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CORPORATE SIZE–PERFORMANCE RELATION ACROSS COUNTRIES AND INDUSTRIES: FINDINGS FROM THE EUROPEAN UNION

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Abstract:

According to the leading theories of the firm the size-performance relation is not obvious neither in terms of its significance nor direction. The review of the previous empirical research also provides mixed evidence in the field. The aim of this study is to further explore this relationship by considering two potentially important factors – the country and industry specificity. In contrast to most studies, where the overall corporate performance often seems to be narrowed to some profitability aspects, this research takes into account a much wider range of corporate performance ratios. The way country and industry features affect size-performance relationship is analysed on a sample of private firms of three sizes from 13 industries across 9 EU countries in the period 2000-2010. The research methodology includes the analysis of variance, taxonomic method of aggregation, linear ranking and adjusted Rand's measure used for comparing partitions. Findings provide evidence that the variability of the size-performance relationship is both country- and industry-dependent, with a slight dominance of the latter factor.

Keywords:

firm size; corporate performance; European Union; country factor; industry factor

JEL Classification: G30

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Introduction

What are the factors responsible for corporate performance seems one of the most commonly addressed question in the corporate finance literature. An almost countless number of determinants have been identified and attributed some real or potential impact on financial performance. The most general classification of these determinants distinguishes two categories, namely the internal and external factors. The first group is controlled by an enterprise itself, whereas the other one results from independent factors describing both direct and indirect environment of firm. Firm size, which belongs to the first category, has enjoyed particular attention of researchers looking for determinants of corporate performance. However, the vast majority of empirical studies aiming to identify the size effect in corporate performance, are limited mainly to analysing the relationship between firm size and its profitability. The profitability ratios, usually being a relation of profits to assets, equity, or turnover, although informative and useful measures, characterise only one, quite narrow aspect of the complex and multivariate phenomenon that is the overall corporate performance.

The aim of this study is to further explore the relationship between firm size and its performance. The review of the theories of firm as well as previous empirical evidence does not provide clear expectations concerning the significance or direction of the relationship, which is why it is purposeful to search for other factors determining this relationship. This study takes into account two factors, namely the country specificity and the industrial classification, as potentially important determinants of the size-performance relation. Specifically, the study aims at finding the importance of the industrial classification of firm and the country where it operates for the size – performance relation. Both factors are commonly accepted and widely evidenced as significant determinants of corporate performance (Koralun-Bereźnicka 2013). However, it is also likely that they might affect not only financial performance as such, but also the way another factor – firm size – impacts this performance. Therefore the main hypothesis to be verified in this study is that the size-performance relationship is both country and industry dependent. This statement could be further decomposed into two detailed research hypotheses:
H1: The size–performance relation is industry-dependent.
H2: The size–performance relation is country-dependent.

This study contributes to the already profuse literature in the field in several ways. First, the wider range of corporate performance ratios is examined instead of the usually analysed profitability ratios. Second, the size-performance relationship is explored in two cross-sections, i.e. across industries and countries in order to identify the impact of national characteristics and industry features on the nature and (or) significance of this relationship. Finally, the study is based on private firms, and not only on the most commonly explored public company data.

Literature review – theory and previous evidence

The review of the leading theories of the firm does not provide clear and direct implications about the size-profitability relation (Kaen, Baumann 2003). The theories classified by Kumar et al. (2001) as organizational, institutional and technological, depending on which aspect of the firm is emphasised, tend to focus on the determinants of firm size rather than on the relationship between size and profitability.

Organizational theories, focusing on the firm's organizational architecture and relations among stakeholders, tie profitability and size together mainly with agency costs, arising out of conflicts of

interest among the stakeholders of the firm due to information asymmetries and self-seeking behaviour (Jensen and Meckling 1976), and transaction costs, i.e. the costs of planning, adapting and monitoring task completion and performance in an organization (Williamson 1985). However, instead of predicting the size-profitability relationship, the organizational theories offer establishing an optimal size for the firm in terms of profitability by predicting that at some point average per unit transaction costs and agency costs increase and offset economies of scale and scope (Kaen, Baumann 2003).

Institutional theories, focusing on the legal and political environment, tie firm size to such factors as legal systems, anti-trust regulations, patent protection, market size and the development of financial markets. As reported in a study by Kumar et al. (2001), capital-intensive firms are larger in countries with efficient judicial systems and R&D intensive industries have larger firms in countries with stronger patent protection. Generally, institutional and market structure factors may affect the observed relations between size and profitability (Kaen, Baumann 2003).

The technological theory based on the production technology used by the firm focuses on the production process, investment in physical capital and economies of scale and scope as factors that determine optimal firm size and, by implication, profitability. Increasing economies of scale that distribute fixed costs over large output volumes, thereby decreasing the average cost of production and increasing the return on capital invested, are associated with increases in firm size. Therefore, the relation between size and profitability due to economies of scale is positive, at least up to the point where the diseconomies of scale appear.

The conclusion reached by Kaen and Baumann (2003) in their study, where they overlay the three theories of firm in order to formulate expectations about firm size and profitability is that "either accounting based measures of profitability initially increase and then level off or decline with respect to size or no relation exists between size and these profitability measures". Therefore, given the existing theories, it cannot be a priori assumed that small firms are generally less profitable than large firms.

The review of empirical findings in the field also provides mixed evidence on the relationship between firm size and profitability. Some of the first attempts to discover the size-profitability relationship include studies as early as the one by Crum (1939) or Hymer and Pashigian (1962). The hypothesis proposed by Baumol (1959) that the increase in size may result in profitability increase, is justified by the fact that large firms can make investments of such scale that is beyond the reach of small firms. Following this stream of research, Hall and Weiss (1967) found that size tended to be associated with higher profit rates among the Fortune 500 companies for the years 1956 through 1962. Similarly, Herendeen (1975) observed a fairly clear pattern with the larger corporations having consistently higher profit rates than the smaller corporations throughout the period 1958-1965 in the population of the U.S. manufacturing firms. However, the author points out that average profit rates for positive net income firms tend to decline with firm size as there are more negative profit firms among smaller firms than among larger firms, which pull down average profit rates of smaller firms.

This intuitively appealing positive relation between size and profitability, rationalised by the common belief that the bigger, the more powerful and thus better performing, is not unanimously confirmed by the empirical research. For example, the opposite conclusions are presented by Stekler (1963; 1964) and Osborn (1970). Profit rates declining with firm size were also found by

Ballantine et al. (1988; 1993). There is also a number of studies where no positive relationship between profitability and firm size was found, e.g. Marcus (1969), Caves and Pugel (1980) or Amato and Wilder (1985). There are even cases where contradictory results were reported by the same researcher. For example Schmalensee (1987) found that firm size and profitability were not strongly correlated at the four-digit SIC level. However, a more recent study by the same author (Schmalensee 1989) based on the two digit SIC level revealed that large firms in general were more profitable than small firms within the same broader industrial category.

The opposite is reported to be the case in a study by Dhawan (2001), who examined the size-profitability relation for U.S. firms between 1970 and 1989. Using Compustat data, he found that profitability measured as operating income to total assets is negatively related to firm asset size. However, the industrial classification used in this study is even broader than the one applied by (Schmalensee 1989), as Dhawan divided his sample only into two broad industries: manufacturing and services, which practically excluded controlling for industry specific factors, which may affect the size-profitability relation.

The results of the earlier mentioned study by Kaen and Baumann (2003) seem to further complicate the issue by revealing more complexity within the considered relationship. Within their sample of sixty-four industries the authors found almost all possible kinds of size-profit relations, depending on industry, level of total assets or sales.

The above literature review is certainly not exhaustive and is only meant to highlight the discrepancies of views on the issue of the size-performance relation. It is worth noting though, that despite the abundance of studies related to this theme, most of them seem to be narrowed just to the problem of profitability, measured with the use of some book-based ratios. In contrast to most studies in the field, this research takes into account not only profitability measures, but a much wider range of corporate performance ratios.

