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Research Article

Structural and Evolutionary Patterns of Companies in a Financial Distress Situation

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The present paper studies the evolution of a set of USA firms during the years 1993–2002. The firms that faced a difficult economic and financial situation in 1993 were considered to be in a distress situation. The aim of this study is to explore if the evolution of this situation depends on the initial features of the distress or if it concerns certain firms' characteristics. If the evolution is independent from the above, the management decisions become crucial in critical times. For the analysis we used a Multidimensional Scaling methodology where the firms are represented in a consensus map according to symptom variables, reaction variables, and recovering variables.

1. Introduction

The research on financial distress has been closely tied to the determination of failure prediction models. Failure is considered to be the result of an evolutionary process, where the underlying idea is the possibility that the crisis can indeed be anticipated [1].

Pioneer prediction models such as the one proposed by Altman [2] built the basics of the research based on prediction. Those researches were mainly centered on minimizing classification errors and maximizing goodness of fit measures using certain variables throughout a wide period of time. In this context, prediction models were evaluated based on their percentage of success in the classification of the control sample companies [3]. The existence of an error in the classification of those companies, which did not fail even though were being described as failed, was considered as a failure of the proposed model. Nevertheless, these results leave an open door to consider the possibility that the companies can indeed survive a difficult situation or even subsist in a permanent crisis situation. This approach would allow considering the possibility that the failure process can sometimes not be an evolutionary-degenerative process, but it can revert so that the companies are able to subsist, even though still indicating certain situations that can determine their survival. In

this sense, prediction models not only provide some essential information in order to take actions against the given default probability, but also warn about a future outcome which, in many cases, may not even take place.

This "passive" use of the models has been highlighted by Altman and Hotchkiss [4] who affirm that stakeholders should have a more active participation instead of being simple onlookers of a given "probability of default". Basically, this default probability should be considered as vital information by the managers not only to improve business strategies in order to manage a distressed situation and return to a healthy financial situation, but also to develop investment strategies for potential investors or auditors assessing a going-concern qualification [5].

In recent years, "revolving" a crisis situation has been of much interest in many research papers the aim of which is to identify those patterns that distinguish companies in crisis situation that are able to resolve their issues against those that are not. These studies show that there exist different strategies that may successfully guide a company through the exit of the crisis situation [6–11]. The main question is: can this evolutionary deterioration always be reverted by means of certain strategic actions or the success may be affected by given structural strong/weak points of the company? Using a metaphoric reasoning, whenever a company is facing a disease such as financial distress, could it return to a healthy state only by means of therapeutic actions or does the cure depend on the absence of certain structural features?

Different researches on the traditional line of failure have shown that the economic and financial structure of the companies that fail seems to be different from the ones that do not [12]. In particular, it is interesting to analyze the structural differences between the companies that, in spite of being in a state of crisis of a different degree, end up resolving the situation and those that do not. In this sense, Gilberts et al. [13] affirm that the financial variables that distinguish between the failed and not failed companies are not the same as those that distinguish between failed companies and firms with difficulties. Nevertheless, Poston et al. [14] found that the financial ratios are questionable regarding their capacity to differentiate between the companies in crisis which are able to resolve the situation and those that are not. As a result, it is necessary to find out if there exist some patterns that determine the recovery possibility when a firm faces a hard financial situation.

This paper concentrates in the analysis of the similarities and differences between structural features of a dataset of 524 companies facing some degree of financial distress situation because they fulfill certain group of widely accepted symptoms. This analysis can be seen through the changes in firms' positions 10 years later, according to certain indicators of the process of "management" of that situation of crisis. We evaluated this process of "management of the crisis" considering three dimensions of analysis: (a) economical and financial situation in the first year of the analysis, (b) reaction path, and (c) strength of the situation. For this evaluation, we chose to use Multidimensional Scaling (MDS), which provides a visual representation of the pattern of proximities (i.e., similarities or distances) among a set of objects. This technique has also been used in other papers that have studied company failure [12, 15–17]. This study does not start off a direct link between company survival and certain economical-financial indicators. The MDS methodology allows us to analyze the profiles of firms in a specific financial distress situation without any *a priori* assumptions on causal relations that could be used as predictors of the status at the end of the analyzed period. The objective is to explore the possible existence of this bond through the analysis of map placement of the companies in difficulties and the changes in these positions, according to their economic and financial structure and their initial starting situation.

2. Situations of Company Crisis

Throughout the years, and also taking as reference the initial works of Beaver [18] and Altman [2], the research has been oriented towards the determination of the structures that differentiate the failed companies from the not failed ones. The purpose of these studies was to reveal the alert status lying underneath [1, 19–23]. These researches differed with respect to the use of different statistical techniques for the creation of models or the use of distinct predictive variables. However, most of them were characterized by using paired samples of healthy and financially distressed companies [5]. In addition, they have not been free of critics associated to the used models, the variables, or the sample selection [1, 22, 24]. These investigations have reached some interesting conclusions regarding firm distress. Many of these contributions are consequence of the approaches that tried to resolve some of methodological deficiencies of the initial studies, such as the use of deterministic techniques that did not allow to analyze the failure as a continuous process [25–27], the problems to distinguish the outcome of the companies in crisis [5, 13, 14] or the nonconsideration of failure as a situation in any point where a company can have serious problems that introduce some uncertainty and risk in its future [28].

In this sense, in the last years, various researches have introduced a variant on the prediction models by considering that the failure processes are continuous and that they are not identical for all the companies [29]. Articles like those of Laitinen [24], Luoma and Laitinen [25], Shumway [27], and Laitinen [30] consider some scenes that had already been introduced by other authors like Argenti [31]: the failure has different phases and each phase has different features. The failure state is identical for all the companies that fail, but its evolution is different and the explanatory variables commonly associated to the failure process vary according to the phase the company is in [30, 32]. This approach can be found in other studies that "catalogue" companies based on the process that leads to a certain outcome [24, 33–35]. As a result, failure is identified as a final state that begins with situations in which a company declares to have difficulties or problems [25]. Nevertheless, the difficult situations are evolutionary. This means that they can degenerate, remain still (which would go against the survival theory), or they can be solved independently of the difficulty degree of the problem. Hence, there exists a state of "safety" where companies which at some time presented some serious problems of continuity have been able to resolve them.

Although the term financial distress is generally linked to an objective situation as bankruptcy status, receivership, creditors' voluntary liquidation, bond default, filing for Chapter 11, or disappearance of the company [2, 5, 18, 36], it should to be considered in a broader sense. The conditions that produce financial distress do not have to be the same as those of a bankruptcy situation [28, 37]. Thus, *crisis* should be understood as a situation of threat for the viability of the company where certain financial events reflect a variety of enterprise adversity [28]. In these cases there exists some "incapacity" to generate resources and/or to fulfill the payment of debts in time. This "incapacity" can be transitory and of a major or minor gravity. It can be seen through a series of symptoms that are independent of the causes and of the consequences. These symptoms constitute the alert that the health and the future of the company is at risk.

The symptoms that detect a company in crisis are common in most of the studies that have investigated on this subject. Certain variables show that the economic and financial information in the annual statements reflects some problems in the health of the company. Some of these variables are Negative Net Income (in some cases Negative Operating Income), Negative Working Capital, Negative Cash Flow (in some cases Operating Cash

Flow), Negative Equity, or Negative Retained Earnings in previous years [38–41]. Ponemon and Shich [42] perform an inverse selection. They select those companies that did not have problems, so, these companies had positive Net Income, sufficient Current Assets, positive Operating Cash Flow, and positive liability ratios. Poston et al. [14] also classified companies in crisis those that had a solvency ratio less than unity. Martin [43] associates the return on equity with the companies that can be in a difficult situation (and susceptible to receive a qualified audit opinion). This ratio responds to financial characteristics as well as nonfinancial ones. Another criterion could be when a company shows less Operating Income than its financial expenses [44]. Smith and Graves [3] use a Z-score model developed by Taffler [45] to identify firms in financial distress situation. In most of the papers, a crisis situation existed when several symptoms of the previous were combined. However, in some works [38, 40, 41] a company was considered in a difficult situation when fulfilling only some of them. Along with the previous criteria, it is frequent to use the auditors' qualified opinion report to list a company in crisis [38, 42] or to better expose the difficult situation it is passing through [40].

The previous variables are simply symptoms that a crisis situation may take place. The differential matter is the latent factors [26] that lie beneath, that is, the weaknesses and deficiencies in the management of the company that are transformed in that incapacity from an economic or financial point of view. In this sense, Geiger et al. [39] group the failed companies in three types according to their symptoms: frequent negative Cash Flow, frequent Operating Losses, or negative Working Capital. By doing this, they assume that different underlying structures can exist in crisis processes. This distinction between symptoms and causes can be easily seen also in the different papers that have studied company crisis. For instance, ratios or variables were used as numerical indicator of the deficiencies and then were introduced as explanatory variables of certain models. Neophytou and Molinero [12] consider latent variables that describe several aspects of a company and frequently they refer to dimensions like: liquidity, risk, returns, quality of the assets, activity, or management.

There is no longer a direct relationship between symptoms and failure. The outcome depends on external variables (economic environment) and internal or structural variables (management decisions). In this sense, some authors suggest that small companies seem to fail because of financial problems while big companies fail due to problems associated to management [46]. Gilbert et al. [13] indicated that the resolution of a problem may be influenced by nonfinancial factors while Poston et al. [14] uphold the identification of variables, other than financial ratios, discriminating distressed firms that will survive against those that will not.

