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From Financial Information to Strategic Groups: A Self Organising Neural Network Approach.

Carlos SERRANO CINCA

Lecturer in Accounting and Finance.

University of Zaragoza, Spain.

Address: Departamento de Contabilidad y Finanzas, Facultad de Ciencias Económicas y Empresariales, Universidad de Zaragoza. Gran Vía 2, 50005 Zaragoza, Spain. Tel: +34-976762157. Fax: +34-976761769. E mail: serrano@posta.unizar.es

Biography: Dr Carlos Serrano is Lecturer in Accounting and Finance at the University of Zaragoza (Spain). His research interests include: the applications of Artificial Intelligence in Accounting and Finance; the external analysis of quantitative financial information with multivariate mathematical models; and Information Technologies in Accounting and Finance. Dr Serrano-Cinca has published articles in Journals such as Decision Support Systems, Neural Computing & Applications, The European Journal of Finance, Omega: The International Journal of Management Science, etc.

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Abstract

This paper sets out to determine the strategic positioning of Spanish Savings Banks, using data drawn from published financial information. Its starting point is the idea of the strategic group, regularly employed in Business Management to explain the relationships between firms within the same sector, but with the peculiarity that the strategic group is identified using financial information. In this way, groups of firms that follow a similar financial strategy -with similar cost structures, levels of profitability, borrowing, etc.- have been obtained.

As the exploratory data analysis technique used to obtain these strategic groups, a combination of a non-supervised neural network, the Self-Organising Feature Maps (SOFM) with Cluster Analysis (CA) is proposed. This methodology permits the visualisation of similarities between firms in an intuitive manner. The application of the proposed methodology to the financial information published by the totality of Spanish Savings Banks allows for the identification of the existence of profound regional differences in this important sector of the Spanish financial system. Thereafter, a bivariate study of the financial ratios details the aspects that distinguish the Savings Banks that operate in the different Spanish regions.

Keywords

Self-Organising Feature Maps, Neural Networks, Kohonen Maps, Financial Statement Analysis, Strategic Groups, Savings Banks.

1. Introduction

The different strategies that can be followed by the management of a firm are responsible for the economic and financial situation of their companies. Furthermore, a direct relationship exists between many strategic decisions and the information that can be found in the accounting statements of these companies. Consider, for example, decisions on the volume and type of investments to be made; here, the methods of financing the investments or the decisions on the use of cash from operations have a direct influence on specific accounting items of the Balance Sheet and the Profit and Loss Account.

The reverse process is also possible; that is to say, an analysis of the financial statements can provide information about the strategy that the company is pursuing. A well-known example is the breaking down of Return on Investments (Earnings over Total Assets) into two components: Margin (Earnings over Sales) and Sales Turnover (Sales over Total Assets). Using the Balance Sheets and the Profit and Loss

Accounts of different companies as a starting point, it is simple to calculate the Margin and the Sales Turnover and to determine if the company is obtaining profitability on the basis of a strategy of high Margin and low Sales Turnover, or vice versa. Obviously, if the totality of variables or financial ratios in a sector is broad and we are interested in determining the different strategies of the firms that make up that sector, it will be necessary to employ multivariate statistical techniques.

In 1972, Hunt introduced the idea of the strategic group, defining this as a group of firms in an industry with many similarities in their cost structure, levels of diversification and systems of organisation, as well as the provision of incentives. The strategic group is a unit larger than the firm but smaller than the sector. Each sector can have different strategic groups within it, depending upon the strategy followed by the firms.

A knowledge of the strategic groups within a specific industry is useful for the individual firm. If a firm wishes to change its strategic positioning, it must have a prior knowledge of the fundamental problems it will have to face when designing an appropriate plan of action. This knowledge might be useful for those firms who are considering entering this sector in order to evaluate the interest or attraction of the same, to know with greater certainty the opportunities for future profits and to take advantage to the greatest extent of the possible structural changes that might take place in the industry.

Concerning the most common tools employed in the analysis of the construction of strategic groups, those which are particularly prominent are Principal Component Analysis (PCA) to determine the strategic dimensions, and Cluster Analysis (CA) to classify the firms into groups, see McGee and Thomas (1986). Our proposal is to combine a neural model, the Self Organising Feature Maps (SOFM), and Cluster Analysis. SOFM projects a multidimensional input space, in this case financial ratios, into a bidimensional output space called the self-organising map. This non-linear projection preserves the essential characteristics of this data in the form of neighbourhood relationships in the self-organising map that summarises, in a graphical way, the main characteristics of the data. An examination of such a map could provide powerful insights into the strategic groups of the sectors.

In this type of empirical study there are various strategic dimensions which usually appear, according to the sector and the variables employed. Porter (1980) suggests, amongst others, product specialisation, customer segmentation and geographical markets, the selection of distribution channels, the quality of the product, the degree of vertical integration, the degree of leverage, etc. The variables used in this type of study are extremely diverse: the price of the product, market share, type of and total investment in publicity, etc. Given the objective described at the beginning of this paper, we limit ourselves to using only published accounting information when seeking to classify firms according to their strategic behaviour.

