Companies in Portugal and in Europe:

Comparative study based on financial ratios

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ABSTRACT

This study compares the economic and financial performance of a representative set of companies located in seven European countries for the period of 2000-2013. The study finds its support in the BACH-ESD database, allowing comparisons among seven countries, fourteen years, fifteen sectors and three sizes. Multivariate statistical analysis, namely cluster analysis, and different statistical tests were used as methodology. Key findings encompass the major influence of the variable country as well as the sector and size on explaining the differences among observations. Furthermore a sub effect – the 2008 crisis - was detected as responsible for a break in the values of the ratios, primarily the ones regarding profitability. France, Austria and Germany were identified as the most profitable countries, while, on the opposite side, Portuguese and Italian firms, appeared as the least profitable and the most liquid countries. Small firms emerged as the least profitable, least efficient and the most indebted comparatively with the larger ones.

Keywords: Financial ratios, European companies, multivariate statistical analysis, cluster analysis, MANOVA

1. INTRODUCTION

Financial analysis requires the examination of an extensive amount of data provided by financial statements. Due to this extension of information, it becomes indispensable to synthesize and relate these data under the form of ratios which can also be used to relate other forms of information, enabling, thus, a more operational analysis of the data available. Besides this, through the use of ratios, a greater control over the size effect on the variables can be achieved allowing

consequently a better evaluation of companies regardless their size. This is clearly one of its main advantages and one of the reasons of its popularity among financial analysts.

The existence of different accounting standards between companies from different countries was a serious obstacle for economic and financial comparisons. In order to overcome this problem and, therefore, establish solid future projections, analysts studied several processes for harmonizing the elements that integrate the ratios. In this field, the standardization operated by the European Union enabled comparisons between member-states in a much easier and efficient way. It was paramount the establishment by the European Commission in 1985 of the Bank for the Accounts of Companies Harmonized (BACH), a special database for detailed analysis of financial structures and aggregate performances of European companies, which was merged in 2010 with the European Sectorial references Database (ESD) providing both the structure of financial statements and financial ratios.

2. DATA AND METHODOLOGY

The BACH-ESD database includes harmonized information from the financial statement of non-financial companies of twelve different countries from the Euro Zone as well as dispersion statistics of 29 financial ratios. The resulting information is aggregated by country, year, size and sector. Table 1 illustrates the 29 financial ratios aggregated in 5 groups, as well as some absolute values in a sixth group ("dimension"), from which this study took support. The ratios underlined were the ones selected as the most relevant for a deeper statistical analysis.

The comparative analysis is based on the weighted averages of the ratios (instead of quartiles) in order to take into account the diversity of all the values on the results. The aggregation in sectors of activity on the BACH database is based on the NACE Rev. 2 "Statistical Classification of Economic Activities in the European Community" classification [1]. However, this study used a different sectorial aggregation, combining the previous into a set of 15 sectors, following Soares and Pina [2]. The classification of the companies in three different sizes (small, medium and large) is based on the European Commission classification for the turnover criterion only. Countries with missing information regarding some years, sectors or one of the 29 ratios were excluded as were also observations with non-positive values (to avoid bias on cases where both the numerator and the denominator are negative and the resulting ratio would be positive). The resulting information included almost 700 thousand observations.

A descriptive analysis was carried out for each one of the 4 factors in the study: country, year, sector and size. This analysis was followed by a cluster analysis in order to categorize the observations in terms of their similarities among each other. The hierarchical clustering method was selected given the interest in this analysis on the agglomerative process of the observations and due to the fact that the number of clusters to retain was unknown. The Ward's method was selected as grouping procedure for this study due to its robustness of results and consequently the squared Euclidean distance was chosen for the