Given the above-mentioned theories of the firm, as well as the hitherto empirical evidence, it seems that a straightforward relationship between size and performance, either of positive or negative character, would be too simplified, the more so for a wide variety of companies in terms of such aspects as industrial classification, country specificity or other external features.

Database

The source of data is the BACH-ESD database (Bank for the Accounts of Companies Harmonised - European Sectoral references Database) published by the European Commission. The study includes companies of three sizes: small (with the net turnover of less than EUR 10 million), medium (with a turnover of 10 million euros to 50 million euros) and large (with a turnover over EUR 50 million) in thirteen industries according to the NACE classification (Nomenclature Statistique des Activités économiques dans la Communauté Européenne) and in nine European Union countries available in the BACH-ESD database: Austria, Belgium, Germany, Spain, France, Italy, the Netherlands, Poland and Portugal. Table 1. shows the industries covered by the study and the three-letter symbols assigned to each section used in the following sections of the paper.

Table 1. Industrial sections covered by the analysis

NACE	Section	Symbol
A	Agriculture, forestry and fishing	AGR
B	Mining and quarrying	MIN
C	Manufacturing	MNF
D	Electricity, gas, stream and air conditioning supply	ELE
E	Water supply; sewerage, waste management and remediation activities	WAT
F	Construction	CST
G	Wholesale and retail trade; repair of motor vehicles and motorcycles	TRD
H	Transport and storage	TRS
I	Accommodation and food service activities	HOT
J	Information and communication	INF
L	Real estate activities	RLE
M	Professional, scientific and technical activities	PRF
N	Administrative and support service activities	ADM

Source: Statistical Classification of Economic Activities in the European Community, Rev. 2 (2008)

The diagnostic variables are grouped into several categories illustrating different economic areas shown in Table 2.

Table 2. Financial ratios used in the analysis

Ratio category	Ratio structure	Ratio number in BACH-ESD
Profitability	Added value / Net turnover	R01
	Staff costs / Net turnover	R02
	Gross operating profit / Net turnover (ROS)	R03
	Gross Operating profit / Total net debt	R04
	Net operating profit / Net turnover	R05
	Net turnover / Total Assets	R16
	Net operating profit / Total Assets (ROI)	R10
	Profit or loss of the year before taxes / Capital and reserves (ROEBT)	R11
	Profit or loss of the year / Capital and reserves (ROE)	R12
Working capital	Inventories / Net turnover	R17
	Trade accounts receivable / Net turnover	R18
	Trade accounts payable / Net turnover	R19
	Operating working capital / Net turnover	R20
Financial situation	Interest and similar charges / Net turnover	R07
	Interest and similar charges / Gross operating profit	R06
	Financial income net of charges / Net turnover	R09
	Financial income net of charges / Gross operating profit	R08
Assets structure	Financial fixed assets / Total assets	R13
	Tangible fixed assets / Total assets	R14
	Current assets / Total assets	R15
	Current investment and cash in hand or at bank / Total assets	R21

Liabilities structure	Capital and reserves / Total assets	R22
	Provisions / Total assets	R23
	Bank loans / Total assets	R24
	Long and medium-term bank loans / Total assets	R25
	Short-term bank loans / Total assets	R26
	Long and medium-term debt / Total assets	R27
	Short-term debt / Total assets	R28

Source: BACH-ESD database.

Summarising, the subject of the study is formed by the groups of companies of different sizes, from different industries in different countries and years. The corporate performance, measured with the use of financial ratios is the object of the analysis. Thus the study includes 28 financial ratios for the three size groups of enterprises in thirteen industrial sections and in nine countries for eleven years, which taking into account the missing data gives 88,536 data items. The descriptive statistics for the total sample are presented in Table 3.

Table 3. Descriptive statistics for all years, countries, industries and size groups

Ratio	N	Mean value	Median	Minimum value	Maximum value	Standard deviation
R01	3317	0,357	0,368	0,000	0,848	0,129
R02	3317	0,220	0,213	0,000	0,590	0,109
R03	3317	0,137	0,111	-0,304	0,668	0,093
R04	2993	0,228	0,184	-11,65	7,967	0,340
R05	3317	0,065	0,050	-0,442	1,282	0,068
R16	3314	0,890	0,797	0,000	3,891	0,571
R10	3314	0,046	0,042	-0,249	0,475	0,036
R11	3307	0,129	0,117	-7,495	2,603	0,214
R12	3307	0,097	0,088	-6,800	2,369	0,183
R17	3314	0,131	0,067	0,000	4,823	0,278
R18	3005	0,234	0,198	0,000	1,890	0,169
R19	2381	0,186	0,169	0,000	1,499	0,103
R20	2381	0,204	0,143	-1,189	4,851	0,333
R07	3238	0,051	0,022	0,000	5,122	0,176
R06	3231	0,385	0,190	-72,25	97,55	2,837
R09	3238	0,011	-0,005	-0,857	2,169	0,143
R08	3231	0,249	-0,046	-16,79	100,9	3,671
R13	3317	0,151	0,103	0,000	0,962	0,141
R14	3317	0,345	0,317	0,000	0,881	0,201
R15	3317	0,452	0,447	0,000	0,914	0,189
R21	3006	0,082	0,074	0,000	0,487	0,047
R22	3317	0,349	0,331	-0,079	0,921	0,135
R23	3317	0,062	0,034	0,000	0,697	0,073
R24	2891	0,183	0,168	0,000	0,762	0,106
R25	2928	0,115	0,092	0,000	0,590	0,089
R26	2970	0,069	0,057	0,000	0,740	0,055
R27	3317	0,212	0,187	0,000	0,699	0,119
R28	3317	0,352	0,350	0,000	0,865	0,138

Source: author's calculations based on BACH-ESD database.

Methodology

The scope of research, both due to the abundance of data and its multidimensionality, to some extent determines the type of analytical tools employed in the study. The initial phase of the empirical research was meant to establish whether the differences between ratios shown by the analysis of their descriptive statistics are statistically significant. For this purpose the one-way analysis of variance (ANOVA) was implemented (Fisher 1954) with the firm size and time used as the grouping factors.

When dealing with a relatively large set of objects (industries, countries, size groups and years) described by a number of diagnostic variables, a natural procedure is to simplify the data structure. As shown by many previous studies aiming to solve similar research problems (e.g. Cinca et al. 2005; Gupta, Huefner 1972; Leal, Powers 1997; Sell 2005; Helg et al. 1995; Boillat et al. 2002), the methods of multivariate statistical analysis provide an effective tool of identifying the most important regularities within such data sets.

Due to the fact that the diagnostic variables vary within different ranges, they require standardisation before further data aggregation. The variables were normalised according to the unity-based method, which makes them comparable by rescaling them to a fixed [0,1] range of variation. Such normalisation approach which involves division by the range of the variable was found effective e.g. by Milligan and Cooper (1988).

The details of the unity-based normalisation procedure, which can be found e.g. in Borys (1978), depend on the nature of variables, i.e. their relation with the performance. Most of the ratios are stimulants, with the exception of the ratios R02, R06, R07, R13, R14, R19 and R23-R28, which were considered as anti-stimulants, i.e. ratios whose lower value means better performance. In some cases, the classification of variables is disputable, as e.g. in the case of the current assets to total assets ratio (R15) or cash to total assets ratio (R21). In practice, the value of these ratios should not exceed certain optimal level (different for each company, depending on its operating cycle, technology, size etc.), so theoretically they should not be classified as stimulants. In practice, however, the excessive liquidity problem characterised by these ratios is much rarer than insufficient liquidity. Therefore, the higher the ratios, the safer the financial situation, which is why they were also treated as variables whose higher values mean a better object evaluation.