An antecedent of this work in the area of finance is that of Gupta and Huefner (1972), who applied Cluster Analysis with the aim of studying whether financial information was capable of revealing the underlying characteristics of an industry, that is to say, if the companies which belong to different sectors presented values of the ratios that were similar for all of them and specific for each sector. This has

subsequently proved to be a rich line of work in empirical research, where special mention should be made of the work of Sudarnasam and Taffler (1985), who applied Discriminant Analysis to eighteen financial ratios of two hundred and fifty firms classified into fourteen sectors according to the SEIC (a system of classification used in the UK Stock Market) or, more recently, that of Trigueiros and Berry (1991) who, with similar proposals, used a neural network model, the Multilayer Perceptron. Our work can be distinguished from earlier studies in that it does not look for differences between sectors, but rather for different groups in the firms which belong to the same sector.

The strategic groups have been obtained using data drawn from the financial information supplied by the Spanish Savings Banks. The Savings Banks play a very important role in the context of the European Union. Their market share is approximately 25% of the external funds of the financial system. This percentage is even higher in Spain, some 43%, and has not ceased to grow in the last few decades, with its total now being some 25,000 million US dollars. As the century draws to a close, the Savings Banks, which are even now immersed in a merger process involving many of them and are facing greater competition from the national and international banks and non-financial institutions, will have to confront new challenges. In the context of EU construction many questions can be posed with respect to the future of these entities. In this empirical study, some evidence is provided on the strategy these entities are following.

The paper is structured as follows: Section 2 describes the methodology applied, namely the Self-Organising Feature Maps; Section 3 is devoted to the results of self-organisation in the Savings Banks; Section 4 describes to a bivariate study of the financial ratios, which allowing for a detailed analysis of the strategies that have been detected; and, finally, Section 5 summarises the results and presents the main conclusions.

2. The Self-Organising Feature Maps

Self-Organising Feature Maps (SOFM) is a neural model that tries to project a multidimensional input space, which in our case could be financial information, into an output space which is usually bidimensional, in such a way that the input patterns whose variables present similar values appear close to one another on the map which is created. To that end, the so-called non supervised learning is employed. It is for this reason that the name self-organising map is given to the bidimensional space.

This neural system was developed in its present form by Kohonen (1989, 1990) and thus they are also known as Kohonen Maps. It has demonstrated its efficiency in real domains, including clustering, the recognition of patterns, the reduction of dimensions and the extraction of features. Any personal computer with a link to Internet can access the server <http://nucleus.hut.fi> which is resident in Finland. This file contains over one thousand bibliographical references on published papers on the subject of SOFM. The use of financial information has been applied by Trigueiros (1991), Blayo and Demartines (1991), Varfis

and Versino (1992), Martín and Serrano (1993, 1995) and Serrano (1996). Other statistical techniques have a similar objective, i.e. of reducing the dimensionality of a problem, namely Principal Component Analysis (PCA) or Multidimensional Scaling (MDS), so that a comparison between neural models and multivariate statistical models is a fertile area of research, see Serrano, Mar-Molinero and Martín (1993) and Blayo and Demartines (1991).

The SOFM model is made up of two neural layers. The input layer has as many neurons as it has variables, and its function is merely to capture the information. Each neuron in this layer is connected to all the neurons of the output layer by way of what are called the synaptic weights. The output space is represented by a rectangular matrix, in the interior of which are found the neurons which carry out the computation. Each neuron learns to recognise a specific type of input pattern. Neurons which are close on the map will recognise similar input patterns whose images, therefore, will appear close to one another on the created map. In this way, the essential topology of the input space is preserved in the output space.

The SOFM uses a competitive algorithm known as "winner takes all". At the beginning, the connections or synaptic weights between the input layer and the output layer are random. A pattern is shown and each neuron computes in parallel the Euclidean distance between the values of the variables of this pattern and the values of its synaptic weights. There is one neuron whose distance is smallest; this is the winner neuron and, as a premium, it and the neurons which make up its neighbourhood update their synaptic weights in such a way that they move towards the input pattern. The procedure is repeated until complete training is achieved. The number of neurons which make up the neighbourhood reduces with training-time. Once the training is completed, the weights are fixed and the network is ready to be used. From now on, when a new pattern is presented, each neuron computes in parallel the distance between the input vector and the weight vector that it stores. The neuron whose distance is smallest is understood to have recognised this pattern. The algorithm used in this paper is described in detail in Martin and Serrano (1993).

3. The Self-Organization of the Spanish Savings Banks

The data employed in the empirical study is taken from the Statistic Yearbook of the CECA (The Spanish Confederation of Savings Banks) in its Annual Report on the results of the Spanish Savings Banks sector, and it corresponds with the public information on each entity for 1991. In our study we have used 30 financial ratios, as reflected in Table 1, which attempt to capture profitability, capital structure, financial costs, risk structure, etc. Further, these ratios were published in the Spanish daily newspaper "El País" on 22nd November 1992. In the first stage of the study, the firms analysed are the 56 Savings Banks that were operating in Spain in 1991.

