Spanish savings banks in the credit crunch: could distress have been predicted before the crisis? A multivariate statistical analysis

Martí Sagarra[a], Cecilio Mar-Molinero[a,b], Miguel García-Cestona[a]

a.-Department of Business Economics, Universitat Autònoma de Barcelona, Spain
b.- Kent Business School, University of Kent, UK

Abstract

Spanish savings Banks (*Cajas de Ahorro*) have had a long and distinguished history over more than one hundred years of existence. They have served well the community and small businesses. However, they have been heavily affected by the banking crisis of 2007. Many of them had to merge with other institutions or were rescued. We show that, before the crisis, there were structural differences between successful *Cajas* and those that had to be rescued. The technical approach is based on Multidimensional Scaling Analysis (MDS). MDS has the advantage that the main characteristics of the study can be presented in a visual form, and thus facilitate communication of the results. We complete the study with the time path of four institutions: two that survived and two that had to be rescued.

JEL classification: G21; G33; G34

Keywords: Bankruptcy, corporate governance, financial crisis, multidimensional scaling, savings banks

Corresponding author: Martí Sagarra Garcia, Department of Business Economics, Faculty of Economics and Business Studies, Universitat Autònoma de Barcelona, 08193 Bellaterra (Cerdanyola del Vallès), Spain. E-mail address: marti.sagarra@uab.cat

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1. Introduction

Spanish Savings Banks (*Cajas de Ahorros*) have their roots in the 19th Century and earlier, when they started as credit cooperatives, charitable institutions, or even mutual aid funds. The modern *Cajas* can be classified as non-for-profit commercial institutions (Hansmann, 1996). They do not have owners or shareholders and this has important consequences: they cannot be acquired, and they cannot merge with a commercial bank, although they can merge or be acquired by another *Caja*. Any profits that they make must either be reinvested or used to promote general welfare. Until the 1980's, they were restricted in their geographical coverage, something that is often reflected in their name. Although they are not controlled by formal owners, they have a general assembly and a board which are made up of representatives from the different stakeholder groups: founding entities, depositors, employees, and public authorities. This last group generally means political party appointments, both local and/or regional. These peculiar arrangements have served them well: the *Cajas* have been successful in capturing the savings of the small investor, and they have lent to small businesses. In this they successfully competed with commercial banks. According to the Report on Banking Supervision in Spain for the year 2010 (Banco de España, 2011), published annually by the Bank of Spain, they accounted for about one half of the Spanish credit market during the decade 2000-2010.

The financial success of the *Cajas* in the years of expansion, a period that starts in the early 80s, has been accompanied by changes in the regulatory legislation. Changes in the regulations started as a consequence of the Spanish banking crisis of the 1970s, with the Bank of Spain taking a more active interest in the solvency of financial institutions (Salas Fumás et al., 2009). The *Cajas* were then permitted to engage in all the functions in which the commercial banks engaged.

The regulatory framework established in 1977 was substantially modified by the 1985 "*Ley de Órganos Rectores de las Cajas* (*Cajas* Governing Bodies Act)" Act. The 1985 Act regulated the presence of the various stakeholders in the governing bodies of the *Cajas*; increased the presence of public authorities, allowed executive chairmen, and abolished social committees. Furthermore, the differences that existed between *Cajas* and commercial banks were removed, allowing free competition between the two types of institutions. A 1988 Royal Decree permitted the *Cajas* to operate anywhere in the country, thus further enhancing competition in the Spanish financial sector. Finally, the 2002 "*Ley de Medidas de Reforma del Sistema Financiero* (*Measures for the reform of the financial system Act*)", set a 50% limit to public bodies' representation on the boards of the *Cajas* to conform to the European law for private banks. And later, the "*Ley Financiera* (*Finances Act*)" 26/2003 introduced some additional information requirements for *Cajas* and not for banks to increase transparency.

As a result of these regulatory changes, the *Cajas* have entered the same financial markets as commercial banks, and compete nationally with them and among themselves. In order to do this, they have multiplied their presence by opening

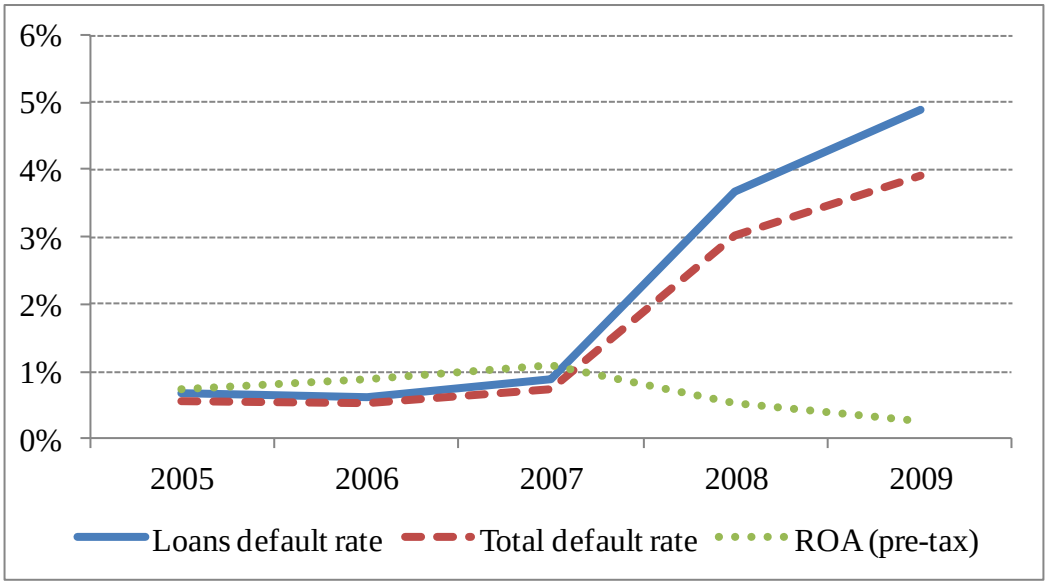
branches all over the country, and have expanded beyond their traditional business products. For example, the number of branches that the *Cajas* had in Spain increased from 9,386 in 1979 to 24,202 in 2009. In contrast, during the same period, the number of branches that commercial banks had, only increased from 12,238 to 14,840, reducing in fact this number since 2007 (Banco de España, 2011).

The *Cajas* have been part of the building boom of the 2000s, either financing new developments, or granting mortgages. The share of real estate loans in the *Cajas'* books in 2006, just before the onset of the financial crisis, ranged from just over 10% to almost 50%.

