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Discussion Papers in
Accounting and Finance

Country and Size Effects in Financial Ratios: A European Perspective

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Number AF01-3

October 2001 **ISSN 1356-3548**

COUNTRY **A**ND **S**IZE **E**FFECTS **I**N **F**INANCIAL **R**ATIOS**: A E**UROPEAN **P**ERSPECTIVE

This version: September 2001

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The work reported in this paper was supported by grant 2FD97-2091 of the European Regional Development Fund (ERDF) under the title "Financial analysis of diversification and similarity of productive structures in the European Union", administered by the University of Zaragoza, Spain.

Cecilio Mar Molinero was a Professor on Sabbatical leave at the University of Zaragoza with a grant from the programme "Ayudas para estancias de profesores, investigadores, doctores y tecnologos en España" funded by the Secretaria de Estado de Educacion y Universidades and by the European Social Fund.

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Country And Size Effects In Financial Ratios: A European Perspective

ABSTRACT

Harmonised aggregate financial statements are published by the European Commission in the BACH database. This information is organised by country, size of firm, and year. Financial ratios obtained from this database are analysed using multivariate statistical techniques in order to explore country and size effects. The data relates to three size groups, eleven countries, fourteen years, and fifteen financial ratios. It is found that financial ratios reflect the size of the firm, but that the way in which this is reflected varies between the different countries. It is also found that there are no significant size related differences in financial profitability, but that such differences appear when countries are compared. Important regularities are found over time. Some time effects are also found in the way countries react to the business cycle.

Keywords: BACH database, firm size, Central Balance Sheet, three-way scaling, INDSCAL, financial statement analysis, European business evolution.

Country And Size Effects In Financial Ratios: A European Perspective

1. INTRODUCTION

Does size matter? Small firms have long been found to differ from large firms in many respects. The study of size effects and the way these are reflected in the financial structure of the firm, has a long pedigree; Hall (1987). Size effects have been found in capital markets; Rees (1995), Cooke (1992); and in bankruptcy prediction; Ohlson (1980), Peel, Peel and Pope (1986). Rivaud-Danset et al (2001) compared the financial structure of small and large firms. Chung (1993) studied the debt structure of small and large firms. The relationship between size and export behaviour has been studied by Calof (1994) and Pierre-Andre (1997).

A way of acknowledging the importance of size, and to control for it, is to work with ratios. This is done in the present paper. Ratio analysis relies on the principle of proportionality. There has been much debate about proportionality in the literature; McLeay and Fieldsend (1987), Fieldsend et al (1987). If proportionality applies, no size effect should be found when working with ratios. However, it will be shown that size is important in the financial structure of European firms, and that its importance has not varied over time.

This paper studies size effects in European firms, as reflected in the BACH database. Other studies of financial structure of European firms, which also use this database are Rivaud-Danset et al (2001), Serrano et al (1999 and 2001).

The Directorate General for Economic and Financial Affairs of the European Commission collects and harmonises annual company accounts statistics for European countries. This is published in the BACH (Bank for the Accounts of Companies Harmonised) database. Data for BACH is provided by the institutions that form part of the European Committee of Central Balance Sheet Data Offices (ECCB); European Commission (2000). A list of these institutions can be seen in Table 1. The BACH database is a very rich data source. It contains information by year, country, industrial sector, and size. From the original data, 15 financial ratios were computed. Table 2 shows the list of ratios and their definition according to BACH conventions. These are the same ratios used by the European Commission (1997 and 1998), and the same ratios on which previous studies were based. These are ratios of means and not means of ratios, since firm level data is not available; McLeay (1986).

Table 1 about here

Table 2 about here

Data was available for 14 years, 11 countries, 3 size groups, 15 financial ratios, and 19 industrial sectors. The sector that provided the highest number of observations is manufacturing, which accounted for 67% of the total. This study, in order to control for homogeneity, is based on manufacturing data only. In total, and taking into account that there are missing observations, there were 6428 data items.

Size can be measured in a variety of ways; e.g., number of employees, turnover, total asset value. The European Commission recommendation 96/280/CE gives priority to number of employees in the definition of size. However, there is general agreement that, for the purposes of economic research, turnover captures best the effect of size; Ozkan (1996), Titman and Wessels (1988), Rajan and Zingales (1995). BACH uses turnover as an indication of size. Three size groups are contemplated: small enterprises, defined as having a turnover smaller than 7 million EUR; large enterprises, with a turnover of 40 million EUR or more; and medium sized enterprises, which contains the in-between group. A further group, containing all firms, a weighted average of the previous data set, is also available in BACH.

The research questions are as follows. Taking all the data into account, in what sense is the structure of financial ratios different between companies that belong to the different size groups? Which financial ratios best reflect the differences? In which countries are the differences more accentuated? Questions can also be asked about the relationship between size and country of origin. Is it possible to find country effects in the financial ratio structure of firms of a given size? Is the financial structure of small Italian firms closer to the financial structure of large Italian firms, than to the financial structure of small Spanish firms? Finally, if there are size and country effects, how do these evolve over time?

To address the above questions, a series of analyses were performed. First, differences between ratios for the different size groups are explored by means of univariate ANOVA. This is done in section 2. Second, a three-group Linear Discriminant Analysis (LDA), in section 3, highlights the classification ability of the ratios. The main body of the paper is formed by a three-way scaling analysis of the data using the INDSCAL model of Carroll and Chang (1970). Section 4 discusses this model and its relevance to the present situation. Hierarchical cluster analysis of the original data attempts to further explore similarities and differences between size and country. The paper is completed with a conclusion section.

2. INITIAL DATA ANALYSIS OF THE FINANCIAL RATIOS

The first step in the analysis was to explore up to what point there are differences between financial ratios for firms in the different size groups. In order to do this, the mean and standard deviation of each ratio was calculated for each size group. The results for the complete data set are shown in Table 3. This exercise was repeated for each country and each year, although the results are not reported here. It was clear that there are differences. The largest differences appear to be related to ratios 12 (debt structure), 6 (relative share of staff costs), and 7 (staff costs relative to value added). Simple visual examination of Table 3 suggests that ratios 3 (return on equity), 8 (relative share of financial charges), and 14 (debt structure) have lower discriminatory power. Are the observed differences significant or just the result of random variation? This question was addressed by means of univariate ANOVA analysis.

Table 3 about here

The discriminatory power of the ratios can be assessed by the value of the F statistic. Results for the complete data set and for individual countries are summarised in Table 4.

For the complete data set, the last column in Table 4, and taking financial ratios one at a time, an F test on Wilk´s lambda finds that, with the exception of ratio 3 (return on equity), all ratios have discriminatory power. It can be seen that the ratios without discrimination power vary from country to country, suggesting that there are country effects in the structure of different sized firms in the different countries. Ratio 3, when acting on its own, does not have discriminatory power in four out of the eleven countries. This issue will be further explored below.

Table 4 about here

3. THREE-GROUP LINEAR DISCRIMINANT ANALYSIS

The previous section has demonstrated that most ratios have ability to discriminate between the different size populations, and that this is true of all the countries. Here we use linear functions made up by linear combinations of financial ratios as discrimination tools. Since the objective of the exercise is to discriminate between three populations, two LDAs are needed. LDA has many limitations when applied to financial data; Eisenbeis (1977). Despite this, it has been widely used in financial and accounting research; Altman et al (1981).

Three-group discriminant analyses were performed for every country and for the complete data set. Model selection was based on a stepwise procedure based on Wilk´s lambda, as implemented in the computer package SPSS. Model selection involves an element of data reduction. If two ratios are highly correlated, only one of them will form part of the final discrimination function. Thus, it is possible for two discriminant functions to appear to be different when in reality they use interchangeable ratios.

