Credit risk assessment and the information content of financial ratios: a multi-country perspective

JOÃO O. SOARES[1] and JOAQUIM P. PINA[2]
[1] Instituto Superior Técnico, Universidade de Lisboa, Av. Rovisco Pais, 1049-001 Lisboa, Portugal
[2] Departamento de Ciências Sociais Aplicadas, Faculdade de Ciências e Tecnologia , FCT, Universidade Nova de Lisboa, 2829-516 Caparica, Portugal
[1] joaosoares@tecnico.ulisboa.pt, [2] jagl@fct.unl.pt

Abstract: This paper revisits the problem of building a multicriteria additive value model for credit risk assessment, with a particular focus on quantitative criteria. The analysis deals with the information content of financial ratios collected from the European BACH-ESD database, covering aggregate firm data for seven countries – Austria, Belgium, France, Germany, Italy, Portugal and Spain – fifteen sectors and three size classes. A cross-sectional study is conducted employing non-parametric testing in order to look for similarities in the data, according to the multiple dimensions of the sample. Profitability, liquidity and leverage ratios exhibit different patterns of variation across countries, sectors and sizes, but the profitability indicators seem to have the greatest discriminating power, implying more specific benchmarks for credit risk assessment. It is also found that size and sector breakdowns are mostly relevant, while the country factor is somewhat less, for performance benchmarking. Moreover, the fact that the financial indicators show negligible differences across firms in many cases conveys a compelling argument for the accrued value, and central role, of qualitative information –market and management – in the decision making process, notably using a MCDA model.

Keywords: Multicriteria assignment; risk assessment; credit scoring; banking; financial ratios; cross-section evidence.

1 Introduction

The financial crisis that hit the world economy since the second half of 2007 brought to light the importance of assessing the risk of credit in the context of bank management. Following the generalised stress tests conducted by monetary authorities, banks have sought to improve the analysis of their portfolios of financial assets and their procedures for assessing credit applications.

The purpose of risk assessment models is to classify the degree of risk associated with each credit transaction in order to suggest the rejection of the transaction or approval with an adequate spread. Several models have been suggested in the literature since the seminal works of Beaver [6] and Altman [2], which are either focused on the risk of bankruptcy or on the risk of credit. Some of them — the credit scoring models — try to encapsulate the assessment of each customer's creditworthiness in a numerical score. First developed for the analysis of residential mortgages, credit cards and small business credit, credit scoring is now also used across the entire credit portfolio of financial institutions, covering firms and sovereigns. In parallel, the credit rating models now have a major impact in the context of the sovereign debt crisis that has swept Europe in 2010 and 2011. Both types of models provide a credit risk assessment, and when scores are gathered into homogeneous risk classes, the result of the score is also a "rating". In practice, credit scoring is mainly referred for internal purposes and credit rating for external purposes, when ratings are made public by specialised rating agencies [20].

If we focus on the technical aspects of the models, we discover that different mathematical approaches support the classification problems implicit in credit analysis. Surveys carried out in [4], [19] or [20], e.g., include discriminant analysis, regressions models classification trees, linear programming, genetic algorithms, expert systems, nearest neighbour methods, and even the combination of models [13]. The Rough Sets Theory [15] [16] and Multicriteria Decision Analysis (MCDA) [22][12] are also applied as tools to support credit granting decisions and, in general, in risk assessment and financial management problems.

The aim of this paper is to develop the work disseminated previously in [7], [8] and [17], which fits into the family of multicriteria additive value models. The original multicriteria model for credit scoring was introduced in the first of the references above; the second paper brought a greater flexibility by enabling the variation of the weights within intervals; the third work validated the hypothesis that the qualitative aspects are of paramount importance in credit analysis, in line with other authors (see [1], [10],[14], [3] and [5]). In this

paper we address the implementation of the model and the building of benchmarks for the quantitative (financial) criteria, in order to establish reference points for the analysts' judgments. Indeed, financial information is valuable for credit risk assessment and, as found in Demirovic and Thomas [11], this accrued value is not equal across firm sizes and activity sectors. Therefore, we test various hypotheses about the variability of these financial indicators according to the country, sector of activity or size of the firm that makes a credit application. The multi-country nature of the study is particularly relevant in comparative terms given the increasing economic integration within the European Union.

The rest of the paper is organised as follows: the next section details the fundamentals of the above-mentioned model; section 3 describes the data, selected indicators and statistical tools we applied to derive our results on cross-sectional benchmarks of quantitative information; finally, section 4 states the major findings and conclusions.