This approach allows us to consider that the financial distress could be "managed" so that they can no longer be considered as evolutionary-degenerative by nature but simply evolutionary. Khal [47] considered the processes of company crisis as a selection mechanism so that the best companies have a greater probability to survive. In his work it was demonstrated that the behavior of the companies during a financial crisis is crucial for the process of "exit" from this situation. Nevertheless, variables like size, liabilities or the complexity of the debt do not seem to affect the survival probability. These questions point out that the "management" in difficulty situations can differentiate the final result of the evolution process more than the firm's specific financial characteristics. Aragonés and Sánchez [37] affirmed that managerial decisions affect the success or failure derived by a company crisis. Also, Luoma and Laitinen [25] established that the causes of the failure are often associated with an inadequate management which can be observed through the deterioration of financial ratios. Ooghe and Prijcker [35] denote that the management of a

firm together with its general and immediate environment can be the causes of bankruptcy. Also, Altman and Hotchkiss [4] assert that highly risky structures can return to a healthy scenario depending on decision management's success. In this context, some papers focusing on the turnaround process highlight the strategies followed by the managers of firms in difficult situation to return to a healthy scenario, such as retrenchment strategies or downsizing strategies [6–9]. As a result, the possibility of improving the economic-financial indicators depends on the type of restructure selected [10, 11]. However, the success of the turnaround process depends on other variables like company size or severity of distressed state [3].

Considering some of the ideas raised by the previous authors with respect to the evolutionary processes related to the company crisis and according to the characteristics of the methodology that we are going to use, we expect that the positions of the analyzed companies in the plot can verify the following.

(1) The existence of structural differences between the companies that show different symptoms of a crisis. If failure is a continuous process and, sometimes degenerative, we can expect that the companies with serious symptoms of crisis are positioned clearly separated from those presenting a weak crisis, according to their variables structures.

(2) The outcome, or the position reached by a company after overtaking surpassing a period of crisis, is independent from the condition it began with. At the end of the period of analysis, the companies will be in a new position of "crisis" or "safety" depending on the following.

   (a) Their structural characteristics, despite of the symptoms they showed at the beginning of the analysis. Authors like Ooghe and Prijcker [35] assert that the difference between the failure processes depends on the distinctive initial lacks.

   (b) The effort of the "management" of the crisis. The companies with greater effort in operating activity will improve their situation in spite of the initial symptoms they had. In this sense, Khal [47] and Routledge and Gadenne [48] affirm that "operating performance" reflects the effort made during a distress situation and determines a successful evolutionary process towards the exit from that situation.

3. Methodology, Sample, and Variables

3.1. Methodology

Multidimensional Scaling (MDS) [49] is a multivariate statistical analysis tool that produces graphical representations of the main characteristics of a data matrix [17]. This technique is based on the generalization of the principal component analysis that allows representing the similarities or differences between various elements according to the distances between certain variables [50]. MDS produces a consensus map when the observed individuals are represented according to the underlying variable's structure. The similarities between the structures of the individuals can be observed through the proximity of the represented points, so that if two individuals appear close to each other it is because they share similar

information. On the contrary they will be positioned far from each other if their information is not similar.

This technique has been used before in the analysis of company failure [12, 15–17] although its use was focused on differentiating between failed and not failed companies.

For this study, we chose the ordinal scaling which works with orderings and does not require the data to be measured on a ratio or interval scale [17]. MDS algorithm does not make any assumptions about the distribution of the financial ratios applied in the analysis and no prior data reduction is necessary. For a list of advantages of this technique, see Neophytou and Molinero [17].

The variables of the original data matrix can also be projected onto the consensus map by the Co-Plot methodology. The coordinates of the variables' positions will be estimates by a multiregression process that will be discussed in detail in the results section.

3.2. Sample

We selected a wide 10-year scenario to analyze the evolution process of companies that, according to the criteria exposed in the first section of this paper, presented some kind of financial distressed situation. In this sense, Khal [47] shows that some companies are able to resolve a situation of difficulty in an average of three years and then perform just as well as the industry average. This period of time is much shorter than the ones considered in other works [14] which raise it in about 7-8 years for a company to get ahead of a crisis situation. However, Smith and Graves [3] consider that a four-year period should be sufficient to detect if a firm in a distressed situation can successfully return to a healthy scenario.

The year 2002 is considered as an important "transit" year for the financial information and the Stock Market. It was marked by events like the Stock Market Crash, the loss of investor's confidence in the Stock Market, or the emergence of corporate fraud and corporate governance. This is the reason why the year 2002 was the end limit for our 10-year analysis period. In this way, the economic and financial data would not be influenced by external factors. Thus, the analyzed scenario covers the years from 1993 until 2002.

The data used in this study were derived from Compustat Database. For their particular structure and function, firms operating in financial service industry were eliminated. We also excluded the companies that presented incomplete or inconsistent information in the analyzed years. Companies that did not have data starting from a certain year were studied separately in order to identify if they were inactive in the market and the reason of their inactivity, by means of Compustat item "Inactive Issue Status Market". A total of 1721 companies were considered valid for the sample because they neither presented any incomplete data in their financial statements in one or various years nor disappeared from the Compustat Database during that period for reason not linked to liquidation or bankruptcy according to the Compustat Inactive Item.

The next step was to identify the companies that in 1993 presented a distressed situation. To select financial accounting symptoms, we chose variables widely used in the previously discussed studies. For this study, we selected the following criteria to classify a firm as being in a financial distress situation in the first year of analysis: Negative Net Income, Negative Operating Income, Negative Retained Earnings, Negative Working Capital, Negative Cash Flow, Negative Operating Cash Flow, and Negative Shareholder's Equity (for detailed definition of these variables, see Table 3). Whenever a firm presented one or more of the above indicators in the first year (1993), it entered in the sample. However, if the company presented a Negative net Income as the only problematic symptom, the fulfillment of at least

Table 1: Sample distribution according to industry and number of distress criteria fulfilled in 1993.

Industry	Nr. of criteria fulfilled						Total	Total (%)
	1	2	3	4	5	6		
Consumer discretionary	59	16	7	8	10	0	100	19,08%
Consumer staples	11	5	4	3	0	0	23	4,39%
Energy	16	10	4	0	4	0	34	6,49%
Health care	17	6	1	3	37	1	65	12,40%
Industrials	52	22	19	7	12	4	116	22,14%
Information technology	24	7	13	9	8	0	61	11,64%
Materials	18	14	7	4	3	2	48	9,16%
Telecommunication service	5	3	2	2	1	0	13	2,48%
Utilities	60	2	2	0	0	0	64	12,21%
Total	262	85	59	36	75	7	**524**	100,00%
Total (%)	50,00%	16,22%	11,26%	6,87%	14,31%	1,34%	**100,00**%	

Table 2: Distribution of probability of default.

Probability of default	Classification levels	Nr. of companies
Very High (VH)	$Z < 1.81$	441 (84,17%)
High (H)	$1.81 < Z < 2.75$	61 (11,64%)
Low (L)	$2.76 < Z < 2.99$	5 (0,95%)
Very Low (VL)	$Z > 3$	17 (3,24%)

one of the other 6 criteria was required in order to classify that firm as facing a distressed situation. In this way, following a similar criterion as Gilbert et al. [13], the company indicated a continued situation when Negative Net Income came together with other symptoms such as losses in previous exercises or problems in other solvency symptoms. The selection criterion allows us to avoid selecting firms that are only presenting a poor performance in that year.

As a result, 753 US companies showed a situation of instability in 1993. However, in 2002, except two companies, the remaining 751 companies were still active in the market. This evidence indicates that there is an important survival rate of firms even though they have undergone a severe crisis.

This number is reduced to 524 companies because some of them did not present some of the necessary information for the further analyses such as interest expenses or stock capitalization. The distribution of the firms by sector and by number of symptoms fulfilled can be found in Table 1.

A total of 77% of the sample firms satisfy 1, 2, or 3 criteria while 23% of the firms are facing a *severe* situation (4 or more criteria). The number of criteria allows us to classify the companies *a priori* according to the gravity of the crisis situation and to analyze their evolution throughout the 10 years. We expect that the companies in a weak crisis situation will have a greater possibility to be placed in a safer position by the final year of analysis.

There exist many failure prediction models that could be used to assess default probability of distressed companies. Some of these techniques are the Z-score models, KMV's EDF model, CreditSights' BondScore model and so forth, [4]. We chose to apply the Z-score [2] and see how the firms of our sample were classified on an indicative basis only. The distribution of the Probability of Default is presented in Table 2. As a result, although 84% of the companies have a very high probability of default they are still active in the market

Table 3: Financial ratios.

Category	Variable name	Variable definition*
Reaction path	V_1	Shareholders' equity/Total liabilities
	V_2	Current assets/Current liabilities
	V_3	Sales/Total assets
Economic and financial structure	V_4	Net income/Total assets
	V_5	EBIT/Total assets
	V_6	Retained earnings/Total assets
	V_7	Working capital/Total assets
	V_8	Cash flow/Total assets
	V_9	Operating cash flow/Total assets
	V_{10}	Shareholders' equity/Total assets
Strength	V_{11}	EBIT-interests (Year$_{n+1}$)
	V_{12}	EBIT/Total assets (Year$_{n+1}$)

* Variables defined according to Compustat (Global) Data Guide. In order of appearance:
Shareholders' Equity = This item represents common/ordinary and preferred/preference shareholders' interest in the company and any reserves reported in the Shareholders' Equity section.
Total liabilities = This item represents the total value of all items reported in the Liabilities section.
Current Assets = This item represents cash and assets expected to be realized in cash and used in the production of revenue during the next 1-year operating cycle.
Current Liabilities = This item represents debt and other liabilities due within one year.
Sales (Turnover) = This item represents gross sales reduced by cash discounts, trade discounts, returned sales, excise taxes, and value added taxes and allowances for which credit is given to customers.
Total Assets = This item represents the total value of assets reported on the Balance Sheet.
Net Income (Net Items) = This item represents all accounts reported after taxes that are not extraordinary exceptional items, discontinued operations, or minority interest.
Operating Income (EBIT) = (Earnings Before Interest and Taxes) This item represents the Pretax Income plus Interest Expense.
Retained Earnings = This item represents cumulative earnings of the company less total dividend distributions to Shareholders and amounts allocated to other reserves.
Working Capital = is the sum of Current assets less current liabilities.
Cash Flow = is the sum of income before extraordinary Items plus Depreciation and Amortization.
Operating Cash Flow (Operating Activities-Net Cash) = This item represents the change in cash from all items reported in the Operating Activities section on the Statement of Cash Flows.
Interests (Interest Expense) = This item represents the company's gross periodic expense in securing long- and short-term debt.

throughout the 10-year period. Do these distressed firms achieve this goal because their economic and financial structure shares similar patterns with healthy companies? Or else, do they perform an effective effort in the management of the situation and accomplish an improvement/recovery?

