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A Study of Insolvent Small and Medium Entities in Spain: A Cluster Analysis

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The objective of this study is to offer a detailed analysis of insolvent small and medium entities (SMEs) in Spain. To this end, a sample of firms was selected for the period 2005-2008 and certain ratios and qualitative information were gathered. The firms in question were very small, independent of other entities, and with family involvement in both ownership and management; in addition, the owners are also managers, with a poor relationship to banks. The ratio analysis showed that although some early warning signs (especially as regards profitability and insufficient resource generation) appear five years prior to insolvency, other factors then emerge as time goes on. Finally, the clustering of insolvent firms shows that in each year prior to insolvency, a majority group of firms appears along with two other groups, which may have the opposite characteristics. No stability was found in either the composition of these groups or in the ratios selected for each year.

Field of Research: Insolvency, bankruptcy, small and medium entities (SMEs)

1. Introduction

The factors that lead a firm to insolvency are always very different and, sometimes, disperse. However, in the current economic crisis it is possible to distinguish a number of regularities that are common to bankrupt firms. Specifically, the building crisis and the credit crunch by financial entities are, without doubt, the two main reasons for the current situation.

The case of small and medium entities (SMEs) deserves closer attention. Although they are affected by the two aforementioned factors, other questions must also be considered. Given that most of these firms concentrate their sales in local markets with limited resources, the entry of new competitors into these sectors, the attitude of financial entities as regards offering them credit, and managerial abilities all become essential features.

In Spain, as in other European countries, the contribution of SMEs is undoubtedly very important. Figures from the Spanish Department of Trade, Industry and Tourism (Ministerio de Industria, Turismo y Comercio 2009) show that of 3,414,779 firms, 99.86% are SMEs.

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This type of business is focused on services, especially in the catering, real estate and retail sectors, as opposed to industry where the large firms are more concentrated. Moreover, the period 1997-2007 saw a large rise (over 40.21%) in the number of new SMEs and this is the main reason to study it. Among SMEs those firms which have no employees account for 51.3%, and the contribution of SMEs to total employment is 38.6%. The average turnover for SMEs in Spain is under €2 million, which is consistent with their small size. Jointly with Greece, Italy and Portugal the percentage of SMEs in Spain is one of the highest in the European Union.

According to statistics provided by the INE (Spanish National Institute of Statistics), up until 2007 the number of failed firms remained low and constant for each quarter (approximately 200-300). However, this number has grown dramatically since the last quarter of 2007, reaching values above 1,000 firms

A more detailed analysis of the statistics shows that:

1. The economic activities with the highest number of bankruptcies are industry and energy, although the housing sector surpasses all others (accounting for 25% of failure in 2008). Among the sectors least affected sectors by the economic crisis are catering and other services (3-4%).
2. Insolvency is concentrated around small firms, those with 0-100 workers (80%), and within this range it is especially relevant for those firms with 10-49 employees.

Therefore, it can be concluded that although all sectors are being hit, the effects are greater in industry and construction, as well as in firms that employ 10-49 people.

To sum up, most firms in Spain are SMEs, and that they are the main contributor to national wealth and overall employment. It should also be noted that the vast majority of these SMEs are set up in sectors that do not require a large amount of money in terms of investment, for example, the service sector.

Given the above the present study is focused on SMEs, and especially those in service sectors, which are the most predominant.

2. Literature Review

The literature review is focused on ratio selection. In this case, was based on a previous study of small and medium entities in Barcelona (Somoza 2000) and, as a result, the variables chosen were:

Figure 1. The most relevant variables according to a previous study.

RATIO SELECTION	FEATURE
1. (Earnings before tax + depreciation) / sales	Earning margin
2. (Cash + marketeable securities) / current liabilities	Short term solvency
3. Fixed assets / net worth	Long term solvency
4. Current assets / Non current assets	Asset structure
5. Allowances / total assets	Self-financing
6. (Earnings before tax + depreciation)/ equity	Financial profitability
7. Debtors / stocks	Short-term solvency
8. Long term debt / total assets	Long –term indebtedness
9. Total assets / sales	Turnover
10. Sales / number of employees	Profitability by employee
11. (earnings before tax + depreciation)/ financial expenditures	Coverage of financial expenditures
12. Total liabilities / net worth	Indebtness
13. Total liabilities / working capital	Short term solvency
14. Sales / cash	Short-term solvency
15. Sales / (current assets less stocks)	Short-term solvency
16. Long term liabilities / net worth	Long-term solvency

The following ratios were also added due to their relevance in previous literature:

Figure 2: The most relevant variables according to previous studies

Ratios	The most relevant studies have used it:
17. Cash flow to total debt	Beaver (1966); Blum (1974); Frydman *et al.* (1985)
18. Working capital to total assets	Altman (1968); Deakin (1972)
19. Allowances to total assets	Altman (1968)
20. Capital to total debt	Altman (1968); Ohlson (1980); Dambolena & Khoury (1980); Zmijewski (1984); Frydman *et al*. (1985)
21. Sales to total assets	Altman (1968)
22. Earnings before interest and taxes/ Interests	Altman (1977); Ohlson (1980)
23. Earnings before interest and taxes / total assets	Altman (1977); Elam (1975)

Ratios were used in the typical form and no transformation was performed. Unlike other studies (Edminster 1972) neither sector nor trend ratio variables were introduced into the analysis.

However, several qualitative variables of relevance to the stated objective were introduced, and these have been used and found to be meaningful by previous studies. In this regard, the following factors were considered:

1. *CNAE*: This is a Spanish codification for sectors, similar to the SEC, which also uses a coding system in which each firm has to locate its activity. There are currently two taxonomies of codes, and the one used here is the revised version of 1993. In this case, the sample used is highly representative of the variety of sub-sectors found.

2. *Insolvency date*: As Ohlson (1980) pointed out it is important to take into account the gap between the last period considered in a study and the exact date on which a firm files for insolvency. Otherwise, if a study includes data from the period in which legal proceedings begin, the conclusions would be biased. In the present study, the time between the last data introduced into the analysis and the date of insolvency is more than one year. The oldest insolvency was in June 2005 and the most recent in December 2008. Furthermore, and as shown in previous studies (Argenti 1983; Keasey & Watson, 1987; Altman *et al.*, 2007, 2008, among others), this variable enables us to calculate the age of the firm, simply by subtracting the date the firm becomes bankrupt from the date it was created. For the present sample the average age is twelve years[1].

3. *Number of employees*: Given that the analysis is focused on SMEs, the number of employees is very small. Specifically, more than 80% of firms have fewer than twenty employees, and 65% have fewer than ten. The minimum is one employee and the maximum is 88, for only one firm; the average is 12.5 employees.

4. *Belonging to a group*: Here the qualitative variable refers to whether a firm is part of a group. A recent study by Altman *et al.* (2008) showed that subsidiaries have a lower default probability than do others, and thus the fact of belonging to a group might be considered to provide cover against insolvency. In the sample, 75% of firms are independent and do not belong to any other firm.

5. *Number of shareholders*: SMEs are normally depicted as being the property of one or two partners. This sample is no exception as 85% of the entities have one or two shareholders. The average is 1.75 shareholders.

6. *Number of managers*: If ownership is concentrated in one or two people, then one would also expect management to be handled by one or two managers. Surprisingly, the average is three managers. This variable has also been used by Argenti (1983) and Keasey and Watson (1987)[2].

7. *Sex of managers*: 75% are men. Laitinen (2008) showed that female-managed and couple-managed reorganising firms have a lower risk of failure in Finland.

8. *Coincidence between ownership and management*. In SMEs the main shareholder is also usually the manager. As expected, the present sample confirms this hypothesis, there being 72% coincidence in this regard.

9. *Family relationships in ownership*. In Spain it is very usual for SMEs (as well as some large companies and banks) to belong to families. The sample is once again representative in this regard, with 83% of firms being family owned.

10. *Family relationships in management.* This is a logical consequence if there is family ownership and if ownership coincides with management. In the present case, a high percentage (89.6%) had this feature.

11. *Number of banks dealt with*. In the recent study by Cipollini *et al*. (2008) the number of banks a company deals with was shown to be a meaningful variable for Italian companies, and it was therefore introduced here as a possible variable. As Jiménez and Saurina (2004) pointed out, the more widespread multiple lending is, the lower the probability of default. In the present sample, the number of banks dealt with is one or two in 77% of cases, while the average is 1.82 banks.

The use of this "soft" qualitative information, in contrast to "hard" information, can, as Berger *et al*. (2007) indicated[3], help to overcome the "opacity problem" that arises with this kind of firm.

As such, it is possible to obtain a snapshot of the type of firms that will be analysed. SMEs in Spain are very small (indeed, they could be considered "microfirms"), without any ownership relationships with other firms, and with a notable rate of family involvement in both ownership and management. Indeed, ownership is highly concentrated around one or two people, while management is only slightly more dispersed. In the vast majority of entities, men are the managers, as well as the major (sometimes the sole) shareholder. Finally, the firms deal with a very limited number of banks.