2 A decision support system for credit risk assessment based on multicriteria analysis: a synthesis

Figure 1 represents the model for credit risk assessment mentioned in the previous section. Its objective is to assist a commercial bank in the analysis and assignment of credit applications from corporate customers to different risk categories. To do so, it takes into account multiple qualitative and quantitative criteria related to the customer and the characteristics of the credit operation. These criteria can be split into three major groups: market, management and finance [18]. The first two are essentially qualitative: the performance of these types of criteria are usually expressed in ordinal scales (e.g., *poor*, *fair*, *good*, *very good and excellent*) or, sometimes, as dichotomous. In turn, the financial criteria are often quantitative but most of the times are also converted into a qualitative scale in the analyst's mind.

Qualitative is not synonymous of judgmental, but often the assessment of qualitative (and even quantitative) criteria is based on analysts' subjective judgments, limiting the usage of the most common statistical analysis ("Judgmental data include economic outlook, market environment, assessment of management quality, quality of disclosure" [20]. An overriding concern is therefore to establish boundaries on that subjectivity, building, e.g., value functions that may express generalised points of view about the significance of the performance outcomes on the different criteria. For the financial criteria, in particular, a common practice is to compare the customer's performance with the reference values of the firms in the same industry sector, size and country. We can illustrate this procedure through the example presented in [7] using the MACBETH software (*Measuring Attractiveness by a Categorical Based Evaluation Technique* – [9]).

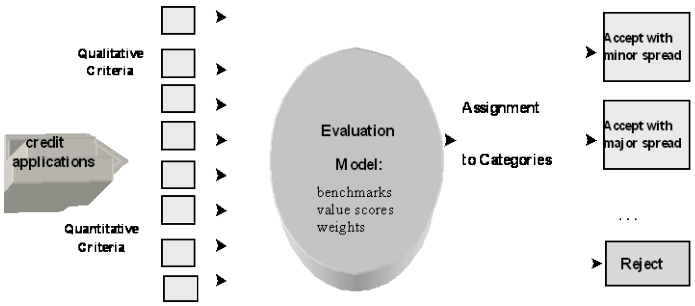

Figure 1 – Outline of the model

The output of the MACBETH software is shown in Figure 2, leading to the development of a value function for the criterion *leverage*. According to the bank's experts, the descriptor of the *leverage* criterion was defined as the ratio between the firm's equity ratio and the equivalent industry standard. A few reference levels were selected: 0 (for any non-positive ratio value), 0.5, 1 (neutral level), 1.5 (good level), 2 and 2.5 (for any value greater or equal to 2.5). The bank officers were then asked to judge the difference in attractiveness between each two of those reference levels by choosing one of the MACBETH semantic categories: very weak, weak, moderate, strong, very strong or extreme. After checking for the consistency of the judgments, the final matrix of judgments shown at the top of Fig. 2 leads to the interval scale proposed by MACBETH (on the right-hand side of the figure; the scores 0 and 100 were arbitrarily assigned to neutral and good, respectively). Eventual adjustments of the numerical values are still allowed, within the limits indicated by the software, to prevent the relationship between the judgments from being violated. The resultant (piecewise linear) value function drawn on the bottom of the figure enables the performances to be translated into value scores, as outlined earlier.

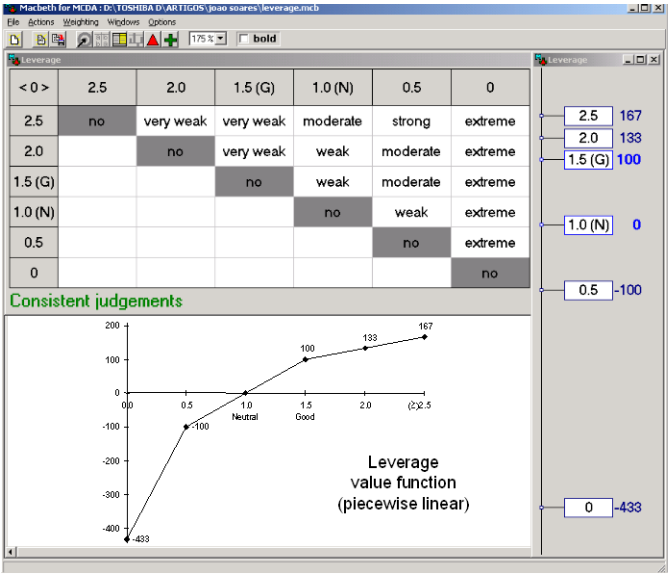

Figure 2 – Criterion *leverage*: Matrix of qualitative judgements, MACBETH scale and piecewise linear value function. (source: Bana e Costa, Barroso and Soares [7])

