Tyagi & Nauriyal, 2017), i.e. that the relationship between the size and the profitability of the firm is positive. These inconsistencies presented by various scholars, might result from underlying differences among various industries, countries or time horizons analysed. Hence, aforementioned inconsistencies call for further investigation of this domain, especially regarding specific industries, countries and periods, as at this stage, yet it is too early to arrive to general, holistic conclusions. Therefore, the objective of this paper, is to study only one industry in one country. The road transportation industry, has been selected for the study, because it plays a significant role in any economy in each country and because it has been insufficiently studied. According to the best knowledge of authors, there is no paper published on the relationship between the size and the profitability of transportation companies. The choice of Poland stems from the fact that road transportation companies registered in Poland deliver around 25% of all road carriages within EU, hence, selected companies, are significant, not only from Poland, but also from European perspective (PWC, 2016). It should be noted that the term road transportation companies registered in Poland is more adequate than the term Polish road transportation companies, since the shareholders of many studied companies are not the citizens of Poland but multinational companies, like DHL, Raben, GLS and others, while the companies registered in Poland are operating as their branches.

Given inconsistencies of research results presented in the literature for different industries, the objective of this paper is to study the relationship between the size and the profitability of transportation companies registered in Poland. The reminder of the paper is organized as follows: in section 2 the literature is being reviewed and the key findings obtained by other researchers are presented; in section 3 the research methodology and its different components like research design, data sources, sample of observations and selection of variables used in the study are disclosed. In section 4 the results of the study are being presented. The last section, of this study comprise discussion, conclusions, managerial implications, limitations of the study and indication of directions for future research.

2. LITERATURE REVIEW

The literature on various factors affecting profitability of companies is vast. In general, studied in the literature, determinants of profitability can be divided into: internal, which stem from various means of management and from the company itself (McGahan & Porter, 1997; Goddard et al., 2005) and external resulting from environment, including, inter alia, changes of gross domestic product, customer behaviours or competitors (Bowman & Helfat, 2001; McGahan & Porter, 2002 Korneta, 2018). Among most frequently studied internal profitability determinants are: age of the firm (Das, 1995; Dahlstrand & Stevenson, 2010), its indebtedness (Jordan et al., 1998; Hall et al., 2000), efficiency (Jovanovic, 1982; Yazdanfar, 2013), working capital management (Bagchi et al., 2012; Al-Debi'e, 2011), spending on research and development (Tyagi & Nauriyal, 2017), the structure of shareholders (Abu-Tapanjeh, 2006) and others, including the size. Size is one of internal determinants of profitability, which depends on the company itself. Despite intuitively positive relationship between firm size and profitability, there is an ongoing debate in the literature on its nature. Significant number of scholars claim relationship between the firm size and the profitability is positive. This is primarily because of advantages, which larger companies have over smaller ones. These advantages, inter alia, include: possibility to exploit economies of scale and scope, possession of more resources, formalized and more efficient procedures, higher spending on research, development and advertising, hence larger companies should outperform smaller ones in many areas, including profitability (Penrose, 1959; Hall & Weiss, 1967; Nunes et al., 2009; Tyagi & Nauriyal, 2017).

Simultaneously, a number of other scholars postulate the opposite, i.e. the relationship between the size and the profitability of the firm is negative. This is mostly because larger companies are subject to higher bureaucratization (Ahuja & Majumdar, 1998), have higher costs than they need to be (Leibenstein, 1976) and require more coordination from management, which makes managerial tasks difficult (Downs, 1967) and so profits of larger companies are lower (Pi & Timme, 1993; Dhawan; 2001; Goddard et al., 2005).

Inconsistent results presented by various scholars might stem from underlying differences between countries, time periods or industries studied, but not only. These differences might result also form methodology employed by various researchers. Size of the firm is usually measured with total of sales, total of assets or the number of employees (Anton, 2018; Tyagi & Nauriyal, 2017; Yazdanfar, 2013). The use of different proxies of size might imply different results. Kartikasari Dwi and Merianti Marisa (2016) found that the size measured with total of assets has a negative impact on manufacturing Indonesian companies, whereas size measured with sales has a positive impact on these companies.

3. METHODOLODY

The data used in this study is from Emerging Markets Information Service (EMIS) database. In particular, 8.723 observations relating to 3.000 Polish

transportation companies, covering a 5-years period between 2013 and 2017, were obtained. All the observations come from financial statements of studied companies disclosed in EMIS database. Since the data relating to each of the 5 contemplated periods of all 3.000 companies has not been available in stated database (potential 15.000), the number of observations is reduced and amounts to 8.723. In this study quantities obtained from financial statements are being used. Such approach has already been done with success by many researches and decision makers. The reasons, to employ quantities calculated on figures from financial statements, among others, comprise: estimation of bankruptcy predictors (Altman, 1968), evaluation of performance of the companies (Kumar & Ravi, 2007; Xiping, 2014; Korneta, 2018), critical success factors identification (Korneta, 2019), and to design performance management systems (Korneta & Krzyszkowski, 2018).