3. Methodology

The source of information used in this study was the Amadeus Database in Spain (known as SABI), which includes a large amount of financial and accounting information about firms in Spain and Portugal. From this database different criteria were applied in order to obtain a sample of firms. Firstly, only firms that applied for insolvency in 2005-2008 were chosen. Secondly, the size of the firms had to meet the legal requirements for presenting abridged accounts (in general, these requirements coincide with small and medium entities). Finally, only service or retail firms were selected.

This selection procedure yielded 217 entities, for whom financial data were collected for the five years prior to insolvency.

The present study differs from others that have sought to predict insolvency, because here a failed firm is not paired with another of similar characteristics. This is because the main objective is not to predict or compare firms but, rather, to identify the profile of these firms and form clusters of similarities.

Cluster analysis has been used in order to test the following hypotheses:

Hypothesis 1: The grouping process is stable over time: the ratios are equal in every year prior to bankruptcy and the composition of the groups is the same for each year.

Hypothesis 2: The relevant factors in each group are stable over time: the factors are the same for each group and they are repeated each year prior to bankruptcy.

Hypothesis 3: The grouping process shows that there are clear signs of future insolvency five years prior to the event.

The first step was to apply a non-hierarchical cluster analysis to the data. As is known, this technique has an exploratory objective but not an inferential meaning (the conclusions are only valid for this sample), and in the case of the non-hierarchical version an important limitation is the fact that the researcher must determine the number of groups in advance. Here, and based on the endograms, three groups were chosen, although it should be acknowledged that one more could be added without altering the validity. The Wald method, which is widely used in social sciences, was chosen in order to use distance criteria between groups.

4. Results

4.1. Descriptive Analysis of Ratios

The descriptive analysis was conducted after deleting ten outliers for each ratio, since these would distort any conclusion to be drawn. The next step was to investigate which ratios show a negative average and asymmetry in the distribution. A test of normality was also applied.

The following figures show the ratios with the negative average and negative asymmetry for each.

Figure 3. Negative averages for each year prior to insolvency.

Ratios	-5	-4	-3	-2	-1	TOTAL
Total debt to working capital	X					1
Cash flow to total debt	X					1
Long term debt to net worth		X				1
Reserves / total assets			X	X	X	3
EBDT / financial expenditures			X	X	X	3
Working capital / total assets			X	X	X	3
EBIT / interests			X	X	X	3
EBDT/ capital				X		1
EBIT / total assets				X	X	2
TOTAL	2	1	4	6	5	18

Figure 4. Negative asymmetry for each year prior to insolvency.

Ratios	-5	-4	-3	-2	-1	TOTAL
EBDT / sales	X	X				2
Reserves / total assets	X	X	X	X	X	5
EBDT / capital	X		X	X		3
Total debt / working capital	X					1
Cash flow / total debt	X		X	X		3
EBIT / total assets	X	X	X	X	X	5
Non current assets / net worth		X	X			2
Long term debt/ net worth		X				1
Working capital / total assets		X	X	X	X	4
EBIT / interests		X	X	X	X	4
EBDT / financial expenditures			X	X	X	3
TOTAL	6	7	8	7	5	33

These results enable several conclusions to be drawn. Regarding the averages, it can be stated that as insolvency gets closer, the number of ratios with negative values increases. The ratios that appear most frequently are: allowances to total assets, which denotes a problem in self-financing; EBDT to financial expenditures, which represents the coverage of financial expenditures by generating resources and, therefore, denotes a solvency problem; working capital to total assets, which is the most representative ratio of short-term solvency; and, finally, EBIT to financial expenditures, very similar to EBDT to financial expenditures.

In relation to the negative asymmetric distribution, this is especially important for allowances to total assets, so once again there is a problem of self-financing. Other important ratios are EBIT to total assets, which illustrates the unsatisfactory generation of resources; working capital to total assets (solvency), EBIT to interest (insufficient interest coverage) and, less importantly, EBDT/capital, cash flow to total debt and EBDT to financial expenditures.

Consequently, in the years prior to insolvency some ratios indicate that SMEs experience problems in terms of self-financing, in other words, firms are undercapitalised and fail to generate enough cash. Given that an economic crisis worsens the financial situation, the negative values become widespread over time and affect other aspects of the entities.

As for the standardised values, the results are very similar to those above. In general, it can be stated that half the ratios have an average below zero for each year prior to insolvency, while the Kolmogorov-Smirnov test does not enable us to reject the normality of the distribution in several ratios.