One of the ways of data aggregation is based on the use of the taxonomic measure of performance, which enables the comparison of multi-attribute objects by means of a synthetic instrument, containing information about all primary input variables (Grabiński 1992; Nowak 1990). The taxonomic method is characterised by highly transparent and communicative indications, which greatly facilitates the diagnosis of multi-dimensional phenomena. The taxonomic method with a standard object described by Hellwig (1968) was applied as a tool of aggregating multidimensional data and at the same time simplifying the data structure. It was calculated for each size group in the following versions: for the whole dataset (all countries, industries and years), for each country, for each industry and for the binominal objects, i.e. for size groups in countries and for size groups in industries. The results were used as the basis for ranking the objects.

The linear ranking based on aggregated measures, constitutes a convenient way of discovering the most important regularities within the explored population. Although the ranking procedure

facilitates the recognition of multi-dimensional phenomena, it is not free from disadvantages. One of its major weaknesses is the considerable simplification of complex data structures, mainly by distortion of the actual distances between the objects being ranked, as well as the loss of a significant portion of the information due to the aggregation process. Assigning ranks to objects results in separating them from each other by conventionally identical distances in only one dimension, when in fact they are characterised by a much larger set of attributes and their relative position in the multidimensional space may seriously deviate from their uniform distribution with the artificially fixed spaces. Nevertheless, the ranking method is often used as the primary classification method revealing the most general patterns.

Due to the large number of items in the ranking, which complicates the direct comparison across countries and industries, the ranked binominal objects were further divided into only three equal classes based on the general corporate performance. The number of classes corresponds to the number of size groups, which makes the comparisons more communicative and clear.

In order to compare the grouping results of size groups in industries and size groups in countries with the size-based classification of objects, i.e. to evaluate the similarity of the grouping results, the adjusted Rand's measure was implemented. The calculation method of the measure can be found e.g. in Rand (1971). The higher the value of the measure, the more similar the grouping results. Negative values indicate dissimilarity.

In order to further explore how the size-performance relation depends on the country- and industry-specific features, a regression was estimated with the firm size as the dependent variable. Following the approach adopted in many studies, e.g. by Niresh and Velnampy (2014), the logarithm of total assets (TA) was used as a proxy for form size, whereas the main explanatory variable in the model describing performance was the ROE – one of the most commonly applied profitability ratio. Apart from the main performance measure, the model was expanded by introducing interactions between the profitability ratio and the country dummies and between the profitability ratio and industry dummies, so as to find the importance of country effect and industry effect in the examined relation. Taking into account that the influence of performance on corporate size obviously might not be immediate, all the explanatory variables were lagged up to three years. The regressions were performed for all 13 industries and 9 countries in the whole period available.

The regression model could be estimated as a FE (fixed effect) or RE (random effect) panel data model. Therefore, a Hausman test was used to indicate the appropriate specification. In every case the null hypothesis in Hausman test was rejected, which indicated the inconsistence of the GLS estimator for RE model. Therefore the model was estimated by OLS with standard errors robust for heteroscedasticity and autocorrelation.

In order to verify which group of factors (country or industry) is more important in its impact on the profitability-size relation, a test for joint significance of groups of parameters was applied. First, it was meant to test if all interaction parameters for countries were statistically different from zero, which would indicate the significant influence of country-specific factors on the profitability-size relation. Then, it was used to verify whether the interaction parameters for industries were statistically different from zero, i.e. whether the industrial classification significantly influences the considered relation. As both groups of parameters proved significant, another criterion was applied in order to evaluate the relative importance of these factors, namely the Akaike'a criterion

(AIC). For this purpose two additional regressions were estimated with only one group of interactions in each case and then the AIC values were compared to decide which group of parameters (interactions) better explains the considered relation. The lower value of AIC indicates higher power of explaining.

Results

The one-way ANOVA procedure was performed in two sections. First, the firm size was established as the qualitative predictor and the analysis was carried out for the whole population as well as for each country and industry separately. The results are shown in Tables 4 and 5. Due to the amount of the results in the common form of the F statistics and p, their presentation was limited to asterisks for the ratios significantly different across size groups at p=0,05.

Table 4. ANOVA results for total population and for individual countries and industries; size as a differentiating factor (ratios of profitability, working capital and financial situation)

Population	Profitability									Working capital				Financial situation			
	01	02	03	04	05	16	10	11	12	17	18	19	20	07	06	09	08
Total	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*
AT	*	*					*			*	*			*		*	*
BE			*	*	*	*	*	*	*	*		*		*		*	
DE	*	*		*		*	*	*	*		*	n/a	n/a		*		*
ES	*			*		*		*	*		*	*		*	*	*	*
FR	*	*							*	*	*		*		*	*	*
IT	*	*		*	*	*	*	*	*	*	*		*	*	*	*	*
NL	*	*		n/a		*	*	*			n/a	n/a	n/a	*	*		*
PL	*	*								*	*	n/a	n/a				
PT	*	*		*	*	*	*	*		*	*	*	*	*			
AGR	*	*	*			*	*	*	*	*		*	*	*		*	
MIN		*		*	*		*	*	*	*		*	*	*	*	*	*
MNF	*	*		*	*	*		*	*	*	*	*	*	*	*	*	*
ELE	*	*	*	*	*	*	*	*	*	*	*	*		*	*		
WAT		*	*			*	*			*	*		*	*	*	*	*
CST	*	*	*	*	*	*	*			*		*	*		*	*	*
TRD	*	*	*		*	*	*	*		*	*	*	*	*	*	*	*
HOT	*		*			*	*	*	*	*	*	*		*		*	*
TRS	*	*	*	*	*	*	*		*	*	*		*	*	*	*	
RLE	*	*	*	*	*	*	*	*	*	*	*		*	*			
INF	*	*	*	*	*	*	*	*	*	*	*		*	*		*	
PRF	*	*	*				*			*	*	*	*	*	*	*	*
ADM	*	*	*	*			*			*	*	*	*		*	*	

Note: ratios significantly different across size groups at p=0,05 are marked with *; n/a – data not available.

Source: author's calculations based on BACH-ESD database.

The vast majority of ratios demonstrate good discriminating abilities across size groups in most countries and industries, as well as in the population as a total. If the means differ significantly from each other, it can be intuitively concluded that the analysed factor affects the dependent

variable. It is worth noting, that the country with the biggest number of insignificancies is Poland, where only 7 ratios do vary significantly between size groups. Italy, in turn, is the country where role of firm size as a determinant of corporate performance seems to be more important than anywhere, else as evidenced by the number of ratios significantly different across size groups.

Table 5. ANOVA results for total population and for individual countries and industries; size as a differentiating factor (ratios of assets and liabilities structure)

Population	Assets structure						Liabilities structure					
	01	13	14	15	21	22	23	24	25	26	27	28
Total	*	*	*	*	*		*	*	*	*	*	
AT	*	*	*		*	*	*	*	*	*	*	*
BE		*	*	*	*	*	*	*	*			*
DE	*	*		*	*							
ES	*	*	*	*	*	*	*	*	*	*	*	*
FR	*	*		*	*		*	*	*	*	*	
IT	*	*	*	*	*		*	*	*	*	*	*
NL	*	*	*	*	n/a	*	*	n/a	n/a	n/a	*	*
PL	*	*		*			*					
PT	*			*	*		*	*		*		*
AGR	*	*	*	*		*		*	*		*	*
MIN		*			*		*	*	*	*	*	*
MNF	*	*	*	*	*	*	*	*	*	*	*	*
ELE	*	*	*		*		*	*	*	*	*	
WAT		*	*	*	*		*					*
CST	*	*	*		*		*	*	*	*	*	*
TRD	*	*	*	*	*			*	*	*	*	
HOT	*	*	*	*	*	*	*	*	*	*	*	*
TRS	*	*	*	*	*	*	*	*	*	*	*	*
RLE	*	*		*	*	*	*			*		*
INF	*	*	*	*	*		*	*	*	*	*	*
PRF	*	*	*		*	*				*		
ADM	*		*	*	*	*					*	

Note: ratios significantly different across size groups at p=0,05 are marked with *; n/a – data not available.
Source: author's calculations based on BACH-ESD database.