The results are seen in table 5. This table shows, for each country and for the total data set, the variables that enter in the discriminant functions. These variables are ordered by classification importance (by their impact on Wilk´s lambda). Therefore, when a long list of variables is given, the variables that come towards the end of the list have little impact on the classification function. It is usual to use discriminant functions with few variables, but in this case two discriminant functions are involved in each data set, because three groups are being discriminated, and the same variable may have different impact in each function. It can be seen in Table 5 that the variables that appear to have a higher discriminant power are ratios 12, 6, and 7, in line with the results of the univariate exploratory analysis. Ratio 3 appears to have very little discriminatory power with respect to size. This result is also coherent with the findings of the univariate analysis. Discriminant analysis shows that it is possible to classify firms into groups according to financial ratios, and indirectly indicates that the proportionality assumption in ratio analysis does not hold, but it does not explain the rationale of the classification; i.e., in what sense are the ratios of small firms different from the ratios of large firms? This is an issue whose answer will be sought with the help of scaling and clustering models.

Table 5 about here

The classificatory power of the various discriminant functions is also shown in Table 5. The last four columns in this table contain the percentage of firms that have been correctly classified by the discriminant functions. Of these, the first three columns give the percentage of correctly classified cases by size, while the last column shows the overall classification accuracy. As far as individual countries are concerned, the overall percentages vary between 76.6% for Spain and 97.5% for Germany. Clearly, the highest the classification accuracy, the more different are the financial structures of the differently sized firms.

The last row in Table 5 deserves special attention. The group named "Total" is made up of all the firms without taking into account country of origin. Classification accuracy is much lower, both overall and for the different size groups. This suggests that information of country of origin is of great importance, and that there is a country effect. This may result in apparently different discrimination functions being used for different country data. In other words, there may be differences between small and large firms in France, and there may be differences between small and large firms in Netherlands, but the differences between large and small firms, in terms of financial structure, are not the same in both countries. This will also be explored below.

4. A GLOBAL IMAGE AND ITS LOCAL FEATURES

This section attempts to visualise the main characteristics of the data set in order to provide a global image of its main features. In order to clarify the exposition, it will be divided into several subsections. It will start with a summary description of the model. The next subsection will concentrate on time invariant characteristics of the data. This will be followed by a short discussion of change over time; specific country effects will this way become apparent. Cluster analysis, and a discussion of its results, will form the last subsection.

4.1. Three-way scaling models.

Scaling models are members of the class of multivariate statistical methods. They have the peculiarity of attempting to visualise the main characteristics in the data, so that any relationship that may exist between the different data items is revealed in a statistical map. This way of proceeding has the advantage of making the results of the analysis explicit to the non-specialist, although understanding the mathematical basis of the methods requires strong technical knowledge. Scaling models have long been used in finance, accounting and management; Green and Maheshwary (1969), Moriarity and Barron (1976), Belkaoui and Cousineau (1977)**,** Rockness and Nikolai (1977), Frank (1979), Libby (1979), Belkaoui (1980), Brown (1981), Emery et al (1982), Bailey et al (1983), Mar-Molinero and Ezzamel (1991), Mar-Molinero et al (1996), Mar-Molinero, and Serrano-Cinca (2001), and Serrano-Cinca et al. (1999 and 2001).

Scaling models start from a measure of distance between two data items of interest. This is known as a measure of dissimilarity. If there is little difference between two items of data, the dissimilarity measure will be small; if the two items of data are very different, the dissimilarity measure will be large. Next, statistical maps, or configurations, are built in such a way that each data item is represented in the configuration by a point. If the dissimilarity between two data items is small, these two points are placed near each other in the space; if the measure of dissimilarity is large, these points are placed far away in the space. There are statistical tests that can be used to assess the quality of the representation, and special techniques are available to add meaning to the results.

The data set that is being analysed is four way: country, size, year, financial ratios. We want to explore how size and country effects are reflected in yearly accounts. The fifteen financial ratios will be treated as variables. An observation will be the value of such financial ratios for firms of a given size, in a specific country, during a given year.

There are various scaling models that can represent three way data. Examples are Tucker´s (1966) extension of Factor Analysis; the PARAFAC model of Harshman (1970); and Ramsay's (1982) MULTISCALE. Three way scaling models have been reviewed by Kiers (1998). The approach chosen in this particular piece of research, is the Individual Differences model of Carroll and Chang (1970), or INDSCAL. INDSCAL produces two kinds of output, a common map, that summarises what remains invariant over the various data sets that form the input to the model, and a series of weights, which show the way in which the various data sets differ from each other.

The mathematical expression of the INDSCAL model is:

$$\partial_{ij}^{k} = \sqrt{\sum_{d}\left(x_{di} - x_{dj}\right)^{2} w_{d}^{k}} + \varepsilon_{ij}^{k}$$

where,

∂_{ij}^{k}, is the dissimilarity measure between cases i and j for year k.

x_{di} is the co-ordinate in dimension d of case i in the common map,

x_{dj} is the co-ordinate in dimension d of case j in the common map,

w_d^k is the weight associated with dimension d during year k,

ε_{ij}^k is a residual term.

The estimation algorithm is described in detail in Chang and Carroll (1969). An improved algorithm was developed by Pruzansky (1975).

Before proceeding any further, it is important to realise that each financial ratio has its own specific units of measurement. This would make the results data dependent. To avoid it, ratios were standardised to zero mean and unit variance. The measure of dissimilarity is the euclidean distance between standardised ratios.

Similarities were obtained between combinations of country and size. For example, a measure of dissimilarity was calculated between small French firms and large German firms. There was a similarity matrix for each year, making a total of 14 similarity matrices. All countries and sizes were involved in each matrix, as was the group 0, or summary for the country. There are eleven countries, and four group sizes in each country, which results in dissimilarity matrices with 44 rows and 44 columns. As an example, a section of the matrix of dissimilarities for 1998, is given in Table 6. A cell in the dissimilarity matrix reflects how different the financial structure of the companies in the country and group size at the beginning of the row is from the financial structure of the companies in the country and group at the beginning of the column.

Table 6 about here

In some cases data was not available. Some countries were slow to join the BACH database, and others did not provide data for a particular ratio. For ratios 8 and 9, Austria did not provide data for small firms; these were estimated to be equal to the ratios of the medium-sized firms. This procedure introduces an element of error, but scaling methods are robust to errors in the data, and it was preferred to work with estimated data in a few observations rather than loose observations.

The model generated two sets of information: a common map that contains what remained invariant during the period under study, and a set of weights that contain information about evolution over time. These two aspects will be discussed in sequence next.

4.2. The common map.

The common map, which summarises what has remained invariant during the fourteen years under consideration, contains 44 points, one for each combination of size and country. These are points located in the space. A series of Principal Component Analyses, and the study of the change in the value of stress, as suggested by Kruskal and Wish (1978) suggested that a representation in five or more dimensions was appropriate. Six dimensions is the maximum allowed by the software used, SPSS. The common map was thus built in a six dimensional space.

The results of the estimation were excellent. The overall measure of fit, R^2, was 0.91 indicating that the model captures 91% of the variation in the data. As far as matrices for individual years are concerned, R^2, varied in the range 0.80 to 0.97.

Unlike other scaling models, the configuration reported by INDSCAL is not invariant to rotation. The axes of coordinates have to be taken as they appear in the output, and no rotated configurations are possible. This appears to be a disadvantage with respect to other more traditional techniques, such as factor analysis, but it has long been observed that the axes of coordinates returned by the algorithm can be interpreted, and that the interpretation often has a meaning within the context of the problem under study. This does not exclude, however, that there may be no meaning associated with directions other than the axes. It is, for example, possible that diagonal directions may have meaning; Krzanowski (1988).