Having reached this point it now seems necessary to consider some possible solutions, the first of which is obvious: if the main problem is a lack of self-financing, it will be necessary to increase the flow of resources into the firm, for example, by making a capital increase, reducing dividends, and so on. The second problem is the underutilisation of assets, which implies low profitability; this issue should be treated very carefully because in this case a reorientation of the firm's strategy could be a possible solution (the entities should perhaps change the service they offer, or maybe they need to add value). In both cases, it is clear that the firm requires an important change: in the former, if they

choose to issue new capital, the management of the firm might change; in the latter, it is clear that a new strategy also implies a profound change.

It should be stressed that during the period in which the initial problems emerge, others of equal importance are added; for instance, the cash flow to total debt worsens every year, as is the case with interest coverage.

In conclusion, this preliminary analysis illustrates that self-financing and economic profitability are key issues for the future.

The next step involved applying a correlation analysis based on three criteria. Firstly, the Pearson's correlation had to be significant at the level of $p<0.01$; secondly, the correlation index had to be approximately 0.5; and, finally, given that some ratios have the same numerator and/or denominator, only those without a common numerator or denominator were used in order to avoid repetition. The results are shown in the following figure:

Figure 5. Significant correlation indices for each year prior to insolvency.

RATIOS	-5	-4	-3	-2	-1
Total debt to capital Total assets to sales	0,585	0,683	0,942	0,860	0,915
EBIT to total assets Cash flow to total debt		0,634	0,819	0,456	0,876
Reserves to total assets EBDT to sales		0,692		-0,674	
Working capital to total assets EBDT to sales		0,444			-0,594
Cash flow to total debt EBDT to financial expenditures		0,644		0,498	
EBIT to financial expenditures Capital to total debt		-0,842		0,782	
Capital to total debt EBDT to sales				0.878	-0.636
EBIT to total assets EBDT to capital			0.471		0.649

The results show that eight pairs of ratios appear more than once. Specifically, total debt to capital and total assets to sales appear in every year prior to the firm's failure; EBIT to total assets and cash flow to total debt appear in four of five years, from -4 to -1, while the remaining correlations are concentrated in two of the previous five years.

As for the first correlation, it can be seen that the index gets higher as the date of failure approaches. This finding could be interpreted as 'the higher the turnover, the greater the firm's solvency', or, *mutatis mutandi*, as a firm's turnover deteriorates, so does solvency.

Regarding the second most important correlation it can be stated that the higher the profitability, the more capacity the firm has to pay its debts, in other words, it is sounder financially.

The remaining correlations are unstable over time, since they are relevant for one year but not for the following one or two consecutive years. In three cases there is a change of sign (allowances to total assets with EBDT to total sales; working capital to total assets with EBDT to total sales; EBIT to interest with capital to total debt and capital to total debt with EBDT to sales), and only in two cases is the sign the same for the two years (cash flow to total debt with EBDT to financial expenditures and EBIT to total assets with EBDT to capital). When there is a change in the sign, the positive value is always further in time from insolvency than is the negative one, which indicates a deterioration in the ratios; the exception to this is the EBIT to financial expenditures with capital to total debt, whose value goes from negative to positive.

Finally, the remaining correlations are different and there is no apparent profile or path to comment on.

4.2. Analysis of Qualitative Variables

In order to analyse the nature of — and relationships among — qualitative variables, a correlation and correspondence analysis was conducted.

The first conclusion that can be drawn from the correlation analysis is that the following ratios have a meaningful correlation index:

Figure 6. Correlation indices among qualitative variables

	Age of the firm	Number of employees	Number of shareholders	Branch or not of another firm	Number of managers	Familiar relationship in ownership
Number of shareholders	0,298	0,225				
Number of managers		0,191	0,284			
Coincidence between managers and shareholders				-0,37		
Familiar relationship in ownership	0.386		0,601	-0,204		
Familiar relationship in management	0.201				0.205	0.371
Number of banks	0.207					0.259

It can be seen from these results that although the correlations are not very high in general, they are significant at the p=.05 level. More specifically, a positive correlation appears in all cases, except when a firm is a branch of another firm; here there is a negative association between the coincidence of managers and shareholders and family involvement in ownership. This implies that when a firm is part of another entity, the corresponding managers are not shareholders and, of course, there is no family involvement in ownership as the SME belongs to another firm.

As for the other correlations it is worth noting the positive correlation between the age of the firm and: (1) the number of shareholders (the older the firm, the higher the number of shareholders); (2) family involvement in management and ownership (which can be attributed to the fact that relatives commonly work in and manage the firms); and (3) the number of banks dealt with (here, experience entails having more financial entities tacked on).

