

## A Study of insolvent SMEs in Spain: a cluster analysis for the service sector

Antonio Somoza  
Accounting Department  
Business and Economics Faculty  
Barcelona University  
Avda. Diagonal 690  
08034 Barcelona (SPAIN)  
Telephone: 00-34-93-403-58-19  
Fax: 00-34-93-402-90-99  
email: [asomozal@ub.edu](mailto:asomozal@ub.edu)

**Abstract:** *the objective of this study is to make a deep exploration about the insolvent SMEs in Spain. In order to do this, a sample of firms was selected for the period 2005-2008 and some ratios and qualitative information were gathered. This type of firms is very small, independent of other entities, with familiar relationship in ownership and management, also owners are also managers and with a poor relationship with banks. The ratio analysis let us conclude that although five years before the insolvency, some early warning signals appear (especially profitability and insufficient resource generation), as time draws on some other factors appears. Finally, the need for clustering the insolvent firms show that in every year before the insolvency, a majority group of firms appears jointly with other two groups, sometimes with opposite characteristics. No stability is found either in the composition of these groups or in the ratios selected for each year.*

**Keywords:** insolvency, bankruptcy, Small and Medium Entities (SMEs), ratios, qualitative information.

## **Introduction**

The factors that lead a firm to insolvency are always very different and sometimes, disperse. In the current economic crisis it is possible to distinguish some regularities, which are common on the bankrupt firms. Specifically, the building crisis and also the crunch of credit by financial entities are, without a doubt, the two main reasons that commonly explain the current situation.

In the case of Spain, as in other European countries, the weight of SMEs is undoubtedly very important. Some data let us see the predominance of this type of firm in Spanish economy. According to the Industry Department [Ministerio de Industria, Turismo y Comercio: 2008] from 3,414,779 firms, 99.86% are SMEs. This type of society is focused on services, especially in catering, real estates and retail, opposite to industry where the big firms are more concentrated. Also, for the period 1997-2007 there has been a great increase in new SMEs, superior to 40.21%. Among the SMEs the firms which have no employees are 51.3%. The contribution of SMEs in the total employment supposes the 38.6%. The average turnover for SMEs in Spain is under 2 millions of euros, which is consistent with its tiny size. Jointly with Greece, Italy and Portugal the percentage of SMEs is one of the highest in the European Union.

Consequently, we can state that SMEs in Spain is the predominant size of firm, also it is the main contributor to the national wealth and to the occupation as a whole. Also, it is important to remark the vast majority of these SMEs are set up in sectors that don't need a large amount of money in investment, as services.

### **1. Research methodology**

The source of information used in this study has been the Amadeus Database in Spain, called SABI, which covers a great deal of financial and accounting information about firms in Spain and Portugal. From this database different criterion was applied in order to obtain a sample of

firms. First of all, only firms that apply for insolvency in 2005-2008 were chosen. Secondly, the size of the firms should accomplish with legal requirements to present abridged accounts (in general, requirements coincides with small and medium entities), and finally, we only selected service or retailer firms.

The result of this selection was 217 entities. Once we have been done it, financial data were collected for the five years before the event.

This work is different in comparison with other that predicts insolvency because here we have not paired a failed firm with another one with similar characteristics. The main reason is that our objective is not to predict or compare firms, but to identify the profile of these firms and make groups of similarities.

## **2. Literature Review and variables selection**

The ratio selection was based in a previous study made for small and medium entities in Barcelona [Somoza, 2000] and as a result, the variables chosen are:

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

Also the following ratios were added by the relevance in previous literature:

**Figure 2.** The relevant variables according the most relevant studies.

Ratios have been used in the typical form, and no transformation has been made. Unlike other studies (Edminster [1972]) neither sectorial nor trend ratio variable have been introduced into the analysis.

In this study several qualitative variables interesting for the objective have been introduced. Some works before this have used and found them meaningful. In our case, the following factors have been considered:

1. *CNAE*: this is a Spanish codification for sectors, similar to SEC, also uses a codification system in which each firm has to place its activity. In our case, the sample used is very representative of the variety of subsectors we can find it.