Table 1 – Financial indicators in analysis

Group	Code (BACH) - Definition
1 Financial Structure	R11 - Total balance sheet/ Total equity R12 - Total liabilities/ Total equity R13 - Current assets/ Total balance sheet R14 - Other financial assets and cash and bank/ Total balance sheet R15 - Non-current debt/ Total balance sheet R16 - Current debt/ Total balance sheet
2. Financial and Debt Service	R21 – (Financial income net of charges other than interest/ EBITDA R22 - EBITDA/ Interest on financial debts R23 - EBT/EBIT R24 - Interest and similar charges/ Net turnover R25 - Interest and similar charges/ Gross operating profit R26 - Financial income net of charges/ Gross operating profit R27 - Gross operating profit/ Total net debt
3. Profitability	R31 - Gross value added/ Net turnover R32 - Gross operating profit/ Net turnover R33 - EBITDA/ Net turnover R34 - Net operating profit/ Net turnover R35 - EBIT/ Net turnover R36 - EBT/ Net turnover R37 - Net financial income/ Net turnover R38 - Net profit or loss for the period/ Total equity (ROE) R39 - Net operating profit/ Total balance sheet (ROA) R310 - Profit or loss of the year before taxes/ Total equity (ROEBT)
4. Activity and Technical	R41 - Net turnover/ Total balance sheet (Asset turnover) R42 - Staff costs/ Gross value added
5. Working Capital	R51 - Inventories/ Net turnover R52 - Trade receivables/ Net turnover R53 - Trade payables/ Net turnover R54 - Operating working capital/ Net turnover
6. Dimension	Total balance sheet Turnover Gross Value Added Number of firms Employees

dissimilarity measure. Finally, an inferential statistical analysis was carried out involving parametric / non-parametric testing in order to derive statistically significant results and implied conclusions about the economic and financial performance of the companies. When the assumptions of normality of the observations and homogeneity of the variances are present, the parametric tests present more statistical power than the non-parametric ones. However, many studies in the literature show that even when those assumptions are not met and the deviations are not "severe" it is still preferable to carry out with parametric tests particularly MANOVA (e.g. [3] and [4]). Taking that into account and since both assumptions were violated in this study, it was carried out a factorial MANOVA test, for robustness, followed by a non-parametric test, Kruskal-Wallis, in order to strengthen the previous results. The cluster analysis and the inferential statistical analysis were carried out using IBM SPSS Statistics, version 20.

3. ASSESSMENT OF RESULTS

3.1 Descriptive analysis

The analysis of the ratios by country revealed Italy as the one with the most indebted companies and lowest profitability (ROE and ROA). France is the most profitable country of the sample, followed by Austria and Germany, and presents the lowest ratio between staff costs and gross value added. Germany has the largest return on assets and the lowest value for the operating working capital/ net turnover ratio. On the exact opposite side of Germany is Portugal wherein the large values of working capital might be explained by the predominance of short-term financing. Portugal presents also

a bad performance in terms of staff costs/ gross value added, interest burden (EBT/EBIT) and average turnover per company (1M as opposed to 48M in Germany).

Regarding the analysis by size, small companies reveal a worse performance than large ones. In fact, they demonstrate higher levels of debt, less profitability, less return on assets and higher values for working capital as well as staff costs/ gross value added.

As for the sectors it was identified the Construction sector as the most indebted and the one with the largest working capital which is explained by the large volume of activities each company holds in portfolio, its dimension and its ongoing activities. The Electric Equipment sector is the one that shows higher profitability (ROA and ROE) as opposed to the Transports sector, the less liquid of the sample. Despite its good performance in terms of profitability, the Energy Production sector presents the lowest figures for the group of Activity & Technical ratios.

Comparing ratios by year, excepting 2007, the most profitable year, and the progressive grow of the non-current debt over assets (and the inverse for the current debt), it wasn't identified any significant trend. Nevertheless, this analysis suggested a sub-effect associated with the financial crisis of 2007. As a matter of fact, in the years that followed the crisis, it could be observed a smaller profitability and return on assets and a higher staff cost/ gross value added. At the same time the indebtedness progressively increased due to the difficulty in obtaining credit. In order to examine the influence of the crisis on the performance of the companies, statistical tests were carried out so that the actual time period that the crisis effect was reflected on the sample is identified. Since the assumptions of normality of the observations and homogeneity of variances were not met, Mann-Whitney U tests were carried out due to its robustness on the comparisons of pairs of independent samples. The time period 2000-2007 vs 2008-2013 was the one which presented a larger break on the values and therefore was selected for the crisis effect analysis. Thereafter an analysis to both time periods was carried out verifying an overall reduction of the values from the pre-crisis period to the post one mainly in terms of the profitability (26% and 29%) and return on assets (12%). As for the ratios 'staff costs/ gross value added' and 'working capital /turnover' they both show a small increase (5% and 7%).