3.3. Variables

A total of 12 variables (see definitions in Table 3) were selected in order to explain the structure of the underlying data in the analysis of the differences or similarities between the companies that presented certain level of crisis in the first year (1993) and their evolution undergone in the final year (2002). The descriptive statistics of the variables and their correlation are presented in Tables 4, 5, 6, and 7, respectively. These variables are grouped in three categories as shown in Table 3.

(1) *Reaction Path*. This factor defines the initial capacity of a company to make decisions that can improve its future situation. We selected a series of variables that indicate some kind of "alternatives" on which a company can count on to improve. These variables would show the different evolution of companies that had the same

Table 4: Descriptive Statistics for the variables (year 1993).

Variable	N	Minimum	Maximum	Mean	Std. deviation
V_1	524	−0,757	115,780	2,192	7,094
V_2	524	0,112	70,667	3,031	5,832
V_3	524	0,000	7,088	1,073	0,859
V_4	524	−2,008	0,405	−0,044	0,210
V_5	524	−1,903	0,632	0,009	0,197
V_6	524	−13,096	0,796	−0,285	1,113
V_7	524	−1,126	0,986	0,214	0,294
V_8	524	−1,954	0,418	0,004	0,207
V_9	524	−1,589	0,444	0,013	0,183
V_{10}	524	−3,123	0,986	0,416	0,323
V_{11}	524	−520,890	8.161,000	179,229	750,448
V_{12}	524	−2,954	0,589	0,014	0,229

Table 5: Descriptive Statistics for the variables (year 2002).

Variable	N	Minimum	Maximum	Mean	Std. deviation
V_1	524	−0,855	33,560	1,537	3,245
V_2	524	0,077	52,094	2,759	4,862
V_3	524	0,000	5,677	1,059	0,879
V_4	524	−2,280	1,171	−0,043	0,257
V_5	524	−2,217	0,588	0,014	0,199
V_6	524	−19,453	1,048	−0,405	1,933
V_7	524	−1,752	0,950	0,175	0,298
V_8	524	−2,231	1,206	0,009	0,246
V_9	524	−1,789	0,384	0,043	0,179
V_{10}	524	−5,912	0,971	0,382	0,412
V_{11}	524	−3.307,000	18.204,000	317,030	1.617,447
V_{12}	524	−2,498	0,567	0,003	0,223

symptoms in the beginning of the crisis situation. This group is measured by 3 variables:

(a) debt power (V_1), or the possibility to obtain additional funds without deteriorating the financial situation

(b) short-term reaction power (V_2), or short-term obligations accomplishment

(c) resource generation power (V_3).

(2) *Economic and financial structure*. This category reveals information about the initial economic and financial situation of the companies. It is measured by seven variables (V_4 to V_{10}) that point out the economic and/or financial weaknesses of the companies following previously cited papers. These variables reflect deficiencies in returns, financial autonomy, solvency, and so forth, The consideration of this dimension is consistent with previous researches [7, 51] that show how severity of the distressed state influences the *return process*. The use of the 7 original variables applied to classify the firms in financial distress situation is in agreement with

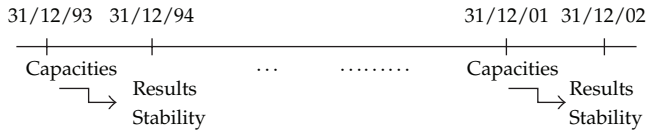

Figure 1: Scheme of the analysis.

the approach proposed by Smith and Graves [3] to test the role of severity of a distressed state in the turnaround process.

(3) *Strength of the situation in the period* $n + 1$ measured by two variables (V_{11} and V_{12}) which imply strength or improvement of the situation after the initial crisis period. Mutchler [41] already introduced the possibility of including a possible improvement of the company. It could be measured by the variation in the Net Income/Total Assets ratio, indicating a possible beginning of an improvement phase although the company maintained a difficult situation. In this sense, Khal [47] proved that the "operating performance" could be used to measure the viability of the company, and it also reflected the effort made during a crisis situation. In this way, Routledge and Gadenne [48] assert that firms in distressed situation with high levels of ROA (Return on Assets) have higher probability of success in the turnaround process. On the other side, the level of interest coverage of a firm is considered to be an indicator of the financial distress risk [44, 52]. In this paper, V_{11} is not presented as a ratio. This means it should be interpreted only as a measure of the existence of a possible distress situation (when the values of V_{11} are less than 0) or the nonexistence of a prior distress situation (when the values of V_{11} are greater than or equal to zero). Thus, we are not evaluating the level of a risky situation of a firm, according to its degree of interest expense coverage. We want to detect its risk status due to its lack in the fulfillment of external capital obligations.

The first two groups mark a starting situation of making certain decisions, while the third group characterizes a final situation of "viability" after those decisions have been made. By combining the three categories, we would be able to identify if the movements throughout the analyzed period are due to the structure of the company or if, on the contrary, they can be attributed to management factors. The latter may have influenced in the improvement, worsening or standing still of the company situation. Since our analysis begins with the data available in the financial statements of December 31, 1993, the set of variables is developed according to Figure 1. The capacities or abilities of a firm in year n will be reflected in the results obtained in year $n + 1$ as well as the stability/instability of the situation.

4. Results

In this section, we are going to analyze the results obtained by means of PROXSCAL routine in SPSS 15.0 statistical package by considering two approaches: (a) structure analysis of the companies and their underlying patterns and (b) position displacements of the companies with respect to their initial situation.

Table 6: Bivariate correlations of the variables (year 1993).

		V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9	V_{10}	V_{11}	V_{12}
V_1	Pearson Correlation	1	,555**	−,194**	−,087*	−,147**	−,052	,296**	−,110*	−,149**	,315**	−,041	−,241**
	Sig. (2-tailed)		,000	,000	,047	,001	,231	,000	,012	,001	,000	,351	,000
V_2	Pearson Correlation	,555**	1	−,196**	−,134**	−,203**	−,081	,552**	−,172**	−,230**	,365**	−,091*	−,322**
	Sig. (2-tailed)	,000		,000	,002	,000	,064	,000	,000	,000	,000	,036	,000
V_3	Pearson Correlation	−,194**	−,196**	1	,027	,142**	−,039	−,086*	,036	,180**	−,331**	−,081	,268**
	Sig. (2-tailed)	,000	,000		,540	,001	,377	,048	,415	,000	,000	,065	,000
V_4	Pearson Correlation	−,087*	−,134**	,027	1	,928**	,690**	−,150**	,987**	,709**	−,079	,109*	,608**
	Sig. (2-tailed)	,047	,002	,540		,000	,000	,001	,000	,000	,070	,013	,000
V_5	Pearson Correlation	−,147**	−,203**	,142**	,928**	1	,696**	−,255**	,916**	,779**	−,228**	,120**	,709**
	Sig. (2-tailed)	,001	,000	,001	,000		,000	,000	,000	,000	,000	,006	,000
V_6	Pearson Correlation	−,052	−,081	−,039	,690**	,696**	1	−,069	,668**	,580**	,046	,113**	,441**
	Sig. (2-tailed)	,231	,064	,377	,000	,000		,116	,000	,000	,292	,009	,000
V_7	Pearson Correlation	,296**	,552**	−,086*	−,150**	−,255**	−,069	1	−,200**	−,432**	,599**	−,197**	−,307**
	Sig. (2-tailed)	,000	,000	,048	,001	,000	,116		,000	,000	,000	,000	,000
V_8	Pearson Correlation	−,110*	−,172**	,036	,987**	,916**	,668**	−,200**	1	,734**	−,102*	,106*	,608**
	Sig. (2-tailed)	,012	,000	,415	,000	,000	,000	,000		,000	,019	,015	,000
V_9	Pearson Correlation	−,149**	−,230**	,180**	,709**	,779**	,580**	−,432**	,734**	1	−,286**	,130**	,641**
	Sig. (2-tailed)	,001	,000	,000	,000	,000	,000	,000	,000		,000	,003	,000
V_{10}	Pearson Correlation	,315**	,365**	−,331**	−,079	−,228**	,046	,599**	−,102*	−,286**	1	−,091*	−,268**
	Sig. (2-tailed)	,000	,000	,000	,070	,000	,292	,000	,019	,000		,037	,000
V_{11}	Pearson Correlation	−,041	−,091*	−,081	,109*	,120**	,113**	−,197**	,106*	,130**	−,091*	1	,113**
	Sig. (2-tailed)	,351	,036	,065	,013	,006	,009	,000	,015	,003	,037		,010
V_{12}	Pearson Correlation	−,241**	−,322**	,268**	,608**	,709**	,441**	−,307**	,608**	,641**	−,268**	,113**	1
	Sig. (2-tailed)	,000	,000	,000	,000	,000	,000	,000	,000	,000	,000	,010	

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 7: Bivariate correlations of the variables (year 2002).