No	Financial Ratio
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R1	Trade Investments/Deposits
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R₂	Bank Loans/Trade Investments
R₃	Cash/Total Assets
R₄	Fixed Assets/Total Assets
R₅	Equity Capital/Total Assets
R₆	Financial Revenues/Total Assets
R₇	Financial Margin/Total Assets
R₈	Operating Margin/Total Assets
R₉	Net Operating Income/Total Assets
R₁₀	Income Before Taxes/Total Assets
R₁₁	Bank Commissions/Operating Margin
R₁₂	Operating Income/Deposits
R₁₃	Net Income/Equity Capital
R₁₄	Dividends/Net Income
R₁₅	Total Expenses/Total Assets
R₁₆	Operating Expenses/Total Assets
R₁₇	Financial Costs of Deposits/Deposits
R₁₈	Personnel Expenses/Operating Expenses
R₁₉	Operating Expenses/Operating Margin
R₂₀	Total Assets/Number of Employees
R₂₁	Operating Margin/Number of Employees
R₂₂	Net Income/Number of Employees
R₂₃	Personnel Expenses/Number of Employees
R₂₄	Deposits/Number of Branches
R₂₅	Number of Employees/Number of Branches
R₂₆	Provisions/Total Assets
R₂₇	Provisions/Net Operating Income
R₂₈	Bad Debts/Deposits
R₂₉	Bad Debts Written Off/Deposits
R₃₀	Income Before Taxes+Provisions/Bad Debts Written Off

Table 1. Financial Ratios used.

The Kohonen neural model was applied in the search for the self-organisation of these Savings Banks. The first stage was to develop a neural architecture pursuant to these ratios. The number of neurons and the chosen similarity measure depend on how the information is presented. A neural network with 30 neurons in the input layer was chosen, that is to say, the same number as the number of available ratios and 196 neurons in the output layer arranged in a 14x14 square grid in order to adequately accommodate the 56 patterns in the data base. The input variables have been standardised to mean zero and variance 1. The Euclidean distance has been used for the similarity measure. Although it is possible to think of many ways of comparing individual firms, the easiest way to do this is to calculate the Euclidean distance between firms using standardised ratios as variables. Any two Savings Banks that have very similar ratio structures will show a small distance between their standardised ratios. The converse will also be true; if two Savings Banks have very different ratio structures, the distance between their standardised ratios will be high.

Once the variables and the input patterns have been selected, it is possible to start the training. The first results show where each Saving Bank is situated on the map after the training, see Figure 1a). A first view reveals the fact that the Savings Banks are distributed throughout the map according to the

geographical environment in which they operate. Taking into account that the data does not contain any information of a geographical type, it is truly surprising that the self-organisation of the data results in an image very similar to the map of Spain. Three Basque Savings Banks are located in the upper part. Various Catalan, Valencian and Balearic Savings Banks appear grouped to the right. The central zone of the map corresponds to the Castile area. The Andalusian Savings Banks are found to the South. Although not occupying the geographical position which corresponds to them, the two Savings Banks from Extremadura and, in turn, those from the Canary Isles, have appeared close to each other on the self-organised map.

[Figure 1 about here]

Figure 1.

- a) Self-organisation of the Savings Banks.
- b) Multidimensional scaling.

When applying other statistical techniques which also allow for the graphical representation of multidimensional space data, such as Principal Component Analysis (PCA) or Multidimensional Scaling (MDS) similar results were obtained, although more confused in that the Savings Banks appeared crowded together in the centre. Figure 1b) represents the first two dimensions obtained with MDS. Further, the problem is highly complex: both techniques detected seven factors or dimensions, which meant had to be represented a considerable number of maps, which added little to what the neural model had already demonstrated. Comparing Figure 1a) and 1b), the added value that the SOFM can contribute as an initial technique for exploratory data analysis can be appreciated, as compared with the techniques that have the same objective of reducing this information and searching for an intuitive representation of a large set of input data.

Another statistical tool, Cluster Analysis (CA), proved to be useful to delimit the groups. When studying the results provided by CA, the earlier mentioned results were confirmed and detailed with greater precision. Various regions were identified which reveal a certain degree of parallelism with the political division of Spain. The first group includes eight of the ten Catalan Savings Banks, the two from the Balearic Islands, one Aragonese Savings Bank and one from Valencia. This macrozone coincides quite well with the Medieval territories of the Crown of Aragon, a name chosen when identifying this cluster. A Galician Savings Bank, also belongs to this group. The second group is located only a short distance away; it is called Al Andalus, a name evocative of the ancient Moorish Spain of the South and which is made up of four Andalusian Savings Banks, two from Valencia, and two from Castile-La Mancha.

