Industry and Size Effects in Corporate Performance: An Empirical Research on Selected EU Countries

Julia Koralun-Bereźnicka

Abstract
The aim of the paper is to analyse the influence of industry specific factors and firm size on corporate performance in the EU countries. Most of the hitherto analyses have focused on corporate performance reflected mainly in stock returns. This paper is one of the few attempts to consider fundamental ratios, which might also be useful indicators for investment decisions based on corporate performance. The analysis is meant to find whether the corporate performance reflected in financial ratios is affected by industry or size effect more, and therefore to compare the relative importance of the two effects. The financial ratios are obtained from harmonised aggregated financial statements published by the European Commission in the BACH database. The ratios characterize three major analytical areas of enterprises, i.e. their profitability, liquidity and solvency. The data analysed relates to three size groups, thirteen industries, ten countries and nine years: 1999-2007. The applied methodology includes analysis of variance and classification method of k-means grouping. Findings provide empirical evidence that in most cases the industry effect tends to dominate over the size effect.

Key words: industry effect, size effect, corporate performance, financial ratios
JEL: G30, G32

1. Introduction
How to search for the factors determining corporate performance is a question asked by many researchers in the area of finance. The factors could be both external, including e.g. macroeconomic, industrial, political or social conditions affecting an enterprise, as well as internal, i.e. controlled by an entity, such as its size or managerial competence. This study focuses on both external and internal aspects of corporate performance, specifically on the industry in which a company operates and its size. Both factors are believed to have a significant impact on corporate activity and therefore economic results, which are reflected in financial ratios.

The following research is involved in an important stream of contemporary economy and finance, which can be defined as the analysis of reasons and consequences of the diversity of objects. The objects can be treated here either as industries or size groups. The industry effect can be defined as the occurrence of certain factors specific for a particular industrial sector and therefore affecting economic entities of that industry in a similar way. The size effect is interpreted likewise. The aim of this study is to determine the influence of the firm size and industry upon corporate performance reflected in financial ratios.

Most of the hitherto analyses focus on corporate performance reflected mainly in stock returns. There are few of those considering fundamental ratios, however, which can be an equally important criterion for investment decisions, especially long-term ones. Therefore updating and broadening the study of industry and size effect within the European Union area seems a useful addition of knowledge to this area.

Analysis of this sort is particularly important in terms of risk diversification. On the one hand, the issue of corporate performance diversity depending on industry, i.e. the industry effect, plays an important

1 Faculty of Management, University of Gdansk
role in cross-industry investment diversification. The size effect, on the other hand, is crucial from the point of view of size group diversification.

In the first, theoretical part of the paper the results of the previous studies concerning industry and size effects are being discussed. The following empirical research attempts to verify which of the two effects prevails when influencing the financial condition of enterprises in the selected EU countries. In order to measure the financial condition, a set of appropriately selected ratios was employed. The ratios are meant to enable a fairly complete corporate performance evaluation. They reflect two basic criteria of corporate assessment, i.e. effectiveness and risk. These criteria are at the same time the most obvious aspects considered when making investment decisions.

2. Review of Theory and Empirical Studies on Industry and Size Effects

The starting point for discussing the diversity of corporate performance depending on size and particularly on industry is the theory of industrial organization (or industrial economics). In a traditional industrial organization paradigm (Bain, 1968) industry structure determined the behaviour or conduct of firms, whose joint conduct then determined the collective performance of the firms in the marketplace (Porter, 1981). The analysis is therefore based on empirical research which aims at explaining the differences in corporate performance of industrial organizations. It is assumed that the differences result from industry structure which in turn directly affect corporate performance. One of the most important analytical concepts here is the idea of cross-section analyses, where enterprises belonging to different industries are compared. The main streams of the paradigm and its contribution to industrial economics are presented by Schmalensee and Williga (1989) and Jacquemin (1985).

Summing up the above theoretical introduction in the context of its relationship with the empirical research, it can be stated that consideration of size effect, and especially industry factors, as determinants of corporate performance, is an approach fully justified. In the theory and practice of industrial organisation corporate performance is the main theme of research, especially in terms of the reasons for its diversity.