After this initial analysis the next step was to apply the correspondence analysis, which consists in analysing the homogeneity among categories, in this case, for each pair of qualitative variables. The results indicate whether two variables are independent, as well as the degree of dependence.

Overall, the majority of firms do not belong to others, and this characteristic is associated with the fact that the owners are also the managers. Another interesting association between the qualitative variables is that family involvement in ownership and management determines the sex of the manager, who in most cases is a man.

The remaining qualitative variables show no dependence. Thus, it can be concluded that failed SMEs are firms which don't belong to others, in which managers are also the owners, and where there tends to be a coincidence between ownership and management.

4.3. Factor Analysis

Here a principal components analysis was used in order to gather all the information contained in the ratios into a few factors, defined as components.

The results show that for each year prior to insolvency the number of relevant factors changes (ranging from six to eight, depending on the year), as does the percentage of explained variance (from 84% to 94%). Thus, the information provided by the original 23 ratios can be captured by 6-8 factors. It then remains to explain the meaning of these new components and to identify any trend across time.

In order to explain the meaning of each component a closed examination of the ratios most strongly correlated with each factor was performed, as shown in the following table:

Figure 7. Results of the factor analysis.

	Year -1		Year -2		Year -3		Year -4		Year -5	
A	7		7		6		6		8* (data matrix with 5 more outliers)	
Factor 1	EBDT to sales Cash flow to total debt **Allowances to total assets** EBIT to interests EBIT to total assets	0,891 0,875 **0,906** 0,888 0,878	**EBDT to capital** Total debt to working capital Fixed assets to net worth	**0,938** 0,923 0,848	Total debts to net worth **Capital to total debt** Working capital to total assets	-0,982 **0,828** 0,815	**Total debt to net worth** Allowances to total assets EBDT to capital Capital to total debt	**0,975** 0,954 0,848 -0,808	**EBDT to capital** Total debt to capital Fixed assets to net worth	**0,940** 0,926 0,753
Factor 2	Sales to total assets **Assets to sales**	-0,933 **0,948**	Total assets to sales **Sales to total assets** EBDT to sales Sales to current assets without stocks	-0,932 **0,893** -0,627 0,537	**Cash flow to total debt** EBDT to sales EBIT to interests	**0,929** 0,898 0,882	**Fixed assets to net worth** Long term debt to net worth Long term debt to total assets Sales to current assets without stocks	**0,928** 0,877 0,837 0,830	**EBDT to sales** EBIT to total assets Cash flow to total debt	**0,929** 0,880 0,871
Factor 3	EBDT to capital **Total debt to net worth**	0,854 **0,939**	**Long term debt to total assets** Cash and marketable securities to current liabilities Total debts to working capital	**0,878** -0,730 -0,650	**Debtors to stocks** Total assets to sales	**0,798** -0,906	Cash flow to total debt **Assets to sales** Debtors to stocks	0,914 **0,929** 0,891	**Allowances to total assets**	**0,962**
Factor 4	**Sales to cash** Total debt to working capital Cash plus marketable securities to current liabilities	**0,879** -0,758 -0,749	**EBDT to financial expenditures** EBIT to interests Cash flow to total debt	**0,940** 0,927 0,785	Long term debt to total assets Long term debt to net worth **Current assets to fixed assets**	0,620 -0,755 **0,909**	**EBIT to interests** Sales to cash	**0,914** 0,851	**Sales to current assets without stocks** Total assets to sales	**0,821** -0,751
Factor 5	**Long term debt to total assets** Current asset to noncurrent assets	**0,783** -0,789	**Allowances to total assets** Sales to number of employees	**0,977** 0,631	**Allowances to total assets** Sales to cash	**0,961** 0,467	**Working capital to total assets** Total debts to working capital	**0,971** -0,841	**Cash and marketable securities to current liabilities** Sales to cash	**0,847** -0,654
Factor 6	**Working capital to total assets** Fixed assets to net worth	**0,911** -0,844	Current assets to fixed assets **Working capital to total assets** EBIT to total assets	0,519 **0,721** 0,586	**Sales to current assets without stocks**	**0,962**	**Cash and marketable securities to current liabilities** EBDT to sales	**0,598** -0,661	**EBDT to financial expenditures** EBIT to interests	**0,947** 0,890
Factor 7	**Sales to number of employees** Total debts to working capital	**0,908** 0,424	Debtors to stocks	0,884					**Current assts to fixed assets** Sales to number of employees	**0,814** 0,611
Factor 8									**Working capital to total assets** Long term debt to total assets	**0,776** 0,758
B	**90,887**		**89,471%**		**94,056%**		**93,795%**		**84,248%**	

A: **Number of components with eigenvalue superior to 1 B: % of variance**

It can be seen that the most strongly correlated ratios in one component share some common characteristics, and although some irregularities can be detected, these features enable each component to be labelled.