The third cluster, the North-West, includes three of the four Galician Savings Banks, three from Castile-Leon, the sole Savings Bank from Cantabria and one from Andalusia. Note in the Figure 1 the affinity between the Savings Banks of Avila and that of Segovia, two small cities which lie geographically close to one another to the North-West of Madrid. The fourth group, the Centre, includes the "Caja Madrid", the "Caja de Navarra", the "Caja de Ahorros de la Inmaculada" from Aragon, the "Caja de

Murcia", plus those of Cuenca and Ciudad Real, Rioja, Asturias and the "Municipal de Burgos". The fifth group, Extremadura, includes the two Extremadura Savings Banks, which have been placed together. The sixth group, the Canary Isles, includes the two Savings Banks of the archipelago, which have also been placed together. Finally, the seventh group, the Basque, includes the three Basque Savings Banks and one from Catalonia, "La Caixa". In Figure 1, the division by groups obtained according to both Cluster Analysis and the self-organized model is superimposed over the map of Spain.

However, the question must be asked why the Savings Banks have been grouped together in this manner? Spain is divided into 50 provinces which belong to 17 Autonomous Regions, each one enjoying a certain degree of self-government. The regional division, although somewhat recent in that it flows from the Constitution of 1976, tries to reflect the traditional division of Spain into natural and historical regions. The country divides itself into a number of natural regions, at least four languages are spoken in Spain, there are differences between the North and the South, differences in salary and differences in culture. Indeed, all the Autonomous Regions have their own jurisdiction over matters pertaining to their Savings Banks. However, none of these factors have been introduced into the neural model, which has only been supplied with data taken from the Balance Sheets and Profits and Loss Accounts of the companies analysed. The strategic groups detected by way of the empirical study based on the financial information of the Savings Banks have revealed the importance of the regional component. What this means is that the Savings Banks belonging to these strategic groups which, as can be seen, coincide with the Regions, have similar margins, profitability, levels of bad debt, solvency and productivity ratios, a similar financial structure, etc. Geographic scope is one of the dimensions which frequently appears in other empirical studies on strategic groups, such as that of Ramsler (1982), who obtained the strategic groups of the 100 largest non-US. Banks with a presence in the US. market.

Royal Decree 1.582/88 of 29th December 1988, repealed the principle which confined the Savings Banks to the territory of their native Autonomous Region. In this way, the credit institutions acquired a universal ambit. The Autonomous Regions supervise and regulate the composition of the governing bodies of the Savings Banks which carry out their activities within the territory of the Region. As non-profit making entities it is their territorial vocation, assisting in the economic development of its areas of activity, together with their performance of activities of a social character, that are the two factors which mark the difference between the Savings Banks and the other financial institutions. The establishment of priorities in geographic areas, that is to say, the strategic expansion of the Savings Banks beyond their traditional regional base, is one of the main strategic questions facing the Spanish Savings Banks, according to a study carried out by Ballarin (1991). According to Egea (1991) it is this strategy of "territorialism", maintained up-to-now by almost all the Spanish Savings Banks, that has been the differentiating factor which has contributed to the growth and strengthening of this group of financial entities. According to José L. Méndez (1994), the Managing Director of the "Caixa Galicia", territoriality is the key factor from which the Spanish Savings Banks draw their strength. The social projection of the Savings Banks, another of the distinctive factors, is also closely linked to territoriality.

Time evolution of the Savings Banks

The model allows us to study the time evolution of each Savings Banks in the self-organising map, introducing the information of successive years. When the new financial information on the Savings Bank is presented, each neuron computes the Euclidean distance between the ratios vector and the weight vector that it stores. The Savings Bank will be located in the neuron whose distance is the least. The edition of "El País" of 14th November 1993 has provided the information on the Savings Banks corresponding to 1992. This information is essentially the same as the year before, save for two ratios, numbers 2 and 19. Further, for the "Caja Provincial de Cordoba", ratio number 30 is not available.

It is quite common when studying the information pertaining to a company and when comparing it with others, that a piece of data is missing or that it is impossible to calculate a ratio. Although this is an important problem, no financial analyst would refuse to issue a report simply because a few pieces of data are missing because, even if the information they might have supplied is important, it is not absolutely vital. Depending on the mathematical model employed, various solutions can be applied. The procedure in the self-organising map is straightforward: it simply ignores the values of both ratios. Instead of calculating the distance between the vector of the 30 synaptic weights and the vector of the 30 ratios presented, each neuron will calculate the distance between two vectors of 28 components, ignoring those for which there is no information. A study of the effect which lack of complete information supposes for the neural network was made. The location of all the entities remained constant except for two, which moved one position ("Caixa de Galicia" and "Caja de Guipuzcoa y San Sebastian"). The fact that both ratios can not be relied on for the study corresponding to 1992 does not give rise to any serious problem for the neural network.