The question arises of up to what point the *Cajas'* special governance arrangements influence the success of their operations, their approach to risk and investment, and their policies. One could argue that, since the boards of the *Cajas* are not under the control of professionals in finance, they lack technical expertise; but it is also possible to argue that, since the boards of the *Cajas* are controlled by their stakeholders, the decisions taken are in the best interest of depositors, borrowers, and the local community. It can also be argued that, since there is no shareholder control, there is much room for abuse and corrupt practices. These are questions that touch agency theory issues; Shleifer and Vishny (1997), Zingales, (1998), Tirole (2001), and Hansmann (1996). For example, Hansmann (1996) argues that the sharing of control between the agent and the principal may result in inefficiencies, particularly when there are differences between the interests and preferences of the various bodies that share the control. However, this view is disputed by the partisans of "shared capitalism" of which the main example is the German codetermination, with representatives of the workers in the board of directors (Salas Fumás et al., 2009). These issues will be explored within the context of the 2008 credit crunch, and its impact on the *Cajas.*

The onset of the financial crisis can be traced to the second half of 2007 (Fiordelisi et al., 2011), but it was not until 2008 and, particularly during 2009, that the *Cajas* were affected by it, in form of a sharp increase in bad debts and a decline in profitability. As can be seen in Figure 1, 2007 marks a turning point, with increasing default rates and decreasing return on assets.

Figure 1 – Evolution of some relevant financial variables for the Spanish *Cajas*



Source: CECA (Spanish Confederation of Savings Banks)

The 2007 financial crisis put some *Cajas* under great financial difficulties. The Spanish government was forced to intervene to avoid some of them failing (Banco de España, 2010). It did so by creating a "Fund for Orderly Bank Restructuring" (*Fondo de Reestructuración Ordenada Bancaria, FROB)* in 2009; Royal Decree 26th June 2009. The FROB complemented the existing system of Deposit Guarantee Funds and provided the context in which *Cajas* mergers took place. Two types of such integration processes were put in place. The first one was the usual approach of a financially sound *Caja* taking over a *Caja* in difficulties. The second process was similar to a merger, with the peculiarity that merged entities maintained their identity and a substantial degree of autonomy within the emerging conglomerate. This second process received the name of Institutional Protection System or IPS. But, as in any merger, it is often the case that a strong institution takes the lead in order not to allow a weak institution to go further in the path to distress. There was a restructuring plan that included a wide range of financial support measures.

The *Cajas* have come under the umbrella of the FROB in two waves, the first one in 2010, and the second one in 2011. The question arises of whether the *Cajas* that needed financial support had structural weaknesses that were present before the financial crisis, or whether their financial difficulties could be attributed to bad management of the situation, perhaps because of an inappropriate management control structure.

In summary, we address the following research questions. First, was it possible, using information prior to the financial crisis, to anticipate which institutions would find themselves in difficulties? Second, were the financial difficulties of *Cajas* that came under FROB support related to the structure of their governing bodies, in particular to the presence of politicians on the board? The third objective was a technical one. Traditionally, distress analysis has been based on the study of financial ratios, but

simultaneously there has been much interest in the analysis of efficiency in banks. Does the addition of efficiency measures improve on financial ratio analysis?

To assess if there were structural weaknesses before 2007, we collected data for all the *Cajas* in Spain for the year 2006 from the BankScope database. This information was transformed into a set of financial ratios. A picture of the relative financial position of the *Cajas* was obtained using multivariate statistical methods: Factor Analysis, Multidimensional Scaling, Property Fitting, Cluster Analysis, and Logit Regression. We found that the *Cajas* that had come under the provisions of the FROB had indeed structural weaknesses that became evident as a consequence of the financial crisis. We explored the evolution of individual institutions through the financial ratios space before and after the crisis.

After this introduction we discuss the data and the choice of financial ratios. The next section deals with the statistical methodology and the results, including the case of 4 *Cajas*. The paper ends with a discussion and conclusions.

2. The data

2.1. Data source

We used the Fitch IBCA/Bureau van Dijk's BankScope database to obtain information about all the *Cajas*. Bankscope contains balance sheet and profit and loss account items for financial institutions. The main body of the analysis was based on financial ratios obtained from the 2006 accounts. We also used financial ratios for the period 1999 to 2008 in order to study in detail the changes that had taken place in four institutions, two successful ones and two that had to be rescued. The period 1999 to 2008 was chosen because it covers 8 years before the onset of the crisis, and 2 years after the crisis. Two *Cajas* were excluded due to lack of data: Caixa Ontinyent, and Caixa Pollensa. This lack of information is probably due to their very small size. The final data set included 43 entities.

Missing values were relatively scarce: in some variables there was a maximum of three missing values. In order not to lose any *Caja* in subsequent analyses, we decided to estimate the missing values. Two frequently used imputation methods are mean substitution and cold deck imputation (Winkler, 2004). Mean substitution involves replacing all the missing values in each field with the field's mean; and in cold deck imputation the missing values are replaced with external constants, one for each field. These methods are easy to implement but very unlikely to maintain the statistical properties of the database. We settled for the *k*-nearest neighbor imputation with *k* equal to three. This method, while maintaining the statistical structure of the data, does not make any statistical assumptions, and does not involve developing a model for each variable with missing data. In this method, a pool of donors (i.e., complete records) is found for each recipient (i.e., incomplete record), and the value for missing cells in recipients is calculated from the values of the donors.

2.2. The financial ratios

The analysis was based on financial ratios calculated from items in the Balance Sheet and in the Profit and Loss account. There is a wide literature on financial ratios; for a review of the subject in the context of financial institutions see Demyanyk and Hasan (2010). The ratios we have used attempt to capture information about capital adequacy, performance, liquidity, risk or assets quality, size and growth. We also used two measures of DEA efficiency. The list of ratios is given in Table 1.

Table 1 – Financial ratios used

Tier 1 Ratio	R1	CAPITAL ADEQUACY or SOLVENCY
Capital Ratio	R2	
K-Buffer	R3	
Equity / Total Assets	R4	
Equity / Net Loans	R5	
Net Interest Margin	R6	PERFORMANCE
Net Interest Revenue / Average Assets	R7	
ROA	R8	
ROE	R9	
CIR (Cost-to-Income Ratio)	R10	
Interbank Ratio	R11	LIQUIDITY
Net Loans / Tot Assets	R12	
Net Loans/(Deposits + Short Term Funding)	R13	
Liquid Assets / (Deposits + Short Term Funding)	R14	
Loan Loss Reserve / Gross Loans	R15	RISK or ASSETS QUALITY
Impaired Loans / Gross Loans	R16	
Loan Loss Reserve / Impaired Loans	R17	
Impaired Loans / Equity	R18	
Total Assets	R19	SIZE and GROWTH
TA Growth	R20	
Gross Loans	R21	
GL Growth	R22	

Capital adequacy is normally measured by means of the capital ratio, as established by the Basel Accords (issued by the Basel Committee on Banking Supervision). Spanish regulation for the analyzed period set this ratio at a minimum value of 8%. Ayuso et al. (2004) argued that, in order to analyse a financial entity, one should not take into account the capital ratio, but the extent to which it differs from the minimum legally required, and defined the K-Buffer ratio as (Regulatory Capital – Minimum Requirements) / Minimum Requirements. The K-Buffer ratio has been calculated and included in the data set.