In general, in year -5 the factors of profitability and earning margin prevail, which may suggest that the early signs of insolvency would be a deficit in both

features, in other words, future failed firms are less profitable than the rest of the population and show problems in their earnings margin. As time goes on, some additional problems appear: for example, in years -4 and -3 problems of debt and resource generation emerge. As insolvency approaches (year -2 and -1) the causes become more evident: for instance, financial profitability and turnover are now relevant in terms of explaining the variance. Finally, the last year before failure seems to highlight the weak spots: self-financing, turnover, liquidity and debt.

Figure 8. The ratios most strongly correlated with each factor and an interpretation

	Year -1		Year -2		Year -3		Year -4		Year -5	
Number of components with eigenvalue superior to 1	**7**		**7**		**6**		**6**		**8* (data matrix with 5 more outliers)**	
Factor 1	Allowances tot total assets	0,906	EBDT to capital	0,938	Capital to total debt	0,828	Total debt to net worth	0,975	EBDT to capital	0,940
	Self-financing		Financial profitability		Indebtedness		Indebtedness		Financial profitability	
Factor 2	Assets to sales	0,948	Sales to total assets	0,893	Cash flow to total debt	0,929	Fixed assets to net worth	0,928	EBDT to sales	0,929
	Turnover		Turnover		Resources generation		Long-term solvency		Earnings margin	
Factor 3	Total debt to net worth	0,939	Long-term liabilities to total assets	0,878	Debtors to stocks	0,798	Asset to sales	0,929	Allowances to total assets	0,962
	Indebtedness		Indebtedness		Short-term solvency		Turnover		Self-financing	
Factor 4	Sales to cash	0,879	EBDT to financial expenditures	0,940	Current assets to fixed assets	0,909	EBIT to interests	0,914	Sales to current assets without stocks	0,821
	Liquidity		Financial coverage		Economic structure		Financial coverage		Short-term solvency	
Factor 5	Long-term debt to total assets	0,783	Allowances to total assets	0,977	Allowances to total assets	0,961	Working capital tot total assets	0,971	Cash to marketable securities to current liabilities	0,847
	Long-term indebtedness		Self-financing		Self-financing		Economic structure Short-term solvency		Liquidity	
Factor 6	Working capital to total assets	0,911	Working capital to total assets	0,721	Sales to current assets without stocks	0,962	Cash and marketable securities to current liabilities	0,598	EBDT to financial expenditures	0,947
	Short-term solvency		Short-term solvency – economic structure		Short-term solvency – turnover		Liquidity		Financial coverage	
Factor 7	Sales to number of employees	0,908	Debtors to stocks	0,884					Current assets to fixed assets	0,814
	Productivity		Short-term solvency						Economic structure	
Factor 8									Working capital to total assets	0,776
									Short -term solvency	
Percentage de variance	**90,887**		**89,471%**		**94,056%**		**93,795%**		**84,248%**	

In conclusion, problems of insolvency are well known five years prior to the event. Profitability and debt are the early warning signs of deterioration,

although other factors appear as time goes on; of particular interest in this regard are short-term solvency, liquidity and financial coverage. Therefore, it seems that the road to insolvency begins long before the start of legal proceedings.

4.4. Testing hypotheses by means of cluster analysis

The following figure summarises the results of testing hypotheses by means of cluster analysis for each group prior to bankruptcy, using the ratios most strongly correlated with each relevant factor found in the previous section.