A map in a six dimensional space is impossible to represent other than mathematically. A mathematical map is a set of points with the coordinates of such points in the space. In this case, each point is associated with six coordinates. Not all coordinates are relevant to the problem under study, and much is to be gained by visual inspection of the various possible representations on pairs of two dimensions. In this case it was found that the main characteristics of the problem could be observed in the representation in Dimension 1 versus Dimension 3. This projection can be seen in Figure 1. The points associated with size group 0, the summary for each county, have not been printed in Figure 1 in order not to clutter the visual impact with information which is neither relevant nor useful in the forthcoming analysis.

Figure 1 about here

If, in Figure 1, we join, for each country, the three points associated with it, starting from small firms and ending with large firms, we will see that, with the exception of Germany, the lines are remarkably straight, and move from the bottom right hand side towards the top left hand side. The lines associated with the different countries tend not to cross. Starting from the top right hand side, and moving towards the bottom left hand side, countries appear in the following order: Austria, Finland, the Netherlands, Sweden, France, Italy, Spain, Belgium, Portugal, Denmark. The line representing Germany moves horizontally from right to left. The points associated with small firms are always at the bottom of the line, and the points associated with large firms are always at the top of the line. Thus, two effects appear very clearly in the representation: a country effect and a size effect. The country effect appears in the direction SW to NE, while the size effect appears in the direction SE to NW. The inclination of the lines associated with the different countries changes from country to country. There are two extreme cases: Germany, which produces an horizontal line, and Sweden whose associated line is almost vertical. The length of the line reflects the extent of the differences between small and large firms: the longer the line, the larger the differences. Larges lines, and larges differences between small and large firms, appear in Germany, Portugal and the Netherlands. The shortest lines, and the smallest differences are apparent in Spain, Denmark, and Sweden.

Meaning can be attached to the directions in the configuration by means of the technique known as Property Fitting (Pro-Fit). Pro-Fit is a regression-based approach that highlights the way in which a particular characteristic of the data varies through the map; Schiffman et al. (1981). The idea is that if the level of the characteristic, say profitability, depends on the position on the map, a linear relationship can be established between the level of the characteristic and the position on the map. This produces lines very much like North-South directions in geographical maps. Being a regression based approach, the usual measures of goodness of fit are available to assess the quality of the representation.

Before applying the Pro-Fit algorithm, there is an issue to be addressed. The common map summarises the behaviour of financial ratios over a fourteen year period. Thus, for every financial ratio we have fourteen sets of data, one for each year. Rather than represent fourteen vectors on the common map, something that would make interpretation quite cumbersome, we have worked with average values over the fourteen year period. All financial ratios were taken, one by one, as properties. Working with average values for the ratios should introduce an errors-in-variables effect and bias down the correlations. Despite this, results were excellent. The lowest value of R^2 obtained was 0.77. The results, for the representation in dimensions 1 and 3 can be seen in Figure 2. The statistical results for the Pro-Fit estimation are shown in Table 7.

Figure 2 about here

Table 7 about here

Figure 2 is the compass that helps to interpret Figure 1. Remembering that the size effect is associated with the direction NW-SE, one should look for vectors in Figure 2 that are oriented in this direction. Ratios 12 (overall debt), 6 (relative share of staff costs), and 7 (staff costs relative to value added), the ones which were found by univariate ANOVA analysis to be most associated with size, point precisely in this direction. Ratios 6 and 7 measure labour productivity, indicating that large firms are more labour productive than small firms, something that is consistent with large firms being more capital intensive than small firms; European Commission (1998). Thus, it could be argued that small firms are more in debt than large firms; that small firms have higher staff costs both in terms of turnover and of value added. Also in this direction but with opposite orientation, are ratios 1 (gross operating profit plus financial charges to turnover), 2 (net profit to net turnover), and 10 (financial results to net turnover). Since ratios 1, 2, and 10 relate to margins, this suggests that, in the European manufacturing sector, large firms operate with larger margins than small firms. It is the moment to remember that ratio 3 (financial profitability) was not strongly associated with size. In Figure 2, the vector representing ratio 3 is perpendicular, in most countries, to the NW-SE directions related to size, indicating that size and financial profitability are largely independent. But if both small and large firms are achieving similar levels of financial profitability, and they have different margins on sales and different cost structures, particularly staff costs, we are finding differences in corporate strategy. Differences in the financial structure of small and large European companies were also reported by Rivaud-Danset et al (2001), this subject was also studied by the European Commission (1997 and 1998). Firms of different sizes reach the same objective travelling along different paths.

The direction SW-NE, on which the country effect is found, is related, on the positive side, to ratio 3 (financial profitability); and, on the negative side, to ratios 8 (relative share of interest charges), and 9 (apparent rate of interest on financial debt). Clearly, the higher the interest rates are, the higher is the value of ratios 8 and 9, and the lower the profitability. This suggests that the highest financial profitability is found in Austria, Finland and the Netherlands, and the lowest financial profitability is found in Denmark, Portugal and Belgium. The reverse is true of relative share of interest charges and apparent rate of interest on financial debt. In this last case, the lowest values are found in Austria, Finland and the Netherlands, while the highest values are found in Denmark, Portugal and Belgium.

As far as the axes are concerned, the ratios associated with Dimension 1 are, on the positive side, 13 (financial indebtedness) and 5 (valued added to net turnover); and, on the negative side, 4 (relative share of purchases of goods and services) and 11 (own funds ratio). Since large firms are situated towards the W of the map, and small firms are situated towards the E of the map, the map supports the view that large firms purchase more goods and services in relation to turnover, have higher own funds ratios, have lower financial indebtedness, have lower value added to net turnover than small firms. Small European manufacturing firms generate more value added, with higher staff costs, achieving similar levels of profitability. This further confirms the existence of strategic structural differences between large and small firms. It can be concluded that small European manufacturing firms have a higher ability to create economic wealth, which is generated by their main activity.

The interpretation of Dimension 1 is particularly relevant to the German case, as the line that is associated with this country is horizontal. This suggests that the differences between small and large firms that have just been identified are particularly accentuated in the German case.

The ratios associated with Dimension 3 are 14 (long term debt to total debt), and 15 (provisions for liabilities to balance sheet total). The higher up in dimension 3, the higher the value of both ratios. Since large firms tend to be situated towards the top of Dimension 3, this is consistent with large firms having more long term debt and more provisions for liabilities than small firms. This is accentuated in the case of Sweden.

In summary, three patterns have been identified: the Swedish case, the German case, and the rest of Europe. Differences between small and large firms in Swedish firms relate mainly to ratios 14 and 15. Differences between large and small German firms relate mainly to ratios 4, 5, 11, and 13. Differences between large and small firms in the rest of the countries relate mainly to ratios 12, 6, 7, 1, 2, and 10. It is to be noticed that this is coherent with the findings of LDA analysis, as reported in Table 5.

4.3. Evolution over time.

Up to now, the analysis has concentrated on invariance over the fourteen year period. The common map, as projected in Figure 1, is an average over the fourteen year period. But this average hides the evolution from year to year. Firms react to a dynamic environment and this may be reflected in their ratio structure. How does the business cycle affect the ratio structure of firms of different sizes in the different countries? Given a particular country, have differences between small and large firms become larger? Have they become smaller? To shed light on these questions we need to examine the weights calculated by the model.

The INDSCAL model reveals the evolution over time through a set of weights, w_d^k. These weights distort the common map by stretching it or contracting it in the direction of the axes. Stretching or contracting an axis implies giving that axis more importance or "salience". Examples of the way in which such map distortions reveal important features of the data can be seen in Kruskal and Wish (1978). Each dimension, in each particular year, has associated with it a weight that reveals the salience of that dimension in that year. The weight by itself is of no particular importance, what matters is the relationship between the weights; i.e., given a particular year, is Dimension 3 more salient than Dimension 1 or the other way round? As only dimensions 1 and 3 have been found to be of relevance to the present study, only the weights associated with these dimensions will be discussed. The relevant statistical tool to compare the weight associated with Dimension 1 with the weight associated with dimension 3 is Young's plot; Coxon (1982). Young's plot combines a measure of goodness of fit with a measure of relative importance of each dimension in each year. Young's plot can be seen in Figure 3.