The data set also included two measures of efficiency calculated for every *Caja* using Data Envelopment Analysis (DEA). There has been much work in recent years on the subject of DEA efficiency in relation to financial institutions; see, for example, Berger and Humphrey (1996) for an extensive literature review up to 1996. There are two main

approaches to banking efficiency modelling: the production model and the intermediation model. Under the intermediation model, a financial institution uses capital and staff, and collects deposits in order to generate profits and interest. Under the production model, a bank is a place that deals with transactions, in which case deposits are an output to be dealt with. Serrano et al. (2011) review the literature on banking efficiency modelling, and show how the different specifications are related. Our production specification contained as inputs labour and physical capital, and as outputs deposits, interest and non-interest income and net loans (gross loans less reserves for non performing loans). The intermediation specification contained labour, physical capital and deposits as inputs, and interest and non-interest income and net loans as outputs.

2.3. The identification of failed and successful *Cajas*

The aim of the research is to establish if distress was related to weaknesses that were already present before 2006, and this required classifying the *Cajas* into two groups: the ones that, in 2011, had survived the crisis, and the ones that had to be rescued. Given that the *Cajas* did not actually fail, but either received the support of the FROB, or merged with other institutions, the classification task was not straightforward. We relied on the newsletters of the FROB and on the information issued by the Bank of Spain (*Nota Informativa Junio 2010*).

Table 2 summarizes the way in which the *Cajas* were restructured. The type of restructuring —merger or IPS— that took place is also shown, as is the amount of FROB funding made available to the *Cajas* that needed it. In the case of mergers and IPSs it was necessary to identify which *Caja* was the "leader" and which *Cajas* were the distressed ones that had to be rescued. We have highlighted the names of the *Cajas* that we identified as successful. To identify the successful *Cajas*: first, we considered as successful those *Cajas* that did not merge and did not receive any FROB support; second, in the case of an IPS with no FROB support, all the *Cajas* were considered as successful, since all the *Cajas* in the IPS continue to have a separate identity within the conglomerate; third, in the case of a merger with no FROB support, we identified the most financially sound institution as the leader; fourth, in the case of *Cajas* that received FROB support, we identified as a leader the most successful institution, normally the largest one in the group. The situation of a small number of *Cajas* was particularly dramatic; amongst these we can mention CCM (Caja de Castilla La Mancha), CajaSur, and CAM (Caja de Ahorros del Mediterraneo).

Table 2 – Restructuring process in the *Cajas*

Institutions involved	Number	Type	FROB 2010 (MM€)	FROB 2011 (MM€)
Mergers approved by the Banco de España, with FROB aid	**28**		**11.381**	**7.551**
1 Catalunya / Tarragona / Manresa	3	Merger	1.250	1.718
2 Sabadell / Terrassa / Manlleu	3	Merger	380	568
3 **Duero** / España	2	Merger	525	
4 CAM / **Cajastur**+CCM / Cantabria / Extremadura	4	IPS	1.493	2.800
5 Caixanova / Galicia	2	Merger	1.162	2.465
6 **Madrid** / Bancaja / Laietana / Insular de Canarias / Ávila / Segovia / Rioja	7	IPS	4.464	
7 **Murcia** / Penedès / Sa Nostra / Granada	4	IPS	915	
8 **BBK**+CajaSur	2	Merger	1.192	
Mergers approved by the Banco de España, without financial aid	**12**			
9 **Navarra / General de Canarias / Municipal de Burgos**	3	IPS		
10 **Unicaja** / Jaén	2	Merger		
11 **La Caixa** / Girona	2	Merger		
12 **Cajasol** / Guadalajara	2	Merger		
13 **CAI / CC Burgos / Badajoz**	3	IPS		
TOTAL RESTRUCTURING SAVING BANKS	**40**			
REST OF SAVINGS BANKS	**5**			
14 **Ibercaja**				
15 **Kutxa**				
16 **Caja Vital**				
17 **Caixa Ontinyent**				
18 **Caixa Pollensa**				
TOTAL SAVINGS BANKS	**45**			

(*) In bold and underlined are marked the leaders of each process

Source: Banco de España (2010)

3. Methodology and Empirical findings

3.1. Analysis

Our data set was thus, a matrix of forty three *Cajas* (cases) by twenty four variables (twenty two ratios and two efficiency measures). The first step was to engage in data reduction. For this, we used Principal Components Analysis, both rotated and unrotated, as a first step to Factor Analysis, in order to explore the dimensionality of the data. Eight components were associated with eigenvalues greater than unity, if the Kaiser criterion is followed, and nine had eigenvalues greater than 0.7 under the more general Jolliffe (1972) criterion. As shown in Table 3, these factors accounted for over 90% of the variance in the data. The first four factors accounted for 64% of the variance. Communalities were high, only one variable had a communality of 0.66, indicating that all variables contribute to later analyses. We also engaged in preliminary interpretation of the factors, and we found that the first factor is associated with capital adequacy and solvency. The second one was found to be related to risk and asset quality. The third factor had to do with performance and size. Finally, the fourth factor

is also related to another measure of performance. The fifth factor was mainly related to efficiency.

Table 3 – Explained variance analysis with Principal Components Analysis

Component	Eigenvalue	Cumulative % of Variance
1	6,02	25,09
2	4,58	44,16
3	2,43	54,27
4	2,26	63,70
5	1,89	71,58
6	1,66	78,50
7	1,31	83,94
8	0,86	87,54
9	0,73	90,59

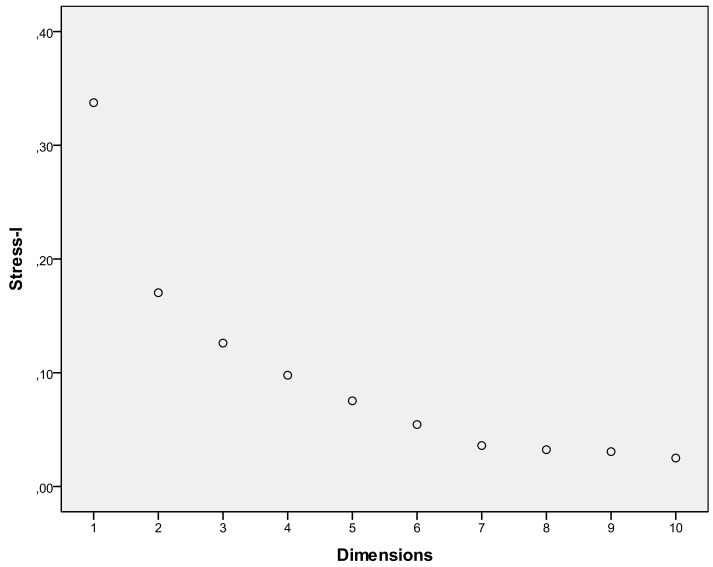
The assumption of normality was rejected for most ratios, in line with the findings of research in this area, Ezzamel et al. (1987). This suggests that a non-parametric approach to modeling is desirable. An appropriate non-parametric alternative to Factor Analysis is Ordinal Multidimensional Scaling (MDS). MDS is a distance-based multivariate statistical technique. A set of distances is calculated between pairs of *Cajas*. This distance is based on the financial ratio structure of the *Cajas*. When two *Cajas* have very similar ratio structures they are placed next to each other in the space; and when two *Cajas* have different ratio structures, they are placed far apart. The distance between ratio structures was based on a Euclidean metric between standardized ratios. MDS is more general than Factor Analysis, being based on relations of order, but both are equivalent when the data is multivariate normal and correlations are used as measures of distance (Chatfield and Collins, 1992). Besides, MDS is robust to the presence of extreme values, a common problem with business data.