Subsequently, having determined the scores for each criterion, and having asserted that they are not redundant and cover all the dimensions of the problem, the possibility of compensation among criteria allows the adoption of an additive value model as follows:

$$V_c(a) = \sum_{j=1}^{n_c} w_j . v_j(a)$$

with

$$\sum_{j=1}^{n_c} w_j = 1$$

and $w_j > 0$ (1)

in which $V_c(a)$ *is* the overall score of the application a, $v_j(a) (j = 1, \ldots, n_c)$ are the value scales on each criterion j , and the weights w_j are *scaling factors* that enable the value units in the different criteria to be harmonised.

Finally, this overall score allows the assignment of the credit applications to specific risk categories, as illustrated in figure 1. In the next section we shall move on to a relevant aspect of its implementation: the variability of the benchmarks set for the financial criteria depending the country, economic sector or size of the applicant.

3. Cross-sectional analysis of financial indicators

In this section we inspect whether firms are all alike, asking how much country, size and sector of activity matter, searching for and establishing relevant benchmarks in evaluating the credit risk. Next we describe the data, the selected indicators and the statistical tools applied to derive our results on cross-sectional benchmarks of quantitative information for credit risk analysis.

Data and indicators

We use the data extracted from the Bank for the Accounts of Companies Harmonised-European Sectoral references Database. More precisely, the data source is BACH-ESD database: Banco de España, Banco de Portugal, Banque de France, National Bank of Belgium, National Bank of Poland, Centraal Bureau voor de Statistiek (the Netherlands), CentraledeiBilanci - Cervedsrl, Deutsche Bundesbank, OesterreichischeNationalbank. [1]

This European data covers aggregate firm data per country – Austria (AT), Belgium BE), France (FR), Germany (DE), Italy (IT), the Netherlands (NL), Poland (PL), Portugal (PT) and Spain (ES) –, activity sector – seventeen sectors following NACE two and three digits –, and size class according to net turnover –three to five sizes.[2] The purpose of the database is to provide useful economic and financial information useful for credit and portfolio analysis. In the current paper we explore this potential and compute various benchmarks.

We selected data that enables, as far as possible, fair comparison across indicator, country, firm size and activity sector. Aware of imperfect comparability due accounting differences across countries, we restrict our focus to ratio analysis. Moreover, due to sampling issues in BACH-ESD (e.g. representativeness of the changing sample composition), data comparisons across time may be biased. Consequently, a decision was made to restrict the analysis at this stage to a set of six indicators for 2006 – the most recent year before the financial crisis – covering liquidity, leverage and profitability (see Table 1). These ratios are also present in [7] [8] [17] and [18], allowing for our results to build on previous findings.

The final set of data we use comprises the median for every indicator and does not contain the observations for the indicators that had a negative denominator or zero values, as BACH-ESD discusses. We choose the medians rather than means as our observations because of robustness against the influence of outliers in the

[1]We gratefully acknowledge the *BACH-ESD team* allowing us to use this rich database created under the *European Committee of Central Balance-Sheet Data Offices*. The results and their interpretation are solely our responsibility.

[2]More detailed information can be obtained at http://www.bachesd.banque-france.fr/?lang=en.

comparisons we perform.[3] Furthermore, we deleted the *blank* observations to obtain the same sample for all the six indicators selected. This filtering delivered a full database with 1116 observations for the six indicators. Unfortunately this process implied that Netherlands was excluded because of lack of information for R20 BACH-ESD ratio.

Table 1 – Indicators

	Indicator	**Abridged description**	**BACH -ESD ratio**
Liquidity	Working capital ratio	Working capital/Turnover	R20
Leverage	Equity ratio	Equity/Total assets	R22
	Interest burden	Interest/ EBITDA	R06
Profitability	Economic margin	EBITDA/ Turnover	R03
	Return on assets	EBIT/Total assets	R10
	Return on equity	Profit or loss/Equity	R12

Methodological tools and results

The following methodological approach has been adopted. First, we compute median values broken down into country and size. Second, we compare countries for each size class and inspect within each country for size differences. Finally, we search for differences among sectors, and conclude by assessing which dimensions appear to have more potential in explaining financial performance. This analysis reinforces the findings of Demirovic and Thomas [11] and provides further evidence for many European countries, financial indicators and various breakdown criteria.