As for the industries where size matters most in terms of financial condition, the manufacturing industry, transport as well as information and communication section should be mentioned. On the contrary, administration, water supply and professional activities are those industries, for which the number of ratios with good cross-size discriminating power is the lowest. The discriminating abilities are the best for the whole population as a total.

Tables 4 and 5 also provide useful information on the ability of individual variables to discriminate across size groups. On the one hand, the ratios with clearly the best abilities in this field are the profitability ratios (R1 and R2) and asset structure ratios (R13 and R21). On the other hand, some other ratios from the profitability category (R3 and R5) as well as the equity to assets ratio (R22) demonstrate much weaker discriminating power with the size factor. The R3 ratio is very specific in the context of the discriminating abilities. It does not vary significantly across size groups in all

countries except Belgium. However, when industries are considered, the ratio appears as one of the best in terms of the cross-size variability.

Lack of cross-size discriminating abilities of variables could be the reason for eliminating such ratios from further analyses. However, no ratio seems weak enough in this aspect to exclude it from cross-size performance examination. All of the diagnostic variables do vary significantly across size groups either for the majority of countries or industries. Therefore all of the ratios contribute to the construction of the taxonomic performance measure.

As mentioned in the methodology section, the ANOVA procedure was also performed with the use of time factor as the grouping variable. For the majority of ratios there is no reason to reject the hypothesis about equal means of variables across years. In fact the only ratios with significant time variability for the population as a total are: R4, R5, R10-R12, R15, R22, R24, R26 and R28. However, even in these cases their discriminatory power is much poorer in this cross-section than across size groups. The results of the analysis of variance across time are important from the methodological point of view of the further analyses, since significant time variability would indicate that the ranking procedure should be performed separately for each year. However, due to the fact that most of the input variables are quite stable in time within the analysed period, the taxonomic measure was computed with the use of time means of ratios. Similarly, the standard object used for constructing the taxonomic measure was also common for all years.

The ranking procedure of size groups is based on the taxonomic performance measure. The results for all countries as a total, as well as for each country individually are shown in Table 6.

Table 6. Cross-country ranking results for size groups based on taxonomic performance measure (average for all years and industries)

Rank	AT	BE	DE	ES	FR	IT	NL	PL	PT	All countries
1	L	M	M	M	L	M	L	S	L	M
2	M	L	S	L	M	L	S	M	M	L
3	S	S	L	S	S	S	M	L	S	S

Source: author's calculations based on BACH-ESD database.

The general pattern revealed by the ranking of size groups shows that the most typical situation is when small enterprises are characterised with the weakest performance, whereas medium and large firms take the first or second place in the list interchangeably. However, this regularity is not homogeneous throughout all countries analysed. Two countries, namely Germany and Poland, clearly stand out from the rest of the population as these are the only two cases where large firms take the lowest positions in the performance ranking.

It is also informative to see whether the same kind of size-performance regularity is observed across industries. Table 7 shows the ranking results of size groups in the industrial cross-section.

Table 7. Cross-industry ranking results for size groups based on taxonomic performance measure (average for all years and countries)

Rank	AGR	MIN	MNF	ELE	WAT	CST	TRD	TRS	HOT	INF	RLE	PRF	ADM	All industries
1	L	L	M	M	S	M	M	M	L	M	L	M	S	M
2	M	M	L	L	M	S	L	S	M	S	M	S	M	L
3	S	S	S	S	L	L	S	L	S	L	S	L	L	S

Source: author's calculations based on BACH-ESD database.

Similarly to the ranking results across countries, in most industries these are the small firms which are characterised with the weakest performance. Medium enterprises are usually ranked first. This pattern, however, is not followed unanimously by all industries. Several industrial sections, such as water supply, construction, transport and storage, information and communication, professional activities or administration demonstrate inverse ranking results with large firms' worst performance. There are only two industries with small firms ranked in the first positions; these are water supply and administrative activities.

In order to detect the influence of industrial characteristics, the ranking of binominal objects, namely size groups in industries, should be analysed. They are shown in Table 8. A quick glance at the table does not reveal any conspicuous patterns in terms of the size-performance regularities. The number of items in the ranking may obviously obscure the image. Therefore, to make the analysis more clear and communicative, the population may be divided into three even classes according to corporate performance.

Table 8. Cross-country ranking results for size groups in industries based on taxonomic performance measure (average for all years)

Rank	Performance class	AT	BE	DE	ES	FR	IT	NL	PL	PT	All countries
1		PRF_S			MIN_M	MIN_L	RLE_M		MIN_S	AGR_L	MIN_L
2		MIN_L	MIN_M	PRF_M	PRF_S	MIN_S	RLE_L	ELE_M	PRF_M	MIN_L	PRF_M
3		PRF_M	ELE_S	PRF_S	MIN_S	MIN_M	MIN_L	INF_L	INF_M	MIN_M	PRF_S
4		PRF_L	INF_M	INF_M	WAT_S	INF_L	INF_M	AGR_S	MIN_M	MNF_L	MIN_S
5		INF_S	MNF_M	INF_S	RLE_S	CST_S	PRF_M	WAT_L	CST_S	PRF_M	MIN_M
6		MNF_L	ELE_M	MNF_M	INF_L	AGR_M	MIN_M	AGR_L	INF_S	INF_M	INF_M
7	I	MNF_M	MIN_S	MIN_M	INF_S	WAT_S	INF_L	WAT_M	CST_M	PRF_S	INF_L
8		HOT_L	CST_M	MNF_S	MNF_M	MNF_S	ADM_M	PRF_S	PRF_S	INF_L	MNF_M
9		CST_S	PRF_M	ADM_M	RLE_M	AGR_L	WAT_L	MNF_S	AGR_M	MNF_M	CST_M
10		MNF_S	CST_S	ELE_M	WAT_M	MNF_M	MIN_S	MNF_L	MIN_L	CST_L	CST_S
11		TRD_M	INF_L	MIN_S	ADM_S	INF_M	ELE_L	TRD_S	AGR_S	WAT_L	PRF_L
12		INF_L	PRF_L	PRF_L	PRF_M	CST_M	MNF_M	MIN_M	MNF_L	TRD_L	MNF_L
13		TRD_S	ADM_M	ADM_S	MNF_S	TRD_S	MNF_L	MIN_S	MNF_S	MIN_S	INF_S
14		TRS_M	WAT_M	ELE_L	MIN_L	MNF_L	WAT_M	ELE_S	TRD_S	TRD_M	MNF_S
15		ADM_S	WAT_S	CST_M	MNF_L	ADM_M	ELE_M	CST_L	MNF_M	RLE_L	HOT_L
16		TRD_L	ELE_L	HOT_S	TRD_M	AGR_S	WAT_S	HOT_S	INF_L	HOT_L	ADM_S
17		CST_M	ADM_S	CST_S	INF_M	WAT_M	ADM_L	WAT_S	ADM_S	AGR_M	ELE_M
18		MIN_S	MNF_L	TRD_M	CST_S	PRF_M	PRF_S	CST_S	TRD_M	MNF_S	AGR_L
19		AGR_S	MNF_S	TRD_S	CST_M	TRD_L	ADM_S	MNF_M	PRF_L	TRD_S	WAT_S
20	II	ADM_M	CST_L	ELE_S	TRS_S	TRD_M	ELE_S	PRF_L	ELE_L	RLE_S	TRD_M
21		CST_L	TRD_S	INF_L	TRD_L	CST_L	PRF_L	ADM_S	TRS_M	ELE_S	AGR_M
22		WAT_S	TRD_M	MNF_L	AGR_L	ELE_L	TRD_L	HOT_M	CST_L	RLE_M	TRD_S
23		ELE_M	PRF_S	MIN_L	ELE_S	ADM_S	HOT_L	PRF_M	TRS_S	ELE_L	ELE_L
24		MIN_M	ADM_L	TRD_L	TRD_S	PRF_S	MNF_S	TRS_L	ELE_M	CST_M	CST_L
25		INF_M	INF_S	TRS_S	ELE_M	WAT_L	CST_L	TRD_L	ELE_S	ADM_L	TRD_L
26		AGR_M	HOT_L	WAT_M	TRS_M	INF_S	TRS_M	ELE_L	WAT_M	WAT_M	WAT_M
27		WAT_L	AGR_M	WAT_S	ELE_L	RLE_S	CST_M	AGR_M	HOT_L	ELE_M	WAT_L
28		ELE_L	WAT_L	HOT_L	AGR_M	TRS_M	INF_S	ADM_L	TRD_L	HOT_M	ADM_M
29		AGR_L	TRS_M	TRS_M	CST_L	TRS_S	TRD_M	TRS_S	ADM_M	WAT_S	RLE_L
30		WAT_M	RLE_S	TRS_L	ADM_M	ADM_L	AGR_M	INF_S	RLE_L	PRF_L	ELE_S
31		ADM_L	TRD_L	ADM_L	AGR_S	PRF_L	TRS_S	HOT_L	WAT_L	ADM_S	AGR_S
32		RLE_L	TRS_S	HOT_M	WAT_L	HOT_L	AGR_L	CST_M	WAT_S	AGR_S	TRS_M
33	III	TRS_S	HOT_M	WAT_L	TRS_L	TRS_L	RLE_S	TRD_M	TRS_L	CST_S	ADM_L
34		ELE_S	MIN_L	CST_L	HOT_L	ELE_M	TRD_S	TRS_M	RLE_M	TRS_S	TRS_S
35		TRS_L	AGR_S	RLE_L	ADM_L	RLE_M	TRS_L	INF_M	RLE_S	HOT_S	RLE_S
36		RLE_M	TRS_L	RLE_S	HOT_M	RLE_L	CST_S	ADM_M	AGR_L	INF_S	RLE_M
37		HOT_M	RLE_M	RLE_M	HOT_S	HOT_S	AGR_S	MIN_L	HOT_S	ADM_M	HOT_M
38		RLE_S	HOT_S		PRF_L	HOT_M	HOT_M		HOT_M	TRS_M	TRS_L
39		HOT_S			RLE_L	ELE_S	HOT_S		ADM_L	TRS_L	HOT_S