		V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9	V_{10}	V_{11}	V_{12}
V_1	Pearson Correlation	1	,496**	−,153**	−,008	−,087*	−,032	,385**	−,029	−,117**	,391**	−,047	−,130**
	Sig. (2-tailed)		,000	,000	,856	,045	,459	,000	,501	,008	,000	,282	,003
V_2	Pearson Correlation	,496**	1	−,181**	−,003	−,088*	,002	,535**	−,039	−,102*	,268**	−,073	−,113**
	Sig. (2-tailed)	,000		,000	,938	,044	,959	,000	,375	,019	,000	,094	,010
V_3	Pearson Correlation	−,153**	−,181**	1	,064	,113**	,010	−,068	,084	,137**	−,092*	−,070	,063
	Sig. (2-tailed)	,000	,000		,144	,010	,827	,122	,056	,002	,034	,107	,151
V_4	Pearson Correlation	−,008	−,003	,064	1	,861**	,592**	,044	,985**	,708**	,275**	,106*	,698**
	Sig. (2-tailed)	,856	,938	,144		,000	,000	,309	,000	,000	,000	,015	,000
V_5	Pearson Correlation	−,087*	−,088*	,113**	,861**	1	,607**	−,090*	,868**	,858**	,139**	,136**	,872**
	Sig. (2-tailed)	,045	,044	,010	,000		,000	,039	,000	,000	,001	,002	,000
V_6	Pearson Correlation	−,032	,002	,010	,592**	,607**	1	,101*	,584**	,591**	,278**	,082	,521**
	Sig. (2-tailed)	,459	,959	,827	,000	,000		,021	,000	,000	,000	,062	,000
V_7	Pearson Correlation	,385**	,535**	−,068	,044	−,090*	,101*	1	−,001	−,103*	,574**	−,115**	−,122**
	Sig. (2-tailed)	,000	,000	,122	,309	,039	,021		,984	,018	,000	,009	,005
V_8	Pearson Correlation	−,029	−,039	,084	,985**	,868**	,584**	−,001	1	,752**	,269**	,106*	,714**
	Sig. (2-tailed)	,501	,375	,056	,000	,000	,000	,984		,000	,000	,015	,000
V_9	Pearson Correlation	−,117**	−,102*	,137**	,708**	,858**	,591**	−,103*	,752**	1	,123**	,110*	,763**
	Sig. (2-tailed)	,008	,019	,002	,000	,000	,000	,018	,000		,005	,012	,000
V_{10}	Pearson Correlation	,391**	,268**	−,092*	,275**	,139**	,278**	,574**	,269**	,123**	1	−,013	,089*
	Sig. (2-tailed)	,000	,000	,034	,000	,001	,000	,000	,000	,005		,769	,042
V_{11}	Pearson Correlation	−,047	−,073	−,070	,106*	,136**	,082	−,115**	,106*	,110*	−,013	1	,129**
	Sig. (2-tailed)	,282	,094	,107	,015	,002	,062	,009	,015	,012	,769		,003
V_{12}	Pearson Correlation	−,130**	−,113**	,063	,698**	,872**	,521**	−,122**	,714**	,763**	,089*	,129**	1
	Sig. (2-tailed)	,003	,010	,151	,000	,000	,000	,005	,000	,000	,042	,003	

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

4.1. Structure Analysis and Underlying Patterns

The variables were standardized to zero mean and unit variance because their measure in different units prevents the use of arithmetic. The presence of discordant observations was identified when standardized values of one or more variable exceeded two and a half [16]. These discordant observations do not affect our analysis since the MDS algorithm uses relations of order so the results are robust to their presence. For the projection of the points in the map, we chose not to omit these cases although the graphical representation is visually less attractive than when the outliers were omitted. Euclidean distance was selected as dissimilarity measure to calculate the proximity between two given companies. When the measure of dissimilarity among two companies is small the points in the space will have a short distance in between. In the same way, in the presence of large values of dissimilarity the companies will be placed far from each other. Thus, companies that in the representation of the initial year of analysis (1993) and in the final year of analysis (2002) are located close to each other and share similar economic and financial structure according to the selected explicative variables.

One of the most important decisions for the interpretability of the data is the number of dimensions in which MDS map is to be drawn. Determining the dimensionality of the MDS maps is equivalent to determining the number of components in Principal Component Analysis (PCA) [15]. A prior PCA procedure would help in determining the accurate number of dimensions for the MDS analysis. The results of this PCA analysis are shown in Tables 8 and 9 for the year 1993 data and Tables 10 and 11 for the year 2002 data. These results only present information on how the initial data can be reduced in a less number of factors.

In analyzing financial ratios, researchers identify up to seven factors so that a representation in seven dimensions would be adequate [15]. For this paper, the first five principal components in 1993 were associated with eigenvalues larger than 0.78 and accounted for 84% of the total variance (see Table 8). Thus, a five-dimension analysis would be accurate, treating the remaining two dimensions as "residual variation" [15].

In this study, we determined the dimensionality of the MDS maps by means of the "elbow test", which is examining how the goodness-of-fit measure changes as the number of dimensions increases [17]. The goodness-of-fit measure chosen for this study is the Kruskals' Stress1 which measures the level of agreement between distances calculated from the map and the dissimilarities from which the map was derived. The stress measure turns out to be a "residual sum of squares", it is positive and the smaller the better [53]. The stress evaluation table can be found in Table 12. Table 13 shows how the values of *Stress1* change as the number of dimensions increases in the first year of the analysis, 1993. This relationship can be seen graphically in Figure 2. The same procedure was performed for the year 2002 data and the results can be seen in Table 14 and Figure 3. Based on these results, a 5-dimensional space would give a good representation for both years (1993 and 2002) and these results are in agreement with the prior-PCA analysis.

Nonetheless, for the visual representation it would be very difficult to interpret the distances between points in a 5-dimensional space. As a consequence, only the first 3 dimensions which better represent the differences and similarities between companies are exposed. This conclusion is in agreement with the stress1 level (0.057) which indicates that a solution in three dimensions gives a good representation for the year 1993 (0.058 for the year 2002).

In order to observe the evolution and the movements that took place during the periods of analysis, we are going to represent the companies in two ways. Firstly, we

Table 8: Total variance explained for the year 1993.

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,973	41,441	41,441	4,973	41,441	41,441
2	2,269	18,910	60,351	2,269	18,910	60,351
3	1,134	9,447	69,798	1,134	9,447	69,798
4	,924	7,702	77,500			
5	,788	6,567	84,067			
6	,490	4,083	88,150			
7	,438	3,650	91,800			
8	,383	3,192	94,992			
9	,326	2,720	97,712			
10	,198	1,650	99,362			
11	,067	,554	99,917			
12	,010	,083	100,000			

Extraction method: principal component analysis.

Table 9: Component matrix* for the year 1993.

	Component		
	1	2	3
*ZV*1**	−,296	,590	−,049
*ZV*2	−,395	,669	,096
*ZV*3	,202	−,392	,661
*ZV*4	,888	,360	,014
*ZV*5	,940	,214	,062
*ZV*6	,702	,399	−,065
*ZV*7	−,449	,638	,318
*ZV*8	,898	,315	,006
*ZV*9	,861	,035	,011
*ZV*10	−,350	,683	−,032
*ZV*11	,185	−,080	−,743
*ZV*12	,785	−,071	,151

Extraction method: principal component analysis.
*3 components extracted.
**ZV indicates the standardized variables.

will consider the number of symptoms the companies met at the beginning of the period (year 1993) and secondly we will consider the Z-score classification for that same period on indicative basis only. The possible existence of divergences in the positions based on these criteria would allow detecting to what extent the failure risk can be disguised under a slight group of symptoms. In the same way, the positions of the companies based on financial statement data for the year 2002 will also be represented in two ways. Firstly, we will consider the number of symptoms each company met in the year 2002 and secondly, we will consider the final situation focusing on number of symptoms the companies had in the first year of analysis (year 1993). The possible existence of similarities between companies in each analyzed period allows us to detect those structures conditioning the evolution of the

Table 10: Total variance explained for the year 2002.

Component	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4,790	39,916	39,916	4,790	39,916	39,916
2	2,433	20,274	60,190	2,433	20,274	60,190
3	1,085	9,042	69,232	1,085	9,042	69,232
4	,864	7,203	76,435			
5	,752	6,269	82,704			
6	,598	4,984	87,688			
7	,497	4,145	91,833			
8	,395	3,291	95,124			
9	,284	2,370	97,494			
10	,225	1,872	99,366			
11	,065	,544	99,910			
12	,011	,090	100,000			

Extraction method: principal component analysis.

Table 11: Component Matrix* for the year 2002.

	Component		
	1	2	3
*ZV*1**	−,091	,725	−,081
*ZV*2	−,090	,749	−,052
*ZV*3	,112	−,260	,707
*ZV*4	,920	,110	,012
*ZV*5	,959	−,059	−,002
*ZV*6	,719	,144	−,007
*ZV*7	−,037	,821	,173
*ZV*8	,933	,070	,021
*ZV*9	,882	−,090	,037
*ZV*10	,245	,726	,061
*ZV*11	,158	−,123	−,733
*ZV*12	,862	−,116	−,047

Extraction method: principal component analysis
*3 components extracted.
**ZV indicates the standardized variables.

Table 12: Kruskal's stress1 evaluation.