The first observation that emerges from the descriptive analysis of Table 2, in appendix, is that the country pattern with respect to profitability ratios exhibit little variation for the Economic margin (EMg), whereas for Return on assets (ROA) and Return on equity (ROE) there is a wider range of variation. Germany, e.g., has an All Sizes ROA more than twice that of Portugal, and an All Sizes ROE more than three times larger than that of Italy. Regarding the Working-capital ratio (W-C), we also observe some variation, with the highest median for Italy more than duplicating that of Belgium. In turn, the leverage ratios have smaller cross-country dispersion. However, one should notice that France has the smallest Interest burden (IB), about half of the overall median, and the majority of countries have an Equity ratio (ER) below the 1/3 rule of thumb traditionally used in financial analysis, with Italy having the lowest value (20.1 per cent) and Belgium the highest (34.7 per cent).

Size class differences have a mixed pattern. The EMg varies little across sizes, but ROA and ROE reveal size differences, albeit not in a stylised way, e.g. large firms in Portugal are the most profitable class while in Austria it is the opposite. The country-size cases observed require complementary information. Specifically, some key explanations may stem from market and management features, such as the level of competition. The liquidity ratio, W-C, shows that large firms have the smallest values, overall and in every country. Concerning the leverage indicators, IB and ER do not show clear firm size differences, although for each country we tend to observe that large firms have the largest ER, with the exception of Belgium and France.

Further to this descriptive analysis, we conducted formal testing, with pairwise and joint comparisons, using, respectively, the nonparametric tests for difference in medians of Mann-Whitney (see results in Table 3, in the appendix) and Kruskal-Wallis.[4] These tests are the best option because of their robustness against the non-normality we found in the data[5]. In Tables 4.1 and 4.2 we present the grouping of countries for each size class and the cross-size comparison within each country.

From Table 4.1, and considering transitivity in pairwise comparisons, we can conclude that the similarity among countries increases with the size of the firms, which is shown by the number of countries inside each box. Putting the emphasis on the different ratios, it is clear that the most homogeneity happens in Economic Margin, followed by the Working Capital and Return on Assets ratios.

The information conveyed in Table 4.2 looks further within each country as regards whether size matters. Considering the six financial ratios analysed, we find that in Germany and France firm size is not key information for discriminating firms, while in Belgium

[3]However, recall that the variance of the mean is $2/\pi$ of the variance of the median, as the sample becomes large, assuming a Normal distribution. That is, the median is a less efficient location statistic.

[4]We further computed the Kolmogorov-Smirnov Z test, which also accounts for possible differences in shape. The results do not reveal a substantially different pattern from that obtained with the Mann-Whitney U test.

[5]Results are available upon request.

and Spain there are many significant differences across sizes. Taken as a whole, mostly small and large firms differ. In terms of indicators, the larger number of matches is the EMg and the W-C, meaning that these usually discriminate less among firm sizes within a given country, whereas the leverage indicators is the more valuable set of ratios for distinguishing sizes.

We further tested for joint median equality for all countries in each size class and for all size classes within each country. The results from the Kruskal-Wlallis H test are presented below, in Table 4.3.[6] All in all, these results reinforce, or at least do not contradict our findings from the pairwise comparisons. We also tested for equality across countries and sizes for each indicator and none was significant at 5 per cent level.

We then analysed the differences across activity sectors within each country, based on the sector breakdown (see Table 5).[7] We focused our analysis on the three financial ratios that offer information for two basic pillars on credit granting analysis – profitability and leverage – and which are among the best factors to discriminate firms across countries and sizes (see Table 6). Taken as a whole, we find significant differences among industries. More specifically, the sectors that show greater Economic Margin are the "Primary sector", and the "Energy, water and waste management" sector. Bucking the trend, ROE is greater in the "Equipment", and "Construction" sectors. Turning to the Equity Ratio, we observe that the "Chemicals", and the "Food, beverages and tobacco" sectors have the top values, whereas the lowest belongs clearly to "Construction". In terms of sectors with wider country variation, measured by (maximum-minimum)/median, hence with larger ability to discriminate firms across countries, our findings are: i) as to profitability, "Wood, pulp, paper and printing", "Automobile industry", "Energy, water and waste management"; ii) as to the equity ratio, "Textiles and leather", "Energy, Water and Waste management", "Construction", "Wholesale and retail trade and accommodation" and "Transportation and storage".