Table 1 contains variables used in this study together with their acronyms and the details of calculations. The profitability of companies is most frequently measured, in the literature, with return on equity (ROE), return on assets (ROA) and return on sales (ROS) ratios (Lam & Lee, 2012; Baah-Acquah et al., 2017; Tyagi & Nauriyal 2017). In this study ROE as a proxy for the profitability of studied companies is being used, as this ratio is the closest to shareholders wealth. ROE is therefore, a dependent variable in this study.

In the extant literature, size of the companies is usually measured with total of sales, total of assets or the number of employees, scaled by the natural logarithm (Anton, 2018; Tyagi & Nauriyal, 2017; Yazdanfar, 2013). In this study total of sales and total of assets are being used as proxies of size of studied companies. These variables are considered independent in the study.

Table 1. Variables used in the study

Variable	Acronym	Description
Profitability	ROE	Ratio of net result to equity
Size 1	SIZES	Natural logarithm of yearly sales revenue in PLN million
Size 2	SIZETA	Natural logarithm of total of assets in PLN million

Source: own elaboration

Once, the variables has been selected to the study, descriptive statistics of each variable are being analysed. In the next step of the research, normal distribution of employed variables is being verified. This verification is due to the fact that the majority of test of significance assumes normality of both tested variables to be met or at least approximately met. Normality assumption is being verified with the use of Doornik-Hansen, Shapiro-Wilk, Lilliefors, Jarque-Bera tests. All of these statistical test have the same null hypothesis, claiming the data are normally distributed (Siddiqi, 2014).

Next, contemplated relationships between studied variables are being visualized on graphs. Visualization of the considered relationships have been achieved through the use of moving medians. This approach is to determine if the relations differ between considered variables in different ranges (Arce, 2005). Median values of both

variables in a moving window containing data of 200 observations are being calculated. Similarly, the moving first and third quartiles to quantify the distribution of data around the median are being calculated. Once the relations have been identified the Spearman rho and the Kendall tau-b coefficients are being calculated. Both of these statistics are non-parametric rank correlation measures, used to measure the ordinal associations between two studied quantities (Bonett & Wright, 2000; Corder & Foreman, 2014).

4. RESULTS

Table 2 contains a descriptive statistic of variables used in the study. The mean value of ROE, in a period between 2013 and 2017, of studied Polish transportation companies amounted to 0,29. A wide range of variations among ROE variables must be noted, as indicated by their standard deviations, minimum and maximum values. The mean value of SIZES variable of 3,02 indicates that mean sales revenue of studied companies is PLN 20,5 million (around EUR 4,8 million), whereas the highest yearly sales revenue (SIZES=8,77) amounted to PLN 6,4 billion (around EUR 1,5 billion). The use of natural logarithms allows to present on one graph, all of these observations together. The mean value of SIZETA variable of 2,31 indicates that mean total of assets value of studied companies is PLN 10,1 million (around EUR 2,4 million), whereas the highest total of assets (SIZETA=10,89) totalled PLN 53,6 billion (around EUR 12,8 billion).

Table 2. Descriptive statistics of 3.000 Polish road transportation companies in the period 2013-2017

Variable	Mean	SD	Median	Min	Max	Skewness	Kurtosis
ROE	0,29	8,37	0,18	-122	743	79,45	7118,57
SIZES	3,02	1,15	2,81	0	8,77	0,98	1,88
SIZETA	2,31	1,35	2,01	0,01	10,89	1,35	2,81

Source: Author's compilation based on 8.723 observations, from EMIS Database, 2019

Table 3 provides results of 4 different normality tests. Since none of the variables have p-value greater than 0.05, the null hypothesis, stating the data are normally distributed, must be rejected. Based on aforementioned results, the decision is made that Speraman's Coefficient of Rank Correlation and Kendall Tau-B are the most appropriate choice for further research.

Table 3. Tests of normal distribution

Test /variable	Doornik-Hansen	Shapiro-Wilk	Lilliefors	Jarque-Bera
ROE	2,9688e+08	0,0262	0,4269	1,8425e+10
P	<0,0001	<0,0001	<0,0001	<0,0001
SIZES	1267,37	0,9442	0,0772	2703,82
p	<0,0001	<0,0001	<0,0001	<0,0001
SIZETA	2957,38	0,911255	0,091926	5535,86
p	<0,0001	<0,0001	<0,0001	<0,0001

Source: Author's compilation based on 8.723 observations, from EMIS Database, 2019

In Figure 1 the original data were plotted and using the methods provided in methodology section the moving medians, the first and the third quartiles were obtained. It is apparent that the moving median and third quartile are declining with the growth of sales (SIZES variable). Although the declining tendency is the sharpest for lower SIZES values, up to 1,8, it should be noted that the majority of observations has a value above stated threshold. In the range over 1,8 (SIZE variable) the negative tendency, although yet visible, is week.