Figure 2 shows the results of presenting the 28 ratios available for each Savings Banks in 1992 to the neural network trained with the 30 ratios of 1991. Most of the Savings Banks have remained stable in both years, but 9 of them have moved to other groups. The trajectory of this Savings Banks has been indicated with an arrow. The Savings Banks that have resulted from a merger process are marked with a thicker line. The "Caja del Mediterraneo", absorbed the "Caja de Ahorros Provincial de Alicante y Valencia" in March 1992 and this has resulted in a displacement of this new entity precisely to the place where the absorbed entity was located. The "Caja de Ahorros de Castilla-La Mancha", is a new Savings Bank created in June 1992 as a result of the merger of the Savings Banks of "Toledo", "Albacete" and that of "Cuenca-Ciudad Real". Note how its location in the map presents a central situation lying between these three entities.

[Figure 2 about here]

Figure 2.

Savings Banks who are modifying their strategy. The Savings Banks that have resulted from a merger process are marked with a thicker line.

The two Savings Banks of the Canary Isles continue to maintain their similarity, being located in the same positions. By contrast, another of the most marked similarities of 1990, that of the two Extremadura Savings Banks, has disappeared. Specifically, the "Caja de Badajoz", has kept its place, but the "Caja de Extremadura" has moved to the North-West group. The three Basque Savings Banks have hardly moved, remaining very close to "La Caixa". The cluster which includes the "Caja de Madrid", the "Caja de Navarra", the Aragonese "Caja de Ahorros de la Inmaculada", and the "Municipal de Burgos", have hardly experienced any changes.

An analysis of the Spanish financial sector in 1993, [Zafra (1994)] has shown that the Savings Banks are participating in initiatives within their own geographical ambit, taking shareholdings in companies in the region. However, in the opinion of Zafra, this regionalist tradition will be broken in the long term. In our opinion, to break such a tradition would be an error, in that we consider the geographical dimension to be one of the strong points in the strategy followed by the Savings Banks.

4. Bivariate Analysis of Ratios

In this Section a bivariate analysis of ratios is carried out with the aim of studying in more detail the strategies which are being followed by each one of the clusters obtained. As the methodology to select a reduced set of ratios starting from the 30 original ratios, Principal Component Analysis (PCA) and a Cluster Analysis (CA) were performed, but this time over the variables. Following the work of Mar-Molinero and Ezzamel (1991), a ratio from each cluster was selected, given that the ratios which belong to the same cluster provide the same information. The ratios selected are numbers 6, 7, 10, 15, 18, 22, 23 and 28.

A study of the 17 Autonomous Regions could have been made, taking the average values for each one of the ratios. However, the choice made was to study the behaviour of each strategic group, and not that of the Autonomous Regions themselves. As can be seen from the above Section, there are Savings Banks belonging to an Autonomous Region whose behaviour does not follow that of the other Savings Banks of that Region. The average value of each one of the eight ratios has been calculated for each strategic group.

[Figure 3 about here]

Figure 3. Bivariate analysis of ratios.

- a) The quantity and quality of the investments.
- b) Financial margin versus economic profitability.
- c) The impact of total costs and personnel expenses.
- d) Employee productivity and technology.

Figure 3a) shows the relationship between what has been called the quantity and the quality of the business. To this end, ratio 6, Financial Revenues over Total Assets is represented on the *x* axis and ratio 28, Bad Debts over Deposits, on the *y* axis. Figure 3b) shows ratios 7, Financial Margin over Total Assets, and 10, Return on Investment. Profitability also depends on the cost structure of the different groups. There is a high negative correlation (-0.919) between return on investment and ratio 15, Total Expenses over Total Assets. Figure 3c) shows Total Expenses over Total Assets and ratio 18, Personnel Expenses over Operating Expenses. Figure 3d) shows ratio 23, Personnel Expenses over Number of Employees, on the *x* axis, and ratio 22, Net Income over Number of Employees, on the *y* axis. The upper zone of the map signifies high employee productivity. The number of auto-tellers per employee has been obtained, with this data being represented in Figure 3d) by way of circles whose areas are proportional to this ratio.

By way of the bivariate analysis of ratios, it is possible to deduce the strategy and circumstances of each group, as follows:

- *Centre*: This group encompasses the most solvent and best managed Savings Banks. A study in the Spanish magazine "Rating" of July 1991, cited the best managed Savings Banks as being the "Caja de Madrid", the "Caja de Navarra", the "Caja de Ahorros de la Inmaculada" and the "Municipal de Burgos", in that order. The financial revenues over total assets figure is very important (Fig. 3 a). The level of bad debts is very moderate (Fig. 3 a). They maintain high margins and, whilst they could survive with a narrower margin, they will no doubt try to maintain this situation (Fig. 3b). They have the highest productivity per employee (Fig. 3d). This is called the "Leader" strategy. Any recommendations would be towards the maintenance of their situation of leadership, although without losing sight of the competition, preparing themselves for a future with narrower margins.

- *Estremadura*: This group, formed by the two Estremaduran Savings Banks, presents the highest financial and operating margins (Fig. 3b). They are leaders in economic and financial profitability. Their employee productivity is not particularly high, nor is the level of employees per office or of automation (Fig. 3c). The level of bad debts is excellent, the lowest of all the groups (Fig. 3a). Estremadura, which lies on the border with Portugal, is a Spanish region characterised by a rural and hardly dynamic economic environment. The absence of aggressive competition in the geographical area in which they operate marks the difference between them and the Centre group, a situation which might be called "Dolce vita", in that they remain very profitable but not as productive as the Centre group and without handling such a volume of customer funds. The recommendation would be to modernise management, attempting to improve productivity and to raise the level of technology, which is not so difficult given that they currently generate large profits.