Figure 3 about here

In Figure 3 we observe that during the years 1987 and 1988, Dimension 3 had more salience than Dimension 1. In the remaining years the situation was reversed, with Dimension 1 having more salience than Dimension 3; this effect was particularly accentuated during the years 1990, and 1991.

To interpret these results, we need to concentrate on individual cases. Let start with Germany. In Figure 1, the differently sized German firms were situated on a horizontal line, indicating that Dimension 1 was the discriminating feature with respect to size. This dimension was found to be related to ratios 4 and 11. Dimension 1 has its maximum salience during the years 1990 and 1991, implying that these were the years when the differences between small and large firms were most accentuated in Germany. Dimension 1 has its minimum salience during the years 1987 and 1988, something that is consistent with the differences between small and large German firms being minimised.

Sweden provides the other extreme case. Differently sized Swedish firms are situated on a vertical line, something that is consistent with Dimension 3 being the main feature that discriminates between small and large firms in this case. Dimension 3 was found to be related to ratios 14 and 15. This reverses the German case, as the differences between small and large Swedish firms are maximised when Dimension 3 takes its maximum salience, in years 1987 and 1988; and are minimised when Dimension 3 takes its minimum salience, in years 1990 and 1991.

Germany and Sweden provide two extreme cases of changes over time, because the lines in Figure 1 that are associated with these countries are either horizontal or vertical. The general pattern in the remaining countries is that the lines tend to approximate the 45º line. This is consistent with the differences between small and large firms in the remaining European countries not being noticeably affected by the passage of time.

4.4. Cluster analysis

It has been argued that in European manufacturing firms there are both size and country effects, and that these are persistent over time. It has also been argued that some of the differences are related to different management strategies. But, are there strategic groups in Europe? Are the ratios of, say, small Italian firms more similar to the ratios of large Italian firms than to the ratios of small Portuguese firms?

This issue will be addressed by means of hierarchical cluster analysis. Up to now we have been working with the projection of a six dimensional map on two dimensions, and this is necessarily a simplification that may hide important features of the data. A way of revealing such features is to complement a scaling exercise with cluster analysis, as recommended by Arabie et al (1987) and Chatfield and Collins (1980).

In the previous section, it has been observed that there is a remarkable degree of robustness in time with respect to the results observed in the common map. Taking this into account, average values for the financial ratios for the fourteen years have been calculated for each country and size group, in the same way as was done earlier on when applying Pro-Fit analysis. Combinations of country and size were taken as cases, and standardised ratios as variables. Clusters were calculated using Ward's approach as implemented in SPSS. This approach maximises within group homogeneity and between group heterogeneity, and has been found to be productive in other similar studies; Blashfield (1976), Cool and Schendel (1987).

The dendrogram that was obtained is shown in Figure 4. In it, three main clusters can be observed. The differences between the clusters are related to country, not to size. A large cluster contains Spain (all sizes), Italy (all sizes), Portugal (all sizes), Belgium (all sizes), and France (medium and large firms). A second cluster is formed by Scandinavian countries: Finland (all sizes), Denmark (medium and large firms), and Sweden (all sizes). The last cluster is contains Austria (all sizes) and Germany (all sizes). It is difficult not to think of cultural differences, the first cluster could be labelled "Latin", the second cluster could be labelled "Scandinavian", and the last cluster could be labelled "Germanic". It is to be noticed than no cultural variables have been entered in the data, and the clusters are based solely on financial ratios. There appear to be three ways of organising manufacturing companies, a Latin one, a Scandinavian one, and a Germanic one. Similar findings were obtained in a previous piece of research, in which the clusters were related to financial ratios and to the macro-economic environment; Serrano Cinca et al (2001). There were, however, exceptions to the general pattern: Netherland does not appear to sit easily in any of the groups, small French companies and small Danish companies appear together in the Germanic group.

Figure 4 about here

In Figure 1, the Germanic cluster appears on the East of the configuration, the Scandinavian cluster appears on the NW of the configuration, and the Latin cluster appears on the SW of the configuration. Taking into account the orientation of the directional vectors in Figure 2, the Germanic cluster appears to be associated with higher than average profitability, high value added, and high staff costs. The Scandinavian cluster is characterised by high values of profit to turnover. The Latin cluster has a high ratio of interest charges to net turnover, and a high apparent rate of interest on financial debt.

5. CONCLUSIONS

In this paper we have studied the financial structure of small, medium sized, and large firms in eleven European countries over a fourteen year period. The data was obtained from the BACH database, which is not at the level of industrial firm, but aggregated by sectors. The main themes of the research have been the presence of size and country effects on financial ratio structure.

Initial data analysis, based on univariate ANOVA, found significant differences related to size in most ratios, the exception being profitability. This suggests that, given a particular country, the differences between small, medium, and large firms do not relate to profitability, but to the way in which a given level of profitability is obtained.

The existence of financial ratio differences between small, medium, and large companies was confirmed by three-group linear discriminant analysis. For each country, high levels of classification accuracy were found. But the discriminant functions were found to differ between countries, suggesting country effects in financial ratio structure.

Both country and size effects became apparent when three-way scaling methods were used. Size effects were found to be associated with ratios 12 (overall debt), 6 (relative share of staff costs), 7 (staff costs relative to value added), 1 (gross operating profit plus financial charges to turnover), 2 (net profit to net turnover), and 10 (financial results to net turnover), meaning that small firms are more in debt than large firms; that small firms have higher staff costs both in terms of turnover and of value added, and that large firms operate with larger margins than small firms. In general, the differences are not in profitability, but on the way in which profitability is achieved. Thus, for a given country, there are size related strategic differences in costs and balance sheet structure.

A country effect was found, and it was fount to be related to ratios 3 (financial profitability), 8 (relative share of interest charges), and 9 (apparent rate of interest on financial debt). The highest financial profitability, and the lowest relative share of interest charges and apparent rate of interest on financial debt were found in Austria, Finland and the Netherlands, the reverse being true of Denmark, Portugal and Belgium.

Three patterns relating to country and size combinations were identified: the Swedish case, the German case, and the rest of Europe. Differences between small and large firms in Swedish firms were found to be related to ratios 14 and 15. Differences between large and small German firms were found to be related to ratios 4, 5, 11, and 13. Differences between large and small firms in the rest of the countries were found to be related to ratios 12, 6, 7, 1, 2, and 10. These differences were found to be important in relation to changes over time. Differences in financial ratio structure between small, medium and large firms remained remarkably stable over time, except in the case of German and Swedish firms.

The question of whether a small Italian firm is more similar to a large Italian or to a small Finish firm was also pursued. It was found that strategic groups exist, and these are related to country and not to size. Three clusters are clearly apparent: a Latin cluster, a Scandinavian cluster, and a Germanic cluster.

This study has a morale. Imagine that a small Italian firm wants to increase its profitability. Our findings suggest that, in general, it would be useless for such a firm to take example from a large Italian firm. It would be much more appropriate for the small Italian firm to model itself on a small Austrian firm. Monetary union in Europe should make country related profitability differences a thing of the past.

REFERENCES

EI Altman, R Avery and RA Eisenbeis (1981) Applications of classification techniques in business, banking and finance. JAI Press, Greenwich, CT.

P Arabie, JD Carroll, and WS DeSarbo (1987) Three-way scaling and clustering. Sage University Paper Series on Quantitative Applications in the Social Sciences number 07-065. Beverley Hills: Sage Pubns.

KE Bailey, JH Bylinsky and MD Shields (1983) Effects of audit report wording changes on the perceived message. Journal of Accounting Research, 21, 355-370.

A Belkaoui (1980). The interprofessional linguistic communication of accounting concepts: an experiment in sociolinguistics. Journal of Accounting Research, 18, 362-374.