Taking into account the results of Principal Components Analysis, we produced a configuration in ten dimensions. As it is common practice in MDS, we assessed the dimensionality of the data using the $Stress_1$ statistic (Kruskal and Wish, 1978). The configuration in ten dimensions returned a $Stress_1$ value of 0.025, which is considered as excellent under Kruskal´s (1964) verbal classification. To find out how the value of $Stress_1$ depends on the number of dimensions, we estimated configurations in 1, 2, 3, 4, 5, 6, 7, 8 and 9 dimensions. The results are given in Table 4, and plotted in Figure 2.

Table 4 –Stress$_1$ and dimensionality

Dimensions	*Stress 1*
1	0,33747
2	0,17038
3	0,12608
4	0,09781
5	0,07533
6	0,05442
7	0,03600
8	0,03235
9	0,03063
10	0,02500

Figure 2 – Elbow diagram



Although there is no clear "elbow" in the graph, we can see that the eighth dimension, and later dimensions, contributes very little to reducing the stress, indicating that a configuration in seven dimensions is appropriate. Nevertheless, the ten dimensional solution was kept, and dimensions eight to ten were treated as "residual variation". Each *Caja* is thus a point in a ten dimensional space. The location of a *Caja* in this space is given by a set of ten coordinates, related to the ten dimensions of the solution. As it is the case with Factor Analysis, the axes of reference are chosen in such a way that the coordinates form an orthogonal set.

If it is the case that distressed *Cajas* have different financial structures from successful *Cajas*, the points associated with distressed *Cajas* will be located in a different area of the space than the points associated with successful *Cajas*. This would have been easy to appreciate if the map had been produced in two dimensions, but cannot be seen in a ten-dimensional map. In order to find out if there are regions of the space that are

associated with successful *Cajas*, and regions of the space that are associated with distressed *Cajas*, we used Logit analysis. The dependent variable in Logit took the value 1 if the Caja had been successful and the value 0 if the Caja had to be rescued. As independent variables we used the coordinates of the *Caja* in the ten dimensional space. The logit model did not include non-linearities or interactions. Not all the dimensions may be relevant in this context, but as the coordinates are orthogonal, the presence or absence of a dimension does not change the beta coefficients of the remaining variables in the solution. With this idea in mind we engaged in a specification search as follows. We used three measures of quality of fit that are common in Logit Analysis: Log Likelihood, Negelkerke R^2, and the percentage of *Cajas* correctly classified by the model. We explored different specifications, and found that the best results were obtained when dimensions 1, 5, and 8 were used as explanatory variables ─ Negelkerke R^2 reached a value of 0.77, and only 4 *Cajas* were misclassified. See Table 5 for full details.

Table 5 – Specification search

Model Coefficients (Significance)				-2 Log likelihood	R-square	Misclassified observations
Dim1 (***)				33,45	0,58	7
Dim2				57,32	0,01	17
Dim3				57,14	0,02	16
Dim4				57,38	0,01	18
Dim5				55,69	0,06	15
Dim6				57,54	0,01	17
Dim7				55,64	0,06	15
Dim8 (*)				54,37	0,10	14
Dim9				57,61	0,00	17
Dim10				57,48	0,01	17
Dim1 (***)	Dim5 [0,12]			30,56	0,63	6
Dim1 (***)	Dim7 (**)			26,72	0,70	6
Dim1 (***)	Dim8 (**)			28,42	0,67	5
Dim1 (***)	Dim5 [0,15]	Dim7 (**)		24,33	0,73	6
Dim1 (***)	**Dim5 (**)**	**Dim8 (**)**		**21,49**	**0,77**	**4**
Dim1 (***)	Dim7 (*)	Dim8		24,99	0,72	4
Dim1 (**)	Dim5 (*)	Dim7	Dim8 (*)	20,37	0,79	5

It is not possible to visualize a ten dimensional set of points, and we are forced to work with projections on two dimensions. Figure 3 shows the projection of the ten dimensional configuration on to dimensions 1 and 5, and Figure 4 shows the projection of the ten dimensional configuration on to dimensions 1 and 8.

Figure 3 – Multidimensional Scaling configuration in Dimensions 1 and 5

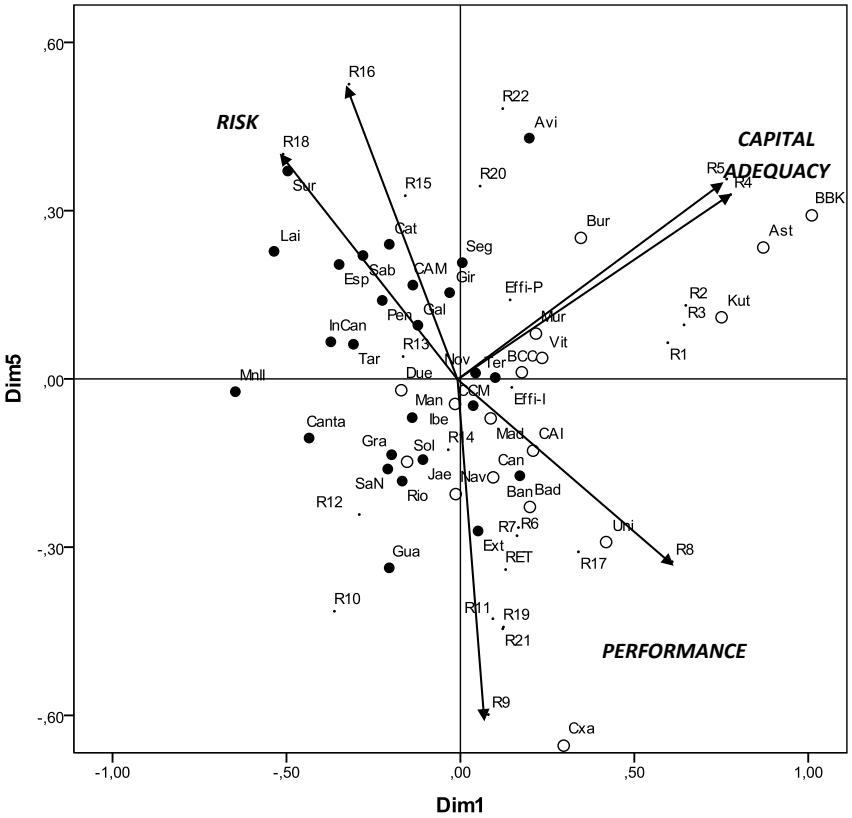
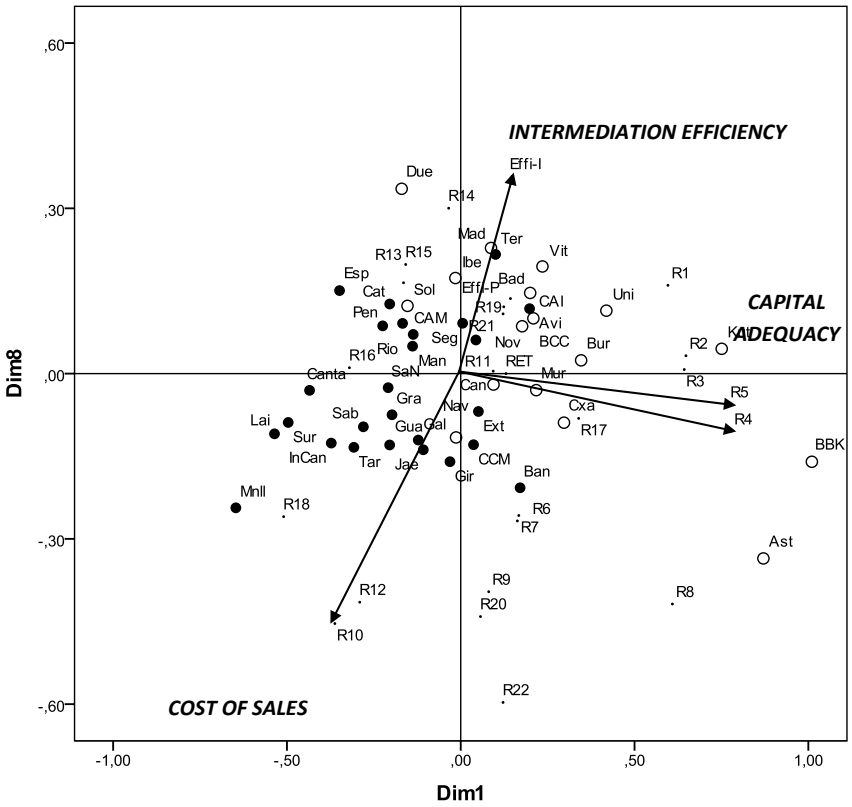