Stress	Goodness of fit
20%	Poor
10%	Fair
5%	Good
2,50%	Excellent
0%	"Perfect"

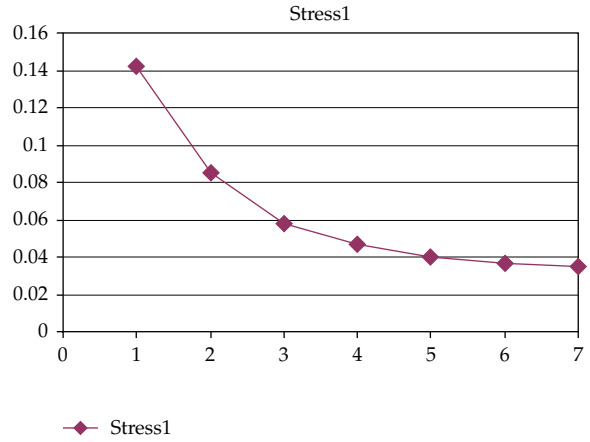

Figure 2: Stress1 Elbow diagram for the year 1993.

Table 13: Changes in stress1 values when dimensionality increases (year 1993).

Dimensions	Stress1
1	0,142412
2	0,085011
3	0,057454
4	0,046997
5	0,040424
6	0,036882
7	0,034510

companies. If those similarities exist, we may be able to affirm that the failure process is a degenerative form of a certain risky situation.

By means of a Co-Plot methodology, we can project the variables of the analysis in the same dimensional space with the companies. For this purpose, twelve linear regressions were run using each variable as dependent variable and the seven coordinates that locate companies in the space as explanatory variables so that.

$$ZV_{\text{in}} = \beta_0 + \beta_1 \dim 1_n + \beta_2 \dim 2_n + \cdots + \beta_7 \dim 7_n + e_i, \tag{4.1}$$

where ZV_{in} is the standardized value of variable n ($n = 1, 2, \ldots, 12$) for company i ($i = 1, 2, \ldots, 524$). The regression coefficient results for the year 1993 and 2002 are reported in Tables 15 and 16, respectively. In this way, we try to explain up to what point the value that a particular variable takes for a given company is associated with the position in the space of the point that represents that company [17]. Note that the goodness of fit, R Square, of the variables for the year 1993 exceeds 65% except for the variable V_{11} which had the worst goodness of fit with a level of 54.5%. In general, the results are powerful enough to interpret the maps.

In the same way, the worst result for the goodness of fit for the year 2002 (Table 16) was a level of 68.7 corresponding to variable V_{11}. For the rest of variables, the goodness of fit exceeded 70%.

Table 14: Changes in stress1 level when dimensionality increases (year 2002).

Dimensions	Stress1
1	0,141454
2	0,085077
3	0,058112
4	0,051121
5	0,042491
6	0,035536
7	0,031408

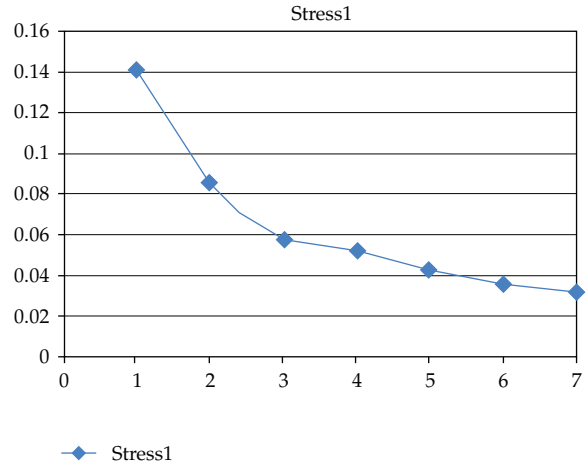

Figure 3: Stress1 Elbow diagram for the year 2002.

The coordinate point that marks the position of each variable can be connected with the origin of the axes by a vector that helps interpreting the importance of each variable in the plotted dimensions. The vectors length indicates the variables that are better represented by the chosen factorial planes. If the feature of the data associated with the vector is not associated with the projection, the vector will have a short length. The angle between the vector and the plotted dimension demonstrates the importance of the features of a variable in the projection, so that an acute angle between variable vector and dimension indicates that that dimension is strongly related to that variable. If two vector endpoints are located next to each other it means that their associated variables convey similar information. Bivariate correlation matrix between the variables for year 1993, and 2002 can be found in Tables 6 and 7, respectively.

It can be noticed that in 1993 (Figure 4 for dimensions 1 and 2; Figure 5 for dimensions 1 and 3) there is a clear differentiation between the companies being in a *weak crisis*, which are located on the right of dimension 1 (x-axis), and those being in a *harsh crisis*, located on the left side of dimension 1. This differentiation is much more remarkable if we focus on companies that fulfill 1 symptom located in a safety zone of profitability (the upper-right quadrant) and those who present problems in the generation of income and cash-flow (located in the bottom-left quadrant). In the same way, dimension 2 would be related to solvency and reaction ability in the financial structure. This fact would allow affirming that

Table 15: Regression coefficient results for the year 1993.

Year 1993	Independent variables								R^2
Dependent variable	Constant	DIM1 Beta	DIM2 Beta	DIM3 Beta	DIM4 Beta	DIM5 Beta	DIM6 Beta	DIM7 Beta	
ZV_1	1,34E−17	−0,762	1,724	−0,404	−2,713	0,076	0,865	0,523	74,4%
ZV_2	−1E−16	−0,989	2,008	−0,906	1,492	0,071	0,010	0,106	78,0%
ZV_3	1,09E−15	0,455	−1,113	−2,796	−0,604	1,910	−1,183	−0,056	84,6%
ZV_4	2,56E−16	1,703	1,406	−0,319	0,162	−1,156	−0,282	0,130	89,9%
ZV_5	1,15E−17	1,840	0,988	−0,596	0,116	−0,805	0,006	−0,545	89,6%
ZV_6	1,02E-16	1,343	1,357	0,356	0,038	0,979	−1,578	−0,372	69,4%
ZV_7	−2,39E−16	−1,122	1,581	−0,597	1,220	1,450	−0,447	−0,105	69,1%
ZV_8	3,86E−17	1,737	1,285	−0,280	0,071	−1,298	−0,241	0,413	90,0%
ZV_9	2,28E−17	1,736	0,488	−0,873	−0,681	−1,335	−0,845	−0,453	82,8%
ZV_{10}	−1,71E−16	−0,971	1,856	0,676	−0,964	0,398	−0,450	−0,197	64,9%
ZV_{11}	3,66E−16	0,789	0,151	1,959	−0,042	2,211	−0,443	−0,085	54,5%
ZV_{12}	4,88E−17	1,607	0,144	−1,044	−0,185	0,518	2,941	−0,721	86,9%

Table 16: Regression coefficient results for the year 2002.

Year 2002	Independent variables								R^2
Dependent variable	Constant	DIM1 Beta	DIM2 Beta	DIM3 Beta	DIM4 Beta	DIM5 Beta	DIM6 Beta	DIM7 Beta	
ZV_1	−1,54E−16	0,199	−2,071	−0,571	−0,635	1,697	−2,260	0,836	83,8%
ZV_2	9,34E−17	0,141	−2,217	−0,025	−0,453	−0,615	1,578	0,188	71,2%
ZV_3	−5,96E−16	−0,286	0,716	3,044	1,434	0,535	−0,318	0,960	72,9%
ZV_4	2,61E−16	−2,059	−0,388	0,497	−0,515	0,143	−0,409	−1,780	92,1%
ZV_5	−7,91E−17	−2,107	0,073	0,506	−0,872	−0,778	−0,576	0,073	92,0%
ZV_6	5,33E−17	−1,706	−0,485	−0,584	0,789	0,108	0,392	1,764	69,9%
ZV_7	5,68E−16	0,162	−2,219	0,458	0,927	−1,599	1,021	−0,506	78,8%
ZV_8	1,16E−17	−2,075	−0,276	0,564	−0,560	0,106	−0,565	−1,495	91,5%
ZV_9	1,58E−16	−1,939	0,160	0,537	−0,846	−0,748	−0,128	1,774	84,9%
ZV_{10}	−3,28E−16	−0,408	−1,857	0,370	2,098	−0,613	−1,923	−0,458	79,8%
ZV_{11}	−3,89E−17	−0,636	0,571	−2,476	1,934	−1,217	−0,112	−0,361	68,7%
ZV_{12}	2,85E−17	−1,894	0,243	0,363	−0,962	−1,539	−0,952	0,047	84,0%

each quadrant assembles companies with a similar underlying structure in 1993, the starting year of the analysis. In order to determine to what extent the companies are represented by the factorial planes, according to their symptoms, we performed a logistic regression where the dependent variable corresponds to the probability of the number of fulfilled criteria and the independent variables are the coordinates of the companies in each dimension. The results here not exposed, showed that, except for the companies with 5 symptoms, the rest of the group-symptom was not well represented. This fact allows affirming that the group of symptoms is not representative of a common underlying structure for the companies that belong to the same group. However, the results of the logistic regression improve when we consider the separation between companies in weak crisis (1, 2 or 3 criteria) and those in harsh crisis (4, 5 or 6 criteria), confirming the results visually obtained in Figures 4 and 5. The

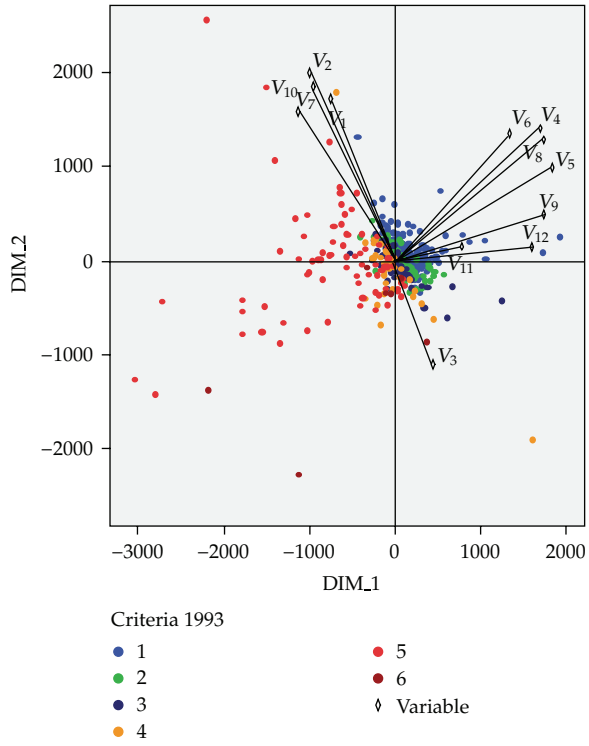

Figure 4: Factorial plane 1-2 for the year 1993.