Figure 9. Results of the cluster analysis

Previous year	Majority group		Median group		Minority group	
-5	Highest	Current assets to fixed assets	Highest	EBDT to sales Allowances to total assets Sales to current assets less stocks Liquid assets to short term liabilities EBDT to financial expenditures	Highest	EBDT to capital Working capital to total assets
	Lowest	EBT to capital EBT to sales Allowances to assets EBDT to financial expenditures Working capital to total assets	Lowest	Current assets to fixed assets	Lowest	Sales to current assets less stocks Liquid assets to short term liabilities
-4	Highest	Total assets to sales Working capital to total assets	Highest	Total debt to net worth Liquid assets to short term liabilities	Highest	Fixed assets to net worth EBDT to financial expenditures
	Lowest	Total debt to short term liabilities Fixed assets to net worth EBDT to financial expenditures	Lowest	Total assets to sales	Lowest	Working capital to total assets Liquid assets to short term liabilities
-3	Highest	Cash flow to total debt Allowances to total assets	Highest	Current assets to fixed assets Sales to current assets less stocks Capital to total debt	Highest	Debtors to stocks
	Lowest	Current assets to fixed assets	Lowest	Cash flow to total debt Allowances to total assets Debtors to stocks	Lowest	Capital to total debt Sales to current assets less stocks
-2	Highest	EBT to capital Sales to total assets EBT to financial expenditures Allowances to total assets	Highest	Working capital to total assets Debtors to stocks	Highest	Long-term debt to total assets
	Lowest	Long-term debt to total assets Working capital to total assets	Lowest	EBT to financial expenditures	Lowest	EBT to capital Sales to total assets Allowances to total assets Debtors to stocks
-1	Highest	EBT to capital Sales to assets EBT to financial expenditures Allowances to total assets	Highest	Working capital to total assets Debtors to stocks	Highest	Long-term debt to total assets
	Lowest	Long-term debt to total assets Working capital to total assets	Lowest	EBT to financial expenditures	Lowest	EBT to capital Sales to total assets Allowances to total assets Debtors to stocks

On the basis of these results it can be concluded that, in general, the composition of each group is different in each year prior to insolvency. Although the vast majority of firms converge into the majority group, they do not always

show the same pattern: at times some of the firms form a minority or median group, apart from the majority one. Obviously, in a few cases from one year to the next, they remain in the same group.

Considering each year prior to the event, the following conclusions can be drawn:

1. For year -5, two groups show symmetrical financial pictures: the majority one is depicted as the group with the least profitability, turnover, self-financing and solvency, and with the highest percentage of current assets compared with fixed assets; the median group, however, shows the opposite picture: it has the highest turnover, self-financing and solvency, as well as the lowest current assets. Thus, the firms with more current assets are associated with those with less profitability and turnover, and also with solvency problems.
2. For year -4 the largest group exhibits the highest levels of assets to sales, in other words, the lowest turnover, while the maximum value is in working capital to total assets and the minimum values are in total debt to net worth, fixed assets to net worth and coverage of financial expenditures. This group illustrates that the problems of the previous year continue. However, there is no symmetrical group as before, since the opposite values are distributed between the other two clusters.
3. For year -3 the majority group shows the highest levels in terms of cash flow to total debt and allowances to assets, but the lowest in current assets to fixed assets. It seems that the main features are different. Whereas two years previous the current assets to fixed assets showed the highest value, the opposite is now true, and the same happens (but in the opposite direction: from the lowest to the highest value) for allowances to total assets. This change can be interpreted in different ways: an improvement of the situation in this group, a window-dressing of the ratios or, perhaps, the result of greater deterioration in the other groups. Regarding this last possible interpretation, it can be seen that the median group shows the symmetrical picture of the majority one.
4. For year -2 a change in the group picture again appears. The majority group has the highest profitability, coverage of financial expenditures and allowances to assets, but the lowest values for debt to total assets and working capital to assets. This situation can be considered to be in line with the previous year, as the most important ratios show maximums; however, it is again difficult to find a single explanation.
5. For year -1 the majority group shows the highest levels in allowances to total assets and sales to cash, and the minimum in total debts to net worth. The opposite picture is seen in the median group.

Having analysed the composition of ratios and values in each group for every year prior to insolvency it can be concluded that the majority group behaves differently to what one would expect from a firm which is heading toward bankruptcy. It is particularly disturbing to see that as the insolvency date approaches, the profitability and solvency ratios improve rather than deteriorate. All in all, this suggests that window-dressing or some other mechanism has been used in order to present a financial and economic situation that is very different from the reality.

The above information can now be used to test the abovementioned hypotheses:

Hypothesis 1: The grouping process is stable over time: the ratios are equal in every year prior to bankruptcy and the composition of the groups is the same for each year. The analysis does not provide full support for this hypothesis. It is true that the composition of the groups, as for the majority one, is more or less the same for each year (even though the number of firms increases in the years closer to the insolvency), but it is also true that the ratios used in each year are different. Thus, the first hypothesis cannot be said to be fully validated.

Hypothesis 2: The relevant factors in each group are stable over time: the factors are the same for each group and they are repeated each year prior to bankruptcy. In this case the analysis shows that neither are the factors the same for each group (not even the majority group) nor are they completely repeated. This second hypothesis is not supported.