Source: author's calculations based on BACH-ESD database.

The first class (the best one) comprises items ranked with positions from 1 to 13, the second – from 14 to 26, whereas the third class (the worst performing) the last 13 positions – from 27 to 39. In the case of three countries with missing data for some sections, the remaining items were placed in the middle of the ranking by skipping first and last positions.

The classified binominal items (size groups in industries) are fairly evenly distributed between classes in terms of size. In general, the first class is slightly dominated by medium firms, the second class by small firms and the third one by large firms. However, the differences in the number of objects of each size group do not show any obvious pattern. It is purposeful therefore to search for these patterns when looking at individual countries. The only two countries where the best class is dominated by large firms are Italy and Portugal. At the same time these are also the countries where the worst performing class is dominated by small enterprises. The opposite pattern, i.e. the one where the best class is dominated by small-sized firms whereas the worst class – by large ones seems to be followed by more countries, i.e. by Austria, Germany, Spain and Poland.

Similarly to the classification of size groups in industries, the population may be considered as a set of size groups in countries, which can be classified according to their performance in order to reveal potential patterns in terms of country-specific influences. The ranking results of size groups in countries are presented in Tables 9 and 10.

Table 9. Cross-industry ranking results for size groups in countries based on taxonomic performance measure (average for all years, NACE sections A-G)

Rank	Performance class	AGR	MIN	MNF	ELE	WAT	CST	TRD
1				NL_M	NL_S	NL_S	PL_M	PL_M
2				PL_S	NL_L	NL_M	PL_S	NL_M
3				PL_M	BE_M	PL_M	NL_M	PL_S
4				PL_L	PL_L	PL_L	NL_S	NL_S
5	I	PL_S	FR_L	NL_S	PL_M	FR_S	FR_S	NL_L
6		FR_M	NL_M	AT_L	NL_M	ES_S	NL_L	PL_L
7		PT_L	NL_S	DE_M	ES_S	PL_S	FR_M	FR_S
8		NL_M	FR_M	NL_L	DE_M	PT_L	FR_L	FR_M
9		FR_L	PT_L	AT_M	IT_L	BE_S	BE_M	ES_M
10		FR_S	FR_S	FR_M	BE_S		NL_L	DE_M
11		NL_S	AT_L	FR_S	PL_S		PL_S	AT_M
12		BE_M	DE_M	ES_M	ES_M	NL_L	PL_M	BE_M
13		ES_L	IT_L	BE_M	DE_S	PL_M	PL_L	FR_L
14	II	PT_M	BE_S	PT_L	IT_S	FR_M	PT_L	PT_M
15		IT_M	ES_M	DE_S	IT_M	IT_L	BE_L	DE_S
16		IT_L	PT_M	FR_L	ES_L	IT_M	ES_S	AT_L
17		BE_S	BE_M	PT_M	FR_L	ES_M	ES_L	BE_S
18		PL_L	ES_S	BE_S	PT_S	NL_L	IT_L	ES_L
19		ES_S	DE_L	DE_L	FR_M	IT_S	IT_M	DE_L
20		AT_S	DE_S	IT_L	DE_L	DE_L	AT_L	PT_L
21		ES_M	IT_S	ES_L	BE_L	AT_S	ES_M	IT_L
22		AT_M	IT_M	ES_S	PT_L	ES_L	AT_S	ES_S
23	III	IT_S	ES_L	IT_M	PT_M	FR_L	DE_L	AT_S
24		PT_S	PT_S	AT_S	AT_L	PT_M	AT_M	IT_M
25		AT_L	BE_L	BE_L	AT_M	AT_L	PT_M	PT_S
26			AT_S	IT_S	FR_S	PT_S	IT_S	BE_L
27			AT_M	PT_S	AT_S	AT_M	PT_S	IT_S

Source: author's calculations based on BACH-ESD database.

The most general regularity emerging from the tables is that lower positions, with weaker performance, are more often occupied by large firms. In order to further simplify the interpretation of the ranking results, again the population was divided into three categories: the best performing

class (ranks 1-9), the middle class (ranks 10-18) and the weakest performing class (ranks 19-27). Small firms are fairly evenly represented in each class of performance. There is about the same number of medium-sized firms in the first two classes, but they are underrepresented in the third class, which is clearly dominated by large firms. This general regularity, however, does not apply equally to all industries, although in fact is noticeable in most of the industrial sections analysed. The inverse pattern, with large firms dominating the first class and the small firms taking the lowest positions most often, is observed in the case of agriculture, mining and accommodation industry.

Table 10. Cross-industry ranking results for size groups in countries based on taxonomic performance measure (average for all years, NACE sections H-N and all)

Rank	Performance class	TRS	HOT	INF	RLE	PRF	ADM	All industries
1		NL_S	NL_L	PL_S		NL_L	NL_S	NL_L
2		PL_S	NL_M	PL_M		NL_S	PL_S	PL_M
3		NL_M	NL_S	NL_M	PL_L	NL_M	NL_M	NL_M
4		PL_M	AT_L	NL_S	IT_M	PL_M	DE_M	PL_S
5	I	NL_L	PL_L	DE_M	ES_S	PL_S	NL_L	NL_S
6		PL_L	PT_L	FR_M	ES_M	DE_M	DE_S	PL_L
7		AT_M	DE_S	DE_S	IT_L	DE_S	PL_M	BE_M
8		ES_S	DE_L	FR_L	PL_M	AT_M	ES_S	FR_L
9		BE_S	PL_S	ES_S	FR_S	AT_S	FR_M	DE_M
10		BE_M	FR_S	PL_L	IT_S	PT_S	AT_S	ES_M
11		DE_S	IT_L	PT_M	PL_S	BE_M	IT_M	FR_M
12		DE_M	PT_M	FR_S	PT_L	PL_L	FR_S	PT_L
13		FR_S	ES_S	PT_L	FR_M	AT_L	BE_S	ES_S
14	II	ES_M	DE_M	BE_M	BE_S	BE_S	BE_M	FR_S
15		FR_L	PL_M	IT_M	FR_L	ES_S	IT_S	BE_S
16		FR_M	FR_L	AT_L	PT_M	DE_L	AT_M	ES_L
17		IT_M	BE_L	AT_S	PT_S	IT_M	BE_L	AT_L
18		DE_L	ES_M	ES_M	AT_M	PT_M	FR_L	DE_S
19		BE_L	FR_M	NL_L	AT_L	BE_L	PT_L	DE_L
20		IT_S	IT_M	AT_M	AT_S	ES_M	ES_M	BE_L
21		IT_L	BE_M	ES_L	DE_S	IT_S	IT_L	PT_M
22		ES_L	ES_L	IT_L	BE_M	FR_L	DE_L	IT_L
23	III	AT_L	IT_S	DE_L	DE_M	FR_M	ES_L	AT_M
24		AT_S	BE_S	BE_S	DE_L	FR_S	AT_L	IT_M
25		PT_S	AT_M	IT_S	ES_L	IT_L	PT_S	PT_S
26		PT_M	PT_S	BE_L		ES_L	PL_L	IT_S
27		PT_L	AT_S	PT_S		PT_L	PT_M	AT_S