Table 17

Reaction path zone	Safety zone
Financial reaction ability	Solid economic and financial structure
Solid economic and financial structure	Income generation
	Cash flow generation
Danger zone	Resource generation zone
Economic issues Financial issues Income generation issues	Resource generation potential by operating level

consensus map obtained by the MDS methodology provides us a picture of the structural features underlaid in the analyzed data set of firms. Table 17 gathers the profiles of firms according to their placement on the map by combining the dimensions 1 and 2.

Figure 6 reflects, only on an informative basis, the positions of the companies using the failure risk, measured through Z-score 93, to differentiate them. The companies with low risk appear clearly differentiated but we cannot affirm that their data structure is different from the companies with very high risk, which are located indistinctly in the four quadrants. There exists a difference between failure risk and the number of crisis symptoms, except for the group of companies that show 5 criteria and very high risk.

A similar representation is reached by the MDS analysis in the year 2002 (Figure 7). Dimension 1 separates the companies with more than four criteria to the right of the axis and

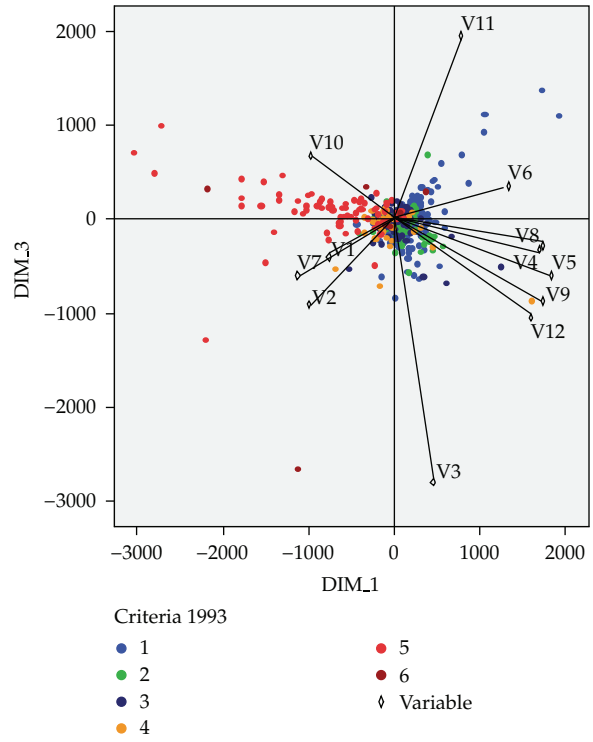

Figure 5: Factorial plane 1-3 for the year 1993.

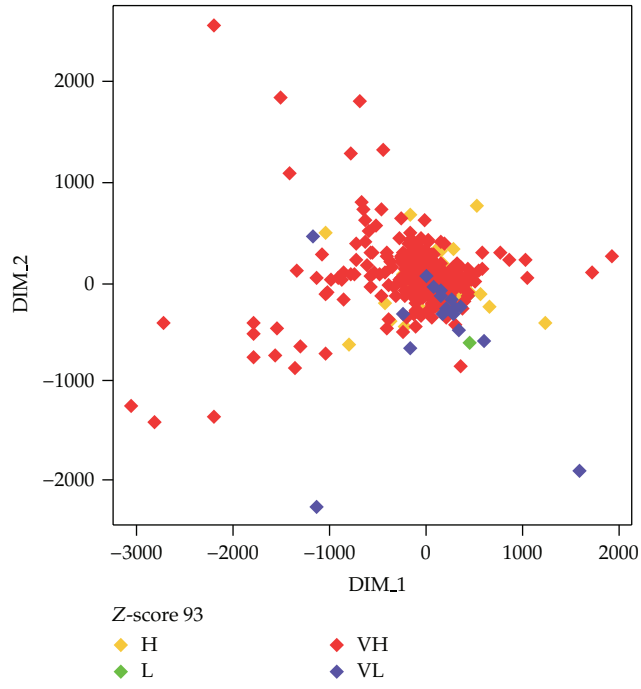

Figure 6: Factorial plane 1-2 for the year 1993 labeled by Z score level.

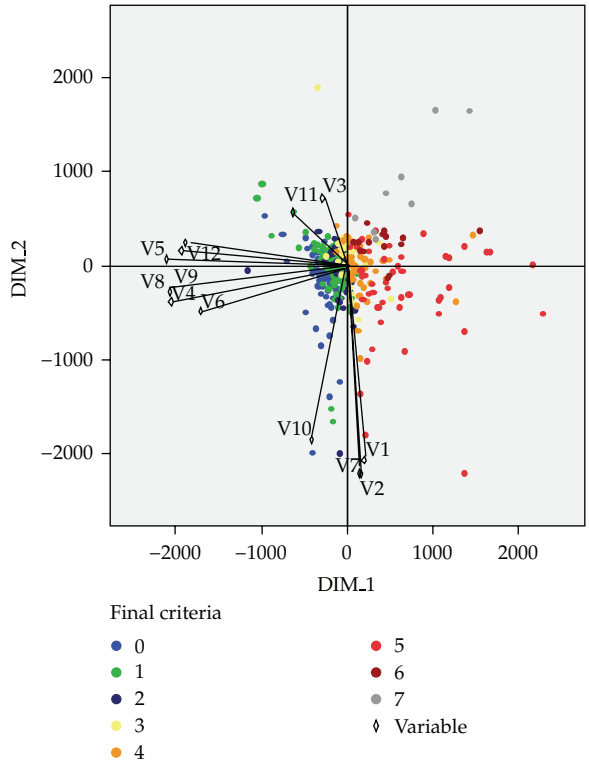

Figure 7: Factorial plane 1-2 for the year 2002.

companies in a weak crisis situation or that have solved this situation to the left part of the axis. The same results could be seen when we represented the companies in dimensions 1 and 3 (Figure 8). It can also be noticed that dimension 2 distinguishes between the positions of the companies that have a different degree of strong crisis situation. Those companies that fulfill 5 criteria are located in the bottom-right part of the axis 2 and those that fulfill 6 or 7 symptoms are positioned in the upper-right part of the same axis.

For the year 2002 (Figure 7), the companies that satisfy certain conditions seem to share a common data structure. As dimension 1 is mainly related with V_4, V_5, and V_{12}, it represents the achievement and performance of the company. The companies located in the left of dimension 1 are characterized by their strengths in the performance and they are in their way to recovery. It is to emphasize that the variable Operating Income/Total Assets, which measures the *strength or stability* of the way out, is an important variable when the companies are positioned on the left side of dimension one. In this sense, the idea that companies which survive crisis periods are characterized by a strong managerial action is reaffirmed [47, 48]. This managerial action is measured by Operating Income/Total Assets. On the other hand, these companies are also distinguished because they achieve higher Cash flow as well as Operating Cash flow.

Dimension 2 gathers information related to variables describing the financial structure. So, those companies located in the lower part of the dimension 2 indicate solidity with respect to their working capital or to their financial autonomy (V_2, V_7, and V_{10}). It can be noticed that the companies that fulfill 6 or 7 symptoms have important financial deficiencies and they are

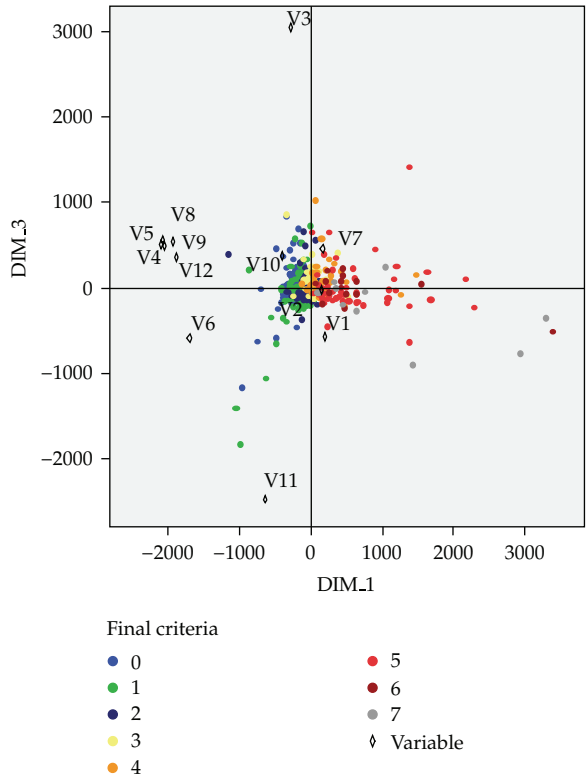

Figure 8: Factorial plane 1-3 for the year 2002.

grouped separately from the rest of the companies. Among the companies that fulfill 4 and 5 criteria, we can detect two groups: the first one is made of companies that have economic and financial deficiencies and lie on the right of dimension 1. The second one is made of companies with financial deficiencies and lie on the upper part of dimension 2.