Hypothesis 3: The grouping process shows that there are clear signs of future insolvency five years prior to the event. The results do not rule out the possibility that five years prior to the event, firms already show signs of financial trouble; however, it is not possible to ascertain with this analysis whether the road to insolvency is clearly indicated. In each year prior to the event, some signs might lead to wrong conclusions being drawn, as mentioned previously.

These hypothesis tests clearly illustrate that the present sample constitutes what Laitinen (1991) called a group of “chronic failure firms”: for the largest group all the financial ratios were behind the average and already poor five years prior to failure. Thus, it cannot be said that the financial ratios deteriorated dramatically in the final year before insolvency.

This analysis has a number of implications for the relationship between banks and SMEs. The first is that although for each year prior to bankruptcy most SMEs have similar profiles and, therefore, can be included in the same majority group, some of them are located in other groups (minority or median) with different features. Thus, following Berger & Frame (2007) the use of banking rules to concede loans would seem to be a good strategy, as most bankrupt SMEs share common characteristics, even though, as the authors state, this solution “may exacerbate informational opacity problems” (*ibid* 19). However, and given the seriousness of the current crisis, it would be better to use a discretional strategy “by adding credit scores to information gathered from one or more of the other lending technologies” (ibid) and, especially, backing on soft information.

5. Conclusions

The majority of firms in Spain are SMEs and these are the main contributors to national wealth. Within this group the predominant activity is services. The current economic crisis has affected these firms, and since the last quarter of 2007 there has been a dramatic increase in the number of failed entities.

The present study sought to explore and draw conclusions about the structure and main traits of failed SMEs. The research methodology is based on a wide sample of firms that filed for insolvency during the period 2005-2007. A matching process was not applied here and only failed firms were studied. The ratio selection was based on both a previous study and the most relevant ratios used in the literature.

The typical SME is a firm with an age of 12 years, fewer than twenty employees, independence from other companies, and with one or two shareholders, usually with family involvement. The average number of managers is three (superior to the number of shareholders); in most cases they are men, and owners are also involved in management of the firm. Finally, these firms deal, on average, with two banks. The analysis shows that these traits are not highly correlated among one another, although when the correlation is positive (for example, as the firm gets older) the number of shareholders increases, family involvement also appears, and the firms have financial relationships with a growing number of banks.

The analysis of ratios revealed some interesting features about the structure of firms and their road to insolvency. Firstly, as insolvency approaches, the number of ratios with either a negative average or negative asymmetry increases. The descriptive analysis demonstrates that the primary problems of these firms are an unsatisfactory generation of resources (in general, profitability), along with problematic self-financing and undercapitalisation. As time goes on, these problems worsen and others appear, for example, short-term solvency.

The correlation analysis showed that the association among variables is unstable over time, although, in general, a pattern can be observed for these firms with a few ratios. Indeed, the factor analysis reduced the number of ratios to be studied to a small group of 6-8 factors, in which all the relevant information about the firms is concentrated. Moreover, these techniques offer a clearer portrait of the SMEs for each year and, as a result, show that the problems of insolvency are detectable five years prior to the event. Profitability and debt are the early warning signs of deterioration, although other factors appear over time: of particular interest are short-term solvency, liquidity and financial coverage. Therefore, it seems that the road to insolvency begins long before the start of legal proceedings.

The final cluster analysis sought to test three hypotheses. The results show that in each year prior to bankruptcy all the firms are grouped into a very small number of clusters: one is the majority group while the others are usually much less numerous. Analysis of the structure and progress of each group revealed that although the vast majority of firms converge in the majority group, they do not always exhibit the same pattern: at times some of the firms go to a minority group from the largest, or vice-versa, although it is clear that in a few cases a firm remains in the same group, except for the largest.

Regarding behaviour in this large group, it can be seen that as the insolvency date approaches, some factors, such as profitability or solvency, show an

improvement rather than a deterioration. Obviously, it has to be asked whether this development is based on real or artificial results.

Endnotes

[1] As Dickerson and Kawaja (1967) pointed out, firms operating for less than one year have only a 50% chance of surviving an additional year; firms operating for three years have slightly greater than an 80% chance of surviving an additional year, and, finally, firms operating for six years have a 90% chance of surviving an additional year.

[2] Gómez *et al.* (2008) show that an increasing number of managers increases the percentage of insolvency for industrial SMEs in Spain.

[3] Berger and Scott Frame use the term "hard" information to refer to that based on financial sources and "soft" information to describe "qualitative information gathered through contact over time with the firm, and often with its owners, managers, and other members of the local community" (2007 6)

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