Figure 1. The relationship between SIZES and ROE variables with the moving median, first and third quartile
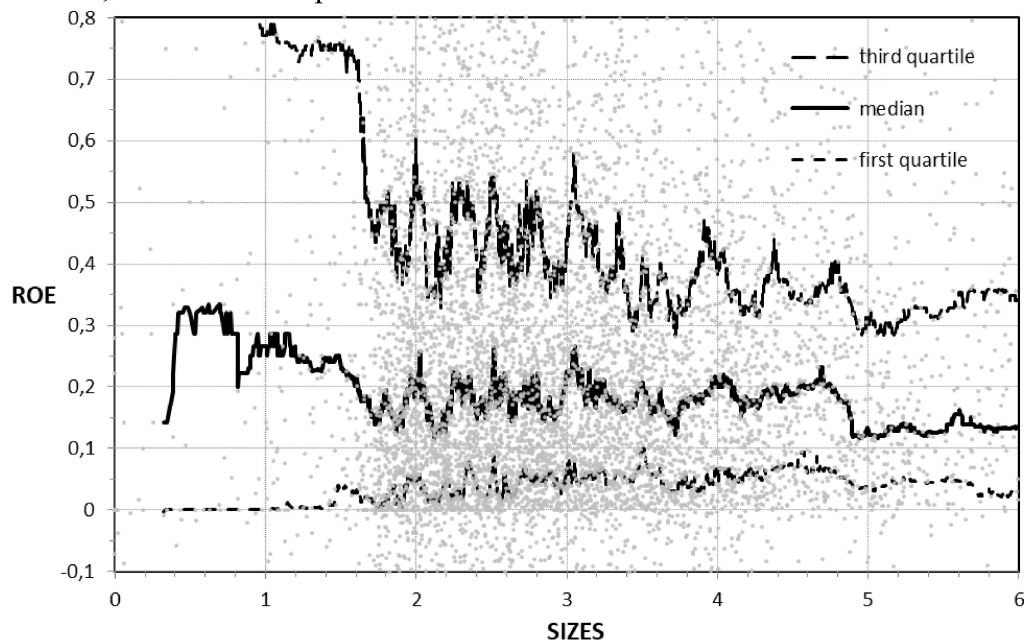
Source: Author's compilation based on 8.723 observations, from EMIS Database, 2019

In Figure 2 the original data, the moving median, the first and the third quartile for SIZETA and SIZES variables were plotted. It is apparent that both the moving median and the moving third quartile display evident declining tendency, which is characteristic for the whole sample.

Figure 2. The relation between SIZETA and ROE variables with the moving median, first and third quartile
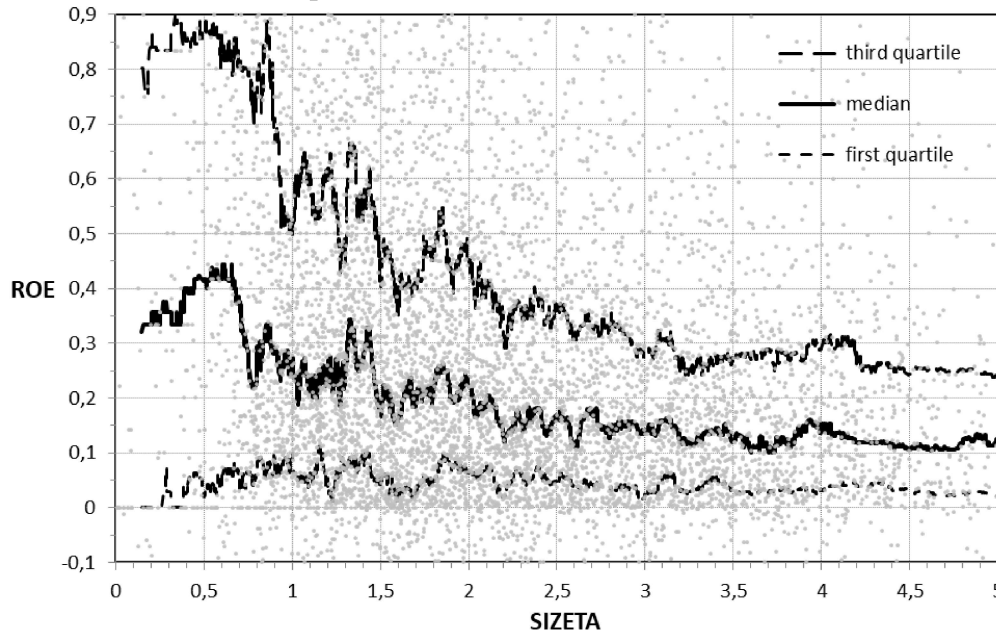
Source: Author's compilation based on 8.723 observations, from EMIS Database, 2019

Table 4 presents results of statistical tests of relations between ROE and both size variables (SIZES, SIZATA), i.e. the Spearman rho and the Kendall tau-b with p-values (one side).