We also computed the Kruskal-Wallis H test (and the Median test) for equality across sectors within each country and concluded in favour (at 5 per cent level) only for the ROA in Belgium, France and Portugal and for ROE in Portugal.

[6]We also used the Median test, which, although being a less powerful test, detects both location and shape differences, finding similar evidence (results are available upon request).

[7]Despite its inclusion in the table, in the following analysis we do not report information for financial and insurance activities since data was not available for these divisions.

Finally, we sum up all the evidence on country, size and sector differences for each financial ratio in Table 7. This enables us to reach a final conclusion about which variable deserves closer attention for credit risk assessment, given the value of its information content for best discriminating the relative performance of firms. Overall, we find that: size matters more than country, particularly due to small firms; sector of activity is more important than country and size for extracting valuable signals from the EMg and W-C; ROE, ROA, W-C and IB are the indicators that differ more across sizes, both within countries and across countries; lastly, ROE appears to be the key ratio to assess relative performance, discriminating countries and sizes, while W-C is the best in discriminating activity sectors.

4. Conclusions

A large stream of literature has been devoted to problems related to credit granting and business bankruptcy. The relevance of such topics has been reinforced by the financial crisis that hit the world economy since the second half of 2007, bringing to light the importance of assessing the risk of credit in the context of bank management. Among several models, this article sustains the usefulness of a multicriteria approach, based on value judgments about relevant qualitative and quantitative criteria. Such judgments require a well-supported definition of benchmarks for those indicators, namely for usual financial ratios.

This paper provides a cross sectional study involving seven members of the Eurozone, discriminated by fifteen sectors and three size classes. Several conclusions arise from such a study. First, the dispersion among the different countries was analysed. It was found that the profitability ratios exhibit greater variation for Return on assets and particularly for Return on equity. Regarding the Working-capital ratio, it is quite surprising that a reasonable variation exists in this case: Italy has the highest median, more than doubling that of Belgium. In turn, the leverage ratios have smaller cross-country dispersion: the majority of countries have an Equity ratio below the 1/3 rule of thumb traditionally used in financial analysis.

Considering the full set of ratios one can conclude that the similarity among countries increases with the size of the firms. Interestingly, in Germany and France firm size is not key information for discriminating firms, while in Belgium and Spain there are many significant differences across sizes. Analysing within each country, mostly small and large firms differ and there are significant differences among industries. The sectors that show greater Economic Margin are the "Primary sector", and the "Energy, water and waste management" sector. Bucking the trend, the ROE is greater in the

"Equipment" and "Construction" sectors. As for the Equity Ratio, the "Chemicals" and the "Food, beverages and tobacco" sectorshave the top values, whereas the lowest clearly belong to "Construction".

All in all, the variability of indicators is more influenced by size than by country, particularly due to small firms; the profitability ratios ROA and ROE are the most relevant to assess relative performance, discriminating countries and sizes; finally, the liquidity ratio Working capital/Turnover is the best at discriminating activity sectors.

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Appendix

Table 2 – Median for each indicator per country and firm size (in percentage)