A Belkaoui and A Cousineau (1977) Accounting information, non-accounting information and common stock perception, Journal of Business Finance, 50, 334-343.

RK Blashfield (1976) Mixture model tests of cluster analysis: accuracy of four agglomerative hierarchical methods. Psychological Bulletin, 83, 377-388.

PR Brown (1981) A descriptive analysis of select input bases of the Financial Accounting Standards Board. Journal of Accounting Research, 19, 232-246.

JL Calof (1994) The relationship between firm size and export behaviour revisited. Journal of International Business Studies, 25, 2, 367-388

JD Carroll and JJ Chang (1970) ‘Analysis of individual differences in multidimensional scaling via an N-way generalization of “Erkart-Young” decomposition’. Psychometrika, 35, 283-319.

JJ Chang and JD Carroll (1969) How to use INDSCAL, a computer program for canonical decomposition of N-way tables in individual differences in multidimensional scaling. Unpublished manuscript, Murray Hill, NJ; AT & T Bell Laboratories.

C Chatfield, and AJ Collins (1980). Introduction to Multivariate Analysis. Chapman and Hall, London.

TE Cooke (1992) The impact of size, stock market listing and industry type on disclosure in the annual reports of Japanese listed corporations. Accounting and Business Research, 22, 229-237.

K Cool and D Schendel (1987) Strategic group formation and performance: the case of the US pharmaceutical industry 1963-1982. Management Science, 33, 1102-1124.

PM Coxon (1982). The User's Guide to Multidimensional Scaling. Heinemann, London.

FH Chung (1993) Asset Characteristics and Corporate Debt Policy: An Empirical Test, Journal of Business Finance and Accounting, 20, 1, 83-98

RA Eisenbeis (1977) Pitfalls in the application of discriminant analysis in business, finance and economics. Journal of Finance, 32, 875-900.

DR Emery, FH Barron and WF Messier (1982) Conjoint measurement and the analysis of noisy data: a comment. Journal of Accounting Research, 20, 450-458.

European Commission (1997) 'Financial situation of European enterprises', European Economy, Supplement A, Economic Trends, No 7, July 1997.

European Commission (1998) 'Financial situation of European enterprises', European Economy, Supplement A, Economic Trends, No 11/12. Nov/Dec. 1998.

European Commission (2000) Guide for BACH data users: transition tables between national layout of national accounts and the BACH statements. European Committee of Central Balance Sheet Offices. Brussels.

S Fieldsend, N Longford and S McLeay (1987) Industry effects and proportionality assumption in ratio analysis: a variance component analysis. Journal of Business Finance and Accounting, 14, 497-517.

WG Frank (1979). An empirical analysis of international accounting principles, Journal of Accounting Research, 17, 593-605.

PE Green, and A Maheshwari (1969). Common stock perception and preference: an application of Multidimensional Scaling. Journal of Business, 42, 439-457.

BH Hall (1987) The relationship between firm size and firm growth in the US manufacturing sector. Journal of Industrial Economics, 35, 583-605.

RA Harshman (1970). 'Foundations of the PARAFAC procedure: Models and conditions for an "explanatory" multi-modal factor analysis'. UCLA Working Papers in Phonetics, 16, 1-84.

HAL Kiers (1998). 'An overview of three-way analysis and some recent developments'. In: A. Rizzi, Vichi, and H.-H. Bock (Eds.), Advances in Data Science and Classification (pp 592-602). Springer. Berlin.

WJ Krzanowski (1988). Principles of multivariate analysis. Clarendon Press. Oxford. UK.

JB Kruskal, and M Wish (1978). Multidimensional scaling. Sage University Paper series on Quantitative Applications in the Social Sciences, number 07-011. Sage Publications, Newbury Park, CA

R Libby (1979) Banker's and auditor's perceptions of the message communicated by the audit report. Journal of Accounting Research, 17, 99-122.

C Mar Molinero, P Apellániz, and C Serrano-Cinca (1996). Multivariate Analysis of Spanish Bond Ratings, Omega, 24, (4), 451-462

C Mar Molinero and M Ezzamel (1991). Multidimensional scaling applied to company failure. Omega, 19, 259-274.

C Mar Molinero, and C Serrano-Cinca (2001) Bank failure: a multidimensional scaling approach, European Journal of Finance, 7, (2), 165-183

S McLeay (1986) "The ratio of means, the means of ratios and other benchmarks: an examination of characteristics financial ratios in the French corporate sector", Finance, The Journal of the French Finance Association 7/1, 75-93.

S McLeay and S Fieldsend (1987) Sector and size effects in ratio analysis: an indirect test of ratio proportionality. Accounting and Business Research, 17, 133-140.

S Moriarity and FH Barron (1976) Modelling the materiality judgements of audit partners, Journal of Accounting Research, 14, 320-341.

J Ohlson (1980) Financial Ratios and the Probabilistic Prediction of Bankruptcy, Journal of Accounting Research, 18 (1), 109-131.

A Ozkan (1996) Corporate bankruptcies, liquidation costs and the role of banks. The Manchester School, 64, 104-119.

MJ Peel, DA Peel and PF Pope (1986) Predicting Corporate Failure-Some Results for the UK Corporate Sector, OMEGA International Journal of Management Science, 14 (1), pp. 5-12.

J Pierre-Andre (1997) A Typology of Strategic Behaviour Among Small and Medium Sized Exporting Business, International Small Business Journal, 15, 2, 33-50.

S Pruzansky (1975). How to use SINDSCAL, a computer program for individual differences in multidimensional scaling. Unpublished manuscript, Murray Hill, NJ; AT & T Bell Laboratories.

RG Rajan and L Zingales (1995) What do we know about capital structure? Some evidence from international data, Journal of Finance, 50, (5) 1421-1460.

JO Ramsay (1982) Some statistical approaches to multidimensional scaling data. Journal of the Royal Statistical Society, 145, 285-312.

B Rees (1995) Financial Analysis, Prentice Hall, Hertfordshire

D Rivaud-Danset, R Salais, and E Dubocage (2001) Comparison between the financial structure of SMES and that of large enterprises (LES) using the BACH database. Economic Paper 155. European Commission, Directorate-General for Economic and Financial Affairs. Brussels, Belgium.

HO Rockness and LA Nikolai (1977). An assessment of APB voting patterns, Journal of Accounting Research, 15, 154-167.

C Serrano Cinca, C Mar Molinero, and JL Gallizo (1999) A multivariate study of the EU economy via financial statements analysis. Discussion papers in Accounting and Finance. Number 99-150. School of Management. University of Southampton. UK.

C Serrano Cinca, C Mar Molinero, and JL Gallizo (2001) Change and invariance in EU aggregate financial statement data. Discussion papers in Accounting and Finance. AF01-1. School of Management. University of Southampton. UK.

JF Schiffman, ML Reynolds, and FW Young (1981) Introduction to Multidimensional Scaling: Theory, Methods and Applications. Academic Press, London.

S Titman and R Wessels (1988) The determinants of capital structure choice. Journal of Finance, 43, 1-19.

LR Tucker (1966). 'Some mathematical notes on three-mode factor analysis'. Psychometrika, 31, 279-311

Countries	Data Source
Austria	Oestereichische Nationalbank
Belgium	Banque Nationale de Belgique / Nationale Bank van België
Denmark	Statistics Denmark
Finland	Tilastokeskus / Statistics Finland
France	Banque de France
Germany	Deutsche Bundesbank
Italy	Centrale dei Bilanci S.r.l.
Netherlands	Centraal Bureau voor de Statistiek
Portugal	Banco de Portugal
Spain	Banco de España
Sweden	Statistiska Centralbyrån / Statistics Sweden
Japan	Ministry of Finance
United States	Department of Commerce

Table 1. List of institutions that contribute data to the BACH database.