Figure 4 – Multidimensional Scaling configuration in Dimensions 1 and 8



The next step in our methodology is to interpret the configuration. This we did with Property Fitting (ProFit), a regression-based technique that comes under the general umbrella of Biplots (Gower and Hand, 1996; Mar Molinero and Mingers, 2007). With ProFit we explore if a particular characteristic of the data grows in a given direction. This results in a series of vectors through the configuration which serve to interpret it, much in the same way in which North-South and East-West directions serve to interpret geographical maps. Using ProFit we have plotted vectors that show the directions in which particular financial ratios grow. For example, in Figure 4 ratio R5 growths from left to right, suggesting that entities Kut (Kutxa) and BBK are associated with high values of this ratio. Not all ratios have been completely represented in order not to clutter the representation. When the vector is not drawn, we have plotted the end point only; the missing vector can be reproduced by joining the centre of coordinates with the end point of the vector. The directional cosines for the variables in the study, together with the coefficients of determination that were obtained in their estimation can be seen in Table 6.

Table 6 – Results of ProFit analysis

Var.	*Name*	*Dim1*	*Dim2*	*Dim3*	*Dim4*	*Dim5*	*Dim6*	*Dim7*	*Dim8*	*Dim9*	*Dim10*	*Adjusted R-square*
R1	Tier 1 Ratio	0,60	-0,22	-0,13	-0,02	0,06	0,00	-0,46	0,16	-0,44	0,38	0,90
R2	Capital Ratio	0,65	-0,22	-0,10	-0,09	0,13	-0,31	-0,10	0,03	-0,63	-0,05	0,90
R3	K-Buffer	0,64	-0,19	-0,07	-0,12	0,10	-0,29	-0,17	0,01	-0,62	-0,16	0,89
R4	Equity / Total Assets	0,78	-0,21	0,10	-0,04	0,33	0,05	-0,24	-0,10	0,39	0,12	0,96
R5	Equity / Net Loans	0,77	-0,17	0,08	0,14	0,36	0,00	-0,18	-0,06	0,43	0,09	0,97
R6	Net Interest Margin	0,16	-0,64	-0,14	-0,26	-0,28	0,05	0,51	-0,27	0,24	-0,07	0,93
R7	Net Int Rev / Avg Assets	0,17	-0,64	-0,14	-0,29	-0,27	0,08	0,53	-0,26	0,19	-0,05	0,93
R8	ROAA	0,61	0,17	-0,21	0,03	-0,33	0,37	0,04	-0,42	0,23	0,29	0,91
R9	ROAE	0,08	0,36	-0,30	0,05	-0,60	0,41	0,26	-0,40	-0,14	0,05	0,88
R10	CIR	-0,36	-0,34	0,22	0,42	-0,41	-0,28	-0,26	-0,45	-0,06	-0,05	0,78
R11	Interbank Ratio	0,09	-0,32	-0,29	-0,06	-0,43	-0,71	0,04	0,00	-0,20	-0,26	0,48
R12	Net Loans / Tot Assets	-0,29	-0,10	0,03	-0,74	-0,24	0,13	-0,21	-0,41	-0,26	0,04	0,83
R13	Net Loans / (Dep + ST Funding)	-0,16	0,39	-0,13	-0,71	0,04	-0,46	-0,10	0,16	0,20	-0,10	0,88
R14	Liquid Assets / (Dep + ST Funding)	-0,03	0,05	-0,18	0,58	-0,13	-0,56	0,38	0,30	-0,26	-0,06	0,83
R15	Loan Loss Reserve / Gross Loans	-0,16	-0,38	-0,40	0,11	0,33	0,23	0,56	0,20	0,32	-0,22	0,77
R16	Impaired Loans / Gross Loans	-0,32	-0,32	-0,67	0,01	0,53	0,19	-0,07	0,01	0,14	-0,03	0,92
R17	Loan Loss Res / Impaired Loans	0,34	0,21	0,49	0,02	-0,31	-0,02	0,13	-0,08	0,49	-0,50	0,85
R18	Impaired Loans / Equity	-0,51	-0,26	-0,59	-0,01	0,40	0,07	-0,16	-0,26	0,10	-0,24	0,95
R19	Total Assets	0,12	0,55	-0,56	0,32	-0,44	0,04	-0,11	0,12	0,17	-0,04	0,91
R20	TA Growth	0,06	0,22	0,02	-0,08	0,34	-0,44	0,52	-0,44	-0,17	0,37	0,90
R21	Gross Loans	0,12	0,57	-0,59	0,26	-0,45	0,06	-0,09	0,11	0,14	-0,08	0,90
R22	GL Growth	0,12	0,49	0,09	0,00	0,48	0,06	0,36	-0,60	0,09	-0,07	0,80
Effi-P	Production model of efficiency	0,14	0,15	-0,12	-0,10	0,14	0,58	0,17	0,14	-0,67	-0,30	0,67
Effi-I	Intermediation model of efficiency	0,15	0,25	-0,43	-0,69	-0,02	-0,34	0,03	0,36	0,09	-0,10	0,90
RET	Boardmember Retribution	0,13	0,53	-0,46	0,44	-0,34	-0,15	-0,26	0,00	0,26	0,18	0,60

It can be seen in Figure 3 that ratios R1, R2, and R3 are at an acute angle with Dimension 1, indicating that this dimension is associated with Capital Adequacy, or Solvency. In the same figure we can see that Dimension 5 is associated with Performance (R9) and Risk (R16). The preponderant role of the Intermediation Efficiency ratio (Effi-I) and its opposite, the Cost to Income Ratio (R10) in the discrimination between healthy and distressed entities can be observed in both Figure 3 and Figure 4. These figures produce, therefore, a visual representation of the role Capital Adequacy, Solvency, Risk, Performance, and Intermediation Efficiency in the distress of the *Cajas*.