Studying the intensity of factors which influence corporate financial parameters has long traditions, particularly in the US, but is also becoming increasingly popular in Europe. It has been empirically shown many times that small companies differ from large ones in a number of aspects (Hall, 1987). Similarly, corporate diversity has also been found in cross-industry analyses. The size effect for example was detected in financial markets (Rees, 1995; Cooke, 1992), corporate failure prediction (Ohlson, 1980; Peel et al., 1986), export orientation (Calof, 1994; Pierre-Andre, 1997), capital structure (Chung, 1993; Gupta, 1969), cost of capital (Archer and Faerber, 1966), entrepreneurial initiative (Ha-Brookshire, 2009), innovativeness (Wagner and Hansen, 2005), subsidiary strategy (Mänik, Hannula and Varblane, 2004), relationships with suppliers (Redondo and Fierro, 2007) or competitiveness (Mady, 2008). Similar observations also refer to industry and also country factors as determinants of corporate performance. Especially the interplay of these two effects has long traditions in empirical research on the relative importance of the industry and country effect (Lessard, 1974; Roll, 1992; Heston and Rouwenhorst, 1995; Baca, Garbe and Weiss, 2000; Cavaglia, Brightman and Aked, 2000). Despite many scientific disputes concerning the importance of the effects in question, it is still not clear which kind of factors plays a bigger role in determining corporate financial condition. Moreover, most of the studies tend to focus mainly on corporate performance reflected in stock returns. This paper is one of the fewer attempts to compare the intensity of industry and size factors in their impact on fundamental financial ratios, while ignoring the market value ratios due to the fact that the analysed population of enterprises is not restricted to the listed companies.

3. Data Characteristics

The analysis involves three groups of enterprises: small companies (with a turnover of less than 10 million euro), medium-size companies (with a turnover between 10 million euro and 50 million euro) and large companies (with a turnover in excess of 50 million euro) in ten EU countries (Belgium, Netherlands,
France, Spain, Italy, Austria, Germany, Portugal, Finland and Poland) and in thirteen industries according to the NACE classification (Nomenclature statistique des Activités économiques dans la Communauté Européenne). The analytical period covers nine years: 1999-2007.

The groups of enterprises according to their size, industry and country constitute the subject of the analysis and at the same time they are the items classified. The taxonomy of economic activity by NACE is two-leveled: one-letter level (sections) and two-digit level (divisions). This analysis involves enterprises grouped at the level of section, i.e. thirteen industries. Several industries were excluded from the analysis due to a very limited data availability. Table 1 shows the industrial range of the research as well as the three-letter symbols attributed to each industry which are applied in the following parts of the paper.

<table>
<thead>
<tr>
<th>NACE</th>
<th>Section</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Agriculture, hunting and forestry</td>
<td>AGR</td>
</tr>
<tr>
<td>B</td>
<td>Fishing</td>
<td>FSH</td>
</tr>
<tr>
<td>C</td>
<td>Mining and quarrying</td>
<td>MIN</td>
</tr>
<tr>
<td>D</td>
<td>Manufacturing</td>
<td>MNF</td>
</tr>
<tr>
<td>E</td>
<td>Electricity, gas and water supply</td>
<td>ELE</td>
</tr>
<tr>
<td>F</td>
<td>Construction</td>
<td>CST</td>
</tr>
<tr>
<td>G</td>
<td>Wholesale and retail trade</td>
<td>TRD</td>
</tr>
<tr>
<td>H</td>
<td>Hotels and restaurants</td>
<td>HOT</td>
</tr>
<tr>
<td>I</td>
<td>Transport, storage and communication</td>
<td>TRS</td>
</tr>
<tr>
<td>K</td>
<td>Real estate, renting and business activities</td>
<td>RLE</td>
</tr>
<tr>
<td>L</td>
<td>Public administration and defense</td>
<td>–</td>
</tr>
<tr>
<td>M</td>
<td>Education</td>
<td>EDU</td>
</tr>
<tr>
<td>N</td>
<td>Health and social work</td>
<td>HLT</td>
</tr>
<tr>
<td>O</td>
<td>Other community, social and personal service activities</td>
<td>COM</td>
</tr>
<tr>
<td>P</td>
<td>Activities of households</td>
<td>–</td>
</tr>
<tr>
<td>Q</td>
<td>Extra-territorial organisations and bodies</td>
<td>–</td>
</tr>
</tbody>
</table>

Source: author’s own compilation based on BACH database.