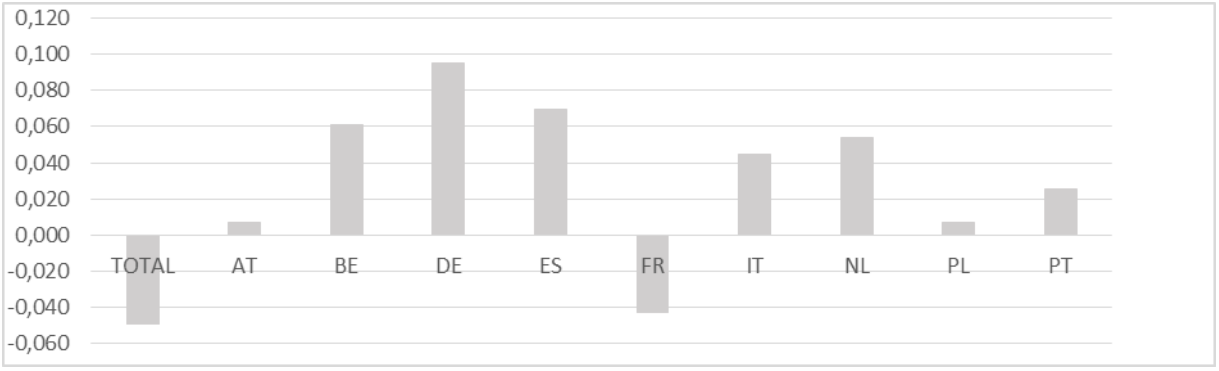
Source: author's calculations based on BACH-ESD database.

As mentioned in the Methodology section, it is purposeful to evaluate the similarity of the grouping results, i.e. to compare the classification of size groups in industries with the pure size classification and the classification of size groups in countries with the size-based classification. In a purely theoretical situation the performance-based classification would ideally correspond to the size-based classification. In such case the first performance class would consist of only small (or only large) firms, the second class – of only medium-sized firms and the third class – of only large (or only small) firms, regardless of their industry or country. Obviously it is not the case here. Moreover, due to the number of items classified, it is difficult to evaluate this similarity visually. Therefore implementing an objective similarity measure is helpful. The adjusted Rand's measure was calculated first for the size groups in industries in all countries as a total and for each country separately. The results are shown in Figure 1.

The negative value of the measure for the total population indicates the dissimilarity of the groupings of the size groups in industries based on financial performance in comparison with the pure size classification of these objects. When looking at the grouping results for individual

countries separately, it appears, however, that there is some weak resemblance in several cases. The highest similarity is observed in the case of Germany, for which the financial ratios based categorisation of size groups in industries indicates rather negative size-performance relation. The third class is dominated by large firms, whereas small and medium-sized firms are most numerously represented in the first two performance classes.

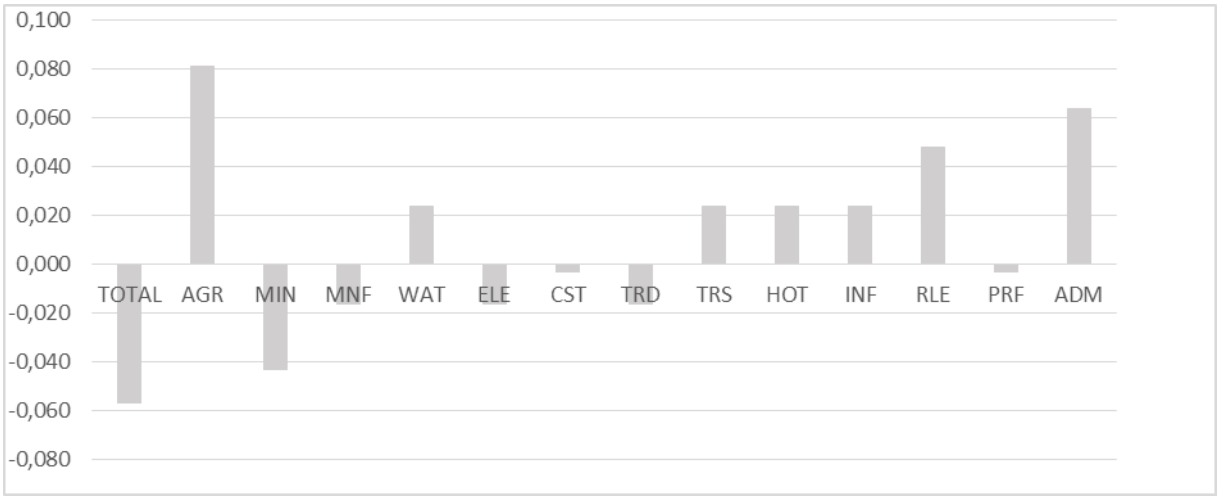
Figure 1. The adjusted Rand's measure values illustrating the similarity between the size-based classification and performance-based classification of size groups in industries.



Source: author's calculations based on BACH-ESD database.

The results of the similarity measure calculations for the size groups in countries for all industries as a total and for each industry separately are shown in Figure 2.

Figure 2. The adjusted Rand's measure values illustrating the similarity between the size-based classification and performance-based classification of size groups in countries.



Source: author's calculations based on BACH-ESD database.

The figure shows that in general the resemblance between the classification of size groups in countries based on corporate performance and the classification of these binominal objects

according to size have little in common. It proves that, although size does influence performance (as evidenced e.g. by the analysis of variance), it certainly cannot be treated as a proxy of financial performance, not even for one industry. The agriculture is the industrial section demonstrating the highest convergence between the two broad classification systems. Nevertheless, even in this case the similarity level still has to be evaluated as weak. The performance-based classification of size groups in countries for the agricultural section corresponds most to the positive size-performance relationship, where the first class is dominated by large firms, whereas small firms prevail in the last class.

When comparing the Rand's measure values for size groups in industries with the one for size groups in countries, it appears that in the first case they are on average three times bigger, though still low. This suggests that the industry effect reflected in the size-performance relationship is relatively more important than the country effect. In other words, within the analysed population, the industrial features affect the relation between firm size and performance a little more than the country-specific features.

The estimation results of the model described by equation (1) are shown in Table 11.