2. *Insolvency date*: this is important to take into account the gap between the last period considered in the study and the exact date the firm files for insolvency, as Ohlson [1980] pointed out. Otherwise, if the study includes data from the period in which the legal proceeding begins, the conclusions would be biased. In our case, the time between the last data we introduced in the analysis and the insolvency is more than one year. The oldest insolvency was in June 2005 and the latest, in December 2008. Also, as it has been shown in previous studies (Argenti [1983], Keasey and Watson [1987], Altman *et al.* [2007, 2008] among others), this variable let us calculate age of the firm, only making an easy subtract between the date the firm comes to bankruptcy and the date it had been created. For our sample, the average age is 12 years.

3. *Number of employees*: given that the analysis is focused on Small and Medium entities, the number of employees is very small. Specifically, more than 80% of the firms have less than 20 employees, and 65% less than 10. The minimum is one employee and the maximum is 88, only for one firm, the average is 12.5 employees.

4. *Belonging to a group*: here the qualitative variable refers if a firm is part of a group. In the recent study of Altman *et al.* [2008] subsidiaries have less default probability than others, so the

fact of belonging to a group might be consider a coverage against insolvency. In the sample 75% of the firms are independent and not belong to any other firm.

5. *Number of shareholders*: normally SMEs is depicted for being the property of one or two partners. This sample is not an exception and 85% of the entities have one or two shareholders. The average is 1.75 shareholders.

6. *Number of managers*: if property is concentrated on one or two people, can be expected that management also should be taken by one or two managers. Surprisingly, the average is 3 managers. This variable has also been used by Argenti [1983] and Keasey and Watson [1987]<sup>1</sup>.

7. *Manager sex*: in 75% are men, only 25% women. Laitinen [2008] shows that female-managed and couple-management reorganizing firms have a lower risk of failure in Finland.

8. *Coincidence between property and management*. In SMEs the main shareholder is usually the manager too. As we expected, our sample confirms this hypothesis and in 72% this coincidence appears.

9. *Familiar relationship in property*. In Spain is very usual that SMEs (and some big companies and banks) belong to families. Our samples also let us say that is representative of this situation with 83% of the sample with this characteristic.

10. *Familiar relationship in management*. This is the logical consequence if there is family relationship in property and if property coincides with management. In our case, a high percentage, 89.6% has this feature.

11. *Number of banks which deal with*. In the recent work of Cipollini *et al.* [2008] the number of banks the company deals with is a meaningful variable for Italian companies this is why we

have introduced it as a possible variable. As Jiménez and Saurina [2004] pointed out, the more widespread multiple lending is, the lower the probability of default. In our case, the numbers of banks are 1 or 2 in 77% of cases, and the average is 1.82 banks.

With all this information, we try to overcome the “opacity problem” of this kind of firms through the use of “soft” qualitative information in contrast with the “hard” one, as Berger *et al* [2007] indicated.

Therefore, we can make a snapshot of the type of firms we are going to analyse. The SMEs in Spain are very small (we can say that they are “microfirms”), without any relationship in property with other firms and with a remarkable familiar relationship both in property and management. The property is very concentrated in one or two people and the management is a bit more widespread, but not so much. In the vast majority of the entities, men are the managers and also, they coincides with the major (sometimes the unique) shareholder. Finally, the firms deal with a very limited number of banks.

In order to analyze the nature and relations among qualitative variables, a correlation and correspondence analysis have been done.

First of all, from the correlation analysis we can state that the following ratios have a meaningful index of correlation:

**Figure 3.** Indexes of correlation among qualitative variables

According to these results, we can state that although the correlations are not very high in general, are significant at  $p=.05$  level. More specifically, the positive correlation appears in all cases, except when a firm is a branch of another firm, whose association with the coincidence between managers and shareholders and the familiar relationship in ownership exhibits negative

values. It implies that when a firm is part of another entity, then the managers aren't shareholders, and, of course, there is not a familiar relationship in the ownership as it belongs to another firm.