The object of the analysis is the corporate performance measured with the use of financial ratios describing three main analytical areas, i.e. profitability, liquidity and solvency. The ratios were computed for each of the aggregated group of enterprises in each industry, each country, each size group (represented by letters S, M and L) and each year in the period 1999-2007. In total, and taking into account the missing data, there were 82210 observations. The source of the data is the European Commission, which publishes the harmonised and aggregated financial reports in the BACH database (Bank for the Accounts of Companies Harmonised). The detailed list of the applied ratios is shown in Table 2. The range of employed ratios is slightly wider than in previous studies based on BACH database, although it involves most ratios previously analyzed (Cinca, Molinero and Larraz, p. 26–45.). Widening the range of financial ratios is meant to enable a more comprehensive analysis of companies. The variables are ratios of means and not means of ratios, as the data available is aggregated.
Table 2. Financial ratios employed in the analysis

<table>
<thead>
<tr>
<th>Profitability and turnover ratios</th>
<th>Liquidity ratios</th>
<th>Long-term solvency ratios</th>
</tr>
</thead>
<tbody>
<tr>
<td>P₁ Gross operating profit/Turnover</td>
<td>L₁ Current assets/Short-term creditors</td>
<td>S₁ Gross operating profit/Interest paid on financial debts</td>
</tr>
<tr>
<td>P₂ Net operating profit/Turnover</td>
<td>L₂ (Current assets - Stocks)/Short-term creditors</td>
<td>S₂ Long-term creditors/Assets</td>
</tr>
<tr>
<td>P₃ Net profit/Turnover</td>
<td>L₃ (Current investments + Cash)/Short-term creditors</td>
<td>S₃ Long-term creditors/Equity</td>
</tr>
<tr>
<td>P₄ Net profit/Equity</td>
<td>L₄ Costs of materials and consumables/Stocks</td>
<td>S₄ Equity/Assets</td>
</tr>
<tr>
<td>P₅ Net profit/Assets</td>
<td>L₅ Turnover/Accounts receivable</td>
<td>S₅ Long-term creditors/Net working capital</td>
</tr>
<tr>
<td>P₆ Net profit/Net working capital</td>
<td>L₆ Cash/Assets</td>
<td>S₆ Interest paid on financial debts/Turnover</td>
</tr>
<tr>
<td>P₇ Costs of materials and consumables/Turnover</td>
<td>L₇ Current assets/Assets</td>
<td>S₇ Interest paid on financial debts/Financial debt</td>
</tr>
<tr>
<td>P₈ Turnover/Assets</td>
<td>L₈ (Current assets - Stocks)/Assets</td>
<td>S₈ Provisions for liabilities and charges/Assets</td>
</tr>
<tr>
<td>P₉ Turnover/Fixed assets</td>
<td>L₉ Stocks/Net working capital</td>
<td></td>
</tr>
<tr>
<td>P₁₀ Value added/Turnover</td>
<td>L₁₀ Stocks/Current assets</td>
<td></td>
</tr>
<tr>
<td>P₁₁ Staff costs/Turnover</td>
<td>L₁₁ Turnover/Net working capital</td>
<td></td>
</tr>
<tr>
<td>P₁₂ Wages and salaries/Value added</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P₁₃ Financial income/Turnover</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: author’s own compilation.

Most of the ratios are stimulants, with the exceptions of ratios P₇, P₁₁, P₁₂, P₁₃, L₉, L₁₀, S₂, S₃, S₄, S₅ and S₆, which are considered anti-stimulants. Although some of the ratios, e.g. liquidity ratios should formally be considered nominants, they were also treated as variables whose higher values mean a better object evaluation, as practically there is no over-liquidity within the analysed population. Due to the fact that the ratios vary in terms of their range, the standardisation of all variables was needed prior to analyses. The ratios were normalised according to [0;1] unitarisation formula.