Definitions of ratios used	BACH items
R1. Gross profit ratio	
Ratio of gross operating profit or loss to net turnover	U/1
R2. Net Profit Ratio	
Ratio of net profit or loss for the year to net turnover	21/1
R3. Return on equity	
Ratio of profit or loss for the year to equity capital	21/L- A
R4. Relative share of purchases of goods and services	
Ratio of consumption of goods and services to net turnover	5/1
R5. Value added ratio	
Ratio of BACH value added to net turnover	T/1
R6. Relative share of staff costs	
Ratio of staff costs to net turnover	6/1
R7. Staff costs relative to value added	
Ratio of staff costs to BACH value added	6/T
R8. Relative share of financial charges	
Ratio of interest charges to net turnover	13/1
R9. Apparent rate of interest on financial debt	
Ratio of interest charges to debt owed to credit institutions	13/F2+I
R10. Ratio of financial result	
Financial result on net turnover	W/1
R11. Own funds ratio	
Ratio of own funds less unpaid share capital to balance sheet total	L- A/FL
R12. Overall Debt ratio	
Ratio of debt with a remaining period to maturity of more than one year + debt with a remaining period to maturity of less than one year to balance sheet total	F+I/FL
R13. Ratio of financial indebtedness	
Ratio of financial indebtedness balance sheet total	F2+I2/FL
R14. Debt Structure	
Ratio of debt with a remaining period of maturity of more than one year to debt With a remaining period of maturity of more than one year + debt with a remaining Period of maturity of less than one year	I/I+F
R15. Ratio of provisions for liabilities and charges	
Provisions for liabilities and charges to balance sheet total	J/FL

Table 2. Ratios used in the study, and their definitions according to BACH conventions.

	Small firms		Medium firms		Large firms		TOTAL	
	Mean	*St. Dev.*	*Mean*	*St. Dev.*	*Mean*	*St. Dev.*	*Mean*	*St. Dev.*
$\mathbf{R_{1}}$	0.095	0.027	0.099	0.038	0.108	0.048	0.101	0.039
$\mathbf{R_{2}}$	0.019	0.072	0.022	0.036	0.031	0.048	0.024	0.054
$\mathbf{R_{3}}$	0.078	0.287	0.077	0.158	0.074	0.257	0.076	0.239
$\mathbf{R_{4}}$	0.603	0.113	0.636	0.101	0.638	0.161	0.627	0.129
$\mathbf{R_{5}}$	0.362	0.062	0.331	0.063	0.316	0.074	0.335	0.069
$\mathbf{R_{6}}$	0.268	0.059	0.232	0.063	0.208	0.063	0.235	0.066
$\mathbf{R_{7}}$	0.735	0.078	0.696	0.133	0.657	0.119	0.695	0.118
$\mathbf{R_{8}}$	0.034	0.039	0.031	0.018	0.032	0.022	0.032	0.027
$\mathbf{R_{9}}$	0.134	0.083	0.143	0.063	0.159	0.149	0.146	0.106
$\mathbf{R_{10}}$	-0.020	0.052	-0.017	0.018	-0.008	0.029	-0.015	0.036
$\mathbf{R_{11}}$	0.295	0.108	0.333	0.094	0.360	0.118	0.330	0.110
$\mathbf{R_{12}}$	0.637	0.095	0.581	0.085	0.524	0.122	0.579	0.111
$\mathbf{R_{13}}$	0.170	0.104	0.181	0.099	0.139	0.100	0.163	0.103
$\mathbf{R_{14}}$	0.290	0.114	0.275	0.103	0.295	0.127	0.287	0.115
$\mathbf{R_{15}}$	0.053	0.046	0.070	0.058	0.102	0.091	0.075	0.071

Table 3. Descriptive statistics: means and standard deviations

	Austria F(2:632)	*Belgium F(2:360)*	*Denmark F(2:525)*	*Finland F(2:129)*	*France F(2:525)*	*Germany F(2:360)*	*Italy F(2:591)*	*Netherland F(2:458)*	*Portugal F(2:301)*	*Spain F(2:558)*	*Sweden F(2:261)*	*TOTAL F(2:4730)*
R_1	0.020	14.053	3.114	16.073	59.028	7.755	6.879	0.427	27.574	0.787	9.834	46.695
	(0.980)*	(0.000)	(0.045)	(0.000)	(0.000)	(0.001)	(0.001)	(0.653)*	(0.000)	(0.456)*	(0.000)	(0.000)
R_2	4.970	10.656	25.210	3.367	6.888	19.355	18.991	11.007	15.446	2.417	8.619	22.994
	(0.007)	(0.000)	(0.000)	(0.038)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.090)*	(0.000)	(0.000)
R_3	9.503	7.519	1.129	5.410	0.917	11.205	1.560	4.011	28.985	3.800	1.290	0.094
	(0.000)	(0.001)	(0.324)*	(0.006)	(0.400)*	(0.000)	(0.211)*	(0.019)	(0.000)	(0.023)	(0.277)*	(0.910)*
R_4	17.485	6.445	33.114	36.507	65.122	23.101	8.404	76.733	3.952	15.000	11.088	37.197
	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.020)	(0.000)	(0.000)	(0.000)
R_5	57.418	1.637	54.681	31.714	50.669	20.676	10.278	76.733	9.864	9.491	14.226	196.130
	(0.000)	(0.196)*	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R_6	69.660	15.779	71.639	67.194	140.920	36.474	33.602	80.081	120.080	12.579	28.048	367.905
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R_7	21.969	36.413	19.645	46.189	360.392	35.315	44.840	13.375	92.206	2.143	15.799	182.224
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.118)*	(0.000)	(0.000)
R_8	385.716	25.141	20.325	16.948	11.740	3.072	22.767	78.041	4.850	6.696	24.915	4.009
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.048)	(0.000)	(0.000)	(0.008)	(0.001)	(0.000)	(0.018)
R_9	797.166	27.504	3.028	6.839	2.248	135.528	9.652	27.574	3.287	6.225	3.991	22.686
	(0.000)	(0.000)	(0.049)	(0.002)	(0.107)*	(0.000)	(0.000)	(0.000)	(0.039)	(0.002)	(0.020)	(0.000)
R_{10}	50.220	4.904	165.374	3.040	13.901	141.111	120.956	33.731	29.875	0.968	4.409	51.380
	(0.000)	(0.008)	(0.000)	(0.051)*	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.380)*	(0.013)	(0.000)
R_{11}	150.177	5.980	79.319	2.188	1.199	457.398	6.312	34.113	108.630	1.390	5.459	141.674
	(0.000)	(0.003)	(0.000)	(0.116)	(0.302)*	(0.000)	(0.002)	(0.000)	(0.000)	(0.250)*	(0.005)	(0.000)
R_{12}	332.647	1.992	90.652	7.714	21.947	1012.984	25.898	10.531	185.730	6.501	37.188	477.967
	(0.000)	(0.138)*	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.000)	(0.000)
R_{13}	48.575	36.140		28.491	33.934	711.928	17.283	268.429	11.271	12.610	5.258	75.085
	(0.000)	(0.000)		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.006)	(0.000)
R_{14}	7.764	22.739	28.789	7.986	22.052	57.201	25.741	26.413	0.938	16.701	4.168	13.407
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.393)*	(0.000)	(0.017)	(0.000)
R_{15}	247.665	84.054	19.742	22.776	209.987	467.898	118.129	222.435	88.780	110.061	160.961	209.729
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Table 4. Univariate ANOVA. F values for each country and p-values

* Significant at the 0.05 level.