- *Basque*: The financial margin over total assets is the lowest of the seven groups, similar to that of the European Savings Banks (Fig 3b). They occupy an intermediate position in economic profitability (Fig

3b). Employee productivity, measured by profit divided by the number of employees, is very high, and these employees are, in turn, very well paid (Fig 3d). The high number of auto-tellers is also worthy of note. On this basis, namely low margin, high employee productivity and highly automated offices, can be supposed strong competition within the environment, similar to that faced by the European Banks and Savings Banks. The Basque region, lying on the border with France, is one of the most industrialised in Spain. It should be recalled that the extremely powerful "Caixa de Barcelona", a Catalan entity, is included within this strategic group. The name "Europe" has been given to this strategy.

- *North-West*: Normality is the tone which emerges from the ratios analysed. It presents a fairly narrow financial margin. Economic profitability is normal, with fairly moderate non-financial costs. Employee productivity is normal. This strategy is called "Moderation".

- *Crown of Aragon*: The most outstanding characteristic, and one in which they are leaders, is that of high financial revenues over total assets (Fig. 3a), which does not translate into high economic profitability, with this being one of the lowest (Fig. 3b). The cause for this is the high total costs over assets, the highest of all the groups. From amongst the costs, those of a financial nature should be highlighted, with personnel expenses being the lowest. Despite this, productivity is not particularly high. They will probably decide to improve employee productivity when they are faced with more competition and the financial margin narrows. The level of activity is very high, because their geographical location is the Mediterranean Littoral, one of the most dynamic in Spain. This strategy might be called "Resistance", because although their Profit and Loss Accounts are beginning to feel the impact of narrowing margins, they are nevertheless resisting any reduction in their costs or any modification of their strategy.

- *Al Andalus*: This groups present high financial margins (Fig. 3b). The operating margin is low and the economic profitability quite low. The explanation lies in the conversion costs which are quite high. Customer funds per branch are also low, half of those of the Basque group. Therefore it is quite similar to the Extremadura group, but with lower employee productivity and a higher level of bad debts. Its current strategy is that of "Risk", in that it is only the high financial margin which is maintaining profits in the Profit and Loss Account.

- *Canary Isles*: Its characteristics are the opposite of those of the Basque group. This group, which encompasses the two Canary Isles Savings Banks, presents very special characteristics which, without doubt, derive from its island nature. Having a high financial margin, it nevertheless reveals the lowest economic and financial profitability (Fig. 3b). The cause lies in the high conversion costs, the highest of all the groups. Furthermore, it is characterised by low employee productivity and by the highest number of employees per branch. The high level of bad debts is worrying (Fig. 3a). High margins with low profits and low productivity are characteristics which have not caused greater difficulties only thanks to the absence of competition. Therefore, this strategy is called "Isolation". The recommendation, in the face of the inevitable arrival of new competition, is for a restructuring and reorganisation of this group, which might even affect the work force.

5. Summary and Conclusions

This work is based on the idea of the strategic group, a unit of analysis superior to the firm but inferior to the sector. The concept is redefined, applying it strictly to the framework of financial information, to obtain groups of firms in the same sector with similarities in their financial structure. As techniques of financial analysis to obtain these clusters, it is proposed to combine a neural network model, the Self-Organising Feature Map (SOFM), and Cluster Analysis (CA). The methodology has shown itself to be very appropriate as an exploratory data analysis technique for financial information, in that it allows the data to speak for itself and permits the synthesis of the principal features of a broad group of variables in a graphical and intuitive form.

The study has been carried out using financial information on the Spanish Savings Banks. The combination of SOFM and CA has shown how the entities belonging to proximate geographical zones present similar values in the ratios analysed. The financial information has been useful in the detection of the strategic groups within the sector. Seven strategic groups have been obtained, with these corresponding to a further seven Spanish macro-regions. Naturally, the correspondence between Autonomous Region and strategic group is not exact for all the Savings Banks.

The study is completed with information coming from the year following the chosen year of study and, as a special circumstance, the data base was incomplete because two of the ratios could not be supplied. This situation, which is a serious inconvenience in many analysis techniques, is not so for the SOFM, which simply calculates the distances between the firms without taking the value of this lost ratio into account. In this study the displacement of certain Savings Banks, who are modifying their strategy can be observed. Finally, a bivariate analysis of ratios has been carried out, which has assisted in identifying the features corresponding to every group.

The policy of expansion of the Spanish Savings Banks into other Autonomous Regions, which has not always met with success is currently the subject of debate. It is probably the case that the regional differences which are so characteristic of Spain have not been taken into account. Similarly, those foreign financial entities, most of them from the European Union, which are opening branches throughout Spain, should themselves be aware of these peculiarities of the Spanish financial sector, which are nothing other than an extension of the rich cultural, linguistic, geographical and social variety of present-day Spain.