The role of Capital Adequacy and Performance Ratios becomes evident in Figure 4, since the vectors pertaining to ratios R5, R8, R1, R2, R3, and R9 point in the direction where the institutions that survived the crisis are to be found. In Figure 4 we can see the crucial role of the Intermediation Efficiency ratio. We conclude that the entities that had to be rescued were already characterized in 2006 (before the onset of the crisis) by low Capital Adequacy ratios, low Performance Ratios, and low Intermediation Efficiency.

3.2. Corporate Governance

The *Cajas* are not-for-profit financial institutions with peculiar governing arrangements within the Spanish system, which is characterized by a banking-oriented financial system with concentrated ownership structures (Azofra and Santamaría, 2011). They have no explicit owners and they are not subject to the control of shareholders, unlike their competitors, the commercial banks (Crespi et al., 2004). The strategic decisions of the *Cajas* are taken by their governing bodies, made up of stakeholders, including political party appointments. There has been much debate on the role of political appointees in government of the *Cajas*, and whether they have contributed to their success or failure. Cuñat and Garicano (2010) have analysed the lending performance of the Cajas, including non-performing loans, before the 2007 financial crisis. They related differences in the composition of governing bodies to the success of the entities and found, amongst other things, that neither the composition of the Board of Directors, nor the importance of the political presence was related to the performance of their credit portfolios.

In this study we have also taken up the issue of Governing Bodies membership. For every *Caja* we have collected information on the percentage of politicians in the Governing Body. This variable has been treated as a "property" in the Property Fitting technique. This involves running a regression in which the percentage of politicians is taken as a dependent variable and the dimensions of the *Cajas* in the ten-dimensional representation are taken as explanatory variables. If the value of R^2 is low, say below 0.5, it appears that the configuration does not bring any light on the role of politicians into *Cajas* distress. As it can be seen in Table 7, values of R^2 are low: 0.30 for "Politicians in the General Asssembly", and 0.29 for "Politicians in the Board of Directors", thus confirming the results observed by Cuñat and Garicano (2010).

The analysis was repeated with the Herfindahl-Hirschman index of stakeholder concentration (Hirschman, 1964), with the ratio of Board Compensation/Total Assets, and with the ratio of Board Compensation/Operating Income. The coefficients of determination took very low values, ranging from 0.10 to 0.15. However, we found that Retribution per Board member was explained by the map. The results have been summarized in Table 7. This is consistent with the view that the directors of the *Cajas*, not being motivated by profit, have growth as an objective, and use their power within the governing bodies to reward themselves by their "success" (Serra Ramoneda, 2011).

Table 7 – Relation of some Corporate Governance issues with *Cajas'* success

Corp. Gov. Issue	*Variable*	*n*	*Adjusted R-square*
Political weight	Politicians in Assembly	43	0,30
	Politicians in Board	43	0,29
Stakeholder concentration	Herfindahl–Hirschman Index Assembly	43	0,10
	Herfindahl–Hirschman Index Board	43	0,15
Board retribution	Board retribution / Total Assets	43	0,14
	Board retribution / Operative Income	43	0,11
	Retribution per boardmember	43	0,60

3.3. Four case studies

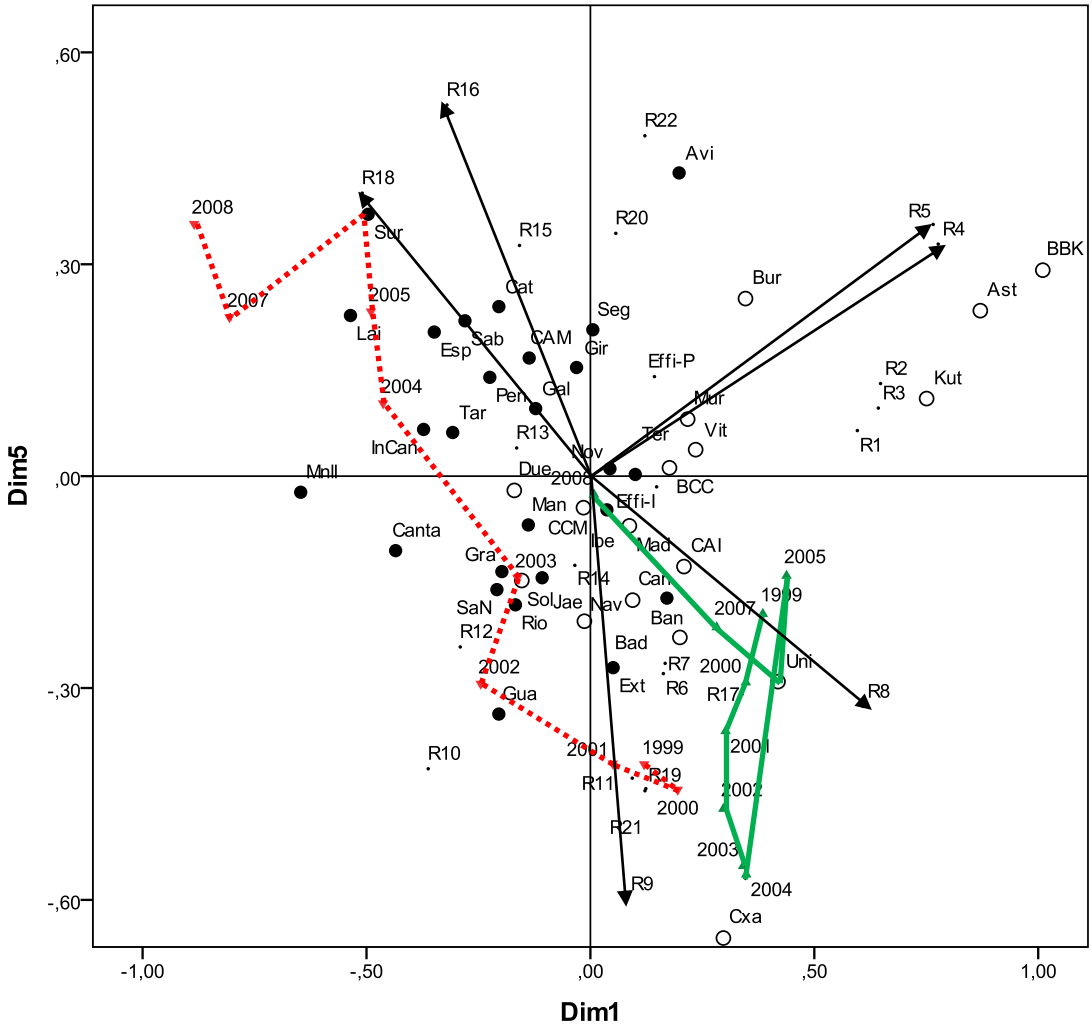
The MDS representation has been constructed with 2006 data, and we have seen that it gives a visual representation of the financial situation of the *Cajas* just before the onset of the financial crisis. It also shows that there were structural differences between the *Cajas* that had to be rescued and the *ones* that survived the crisis. However, this analysis is based on a snapshot of the financial situation at a particular moment. We would also like to explore the dynamics of the process; i.e., the path followed by a particular *Caja* over the years and how this is related to its financial situation in 2011. This the same situation is faced in the prediction of company failure, where the usual approach is to collect data from a sample of failed companies and continuing companies for a given year, to build a model, and to use this model to assess the financial health of a company not included in the sample on the basis of its financial ratios. The data used to build the model having been, in general, collected earlier than the data available for the company whose health is being assessed. The assumption being that the results of the model remain valid, at least for some years. We show here how the life story of a *Caja* over time can be traced using the results we have derived from the 2006 data set.