Table 11. OLS panel regression estimation results (robust HAC)

		(1)			(2)			(3)		
Dependent variable		lnTA								
	Method	OLS FE			OLS FE			OLS FE		
	Interactions:	country			industry			both		
Variables										
Constant		15,13	***	(0,092)	14,80	***	(0,091)	14,82	***	(0,091)
ROE	L1	0,003		(0,252)	-0,150	**	(0,262)	-0,723		(0,507)
	L2	-0,053		(0,262)	-0,303		(0,309)	-0,903		(0,577)
	L3	-1,847	***	(0,640)	-1,714	***	(0,511)	-4,688	***	(1,385)
ROE*BE	L1	0,234		(0,975)				(0,013		(0,880)
	L2	0,193		(0,964)				-0,127		(0,867)
	L3	2,173	**	(1,084)				2,584	*	(1,474)
ROE*DE	L1	2,859	***	(0,846)				1,867	**	(0,891)
	L2	1,980	***	(0,688)				0,659		(0,796)
	L3	2,120	**	(0,876)				4,101	***	(1,382)
ROE*ES	L1	-0,239		(0,975)				-0,171		(1,000)
	L2	3,299	**	(1,309)				2,270	***	(0,832)
	L3	4,634	***	(1,617)				4,840	***	(1,409)
ROE*FR	L1	2,693	**	(1,054)				3,383	***	(1,151)
	L2	1,880	**	(0,782)				1,306		(0,901)
	L3	4,493	***	(1,125)				5,339	***	(1,279)
ROE*IT	L1	1,932	**	(0,946)				1,788	*	(1,025)
	L2	1,555	**	(0,614)				2,636	***	(0,819)
	L3	3,726	***	(1,122)				6,542	***	(1,362)
ROE*NL	L1	0,199		(0,254)				0,817		(0,964)
	L2	-1,037		(0,633)				-2,824	**	(1,231)
	L3	1,617	*	(0,860)				2,554	*	(1,422)
ROE*PL	L1	1,780	**	(0,842)				1,267		(0,872)
	L2	0,246		(1,106)				-0,756		(1,043)
	L3	-0,343		(0,838)				2,087		(1,332)
ROE*PT	L1	0,592		(0,571)				0,293		(0,880)
	L2	0,254		(0,974)				-0,091		(0,689)
	L3	1,913	***	(0,655)				1,139		(0,930)
ROE*MIN	L1				0,353		(0,272)	0,312		(0,882)
	L2				-0,809		(0,740)	-1,341		(0,904)
	L3				0,720		(0,845)	-1,068		(0,981)
ROE*MNF	L1				8,052	***	(1,587)	7,835	***	(1,641)
	L2				7,943	***	(1,354)	8,814	***	(1,697)

		(1)		(2)		(3)	
	L3	12,984	***	(1,630)	12,90	***	(1,704)
ROE*ELE	L1	2,012		(1,861)	0,325		(1,634)
	L2	0,601		(1,028)	2,052	*	(1,136)
	L3	2,317	*	(1,207)	2,109		(1,333)
ROE*WAT	L1	-1,281		(1,636)	-2,376		(1,487)
	L2	0,602		(1,018)	0,582		(0,861)
	L3	0,826		(0,912)	0,858		(1,136)
ROE*TRD	L1	-0,259		(1,046)	-0,284		(0,958)
	L2	3,260	**	(1,560)	3,072	***	(0,791)
	L3	7,786	***	(1,052)	7,763	***	(1,007)
ROE*TRS	L1	6,238	**	(2,449)	5,765	***	(2,230)
	L2	5,917	***	(1,224)	5,852	***	(1,117)
	L3	12,54	***	(2,108)	13,42	***	(1,897)
ROE*INF	L1	4,936	***	(1,210)	4,494	***	(1,115)
	L2	4,386	***	(0,916)	4,409	***	(0,864)
	L3	7,158	***	(1,628)	7,036	***	(1,582)
ROE*RLE	L1	1,894	***	(0,646)	1,868	***	(0,706)
	L2	1,802	***	(0,522)	1,978	***	(0,626)
	L3	2,602	***	(0,628)	3,945	***	(1,026)
ROE*ADM	L1	3,653	**	(1,676)	3,268	**	(1,580)
	L2	-0,209		(1,261)	-0,617		(1,322)
	L3	-1,296		(1,143)	-2,033		(1,357)
Observations		4050		4050		4050	
R-squared		0,092		0,363		0,452	
Joint test for country interactions		38,752 [0,000]		-		41,515 [0,000]	
Joint test for industry interactions		-		100,46 [0,000]		97,751 [0,000]	
AIC		16071,1		14605,6		14043,2	

Notes: 1) Robust standard errors in parentheses
2) *** p<0.01, ** p<0.05, * p<0.1
3) Interpretation of parameters in relation to agriculture section and Austria.

The estimation results indicate that the impact of profitability on firm size is mainly negative, though statistical significance appears only for the ratio lagged by three years. This contradicts the results obtained for US public firms by Lee (2009), who provides evidence that profit rates are positively correlated with firm size, though in a non-linear manner. In addition, the author found industry-specific fixed effects negligible.

As evidenced by the joint tests for interactions, both country and industry interactions proved significant at p<5%. However, according to the AIC criterion, the model which best describes the variability of firm size, represented by the logarithm of assets, is the one with both types of interactions, i.e. country- and industry-interactions. Moreover, the model with only industry interactions taken into account explains size variability considerably better than the model where only country interactions were included. Therefore, in a way, it remains consistent with the conclusions drawn from the comparison of the adjusted Rand's measure value, which indicated greater importance of industrial features for the relation between general corporate performance and firm size.

Conclusions and discussion

Despite the fact that the profusion of previous research aiming to establish the size-performance relation indicates the importance of the size factor, this study attempted to find more detailed country-dependent and industry-dependent regularities in this relationship. The findings suggest that although small firms are typically characterised with weaker performance than their medium

and (or) large counterparts, this pattern is not homogeneous neither across countries nor across industries. The inverse size-performance relationship was observed in the case of Germany and Poland, as well as in several industries, especially water supply and administration.

Detailing the analysis into more specific categories, i.e. classifying binominal objects in the form of size groups in industries and size groups in countries further reveals that the patterns in the area of the size-performance relation are less obvious than they seem to be. In other words, taking into account the country and industry effect, makes the considered relationship even less pronounced. Moreover, when including the industry or country specificity in the size-performance analysis, it appears, that there are examples of both positive and negative direction of this relationship. The positive relationship, i.e. the one where the bigger the firm size, the better performance, was found in the case of Italy and Portugal (when size groups in industries were classified), whereas the negative one in Austria, Germany, Spain and Poland. As for the industrial sections, where the size groups in countries were ranked, the positive size-performance relation was observed only in the case of agriculture, mining and accommodation industry, whereas in most of the other industries the inverse pattern emerged.

The implementation of the adjusted Rand's measure for objective and formal comparison of the classification results based on the aggregated performance measure with the size-based classification results indicate dissimilarity or at best weak similarity between these two categorisation systems. The weak resemblance between the size-based and performance-based grouping results applies both to the classification of size groups in industries and size groups in countries. The poor convergence between the grouping results indicates that, even though the firm size is a significant determinant of corporate performance – as evidenced by the ANOVA results for most ratios – it definitely cannot be identified as a proxy for this performance, the more so for individual industries and countries.

Panel regression results indicate that the way profitability-size relation is significantly affected both by the country, where a firm operates, as well as by its industrial classification. However, again, the industrial features appear to matter more than the country specificity in terms of their influence on the profitability-size relation.

The analysis shows that the variability of the size-performance relationship is both country-wise and industry-wise. However, the impact of the industry-specific features on the relation between firm size and corporate performance is slightly stronger than the influence of the national characteristics. The greater relative importance of the industry effect in comparison to country effect should not be surprising given that the analysis refers to the fairly homogeneous area in terms of economic integration, as it covers mainly old EU member states, most of which belong to the common currency area. Therefore, it would be risky to expect similar proportion in the contribution of the country and industry factors to the size-performance relationship if the analysis was extended to a broader range of countries, even those belonging to the EU. It even seems likely that the larger the number of countries included in the analysis, the higher their diversity which may result in an increase of the relative importance of regional factors.

It is also worth reminding here, that this study refers to private companies solely. Therefore, the above conclusions stem from the research based on the book values. Extrapolating the inference onto public companies again is not recommendable especially due to the fact that the performance of listed firms is usually characterised with market values instead of financial ratios

based on book values. It seems reasonable to expect that performing the analyses on public companies would lead to the conclusion about a more significant difference between the role of country and industry factors, in favour of the latter. This shift could be attributed to the usually higher degree of internationalization of listed companies, which may weaken the impact of domestic factors.