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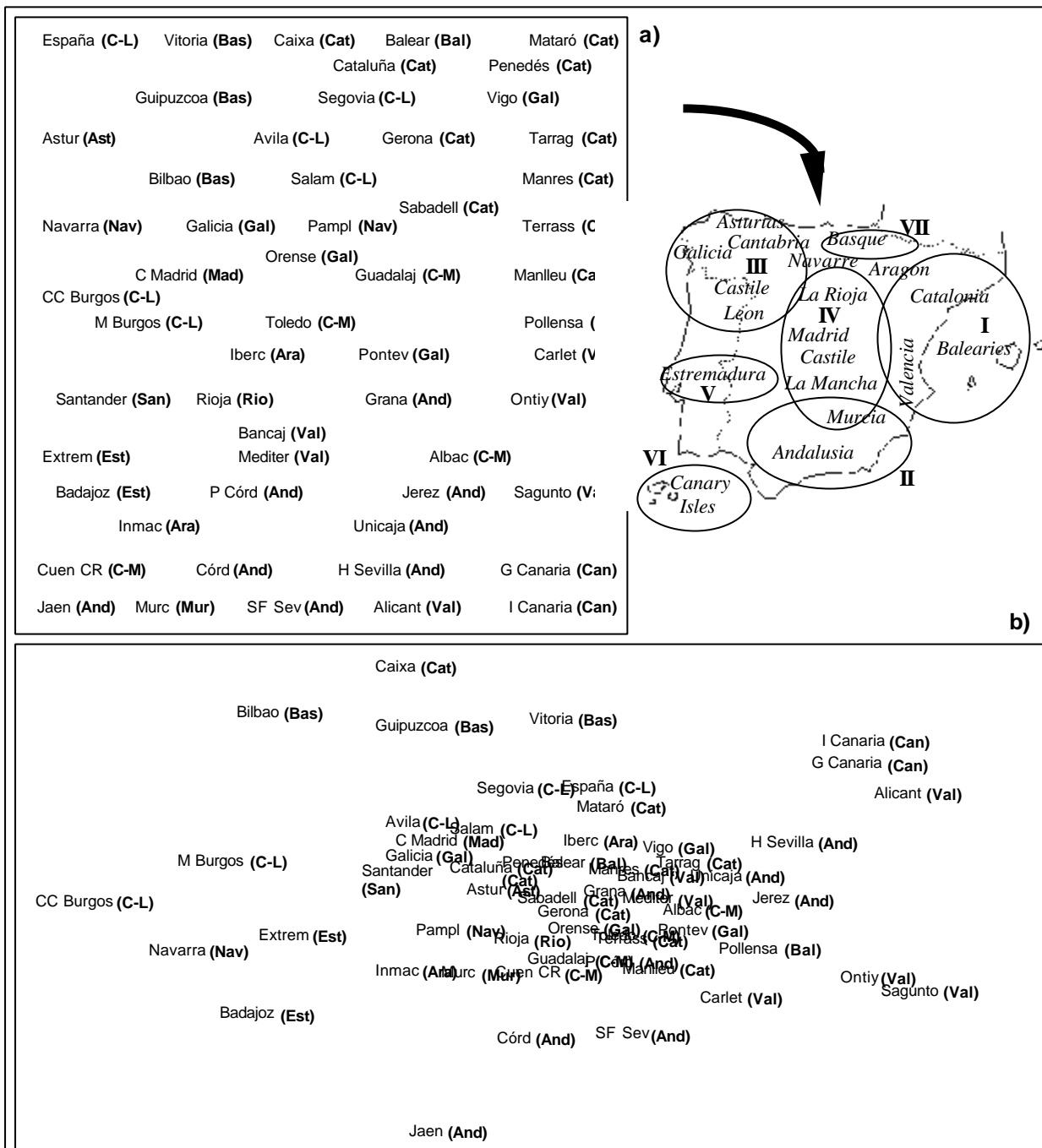


Figure 1.

- a) Self-organisation of the Savings Banks.
- b) Multidimensional scaling.