We present now four case studies: two successful *Cajas* and two *Cajas* that had to be rescued. We are interested in the path that they followed towards success or distress. The methodology we use is the same one that was employed by Mar Molinero and Serrano Cinca (2001). For a given *Caja*, say Unicaja, we collect information from the period 1999 to 2009; 2009 being the latest year for which we had information in the database. The configuration built with 2006 data was kept unchanged. On this configuration we projected Unicaja as 11 points, each point corresponding to a particular year. We did this one year at a time. The result can be seen in Figure 6, which also shows the path followed by a distressed *Caja*, CajaSur. The path followed by two additional *Cajas* can be seen in Figure 7. We have only represented the configuration in Dimensions 1 and 5, as these two dimensions are revealing enough.

We see in Figure 6 that Unicaja (continuous line), had in 1999 a high Return on Assets ratio (R8), a high value of Return on Equity (R9) and also a high value of the ratio Loan

Loss Reserve/Impaired Loans. The value risk ratios R16 (Impaired Loans/Gross Loans) and R18 (Impaired Loans/Equity) was low. This situation remained until 2008 when Performance Ratios (R8 and R9) and Risk Ratios (R16 and R18) deteriorated bringing Unicaja in what would have been a marginal situation between success and failure in 2006. In this same figure we see the evolution of CajaSur (dotted line). CajaSur started in 1999 with excellent values of the Performance Ratios (R8 and R9) and Risk Ratios (R16 and R18). It is worth noticing that in 2006 the CajaSur financial situation had already been steadily deteriorating from year to year, so its distress problems should not have been a surprise. In 2010 CajaSur was taken over by a successful *caja*, BBK.

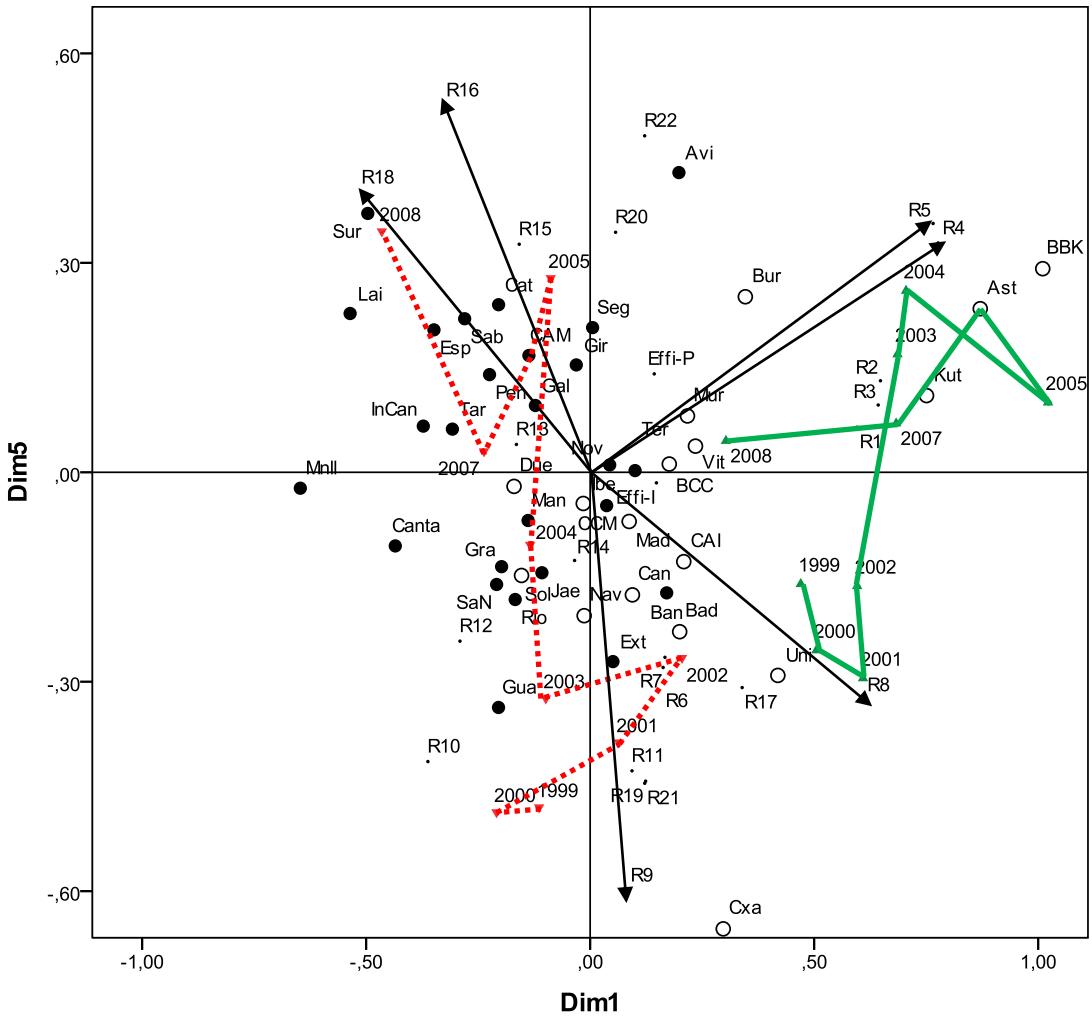
Figure 6 – Time Evolution of Unicaja (continuous line) and CajaSur (dotted line)



In Figure 7 we trace the evolution of the financial ratios of Cajastur (continuous line). We see that in 1999 this *Caja* had high values of Performance Ratios (R8 and R9) and only average values of Solvency Ratios (R4 and R5). From 2001 to 2004 Solvency Ratios increased at the expense of Performance Ratios. The financial crisis caught this *Caja* well prepared. The point associated with Cajastur moved towards the centre of the configuration but stayed on healthy *Cajas* region. A very different story emerges when

looking at the path followed by CAM (dotted line in Figure 7). In 1999 CAM started with high values of Performance Ratios and low values of Risk Ratios, but these ratios continuously deteriorated over time. In 2011, having gone through several unsuccessful attempts to keep CAM with the *Cajas* sector, it was finally taken over by a commercial bank (Banc de Sabadell).