The V_{11} should be interpreted very carefully in both years. As previously exposed, it is only an indicative variable of a status: to be able to cover the financial costs of external debt by means of operating income achieved. It does not measure the degree of this coverage ability. It is used only to determine the existence of a risky situation or not.

4.2. Position Displacements of the Companies with respect to Their Initial Situation

It is of our interest to analyze the starting point of the companies that have survived or are in a phase of overcoming the crisis situation. For this purpose, Figure 9 is a duplicate of Figure 7 but here the companies are represented using their positional markers of severity in the year 1993. Through this representation, we can observe the initial and final economic-financial structure profiles of the firms.

Notice that, although the companies that are in a weak crisis situation in 2002 started from that same situation in 1993, there is an outstanding group of companies that come from situations of strong crisis (5 and 6 fulfilled criteria). It is possible to affirm that there are groups of companies that share similar economic and financial structures at the beginning

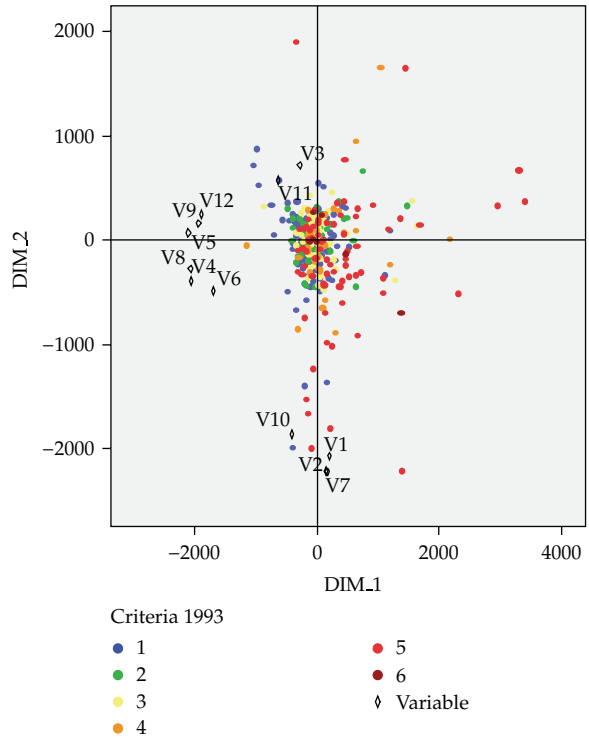

Figure 9: Factorial plane 1-2 for the year 2002 with criteria fulfilled in 1993.

but they also share the same evolution patterns to walk out of the crisis. This fact can come motivated by two reasons.

(1) The crisis in its origin was weak and its development does not cause major problems.

(2) Certain structural deficiencies can be faced by the companies without any difficulties and can be solved by making "routine" decisions.

There is a group of companies that started with 5 or 6 criteria in 1993 and were able to overcome the situation in 2002 by either resolving all the problems or improving their situation presenting only one criterion. In this way, the analysis detected that these companies shared of common underlying data structures in spite of indicating different crisis symptoms. This fact would allow affirming that there are some identity signs in the companies that make them more propitious to solve a crisis situation in spite of showing certain symptoms. These companies did not have an economic achievement deficiency (so presenting a light crisis) or it was not their most important deficiency (so presenting a strong crisis).

Table 18 assembles the number of companies in each crisis-zone for the years 1993 and 2002. Each zone defines the characteristics of the economic and financial of the companies located inside. These characteristics are the result of the interpretation of the variable representativeness in each dimensional space.

82% of the companies that in 1993 were positioned in the healthy zone (right part of dimension 1) and are placed in the same healthy zone in the 2002 chart. 42% of these

Table 18

		Year 1993							
		Safety zone		Resource generation zone		Reaction path zone		Danger zone	
		Weak crisis	Strong crisis	Weak crisis	Strong crisis	Weak crisis	Strong crisis	Weak crisis	Strong crisis
Year 2002	Safety zone	124	—	156	13	29	12	9	25
	Danger zone	24	—	37	4	23	37	4	27
	Total	148	—	193	17	52	49	13	52

companies derive from the so-called safety zone and 58% from the Resource generation zone. Many of them could resolve the crisis situation in spite of starting from a complicated group of symptoms (4% of them showed a severe crisis based on the selection criteria). These companies did not present deficiencies of economic performance and they have the ability to generate resources. This fact may have allowed them to be placed in a better position and to improve their position. A total of 100% of the companies, that in 1993 were located in the safety zone, presented a weak crisis (1, 2 or 3 criteria). 84% of them maintain their placement in this safety zone in the year 2002, confirming the idea that a weak crisis is easier to resolve or it can be "self-healed". 76% of the companies that in 1993 were located in the healthy zone (specifically in the Resource Generation zone) and presenting a severe crisis (4 or more criteria) are also located in the safety zone of the 2002 chart. This movement confirms the fact that retaining certain symptoms of difficulties does not condition the underlying structure. These companies shared similar profiles with the ones that had fewer criterions and have evolved in a similar way, mainly improving their situation.

More than half of the companies that in 1993 presented damaged economic and financial structures, together with income generation issues, are mainly positioned on the right of dimension 1 in 2002. For these companies, the crisis process seems to be "not reversible". The displacement of companies, that in 1993 presented the same damaged structure but moved towards the "safety zone" (left part of the 2002 chart), was mainly achieved through the effort made during the crisis period. This effort can be measured by the ratio Net Income/Total Assets which reflects the economic action and the adjustments measures taken from the directive board of the company facing a crisis situation.

The Reaction Path zone has a similar number of firms in weak crisis and severe crisis in 1993. Nevertheless, the evolution towards the danger zone in 2002 is more notable (60% of the companies). This fact allows us affirming that the financial viability is not sufficient if it is not done together with an accurate economic performance in order to generate income and Cash flow for the debt payments.

Finally, we cannot notice any remarkable movements for the companies that in 1993 were positioned in the danger zone. This fact implies very similar results for the companies that resolved their situation and those that worsened their position. 52% of them have shifted towards the healthy zone in the year 2002, even when presenting a severe crisis in 73% of these cases. This is certainly a group of interest for future research as they are companies with similar deficit situation and symptoms but with a very different evolution. The evolution process followed by these firms proves that the crisis situation can be efficiently managed, despite of the starting severity degree.

Regarding the initial and final positions, Table 18 indicates:

(i) firms that present a stable economic and financial situation are mainly grouped as in weak crisis based on the criteria widely accepted;

(ii) the number of criteria initially used to classify a firm as, being in crisis (weak or strong) does not seem to determine the evolution process;

(iii) an accurate economic performance (profitability and the ability to generate resources) is a fundamental factor in fighting a crisis situation.

5. Conclusions

We used Multidimensional Scaling to detect and to analyze the existence of similarities between economic and financial structures of the companies being in a "crisis situation". The purpose was to explore if they also shared evolutionary patterns of this situation. It is necessary to emphasize that the used technique does not allow establishing causal relationship between the variables and the survival probability. It is only a descriptive technique that is considered robust for the establishment of later relationship hypotheses.

The sample analyzed in this study is composed by 524 US firms which, according to certain symptoms/indicators generally accepted in the literature, presented some weak or severe financial distressed situation in the year 1993. By means of Multidimensional Scaling we plotted the companies in a consensus map based on the twelve structural variables representatives of the underlying economic and financial structure of the firms. In this way, four types of company profiles were identified. Each one of these profiles was independent from the initial symptoms the firms presented.

An important group of companies that did resolve the situation started from a weak crisis in the year 1993 with deficiencies mainly related to the financial structure in the short-term. The "momentary" character of these situations may be one of the reasons that these companies end up in a similar situation at the end of the period of analysis.

The interesting part is when companies that start off a critical situation are been able to resolve it. This allows considering that failure is a reversible process and it is not necessarily degenerative if the company is able to achieve an effort in its economic performance. However, the situations of harsh or severe crises tend to generate those same situations throughout the years. Most of the companies with similar "degenerated" economic and financial structures are more exposed to an evolutionary-degenerative process although they maintain themselves in the market throughout the years.

The evidence shows that the companies that have resolved the crisis situation

(1) have achieved an important effort in their *economic* performance during the crisis and this effort has allowed them to reinforce their situation,

(2) shared common structure characteristics with companies that had less problems and slighter symptoms of crisis.

This fact allows affirming that the symptoms are only manifestations of an underlying situation. The deficiencies and gravities of this situation are the factors that determine the changes in the crisis situation.

It is to consider that, none of the firms identified as in a financial distress situation in 1993, and in conformity with the selected sample, incurred in a bankruptcy process during the period analyzed.

It would be interesting to analyze the differences in profiles between firms that faced some financial distress situation and managed to recover and those that being in the same situation did not recover. A future research line could be trying to identify the relationship between some control variables such as size, industry, and macroeconomic factor and the possibility of revolving the situation. In addition, the fact that the efforts in performance and behavior during a crisis situation are important features of a positive outcome would make it interesting to analyze to what extent the "management" of the crisis process determines this outcome.

References

[1] S. Balcaen and H. Ooghe, "35 years of studies on business failure: an overview of the classic statistical methodologies and their related problems," *British Accounting Review*, vol. 38, no. 1, pp. 63–93, 2006.