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Reference

AMATO, L. and WILDER, R. P. (1985). The effects of firm size on profit rates in US manufacturing. *Southern Economic Journal*. Vol. 52, No. 1, 181-190. http://dx.doi.org/10.2307/1058913

BACH-ESD database available at: http://www.bach.banque-france.fr (20.01.2012)

BALLANTINE, J. W.; CLEVELAND, F. W. and KOELLER, C. T. (1993). Profitability, uncertainty, and firm size. *Small Business Economics*. Vol. 5, No. 2, 87-100. http://dx.doi.org/10.1007/BF01531908

BALLANTINE, J. W.; CLEVELAND, F. W., and KOELLER, C. T. (1988). Corporate Profitability and Competitive Circumstance. *Eastern Economic Journal*. Vol. 14, No. 1, 7-18.

BAUMOL, W. J. (1959). *Business Behavior, Value, and Growth*. New York: MacMillan.

BOILLAT, P., DE SKOWRONSKY, N., and TUCHSCHMID, N. (2002). Cluster analysis: application to sector indices and empirical validation. *Financial Markets and Portfolio Management*. Vol. 16, No. 4, 467-486. http://dx.doi.org/10.1007/s11408-002-0403-4

BORYS, T. (1978). Metody normowania cech w statystycznych badaniach porównawczych (Standardization methods in the statistical comparative studies). *Przegląd Statystyczny* (*Statistical Review*). Vol. 3, No. 2, 371-382.

CAVES, T. A., and PUGEL, R. E. (1980). *Intra-industry differences in conduct and performance: viable strategies in U.S. manufacturing industries*. New York University, Graduate School of Business Administration, Salomon Brothers Center for the Study of Financial Institutions.

CINCA, C. S., MOLINERO, C. M., and LARRAZ, J. L. (2005). Country and size effects in financial ratios: A European perspective. *Global Finance Journal*. Vol. 16, No. 1, 26-47. http://dx.doi.org/10.1016/j.gfj.2005.05.003

CRUM, W. L. (1939). *Corporate Size and Earning Power*. Cambridge: Harvard University Press. http://dx.doi.org/10.4159/harvard.9780674491731

DHAWAN, R. (2001). Firm size and productivity differential: theory and evidence from a panel of US firms. *Journal of Economic Behavior and Organization*. Vol. 44, No. 3, 269-293. http://dx.doi.org/10.1016/S0167-2681(00)00139-6

FISHER, R. A. (1954). *Statistical methods for research workers*. Edinburgh: Oliver and Boyd.

GRABIŃSKI, T. (1992). *Metody taksonometrii* (*Methods of taxonomy*). Kraków: Wydawnictwo AE.

GUPTA, M. C., and HUEFNER, R. J. (1972). A Cluster Analysis Study of Financial Ratios and Industry Characteristics. *Journal of Accounting Research*. Vol. 10, No. 1, 77-95. http://dx.doi.org/10.2307/2490219

HALL, M., and WEISS, L. (1967). Firm Size and Profitability. *The Review of Economics and Statistics*. Vol. 49, No. 3, 319-331. http://dx.doi.org/10.2307/1926642

HELG, R., MANASSE, P., MONACELLI, T., and ROVELLI, R. (1995). How much (a)symmetry in Europe? Evidence from industrial sectors. *European Economic Review*. Vol. 39, No. 5, 1017-1041. http://dx.doi.org/10.1016/0014-2921(95)00006-Y

HELLWIG, Z. (1968). Zastosowanie metody taksonomicznej do typologicznego podziału krajów ze względu na poziom ich rozwoju i strukturę wykwalifikowanych kadr (Application of the taxonomic method for typological classification of countries due to their level of development and the structure of qualified Staff). *Przegląd Statystyczny* (*Statistical Review*). No. 4, 307-324.

HERENDEEN, J. B. (1975). *The Economics of the Corporate Economy*. New York/London: Dunellen Publishing Company.

HYMER, S., and PASHIGIAN, P. (1962). Firm Size and Rate of Growth. *Journal of Political Economy*. Vol. 70, No. 6, 556-569. http://dx.doi.org/10.1086/258716

JENSEN, M.,C., and MECKLING W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*. Vol. 3, No. 4, 305-360. http://dx.doi.org/10.2139/ssrn.382402

KAEN, F. R., and BAUMANN, H. D. (2003). Firm Size, Employees and Profitability in U.S. Manufacturing Industries, http://dx.doi.org/10.2139/ssrn.382402

KORALUN-BEREŹNICKA, J. (2013). *Corporate Performance: A Ratio-Based Approach to Country and Industry Analyses*. Springer. http://dx.doi.org/10.1007/978-3-319-00345-0

LEAL, R. P., and POWERS, T. L. (1997). A taxonomy of countries based on inventive activity. *International Marketing Review*. Vol. 14, No. 6, 445-460. http://dx.doi.org/10.1108/02651339710192984

LEE, J. (2009). Does Size Matter in Firm Performance? Evidence from US Public Firms. *International Journal of the Economics of Business*. Vol. 16, No. 2, 189-203. http://dx.doi.org/10.1080/13571510902917400

MARCUS, M. (1969). Profitability and Size of firm: Some Further Evidence. *Review of Economics and Statistics*. Vol. 51, No. 1, 104-107. http://dx.doi.org/10.2307/1926958

MILLIGAN, G. W., and COOPER, M. C. (1988). A Study of Standardization of Variables in Cluster Analysis. *Journal of Classification*. Vol. 5, No. 2, 181-204. http://dx.doi.org/10.1007/BF01897163

NIRESH, J.A. and VELNAMPY, T. (2014). Firm Size and Profitability: A Study of Listed Manufacturing Firms in Sri Lanka. *International Journal of Business and Management*. Vol. 9, No. 4, 57-64. http://dx.doi.org/10.5539/ijbm.v9n4p57

NOWAK, E. (1990). *Metody taksonomiczne w klasyfikacji obiektów społeczno-gospodarczych* (*Taxonomic methods in the classification of socio-economic objects*). Warszawa: PWE.

OSBORN, R. C. (1970). Concentration and profitability of small manufacturing corporations, *Quarterly Review of Economics and Business*. Vol. 10, No. 2, 15-26.

RAJAN, R. G., ZINGALES, L. and KUMAR, K. B. (2001). What Determines Firm Size?. CRSP Working Paper No. 496, and USC Finance & Business Econ. Working Paper No. 01-1. http://dx.doi.org/10.2139/ssrn.170349

RAND, W. M. (1971). Objective criteria for the evaluation of clustering methods. *Journal of the American Statistical Association*. Vol. 66, No. 336, 846-850. http://dx.doi.org/10.1080/01621459.1971.10482356

SCHMALENSEE, R. (1989). Intra-Industry profitability differences in US manufacturing: 1953-1983. *Journal of Industrial Economics*, Vol. 37, No. 4, 337-357. http://dx.doi.org/10.2307/2098372

SCHMALESSEE, R. (1987). Collusion versus differential efficiency: Testing alternative Hypothesis. *Journal of Industrial Economics*. Vol. 35, No. 4, 399-425. http://dx.doi.org/10.2307/2098580

SELL, C. W. (2005). The Importance of Country versus Sector Characteristics. *Managerial Finance*. Vol. 31, No. 1, 78-95. http://dx.doi.org/10.1108/03074350510769460

STEKLER, H. O. (1963). *Profitability and Size of Firm*. Berkeley: Institute of Business and Economic Research, University of California

STEKLER, H. O. (1964). The Variablilty of Profitability with Size of Firms, 1947-1958. *Journal of the American Statistical Association*. Vol. 59, No. 308, 1183-1193.

WILLIAMSON, O. (1985). *The Economic Institutions of Capitalism*, New York: The Free Press.