4. Methodology of the Research

The initial stage of the analysis was meant to verify whether the differences in ratios between industries and size groups are statistically significant. In order to do so, the univariate analysis of variance (ANOVA) was employed, as a method used for examining observations, which depend on one or more simultaneous factors.

A natural procedure when dealing with a relatively large number of data is organizing the elements of the population according to some criteria, i.e. classifying them. Classification of objects which are combinations of both size and industry (and country) should provide some information about the domination of one of the two effects in question. Therefore two opposing hypotheses could be formulated:
(1) firm size has higher influence on corporate performance than industry,
(2) industry factors have higher influence on corporate performance than size.

If different industry sectors from the same size group had a tendency to group in the same clusters, it would mean that the first hypothesis is true. At the same time it could be also expected that the same industry from different size groups would be scattered into various clusters. In other words, the obtained clusters would be closer to the size groups than to the industrial division of the objects.

However, if the same industry from different size groups was classified into the same cluster, whereas sizes were dispersed, regardless of industry, the other hypothesis would be favoured. It would mean that the resulting categorisation is more similar to industrial than size classification of the population.

It might also occur that none of the above statement is favoured, as there might be clusters where it is difficult to indicate a dominating element of either industry or size. This would prove that none of the two effects prevails when affecting corporate financial condition.

Classification of the objects is a useful tool which can be employed in order to answer the above question. Classification can be interpreted as categorizing objects according to their characteristic features. Identifying the nature of each cluster either as size-dominated or industry-dominated groups will reveal the prevailing effect.

Clustering algorithms, such as for example $k$-means grouping or agglomerative clustering, are some of the most commonly used classification methods. The $k$-means algorithm assigns each point to the cluster whose center is nearest. This centroid is the average of all the points in the cluster – that is, its coordinates are the arithmetic mean for each dimension separately over all the points in the cluster. The main advantages of this algorithm are its simplicity and speed which allows it to run on large datasets. That is why $k$-means clustering method was performed on the whole dataset, i.e. for grouping three-dimensional objects: country-industry-size items. In this case – due to the large number of objects – agglomerative hierarchical grouping does not seem a convenient method in terms of graphical visualization of clustering results. Classification of objects can be based on various characteristics. The criterion used in the following analysis is the general corporate performance measured with the use of financial ratios.

The diagnostic variables in cluster analysis should be characterized with significant variability and independence. These conditions mean that from the initially suggested set of ratios those that do not discriminate the analyzed objects should be excluded. Similarly, the effect of doubling the information carried by different variables should also be eliminated.

The variability of ratios was examined with the use of variability coefficient. Within the set of proposed variables, none of them is a stable variable. In each case standard deviation is at least a few times bigger than the mean. However, taking into account the interdependence of variables (the results are not reported here), several of them had to be eliminated because of correlation coefficient exceeding the arbitrarily accepted level of 0.7. As a result the following ratios were eliminated from further analysis: $P_2$, $P_3$, $P_9$, $L_{11}$, $S_5$ and $S_6$.

5. Results and discussion

When employing clustering algorithms, the analytical variables should have significant variability and independence. Therefore, the first stage of the analysis was the ANOVA procedure, which was supposed to verify whether and which variables are significantly different between groups. The procedure was performed on normalized variables in four sections corresponding to the data dimensions, i.e. for countries, industries, size groups and years. The list of ratios with significant between-group variability is shown in Table 3.
Due to the fact that the majority of variables, with only few exceptions, does not have significant variance in time, it was assumed that the following analyses will be performed with the use of mean variables, which constitute an approximated representation of a certain typical level of each characteristics within the whole nine-years’ period. Moreover, the ANOVA procedure reveals that the majority of ratios do differ significantly when other three sections are considered, i.e. across size groups, across industries and across countries. However, the analysis of variance across size groups shows that there are slightly less ratios with significant between-group variability than in the other two cases (industry and country), which is a first indication about the minor importance of size influence on corporate performance.

Taking into account the results of the ANOVA, the interdependence of variables, as well as the meaning and information capacity of each ratio, the following variables were excluded from further analyses: $P_2$, $P_3$, $P_6$, $S_5$, $S_8$, $S_9$, and $S_7$. As a result the final set of selected variables involved 25 ratios.