Figure 7 – Evolution of Cajastur (continuous line) and CAM (dotted line)



4. Conclusion

The Spanish saving banks or "*Cajas de Ahorros*" have a long and successful history within the Spanish financial system spanning over a century. They have suffered much during the 2007 credit crunch. This was unprecedented, as no *Caja* had ever been rescued by the Deposit Guarantee Fund. The question that we addressed in this research is whether there were underlying financial weaknesses in the system that had remained hidden and were brought forward as a result of the credit crunch. We were also interested to find out if past financial information could be used to trace the path that *Cajas* had followed in the way to success or distress. We have used multivariate statistics to show that this was indeed the case.

We have used a multivariate statistical methodology that, while having a strong theoretical basis, visualises the results in the form of maps making the results accessible to the person who does not have a strong statistical background. The statistical maps have revealed that the *Cajas* that had to be rescued had low values of Capital Adequacy Ratios, low Performance Ratios, high Risk Ratios, high Cost of Sales Ratios, and low Intermediation Efficiency in the Data Envelopment Analysis sense. We have also used the statistical maps to trace the time evolution of two successful *Cajas* and two *Cajas* that had to be rescued.

The changes in financial regulation that allowed the *Cajas* to compete with commercial banks made it possible for these institutions to expand beyond their traditional local environment and to take up business that, in the past, would have been left to commercial banks. By opening new branches and taking on more risky business, the *Cajas* increased their assets and, by so doing, the denominator of their solvency coefficient. But the *Cajas* had to keep their solvency coefficient above the limit set by the financial regulator, something that they could only do in a limited way, as they have no shareholders and can only increase their capital (numerator or the coefficient) through the way of retained profits. The result was deterioration in their solvency ratios, something that left those with "ambitions" in a very delicate position when the credit crunch arrived. The *Cajas* could have remained within their traditional regions and ignored the temptation to expand. Some of them did just this, but most managers saw growth as an opportunity to increase their power, their status in society, and their income, as argued by Serra Ramoneda (2011). This interpretation of events is consistent with the findings of our research.

A separate question is whether the peculiar Corporate Governance arrangements of the *Cajas* had influenced their success or failure. We were particularly interested in the presence of political appointees in Boards of Directors. The analysis did not reveal any association with distress, as measured through the financial ratios.

The next obvious question to explore is whether commercial banks are more or less successful than charitable organisations such as the *Cajas*. We leave it for a further study.

References

Ayuso, J., Pérez, D. and Saurina, J. (2004) Are capital buffers procyclical? Evidence from Spanish panel data. *Journal of Financial Intermediation*, 13, 249-264.

Azofra, V. and Santamaría, M. (2011) Ownership, control, and pyramids in Spanish commercial Banks. *Journal of Banking and Finance*, 35, 1464-1476.

Banco de España (2010) *Nota Informativa*. La Reestructuración de las Cajas de Ahorro en España, situación a 29 de junio de 2010.

Banco de España (2011) *Report on Banking Supervision in Spain 2010*.

Berger, A.N. and Humphrey, D.B. (1997) Efficiency of financial institutions: International survey and directions for future research. *European Journal of Operational Research*, 98 (2), 175-212.

Chatfield, C. and Collins, A.J. (1992) *Introduction to Multivariate Analysis*. Chapman and Hall, London, UK.

Crespí, R., García-Cestona, M. and Salas, V. (2004) Governance mechanisms in Spanish banks. Does ownership matter? *Journal of Banking and Finance*, 28, 2311-2330.

Cuñat, V. and Garicano, L. (2010) Did Good Cajas Extend Bad Loans? The Role of Governance and Human Capital in Cajas' Portfolio Decisions. Working Paper. *Fundación de Estudios de Economía Aplicada*.

Demyanyk, Y. and Hasan, I. (2010) Financial crises and bank failures: a review of prediction methods. *Omega*, 38(5), 315–324.

Ezzamel, M., Mar Molinero, C. and Beecher, A. (1987) On the distributional properties of financial ratios. *Journal of Business Finance and Accounting*, 14, 463-482.

Fiordelisi, F., Marques-Ibañez, D. and Molyneux, P. (2011) Efficiency and risk in European banking. *Journal of Banking and Finance*, 35, 1315–1326.

Gower, J.C. and Hand, D.J. (1996) *Biplots*. Chapman & Hall, London.

Hansmann, H. (1996) *The Ownership of Enterprise*. Harvard University Press, Cambridge, MA.

Hirschman, A.O. (1964) The Paternity of an Index. *The American Economic Review*, 54 (5), 761.

Jolliffe, I.T. (1972) Discarding Variables in a Principal Components Analysis, I: Artificial Data. *Applied Statistics*, 160–173.

Kruskal, J.B. (1964) Multidimensional scaling by optimizing goodness of fit to a non-metric hypothesis. *Psychometrika*, 29, 1–27.

Kruskal, J.B. and Wish, M. (1978) *Multidimensional Scaling*. Sage Publications, London, UK.

Ley 31/1985, de 2 de agosto, de regulación de las normas básicas sobre Órganos Rectores de las Cajas de Ahorro (LORCA).

Ley 44/2002, de 22 de noviembre, de Medidas de Reforma del Sistema Financiero.

Ley 26/2003, de 17 de julio, de Fomento de la Transparencia y Seguridad en los Mercados y Sociedades Cotizadas.

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

Mar Molinero, C. and Mingers, J. (2007) Mapping MBA Programmes: an alternative analysis. *Journal of the Operational Research Society*, 58, 874-886.

Real Decreto 1582/1988 de 29 de diciembre, de modificación del Real Decreto 1370/1985, en materia de expansión de Entidades de Depósito.

Real Decreto-ley 9/2009, de 26 de junio, sobre reestructuración bancaria y reforzamiento de los recursos propios de las entidades de crédito.

Salas Fumás, V., De Guindos, L., Martínez Pujalte, V. and Sevilla, J. (2009) *Pasado, Presente y Futuro de las Cajas de Ahorro*. Editorial Aranzadi – Thomson-Reuters.

Serra Ramoneda, A. (2011) *Los errores de las cajas*. Ediciones Invisibles. Barcelona, Spain.

Serrano Cinca, C., Mar Molinero, C. and Fuertes-Callén, Y. (2011) Modelling Banking Efficiency with DEA. Working Paper. *University of Kent*.

Shleifer, A. and Vishny, R. (1997) A Survey of Corporate Governance. *Journal of Finance*, 52, 2, 737-783.

Tirole, J. (2001) Corporate Governance. *Econometrica*, 69, 1-35.

Winkler, A. (2004) Missing Data – Where is the Solution. *OR lnsight*, 17 (1), March – May 2004.

Zingales, L. (1998) *Corporate Governance*. The New Palgrave Dictionary of Economics and the Law.