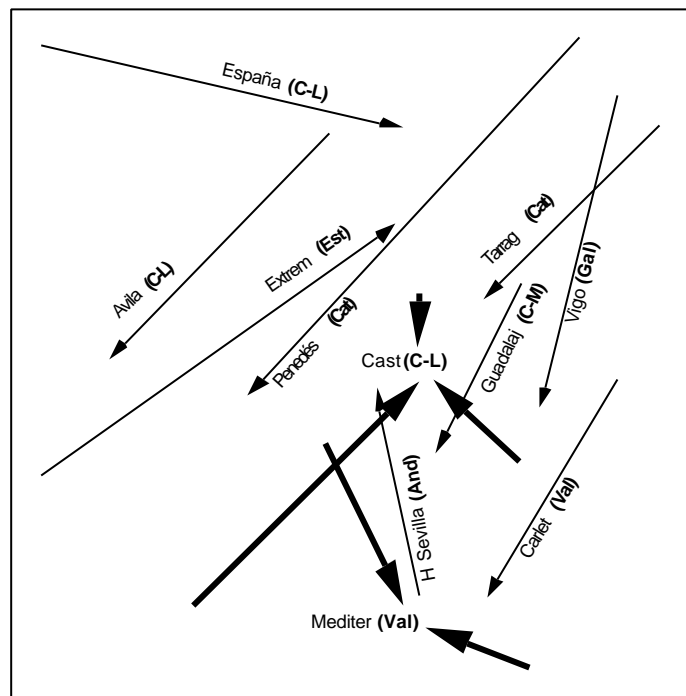


Figure 2.

Savings Banks who are modifying their strategy. The Savings Banks that have resulted from a merger process are marked with a thicker line.

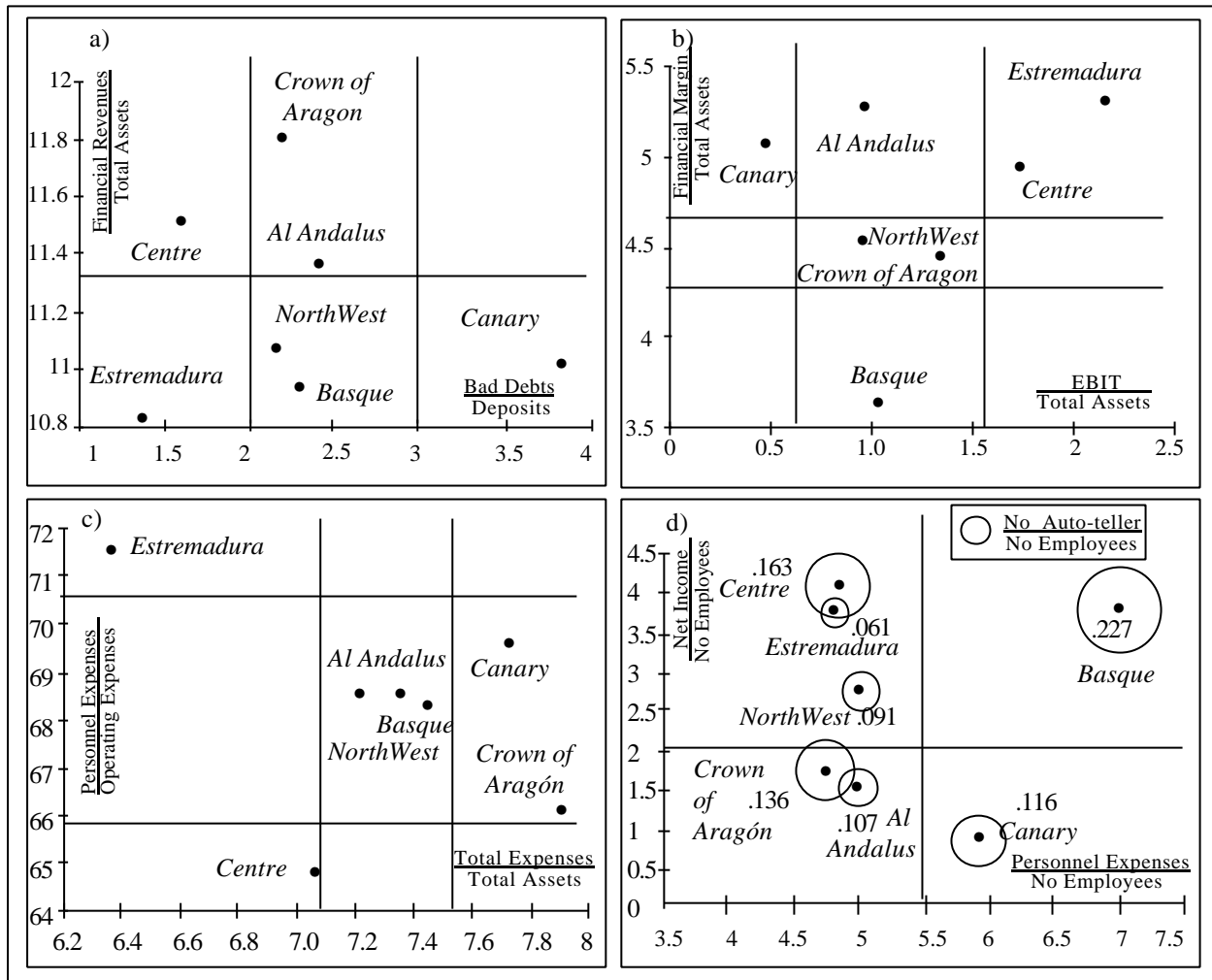


Figure 3. Bivariate analysis of ratios.

- a) The quantity and quality of the investments.
- b) Financial margin versus economic profitability.
- c) The impact of total costs and personnel expenses.
- d) Employee productivity and technology.