When performing the procedure of $k$-means grouping, the number of clusters must be declared beforehand. In order to facilitate the identification of the dominating effect within clusters, the classification of the analysed population should lead to such a number of clusters, that they have a similar, but fairly small number of objects. The higher the number of items in each cluster, the bigger the within group variance and therefore the more difficult it becomes to discover the prevailing factor. As the clustering should allow for classifying each of the identified group as industrial- or size-dominated, a partition in which the number of clusters corresponds to the number of industries (thirteen) or size groups (three) seems the most natural solution. Bearing this in mind, as well as the fact that dividing the population into just three groups would result in an excessive numerosness of clusters making it next to impossible to determine their nature, the final number of clusters was set at thirteen. Therefore the number of clusters is the same as the number of industries analysed.

The detailed structure of each cluster is shown in Appendix. It is perhaps worth mentioning here that the three symbols characterizing each item refer to their country, industry and size group. For instance, PL_AGR_S would stand for the aggregated group of small agricultural enterprises in Poland.

Considering the main aim of the research, i.e. the comparison of relative importance of industry and size effect, it is necessary to identify the nature of each of the distinguished clusters as either industry- or size-dominated. When looking at the number of the same industries and items of the same size, as shown in table 4, it is clear that the majority of clusters are industry-dominated.
According to the kind of industry which prevails in each cluster, they could be described as a manufacturing and mining cluster (no 1), transport, electricity and community services cluster (no 2), health care, hotels and community services cluster (no 3), construction and manufacturing cluster (no 4), real estate, education, health care and construction cluster (no 5), trade and agriculture cluster (no 6), hotels, mining and community services cluster (no 7), education and health care cluster (no 9), mining, electricity and real estate cluster (no 11), agriculture, manufacturing, construction and trade cluster (no 12) and electricity, hotels, transport and real estate cluster (no 13).

In all of the above-listed eleven clusters, there is usually a fairly proportional mixture of different size groups. Only the two remaining clusters, i.e. no 8 and 10 could be classified as size-affected, as they mainly consist of small enterprises. The latter one, in fact is restricted to items from just one country, namely Germany, which suggests a strong influence of country-specific factors. The same effect refers to cluster no 12, where there are all size groups and four different industries (both respectively in equal proportions), but only from one country: Spain. Due to the same reason (country effect), objects from the same industry are sometimes scattered across two or more clusters, where they have a relatively smaller share.

When analyzing the structure of each cluster, it is also easy to indicate industries with stronger common factors, because they tend to be grouped in a smaller number of clusters. This is particularly obvious in the case of trade industry, which is mainly concentrated in just one cluster, irrespectively of size and country. It might be interesting to detect what it is that makes the trade industry so specific and therefore so clearly separated from most other industries. A closer look at the primary data reveals that the characteristic feature concerning financial ratios of this industry is the low profitability accompanied by very high turnover ratios. This tendency is observed throughout most countries and in all size groups. At the same time there are also industries with significantly smaller industrial factors, such as agriculture or fishing. This is shown by their dispersion among many different clusters.

Similarly, it is worth finding what makes small companies different from medium and large entities, which is clearly visible in the structure of the two size-affected clusters. The results of the post-hoc analysis carried out for the ratios with significant between-group variance reveal that it is the usually smaller profitability and better liquidity that are responsible for the distinction of the small-sized enterprises.

6. Summary and Conclusions

With reference to the main aim of the research, which was to determine the relative importance of industry and size group factors in their impact on corporate performance, it can be stated that, according to the analytical results, it is the industry effect which should be recognized as the dominating one. Industry-specific factors are particularly visible in the case of trade, but also construction and manufacturing industry, which is confirmed by a relatively high resemblance of e.g. trade enterprises from different size groups. The prevalence of industry effect does not mean that size factors are completely unobservable within the examined population. However, their presence was noticed in only two clusters out of thirteen. Moreover, the size effect seems to concern mainly small enterprises. Considering the above inference, it can be concluded
that despite of occurrence of both industry and size impacts within the examined population, the industry factors constitute a more useful indicator of corporate performance. This, in turn, implies a superiority of diversification strategies based on cross-industry sections rather than on cross-size sections.

References