Ratios in discriminant functions		Accuracy (%)			
		Small	*Medium*	*Large*	*TOTAL*
Austria	R9 R12 R13 R10 R8 R7 R11 R5 R4 R14 R2 R3	99.5	94.1	81.0	91.3%
Belgium	R15 R9 R14 R11 R6 R8 R4 R13	83.5	81.8	90.1	85.1%
Denmark	R10 R5 R12 R8 R14 R9 R11 R2	85.2	84.7	69.3	79.7%
Finland	R6 R8 R13 R11 R12 R4 R5	88.6	77.3	81.8	82.6%
France	R7 R15 R14 R13 R11 R12 R9 R4 R1 R8	83.0	89.2	81.3	84.5%
Germany	R 12 R4 R11 R2 R13 R7 R1 R5 R8 R9 R14	96.7	96.7	99.2	97.5%
Italy	R10 R8 R6 R15 R12 R14 R11 R13 R4 R9	81.3	88.4	89.9	86.5%
Netherlands	R13 R11 R4 R8 R15 R10 R14 R9	100	86.2	77.3	84.4%
Portugal	R12 R6 R15 R13 R14 R5 R4 R10 R8 R2	85.8	82.1	84.8	84.2%
Spain	R6 R8 R13 R10 R12 R4 R11 R5 R14 R9	76.5	76.5	77.0	76.6%
Sweden	R15 R6 R4 R14 R1	87.5	75.0	76.1	79.5%
TOTAL	R12 R6 R15 R11 R13 R8 R3 R14 R7 R1 R2	57.7	55.9	64.1	59.3%

Table 5. Three-way discriminant análisis. Ratios in order of discrimination importance and correct classification ratios for each group

		Nl0	*Nl1*	*Nl2*	*Nl3*	*Be0*	*Be1*	*BeE2*	*Be3*
	Nl0	.000	.	.	.	.	.	.	.
	Nl1	6.116	.000	.	.	.	.	.	.
	Nl2	4.251	3.760	.000	.	.	.	.	.
1998	*Nl3*	1.092	6.695	4.346	.000	.	.	.	.
	Be0	4.290	5.062	3.110	4.499	.000	.	.	.
	Be1	5.874	4.649	3.147	6.038	2.231	.000	.	.
	Be2	5.609	5.157	3.652	5.765	1.717	1.599	.000	.
	Be3	3.789	5.370	3.338	4.015	.810	2.991	2.485	.000

Table 6. Example of a segment of the distance matrix for the year 1998.

	Directional cosines						F	Adj R square
	γ_1	γ_2	γ_3	γ_4	γ_5	γ_6		
R_1	-0.23 (-3.736)*	0.30 (4.738)*	0.49 (7.995)**	-0.76 (-12.665)**	-0.20 (-3.360)	0.00 (1.028)	52.32	0.877
R_2	-0.38 (-4.422)*	0.44 (5.028)*	0.60 (7.180)**	0.14 (1.734)	-0.53 (-6.567)**	0.06 (0.828)	40.14	0.845
R_3	0.27 (2.509)	0.72 (6.556)**	0.47 (4.423)*	0.43 (4.206)*	-0.09 (-6.508)**	0.02 (0.220)	37.98	0.838
R_4	-0.40 (-5.328)*	-0.91 (-11.832)*	0.01 (0.172)	-0.12 (-1.633)	-0.04 (-0.580)	0.00 (0.014)	45.97	0.863
R_5	0.61 (10.869)**	0.69 (12.073)**	-0.27 (-4.943)*	0.00 (0.028)	-0.29 (-5.566)*	-0.01 (-0.170)	88.52	0.924
R_6	0.65 (11.416)**	0.52 (8.937)**	-0.44 (-7.867)**	0.29 (5.346)*	-0.19 (-3.630)*	-0.03 (-0.600)	93.07	0.928
R_7	0.53 (0.442)	0.13 (0.112)	-0.56 (-0.471)	0.62 (0.524)	-0.02 (-0.018)	-0.03 (-0.028)	73.75	0.910
R_8	-0.55 (-5.406)*	-0.05 (-0.442)	-0.30 (-3.013)	-0.41 (-4.229)*	-0.13 (-1.318)	0.66 (7.166)**	20.48	0.731
R_9	-0.69 (-16.505)**	0.26 (6.239)**	-0.60 (-14.704)**	0.10 (2.447)	0.29 (7.277)**	0.05 (1.215)	75.29	0.912
R_{10}	-0.46 (-4.440)*	0.14 (1.289)	0.47 (4.579)*	0.70 (7.117)**	-0.21 (-2.164)	-0.10 (-1.092)	23.74	0.760
R_{11}	-0.81 (-13.096)**	-0.01 (-0.147)	0.08 (1.350)	-0.27 (-4.602)*	-0.25 (-4.208)*	-0.45 (-8.124)**	61.24	0.894
R_{12}	0.74 (10.565)**	-0.42 (-5.958)*	-0.38 (-5.576)*	-0.17 (-2.569)	-0.32 (-4.856)*	0.07 (1.185)	38.59	0.840
R_{13}	0.62 (9.270)**	-0.18 (-2.695)	0.20 (3.080)	-0.64 (-10.176)**	0.36 (5.720)*	0.00 (0.073)	41.12	0.848
R_{14}	-0.04 (-0.512)	0.31 (3.984)*	0.50 (6.743)**	-0.14 (-1.929)	-0.68 (-9.527)**	0.41 (5.914)*	44.45	0.858
R_{15}	0.02 (0.544)	0.43 (9.638)**	0.28 (6.528)**	0.53 (12.675)**	0.65 (15.627)**	0.15 (3.672)*	95.89	0.930

** Significant at the 0.01 level (two-tailed test).

* Significant at the 0.05 level (two-tailed test).

Table 7. Pro-fit Analysis. Regression results for average financial ratios.