		Economic margin	Return on assets	Return on equity	Working capital ratio	Interest burden	Equity ratio
Austria	Small	10.44	7.17	19.80	12.78	12.09	19.70
	Medium	6.90	5.32	15.16	13.24	9.13	25.47
	Large	8.76	5.83	16.13	12.15	8.51	30.72
	All sizes	***8.67***	***5.83***	***17.09***	***12.58***	***10.73***	***22.71***
Belgium	Small	10.91	3.82	6.99	9.12	10.99	35.59
	Medium	7.74	5.53	11.96	12.21	11.85	34.30
	Large	6.35	4.56	12.30	7.63	17.50	31.99
	All sizes	***8.83***	***4.53***	***9.18***	***9.79***	***12.38***	***34.73***
Germany	Small	6.18	6.74	17.24	10.90	11.43	26.24
	Medium	6.74	7.78	19.20	11.84	8.65	28.72
	Large	7.22	6.95	18.70	9.85	6.81	30.35
	All sizes	***6.51***	***7.09***	***18.66***	***10.90***	***9.03***	***27.99***
Spain	Small	6.55	3.75	8.67	18.27	8.99	27.86
	Medium	8.30	5.39	10.67	20.23	10.93	39.08
	Large	8.77	5.29	14.09	14.05	11.84	33.27
	All sizes	***7.68***	***4.43***	***9.79***	***18.10***	***10.67***	***32.24***
France	Small	7.33	6.14	15.18	15.05	5.19	32.60
	Medium	7.57	5.47	12.98	13.50	5.74	31.59
	Large	7.09	4.54	12.55	10.24	6.87	27.12
	All sizes	***7.37***	***5.56***	***13.93***	***13.42***	***5.78***	***31.65***
Italy	Small	7.64	4.22	3.41	25.26	16.90	18.95
	Medium	7.59	4.50	5.23	23.41	12.28	21.31
	Large	7.89	4.51	6.92	18.29	12.28	23.29
	All sizes	***7.73***	***4.43***	***5.10***	***22.26***	***13.66***	***20.14***
Portugal	Small	8.00	1.50	5.22	16.75	8.59	22.63
	Medium	8.00	4.46	10.43	17.96	16.46	29.38
	Large	8.60	5.20	13.41	8.02	16.89	32.83
	All sizes	***8.09***	***2.91***	***7.84***	***15.53***	***11.88***	***25.80***
All	***Small***	7.92	4.23	8.43	14.76	10.30	26.03
	Medium	7.57	5.31	11.75	15.41	10.71	29.37
	Large	7.73	4.97	12.31	11.82	9.93	29.25
	All sizes	***7.74***	***4.79***	***10.80***	***13.91***	***10.25***	***27.48***

Table 3– Mann-Whitney U test for firm size comparison between countries

	Economic margin	Return on assets	Return on equity	Working capital ratio	Interest burden	Equity ratio
Small size	AT-BE			AT-BE	AT-BE	
		AT-DE		AT-DE	AT-DE	
		AT-FR				
				AT-FR		
						AT-IT
				BE-DE	BE-DE	
		BE-ES				
						BE-FR
		BE-IT				
	DE-ES					DE-ES
		DE-FR	DE-FR			
	ES-FR					
				ES-IT		
				ES-PT	ES-PT	
	FR-IT					
	FR-PT			FR-PT		
	IT-PT					
Medium size	AT-BE	AT-BE		AT-BE		
	AT-DE		AT-DE	AT-DE	AT-DE	AT-DE
	AT-ES	AT-ES			AT-ES	
	AT-FR	AT-FR	AT-FR	AT-FR		
	AT-IT					
	AT-PT	AT-PT				
				BE-DE		
	BE-ES	BE-ES	BE-ES		BE-ES	
	BE-FR	BE-FR		BE-FR		BE-FR
	BE-IT				BE-IT	
	BE-PT		BE-PT			
	DE-FR			DE-FR		DE-FR
						DE-PT
	ES-FR	ES-FR				
	ES-IT			ES-IT	ES-IT	
	ES-PT	ES-PT	ES-PT	ES-PT		
	FR-IT					
	FR-PT	FR-PT		FR-PT		FR-PT
	IT-PT	IT-PT				
Large size	AT-BE	AT-BE				AT-BE
	AT-DE	AT-DE	AT-DE	AT-DE	AT-DE	AT-DE
	AT-ES	AT-ES	AT-ES	AT-ES	AT-ES	AT-ES
	AT-FR		AT-FR	AT-FR	AT-FR	AT-FR
	AT-IT		AT-PT	AT-PT		
	AT-PT	AT-PT				AT-PT
	BE-DE			BE-DE		BE-DE
	BE-ES	BE-ES	BE-ES			BE-ES
	BE-FR	BE-FR	BE-FR	BE-FR		BE-FR
	BE-IT	BE-IT				
	BE-PT	BE-PT	BE-PT	BE-PT	BE-PT	BE-PT
	DE-ES					DE-ES
	DE-FR			DE-FR	DE-FR	DE-FR
	DE-IT			DE-PT		
	DE-PT		DE-PT			DE-PT
	ES-FR	ES-FR	ES-FR	ES-FR		ES-FR
	ES-IT			ES-IT	ES-IT	
	ES-PT	ES-PT	ES-PT	ES-PT		ES-PT
	FR-IT	FR-IT				
	FR-PT	FR-PT	FR-PT	FR-PT		FR-PT
	IT-PT	IT-PT				

Note: AT-Austria. BE-Belgium. DE-Germany. ES-Spain. FR-France. IT-Italy and PT-Portugal; reported matches are those significant at a 5% level.