3.2 Cluster Analysis

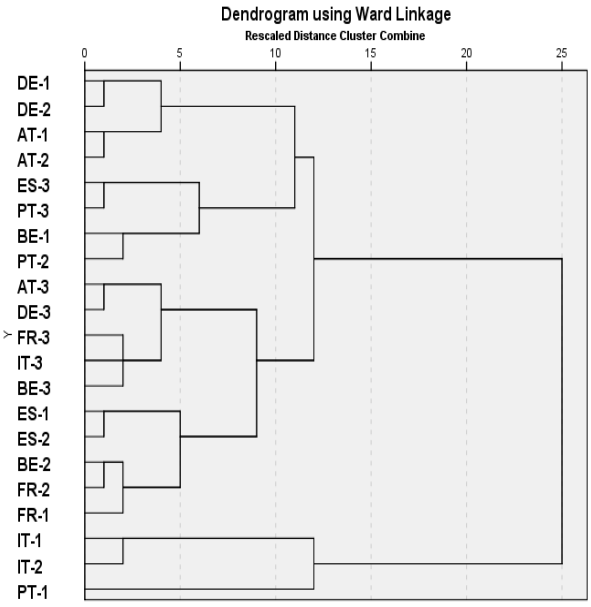
Country-Dimension

Unlike the results obtained by Serrano-Cinca [5] and Soares and Pina [6], who found predominance of the Country effect over Dimension, this study found no evidence of any predominance of none of these grouping variables (Figure 1). German, Austrian, Spanish and Italian SME showed indeed a predominance of a Country effect, but this is not evident for the other countries of the sample. A similar analysis carried out for both sub-periods–pre and post crisis-, instead of just one, showed essentially the same results[1]. Nevertheless, it was possible to see a clearer grouping between large companies from different countries during the post crisis period.

[1] Data available at dissertation [7]

During this period it could be seen also a greater homogeneity on the economic and financial performance across the diverse countries and sizes.

Figure 1 - Country-Dimension dendrogram



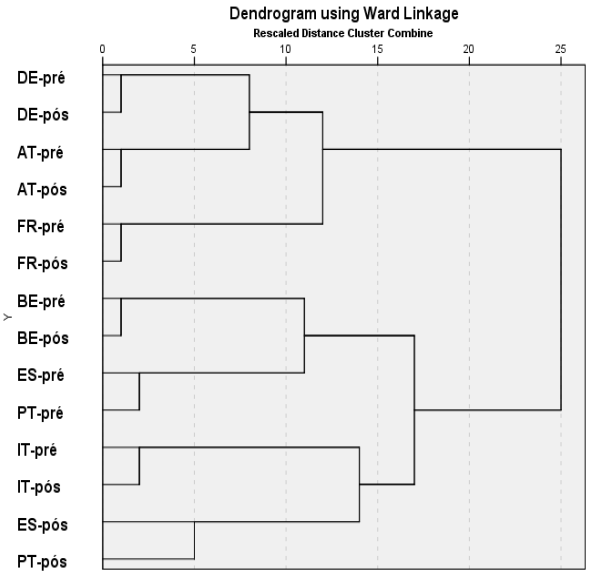
AT-Austria; DE-Germany; ES-Spain; FR-France; IT-Italy; PT-Portugal

1, 2 and 3 represent small, medium and large companies respectively

Country-Year and Country-Crisis

The 'Country effect dominates the time (year) effect[1]. The grouping process suggested also a regional effect under which French, German and Austrian companies group in one side while Spanish, Portuguese, Belgium and Italian companies group on the other. Lastly, it became visible a bigger resemblance between the economic and financial performance between Portuguese and Spanish companies, especially during the period before the crisis. A final test on the Country-Crisis pair (Figure 2) was also conducted and its results confirmed the predominance of the Country effect with the only exception being Portugal and Spain wherein the Crisis effect have been predominant.

Figure 2 - Country-Crisis dendrogram



AT-Austria; DE-Germany; ES-Spain; FR-France; IT-Italy; PT-Portugal

Country-Sector

Findings regarding this pair were not conclusive. There were cases where grouping was done by countries while in other cases the grouping was done by sectors[1]. A regional effect was also observed in terms of homogeneity of performance of Austria and Germany on one side and France, Belgium, Spain and Portugal on the other. The Sector effect was predominant in some sectors namely the one of Pulp and Paper Industry, Trade and Hospitality, Real Estate and Services while the Country effect was predominant on the Italian companies.