Table 4. Results of statistical tests of relations between GRS and studied variables. p-values are one side values.

	Spearman		Kendall	
	coefficient	P	Tau-B	p
SIZES	-0,0162	0,0655	-0,0116	0,0522
SIZETA	-0,1937	<0,0001	-0,1337	<0,0001

Source: Author's compilation based on 8.723 observations, from EMIS Database, 2019

Obtained and presented in Table 4 results confirmed negative relationships between profitability and both size variables. It should be noted however, the relationships between SIZES and ROE are statistically significant with p-values above 0,05 (or below 0,1), while the negative relationships between SIZETA and ROE are statistically more significant, i.e. the p-values are below 0,05.

5. DISCUSSION AND CONCLUSION

The results of this study show clearly the relationship between the size and the profitability of transportation companies registered in Poland is negative and statistically significant with p values below 0,1 or 0,5, regarding size measured with sales and total of assets, respectively. The difference in p values and coefficients for

SIZES and SIZETA variables indicate that, the relationship between the size measured with total of assets and profitability is considerably stronger than the relationship between the size measured with sales and profitability. Therefore, there are two practical implications of this study. The first is that studied transportation companies should expect lower profitability rates when they grow, i.e. the side effect of growth is decreasing of profitability in studied industry. The second is that, stated negative relationship between size and profitability is weak in terms of size measured with sales (Spearman coefficient -0,0162; Kendall Tau-B -0,0116) and significantly stronger in terms of size measured with total of assets (Spearman coefficient -0,1937; Kendall Tau-B -0,1337). Hence, growing transportation companies, in order to remain profitable should control levels of total of assets, as this variable has a significant impact on their profitability. Growing sales have considerably lower impact on profitability. One of the practical recommendations for studied companies is to consider outsourcing of fixed assets (primarily car fleet) and to shorten trade receivable cycles as these positions are supposed to make up for the highest share of total of assets, which as indicated should be minimized.

The results of this study are aligned to results presented by other scholars (Ahuja & Majumdar, 1998; Leibenstein, 1976; Downs, 1967; Pi & Timme 1993; Dhawan 2001; Goddard et al., 2005), who postulate the relationship between the size and the profitability of the firm is negative. The results of this study are opposite to the findings of scholars who postulate that larger companies have advantages over smaller companies and so are deemed to be more profitable (Penrose, 1959; Hall & Weiss, 1967; Nunes et al., 2009; Tyagi & Nauriyal, 2017). Therefore, the results of this study indicate that the significance of economies of scale and scope and other advantages related to large size companies is weaker than the significance of disadvantages related to large size companies, like bureaucratization, or management difficulties resulting from higher complexity, for transportation companies registered in Poland. The findings of this study, as compared to results obtained by other researchers indicate also that there might exist underlying differences among various industries, hence specific industries should be studied separately.

This study has however, several limitations. Firstly, it should be noted the sample used in this study comprise only Polish transportation companies. As a consequence, the findings, of this paper might not be generalizable to other countries or other industries. Secondly, it must be noted that the studied period is relatively short, i.e. it comprise only the time of economic growth. Contemplated relationships, might differ in the times of recessions. Both of aforementioned limitations have been done deliberately as the aim of this paper is to arrive to conclusions only for transportation industry, which differs significantly from other industries, especially manufacturing ones.

Aforementioned limitations of the study are a good indication for further research. The results of studies of the relationships between the size and the profitability of the transportation companies, in other regions, especially outside European Union could successfully contribute to confirm the results of this study and allow to generalize the findings for the whole transportation industry. It would be also, very interesting to study the relationships between the size of companies and their profitability, or the default risk during economy slowdowns. On the one hand, if the

macroeconomy conditions revers, smaller transportation companies, possessing less resources have greater chances of going bankrupt than larger ones, and so should be less profitable. On the other hand, smaller companies, as postulated by Ahuja and Majumdar (1998), are less bureaucratized and so have greater chance of adjusting quickly to changing market conditions and in that way to outperform larger companies in terms of profitability.

6. REFERENCES

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