Table 4.1 - Country grouping implied by Mann-Whitney U tests

	Economic margin	**Return on assets**	**Return on equity**	**Working capital ratio**	**Interest burden**	**Equity ratio**
Small size	France Italy Portugal	Austria Germany France		Austria Belgium Germany	Austria Belgium Germany	
Medium size	Germany France Austria * France Austria Belgium Spain Italy Portugal	Belgium Austria Spain France * Austria Spain France Portugal	Belgium Spain Portugal	Austria Belgium Germany France	Belgium Spain Italy	Germany France Portugal
Large size	Austria Belgium Germany Spain France Italy Portugal	Austria Spain Belgium Portugal * Belgium Portugal France Italy	Germany Austria Portugal * Austria Portugal Spain France * Portugal Spain France Belgium	Austria Spain France Portugal * France Portugal Belgium Germany	Austria Germany France	Austria Belgium Germany Spain France Portugal

Table 4.2 – Mann-Whitney U test for firm size comparison within each country

	Economic margin	Return on assets	Return on equity	Working capital ratio	Interest burden	Equity ratio
Small-Medium size			Austria	Austria		
					Belgium	Belgium
	Germany	Germany	Germany	Germany		Germany
			Spain	Spain	Spain	
	France		France	France	France	France
	Italy	Italy		Italy		Italy
	Portugal			Portugal		
Small-Large size	Austria	Austria		Austria		
				Belgium		
	Germany	Germany	Germany	Germany		Germany
	France			France		
	Italy	Italy				
	Portugal					
Medium-Large size	Austria	Austria	Austria	Austria	Austria	
	Belgium		Belgium			Belgium
	Germany	Germany	Germany	Germany	Germany	Germany
	Spain	Spain			Spain	
	France		France	France	France	France
	Italy	Italy			Italy	Italy
	Portugal	Portugal	Portugal		Portugal	Portugal

Note: P-values for Mann-Whitney U tests are available upon request. The p-values provide a good approximation since we are dealing with large samples, around 60 observations (well above the threshold of 10 pointed out in SPSS). The results reported are those significant at a 5% level.

Table 4.3 – Kruskal-Wallis H test results

	Economic margin	**Return on assets**	**Return on equity**	**Working capital**	**Interest burden**	**Equity ratio**
	Are all sizes equal within each country?					
Austria			Yes	Yes		
Belgium						Yes
Germany	Yes	Yes	Yes	Yes		Yes
Spain	Yes					
France	Yes		Yes	Yes	Yes	Yes
Italy	Yes	Yes				
Portugal	Yes					
	Are firms alike across countries?					
Small						
Medium	Yes					
Large	Yes					

Note: only positive results at 5 per cent significance level are reported.

Table 5– Sector breakdown

	BACH-ESD divisions
Primary sector	1-3. 5-9
Food, beverages and tobacco	10-12
Textiles and leather	13-15
Wood, pulp. paper and printing	16-18
Chemicals	19-23
Metals	24-25
Equipment	26-28
Automobile industry	29-30
Other industry	31-33
Energy, water and waste management	35. 36-39
Construction	41-43
Wholesale and retail trade and accommodation	45-47. 55-56
Transportation and storage	49-53
Information and communication	58-63
Financial and insurance activities	64-66
Other services	68-99

Table 6 – Median for sector and firm size comparison within each country
Economic margin (EMg). Return on equity (ROE). Equity ratio (ER) (in percentage)