Dimension-Year and Dimension-Crisis

Dimension effect was predominant over the Year effect. The disparity among performances of large companies vis-à-vis the SME was quite clear[1]. Particularly, the results of the analysis of the Dimension-Crisis showed the predominance of the Crisis effect on the SME and the predominance of the Dimension effect on the large companies.

3.3 Inferential Statistical Analysis

Parametric Tests

Due to the fact that the comparative analysis encompassed more than one dependent variable, a MANOVA test was performed. This allowed the comparison and analysis among the 8 ratios selected for the 7 countries, 15 sectors, 3 dimensions and 14 years. The tests were performed for the two different periods: pre and post crisis. Since the ratios are influenced by more than one grouping variable simultaneously, a factorial MANOVA was performed (instead of a MANOVA One-Way) in order to examine also the influence that each grouping variable can exercise over the response of the dependent variable to another grouping variable [8]. For each one of the four resulting statistics of MANOVA test (Pillai's Trace, Wilks' Lambda, Hotelling's Trace and Roy's Largest Root) the results were essentially the same[2]. It was shown for individual factors a significance of 1% proving the existence of Country, Size, Sector and Year effects over the ratios for both periods. This could also be seen on the interaction between factors, especially on the following combinations: Country-Size, Country-Sector, Size-Sector, Country-Size-Sector, and Size-Sector-Year. For the pre-crisis period, the Country-Year and Size-Year combinations can be added as well as the Size-Sector-Year combination for the following period. This also supports the previous finding of a greater homogeneity among economic and financial performances of countries and sizes as a consequence of the financial crisis verified.

Tests to the effects among ratios were also conducted, corresponding to eight different ANOVA's – one for each ratio – for each factor in analysis. As a result it could be seen a clear effect of the crisis on the interest burden ratio where it was noticeable the increase of the probabilities of significance from one period to another demonstrating an increasing homogeneity of the performances for that ratio[2]. For this ratio it was assumed absence of statistical significance, particularly clear in the post crisis period. Hereupon, eliminating this ratio from the analysis, it could be seen that the Country, Size, Sector, Country-Size, Country-Sector and Size-Sector factors show significant evidence at less than 1% in the majority of ratios (Table 2). Curiously, the Country-Size-Sector factor showed statistical evidence for the second period in the ROE (R38) and ROEBT (R310) ratios while the opposite could be seen for the staff costs/ gross value added (R42) and operating working capital/ net turnover (R54). Regarding the Year effect it was shown that its influence on the performance of the ratios was mainly translated in terms of profitability (presenting p-values below 1%). For the rest of the ratios it was clear the homogeneity among annual values of ratios with probabilities of significance above 10%.

Once identified the specific variables which were affected by the factors, the particular groups among those factors which were statistically different remained to be identified. Therefore, multiple comparisons among groups were made through post-hoc tests (only for the ANOVAS which presented statistical significance previously, that is, for all ratios except interest burden). Due to the extensive information provided by those tests, they were only performed for the factors which

[2] Data available at dissertation [7]