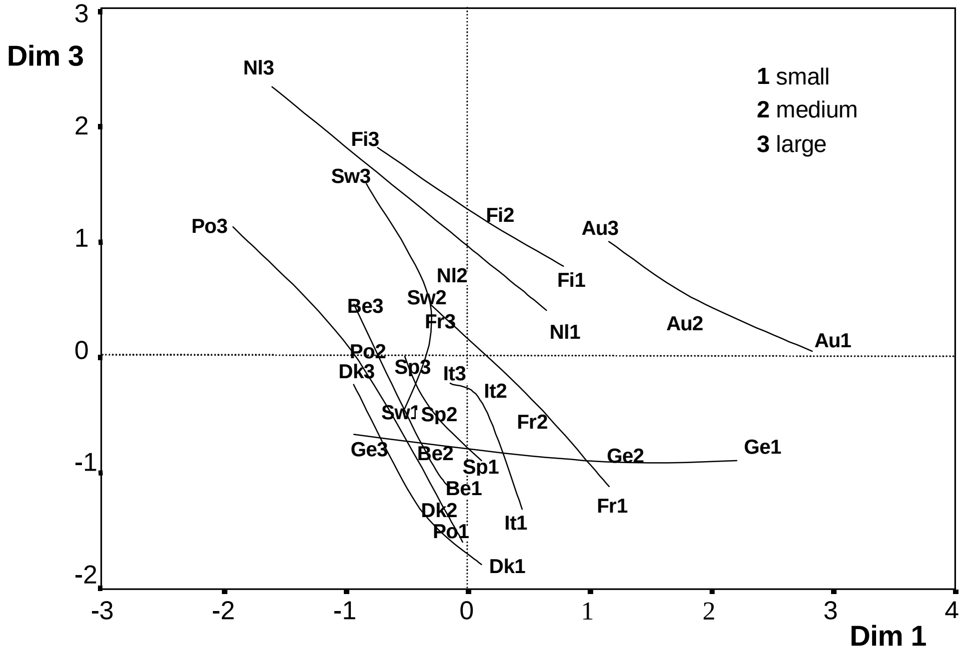

Figure 1. Common space. Projection on Dimension 1 and Dimension 3

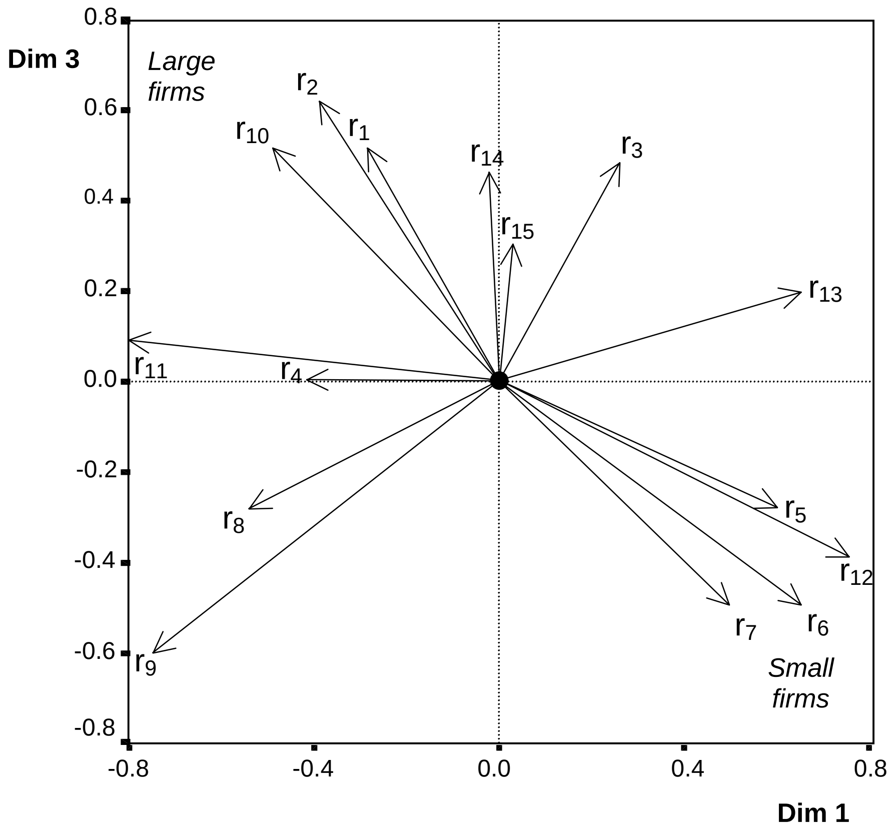

Figure 2. ProFit Analysis. Mean vectors for each financial ratio. Dimension 1 and 3

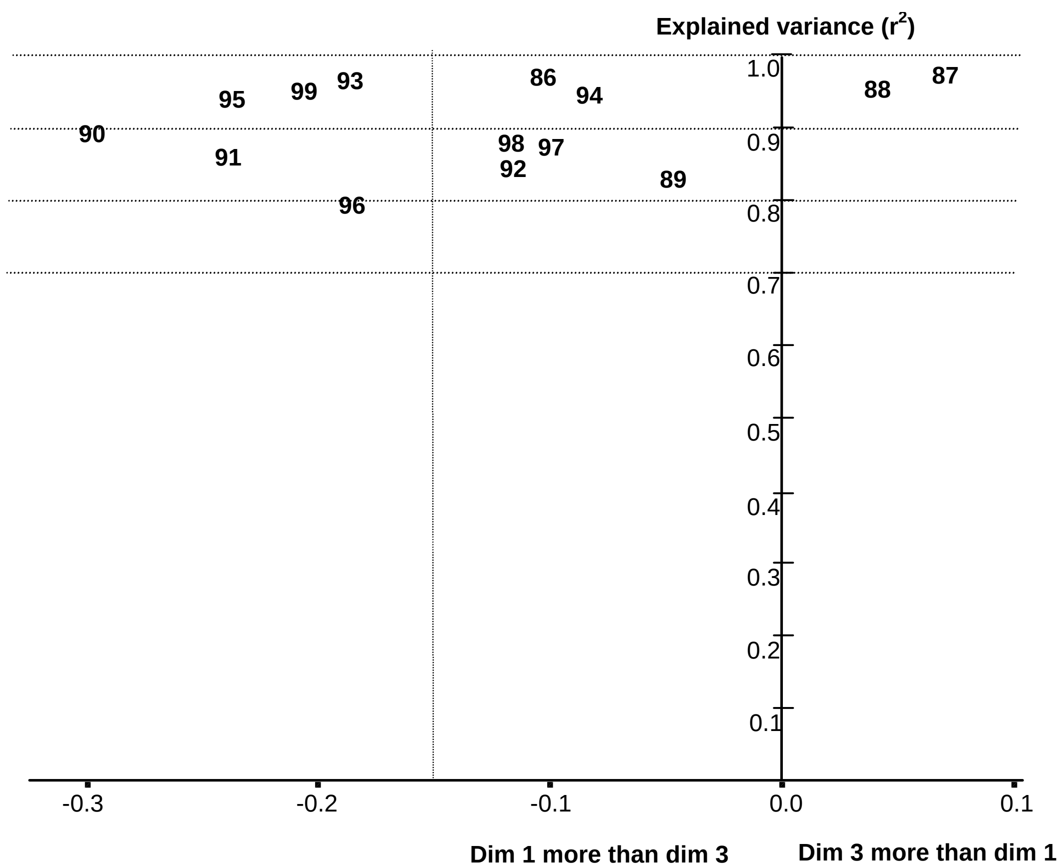

Figure 3. Young' Plot, Dimension 1 versus Dimension 3

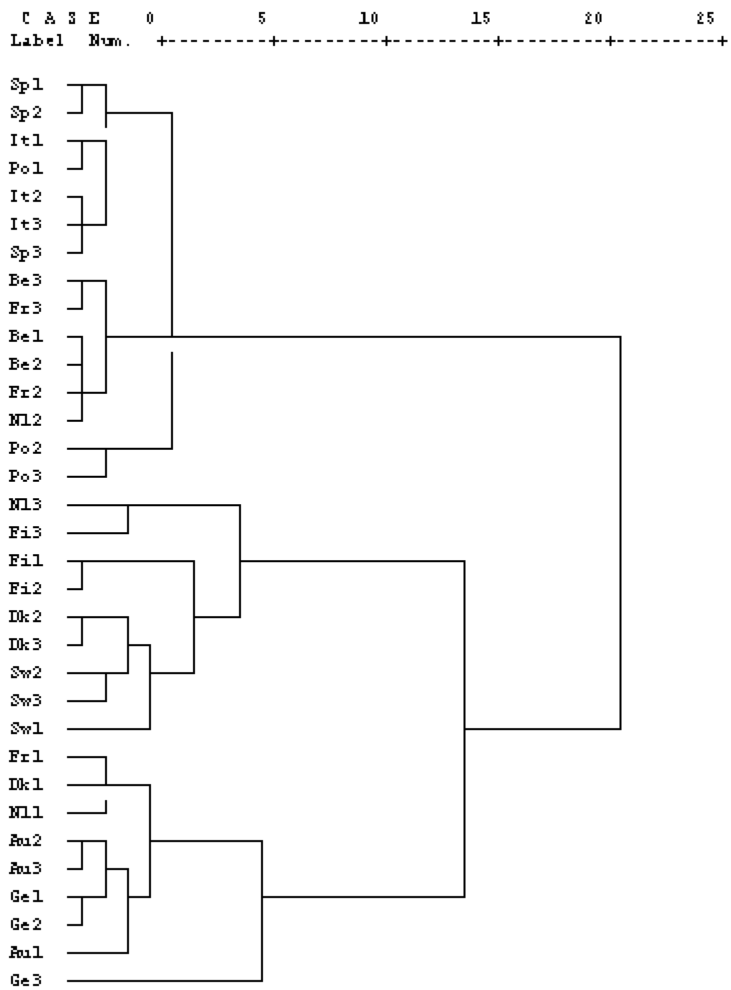

Figure 4. Dendrogram. Ward´s clustering method.