		AT	BE	DE	ES	FR	IT	PT	**Sector**
Primary sector	EMg	16.58	17.08	--	10.19	9.86	11.58	13.69	**13.28**
	ROE	14.41	6.10	--	7.75	10.55	0.84	4.40	**7.75**
	ER	19.99	31.75	--	36.69	39.76	26.89	26.91	**33.45**
Food, beverages and tobacco	EMg	9.71	10.22	5.98	9.34	7.16	6.89	8.90	**7.85**
	ROE	10.33	8.50	11.19	5.77	8.04	2.66	3.78	**7.13**
	ER	28.21	35.41	34.36	35.69	37.44	22.05	33.18	**34.26**
Textiles and leather	EMg	6.13	6.69	5.73	4.77	6.34	6.34	7.01	**6.27**
	ROE	12.07	5.95	10.74	5.19	8.30	3.67	5.97	**7.48**
	ER	24.65	34.81	37.63	35.70	44.50	21.83	26.53	**33.71**
Wood, pulp, paper and printing	EMg	8.37	8.75	7.14	9.10	5.91	7.49	10.79	**7.49**
	ROE	15.51	6.24	17.97	7.92	8.78	2.45	4.99	**7.86**
	ER	29.00	37.16	31.43	30.21	35.98	25.11	31.02	**32.64**
Chemicals	EMg	8.95	9.73	8.64	9.07	7.41	8.25	8.54	**8.61**
	ROE	15.25	10.45	18.88	9.58	11.91	4.15	5.50	**11.36**
	ER	32.03	38.11	31.94	41.87	38.87	25.67	35.88	**36.92**
Metals	EMg	9.84	8.37	7.31	7.79	7.59	7.76	8.34	**7.69**
	ROE	19.27	13.04	20.80	9.72	11.77	6.02	7.49	**11.77**
	ER	28.88	37.26	28.27	31.75	36.77	20.75	35.55	**31.37**
Equipment	EMg	8.71	8.76	6.72	8.43	8.53	8.31	7.66	**8.37**
	ROE	22.49	14.26	20.48	10.43	14.07	7.31	10.64	**14.03**
	ER	30.81	35.90	30.35	32.91	35.43	23.70	33.95	**32.86**
Automobile industry	EMg	10.39	6.98	7.01	6.14	6.08	7.56	6.84	**6.98**
	ROE	24.82	8.39	19.20	7.20	12.05	4.91	7.40	**8.92**
	ER	34.67	27.30	29.54	34.33	29.41	23.11	33.51	**28.71**
Other industry	EMg	7.02	8.07	6.38	6.15	6.34	7.12	8.24	**7.05**
	ROE	16.91	7.42	17.01	7.61	11.96	3.82	8.21	**10.98**
	ER	22.50	35.17	28.63	29.65	37.95	23.36	24.50	**27.91**
Energy, water &waste manag.	EMg	13.78	14.70	15.68	14.23	10.99	11.36	21.77	**13.78**
	ROE	10.81	5.56	11.08	8.38	21.25	4.88	8.62	**9.19**
	ER	25.41	36.71	35.91	44.43	25.79	16.86	24.80	**27.81**
Construction	EMg	5.34	5.83	4.51	6.99	6.48	6.42	7.51	**6.33**
	ROE	20.46	10.92	17.24	16.71	26.32	6.27	9.50	**14.01**
	ERt	19.13	28.05	20.06	20.47	18.49	14.49	23.37	**19.62**
Wholesale & retail trade &accom.	EMg	4.22	4.71	3.22	4.36	4.18	4.12	4.12	**4.12**
	ROE	15.44	10.38	17.56	9.80	14.29	6.78	5.80	**11.21**
	ERt	18.62	29.40	22.72	30.59	26.31	14.56	23.42	**23.65**
Transportation and storage	EMg	5.56	7.25	6.12	8.24	4.74	5.01	8.57	**6.72**
	ROE	16.27	8.41	16.20	8.25	13.93	5.74	10.25	**10.61**
	ERt	17.91	28.83	19.60	37.43	26.75	17.65	25.11	**22.45**
Information and communication	EMg	10.98	10.95	7.04	8.71	9.95	9.81	8.72	**9.30**
	ROE	24.69	11.65	21.07	12.39	17.68	6.42	8.30	**12.81**
	ERt	19.80	34.99	30.62	29.56	29.94	21.94	22.46	**26.76**
Other services	EMg	13.46	10.45	6.51	7.17	7.36	7.82	7.79	**7.93**
	ROE	31.62	10.19	19.87	13.18	17.14	5.81	8.03	**12.25**
	ERt	21.98	33.65	23.27	28.26	28.31	14.77	22.66	**23.19**

Table 7– Normalized range of variation ((maximum-minimum)/ median)

	Economic margin	**Return on assets**	**Return on equity**	**Working capital ratio**	**Interest burden**	**Equity ratio**
Countries	0.300	0.873	1.256	0.896	0.769	0.531
Sizes	0.610	1.311	1.518	1.267	1.201	0.733
Small	*0.597*	*1.341*	*1.944*	*1.093*	*1.137*	*0.639*
Medium	*0.206*	*0.625*	*1.189*	*0.751*	*1.001*	*0.605*
Large	*0.313*	*0.491*	*0.957*	*0.902*	*1.077*	*0.341*
Sectors	1.248	0.388	0.639	1.675	0.446	0.630