Table 2- Results of the tests to the effects among ratios

		R12	R38	R39	R310	R41	R42	R54
Ctr	Pre	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	Post							
Siz	Pre	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	Post							
Sect	Pre	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	Post							
Year	Pre	0,000	0,001	0,000	0,002	0,660	0,556	0,984
	Post	0,182	0,000		0,000	0,003	0,471	0,837
Ctr * Siz	Pre	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	Post							0,011
Ctr *Sect	Pre	0,000	0,000	0,000	0,000	0,000	0,000	0,000
	Post							
Ctr *Year	Pre	0,222	0,661	0,000	0,798	1,000	1,000	1,000
	Post	0,090	0,069	0,719	0,093	0,990	1,000	1,000
Siz*Sect	Pre	0,000	0,230	0,000	0,034	0,000	0,000	0,000
	Post		0,000		0,000			0,001
Siz *Year	Pre	0,448	0,731	0,481	0,569	0,990	0,996	0,981
	Post	0,508	0,477	0,524	0,584	0,998	0,999	0,999
Sect *Year	Pre	0,959	0,156	0,001	0,080	1,000	1,000	1,000
	Post	0,770	0,001	0,011	0,003	1,000	1,000	1,000
Ctr *Siz * Sect	Pre	0,000	0,559	0,000	0,101	0,000	0,000	0,000
	Post		0,000		0,000		0,523	0,992
Ctr * Siz * Year	Pre	0,566	0,874	1,000	0,926	1,000	1,000	1,000
	Post	0,155	0,790	1,000	0,948	1,000	1,000	1,000
Ctr*Sect * Year	Pre	1,000	1,000	1,000	1,000	1,000	1,000	1,000
	Post	0,983	0,997	1,000	1,000	1,000	1,000	1,000
Siz *Sect * Year	Pre	0,946	0,974	1,000	0,981	1,000	1,000	1,000
	Post	0,812	0,994	1,000	1,000	1,000	1,000	1,000
Ctr*Siz* Sect*Year	Pre	1,000	0,993	1,000	1,000	1,000	1,000	1,000
	Post	0,999	1,000	1,000	1,000	1,000	1,000	1,000

Ctr- Country; Siz – size; Sect – sector

showed an *overall* statistical significance (i.e p-values of 0,000 for all ratios in both periods): Country, Size and Sector. For the Country factor (Table 3), the tests showed a high resemblance (that is, presented significance-values above 10%) between Austrian and German performances (in 6 out of 7 ratios) as well as Spanish, Italian, Belgian and Portuguese (with 4/5 out of 7 ratios being similar). This reinforces to some extent the previous finding of a regional effect. This analysis also demonstrated the influence of the financial crisis on the performances of the companies translated in a bigger homogeneity for the ratio return on assets (R41) and a bigger heterogeneity for the profitability ratios (R38-R310). As for the Size factor (Table 4), the similarities among pairs of observations were not that clear. However, a greater resemblance between SME as opposed to larger companies was corroborated here as well as a bigger homogeneity among performances on the pre-crisis period. Finally, the tests for the Sector factor[3] showed similar performances among the industrial sectors for most of the ratios analyzed namely Agriculture, Food and Industry, Clothing Industry, Chemical Industry and Electric Equipment. The similarities identified were mainly in terms of ROE (62 out of 105 possible combinations proved similar for that ratio). On the contrary, the staff costs/ gross value added was the ratio which shown the least similarities among sectors (showing similarities in 16 out of 105). Besides this, a bigger homogeneity for the staff costs/ gross value added and working capital/ turnover ratios on the pre-crisis period was identified as well as a bigger heterogeneity for the total liabilities/ total equity and profitability ratios.

[3] Data available at dissertation [7]

Table 3 –Results of post-hoc tests for Country factor

	R12	R38	R39	R310	R41	R42	R54
AT-BE							***
AT-DE	***	***	**	***		**	***
AT-ES			*			**	
AT-FR					*		**
AT-IT	***						
AT-PT	**						
BE-DE							***
BE-ES	**				***	*	
BE-FR	*						**
BE-IT		*	*		***	***	
BE-PT		***		***	**		
DE-ES		*	*				
DE-FR	**		*			*	
DE-IT	***						
DE-PT	**						
ES-FR		*	*	*			
ES-IT		**	**	*	**		*
ES-PT					**		**
FR-IT				*			
FR-PT	*	*	**				
IT-PT		***		*	**		*

*, ** and *** indicate absence of statistical significance at 10% on the pre, post and both periods respectively

Table 4 - Results of post-hoc tests for Size factor

	R12	R38	R39	R310	R41	R42	R54
S-M	**	*		*			*
S-L	*				**		
M-L					***		

*, ** and *** indicate absence of statistical significance at 10% on the pre, post and both periods respectively

Non-parametric Tests

Kruskal-Wallis non-parametric tests were also performed for comparison of differences, e.g., of countries for each size, year and sector. This enabled, similarly with what happened with the Cluster Analysis, to extract conclusions about the predominance of the effects.

Analysis of the Country variable

Comparisons between countries were made for each one of the other 3 factors: size, year and sector. As a result, the null hypothesis - equality of the two populations - was rejected for all the tests performed for all the ratios within each factor (the only exception being the Communications sector where the null hypothesis was not rejected for the ROEBT during the period pre-crisis). Furthermore, the vast majority of the results presented significance-values below 1%[4]. Therefore, it is possible to conclude that the economic and financial performances of the companies *do* differ greatly from country to country.