[2] E. I. Altman, "Financial ratios, discriminant analysis and the prediction of corporate failure," *Journal of Finance*, vol. 23, no. 4, pp. 589–609, 1968.

[3] M. Smith and C. Graves, "Corporate turnaround and financial distress," *Managerial Auditing Journal*, vol. 20, no. 3, pp. 304–320, 2005.

[4] E. Altman and E. Hotchkiss, *Corporate Financial Distress and Bankcrupty*, Wiley, Hoboken, NJ, USA, 2006.

[5] R. Barniv, A. Agarwal, and R. Leach, "Predicting bankruptcy resolution," *Journal of Business Finance and Accounting*, vol. 29, no. 3–4, pp. 497–520, 2002.

[6] K. Robbins and J. A. Pearce, "Turnaround: retrenchment and recovery," *Strategic Management Journal*, vol. 13, no. 4, pp. 287–309, 1992.

[7] J. A. Pearce and K. Robbins, "Toward improved theory and research on business turnaround," *Journal of Management*, vol. 19, no. 3, pp. 613–636, 1993.

[8] J. A. Pearce and K. Robbins, "Retrenchment remains the foundations of business turnaround," *Strategic Management Journal*, vol. 15, pp. 407–417, 1994.

[9] V. L. Barker III and I. M. Duhaime, "Strategic change in the turnaround process: theory and empirical evidence," *Strategic Management Journal*, vol. 18, no. 1, pp. 13–38, 1997.

[10] W. F. Cascio, C. E. Young, and J. R. Morris, "Financial consequences of employment-change decisions in major U.S. corporations," *Academy of Management Journal*, vol. 40, no. 5, pp. 1175–1189, 1997.

[11] J. Morris, W. Cascio, and C. Young, "Downsizing after all these years: questions and answers about who did it, how many did it, and who benefited from it," *Organizational Dynamics*, vol. 27, pp. 78–87, 1999.

[12] E. Neophytou and C. M. Molinero, "Financial ratios, size, industry and interest rate issues in company failure: an extended multidimensional scaling approach," Working Paper 100, Kent Business School, 2005.

[13] L. R. Gilbert, K. I. Menon, and K. B. Schwarz, "Predicting bankruptcy for firms in financial distress," *Journal of Business Finance and Accounting*, vol. 17, no. 1, pp. 161–171, 1990.

[14] K. M. Poston, W. K. Harmon, and J. D. Gramlich, "A test of financial ratios as predictors of turnaround versus failure among financially distressed firms," *Journal of Applied Business Research*, vol. 10, no. 1, pp. 41–57, 1994.

[15] C. M. Molinero and M. Ezzamel, "Multidimensional scaling applied to corporate failure," *Omega*, vol. 19, no. 4, pp. 259–274, 1991.

[16] C. M. Molinero and C. Serrano-Cinca, "Bank failure: a multidimensional scaling approach," *The European Journal of Finance*, vol. 7, pp. 165–183, 2001.

[17] E. Neophytou and C. M. Molinero, "Predicting corporate failure in the UK: a multidimensional scaling approach," *Journal of Business Finance and Accounting*, vol. 31, no. 5, pp. 677–709, 2004.

[18] W. Beaver, "Financial ratios predictors of failure. Empirical research in accounting: selected studies 1966," *Journal of Accounting Research*, vol. 4, pp. 71–111, 1967.

[19] E. I. Altman, R. G. Haldeman, and P. Narayanan, "ZETA analysis a new model to identify bankruptcy risk of corporations," *Journal of Banking and Finance*, vol. 1, no. 1, pp. 29–54, 1977.

[20] E. I. Altman, "The success of business failure prediction models: an international survey," *Journal of Banking and Finance*, vol. 8, no. 2, pp. 171–198, 1984.
[21] A. I. Dimitras, S. H. Zanakis, and C. Zopounidis, "A survey of business failures with an emphasis on prediction methods and industrial applications," *European Journal of Operational Research*, vol. 90, no. 3, pp. 487–513, 1996.
[22] P. Cybinski, "Description, explanation, prediction the evolution of bankruptcy studies?" *Managerial Finance*, vol. 27, no. 4, pp. 29–44, 2001.
[23] P. R. Kumar and V. Ravi, "Bankruptcy prediction in banks and firms via statistical and intelligent techniques—a review," *European Journal of Operational Research*, vol. 180, no. 1, pp. 1–28, 2007.
[24] E. K. Laitinen, "Financial ratios and different failure processes," *Journal of Business Finance and Accounting*, vol. 18, no. 3, pp. 649–673, 1991.
[25] M. Luoma and E. Laitinen, "Survival analysis as a tool for company failure prediction," *Omega*, vol. 19, no. 6, pp. 673–678, 1991.
[26] A. H. Catanach and S. E. Perry, "An evaluation of the survival model's contribution to thrift institution distress prediction," *Journal of Managerial Issues*, vol. 12, no. 4, pp. 401–417, 2001.
[27] T. Shumway, "Forecasting bankruptcy more accurately: a simple hazard model," *Journal of Business*, vol. 74, no. 1, pp. 101–124, 2001.
[28] H. F. Turetsky and R. A. Mcewen, "An empirical investigation of firm longevity: a model of the Ex Ante predictors of financial distress," *Review of Quantitative Finance and Accounting*, vol. 16, no. 4, pp. 323–343, 2001.
[29] M. Bardos, "Développements récents de la méthode des scores de la banque de France," *Bulletin de la Banque de France*, no. 90, 2001.
[30] E. K. Laitinen, "Survival analysis and financial distress prediction: finnish evidence," *Review of Accounting & Finance*, vol. 4, pp. 75–90, 2005.
[31] J. Argenti, *Corporate Collapse. The causes and Symptoms*, MacGraw-Hill, London, 1976.
[32] E. Laitinen, "Financial predictors for different phases of the failure process," *Omega*, vol. 21, no. 2, pp. 215–228, 1993.
[33] M. Bardos, "Détection précoce des défaillances d'entreprises à partir des documents comptables," *Bulletin de la Banque de France, Etudes*, no. 3, pp. 57–75, 1995.
[34] C. Abad, J. L. Arquero, and S. M. Jiménez, "El fracaso empresarial: características y tipos," *Accounting Review*, vol. 38, pp. 63–93, 2007.
[35] H. Ooghe and S. Prijcker, "Failure processes and causes of company bankruptcy: a typology," *Management Decision*, vol. 46, no. 2, pp. 223–242, 2008.
[36] V. Agarwal and R. Taffler, "Comparing the performance of market-based and accounting-based bankruptcy prediction models," *Journal of Banking and Finance*, vol. 32, no. 8, pp. 1541–1551, 2008.
[37] J. R. Aragonés and J. G. Sánchez, "Gestión continuada versus crisis financiera empresarial. Algunos criterios de previsión," *Revista Técnica del Instituto de Censores Jurados de Cuentas de España*, vol. 23, pp. 37–45, 1991.
[38] K. Raghunandan and D. V. Rama, "Audit reports for companies in financial distress: before and after SAS Nº 59," *Auditing*, vol. 14, no. 1, pp. 50–63, 1995.
[39] M. A. Geiger, K. Raghunandan, and D. V. Rama, "Reporting on going concern before and alter SAS n 59," *The CPA Journal Online*, vol. 53, 1995.
[40] J. F. Mutchler and D. D. Williams, "The relationship between audit technology, client risk profiles, and the going-concern opinion decision," *Auditing*, vol. 9, no. 3, pp. 39–45, 1990.
[41] J. F. Mutchler, "A multivariate analysis of the auditor's going-concern opinion decision," *Journal of Accounting Research*, vol. 23, no. 2, pp. 668–682, 1985.
[42] A. Ponemon and A. G. Shich, "Financially distressed companies and auditor perceptions of the twelve characteristics of decline," *Auditing*, vol. 10, no. 2, pp. 70–84, 1991.
[43] R. D. Martin, "Going-concern uncertainty disclosures and conditions: a comparison of French, German, and U.S. practices," *Journal of International Accounting, Auditing and Taxation*, vol. 9, no. 2, pp. 137–159, 2000.
[44] P. Jostarndt, *Financial Distress, Corporate Restructuring and Firm Survival: An Empirical Analysis of German Panel Data*, Dissertation Universität München, 2006.
[45] R. J. Taffler, "The assessment of company solvency and performance using a statistical model," *Accounting and Business Research*, vol. 15, pp. 295–307, 1983.
[46] A. V. Bruno, J. K. Leidecker, and J. W. Harder, "Why firms fail," *Business Horizons*, vol. 30, no. 2, pp. 50–58, 1987.

[47] M. Khal, "Financial distress as a selection mechanism: evidence from the United States," Paper 16, UC Los Angeles, Anderson School of Management, 2001.
[48] J. Routledge and D. Gadenne, "Financial distress, reorganization and corporate performance," *Accounting and Finance*, vol. 40, no. 3, pp. 233–259, 2000.
[49] J. B. Kruskal and M. Wish, *Multidimensional Scaling*, Sage, London, 1984.
[50] D. Peña, *Análisis de Datos Multivariantes*, MacGraw Hill, 2002.
[51] K. Arogyaswamy, V. L. Barker III, and M. Yasai-Ardekani, "Firm turnarounds: an integrative two-stage model," *Journal of Management Studies*, vol. 32, no. 4, pp. 493–525, 1995.
[52] P. Asquith, R. Gertner, and D. Scharfstein, "Anatomy of financial distress: an examination of junk-bond issuers," *The Quarterly Journal of Economics*, vol. 109, pp. 625–658, 1994.
[53] J. B. Kruskal, "Nonmetric multidimensional scaling: a numerical method," *Psychometrika*, vol. 29, no. 2, pp. 115–129, 1964.