Analysis of the Year variable

Looking into the Year variable it was observed a general resemblance (i.e p-values above 10%) between annual values for Activity & Technical and Working Capital ratios within Country factor as well the Size one. It was also shown the lack of influence of the variable on the annual values of Portugal. For the remaining ratios, statistical difference was shown for both factors. Globally, within each Country-Size pair the differences between annual averages were not statistically significant. Some exceptions include profitability

[4] Data available at dissertation [7]

ratios and EBT/EBIT for SME's (and large companies in the pre-crisis period) for all countries but Portugal. The Year variable showed also influence on what concerns Financial Structure and Profitability in some sectors namely Metallurgic Industry, Electronic Equipment Industry and Clothing Industry[5]. Consequently one can conclude that, notwithstanding some influence played by the Year variable over the ratios, it isn't really absolute.

Analysis of the Size variable

During the analysis of the Size variable, it was visible a general statistical significance (with p-values below 10%) between sizes as far as countries were concerned. Nevertheless, there were some resemblances between sizes in the post-crisis periods mostly on France. Regarding the years, statistical differences between sizes were found for the ratios: interest burden, ROE, cost of staff/ gross value added and working capital/ net turnover. Nevertheless, for the remaining ratios the Size variable didn't play a significant influence for the initial years of the sample (and for the last two years in the case total liabilities/ total equity ratio). For the majority of the sectors statistical differences between sizes were identified particularly clear in the Food Industry, Clothing Industry and Chemical Industry which presented p-values below 1%. The exception was the Energy Production sector where the differences between sizes were not clear for the majority of the ratios[5]. To sum up, despite not being dominant, the Size effect is observable. This means that the economic and financial performances under analysis *do* depend on which size class the companies are inserted in.

[5] Data available at dissertation [7]

Analysis of the Sector variable

Lastly, it was observed in an almost absolute way the influence of the Sector variable on the financial and economic performance of each country, size, country-size and each year for both periods in analysis (some exceptions include the year 2013 in what concerned ROE and ROEBT as well as Spanish medium companies during post-crisis period for the EBT/EBIT ratio). In fact, the statistical differences shown were below 1% for the big majority of the observations[5]. Therefore, one can conclude that the performance of the observations under analysis also differ greatly from sector to sector.

4. Conclusions

This study corroborated the influence of a country effect on the performance of the companies even in integrated economies like the ones in the Euro Zone. It also demonstrated the existence of a regional effect which is translated in two different groups: Germany, Austria and France who shown good levels of profitability and low levels of debt and on the opposite side Belgium, Spain, Italy and Portugal.

The size effect on the variables was also demonstrated in this study. In fact, the more restricted access to the capital and debt market shown by small companies makes them more indebted, less profitable and less efficient when compared to the larger ones. It was also proven the great similarity of performances among SME.

The influence of the industry (i.e the sector effect) was also quite clear. Similar performances among the industrial sectors namely Agriculture, Food and Industry, Clothing

Industry, Chemical Industry and Electric Equipment were shown for most of the ratios analyzed. The similarities between sectors were mainly in terms of ROE and the differences in terms of staff costs/ gross value added.

The existence of the year effect even though present was not that clear meaning the performance of the companies didn't change much from one year to another. However, a sub-effect was clear – the crisis effect – responsible for a notable break on the values particularly in terms of profitability and return on sales. The gradual increase of the current debt over assets, shown on the years preceding the crisis, can be interpreted as a foresight of the crisis validating the utility of the financial ratios on a predictive analysis.

All these previous analyses demonstrate that the economic and financial performance of the companies do indeed reflect their macroeconomic environment.

In terms of predominance of effects this study showed mixed evidence for the effects Country and Size as well Country and Sector. Particularly, the Country effect was predominant for the SME while the Size effect was predominant for the large companies. Moreover, for some sectors mainly Pulp and Paper Industry, Trade and Hospitality and Real Estate and Services the companies were grouped by sector regardless of the country while italian companies grouped with national companies regardless the sector. The year effect, as expected, was dominated by the effects country and size. Furthermore, the agglomerative process of clustering demonstrated a bigger homogeneity of performances on the period post-crisis.

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