From the rest of correlations it should be emphasized the positive correlation of the age of the firm with the number of shareholders (the greater it is, the higher number of shareholders have), with familiar relationship in management and ownership (it can be attribute to the fact that is very usual that relatives work and manage the firms), and with the number of banks (here the experience entails to have more financial entities to tacked on).

Following the analysis, the first step was to apply the correspondence analysis. As it is known this technique consists on analysing the homogeneity among categories, in our case, for each pair of qualitative variables. The results let us say if two variables are independent and the degree of dependence.

All in all, we can say that the majority of the firms don't belong to others and this characteristic is associated with the fact that the owners are also the managers. Also, another interesting association between qualitative variables is that the familiar relationship in property and management determines the sex of the manager, which in most case is man.

The rest of qualitative variables don't have any dependence. So, what it has been said, we can conclude that failed SMEs are firms which don't belong to others, in which managers are also the owners, and tend to be a coincidence between property and management.

#### **4. Factorial analysis**

We have used the Component Principal Analysis technique in order to sum up all the information contained in the ratios into a few factors, defined as components.

The results show that for each year previous the insolvency, the number of relevant factors changes (in a range from 6 to 8, depending on the year) and also the percentage of explained variance (from 84% to 94%), so we can say that the information given by the original 23 ratios can be captured by 6-8 factors. The following question is to explain the meaning of these new components and also if we can detect any trend along the period.

In order to explain the meaning of each component, a closed examination of the most correlated ratios with each factor has been made, as it appears in the following table:

**Figure 4.** Results of the factor analysis.

As it can be seen, the most correlated ratios in one component share some common characteristics and, although some irregularities can be detected, it is true that these features let us label each component.

In general, in year -5 the factors of profitability and earning margin prevail, what might point out that the early signals of insolvency must be a deficit in both features, in other words, future failed firms are surely less profitable than the rest of population and show problems in the earnings margin. As the time draws on, some additional problems appear, for example, in years -4 and -3, the indebtedness and the resource generation emerges. When the insolvency gets closer (year -2 and -1) the causes are more evident and, for instance, financial profitability and turnover become relevant to explain the variance. Finally, the last year before the failure seems to come to light the weak spots: self-financing, turnover, liquidity and indebtedness.

**Figure 5.** The most correlated ratios with each factor and an interpretation

In conclusion, the problems of insolvency are well known 5 years before the event. Profitability and indebtedness are the early warning signals of deterioration, but as time goes by, some other factors appear, especially interesting are short-term solvency, liquidity, and financial coverage. Therefore, it seems that the insolvency path begins long before the legal proceedings start.

## **5. A test of hypothesis through Cluster Analysis**

We have used the cluster analysis in order to test the following hypothesis:

**Hypothesis 1:** the grouping process is stable over time: the ratios are equal in every year previous the bankruptcy and also the composition of the groups for every year.

**Hypothesis 2:** the relevant factors in each group are stable over time: the factors are the same for each group and the factors are repeating every year before the bankruptcy.

**Hypothesis 3:** the path to insolvency through the grouping process is a way with clear signs 5 years before the event.

First of all, a non hierarchical cluster analysis has been applied to the data. As it 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 non hierarchical version, one important limitation is the fact that the researcher should determine the number of groups previously. In our case, and based on the endograms the decision was to choose 3 groups, although we have to recognise that it would be possible to add one more with the same validity. In order to use distance criteria between groups we have chosen the Wald Method, which is widely used in social sciences.

The results are sum up in the following figure for each group before the bankruptcy using the most correlated ratios with each relevant factor found in the previous section.

**Figure 6.** Results of cluster analysis

From these results we can conclude that, in general, the composition for each group is different in every year before the insolvency, although the vast majority of the firms converge to the majority group, they don't always exhibit the same pattern, sometimes some of the firms go to a minority group or a median group from the majority one. And, of course, in few cases from one year to the next, they keep in the same group.

And, for each year previous to the event:

1. For the year -5, two groups show symmetrical financial images, 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 asset; the median group, however, shows the opposite image: with the highest turnover, self-financing and solvency and with the lowest current assets. So, the firms with more current assets are associated with those with less profitability and turnover, and also with problems in solvency.
2. For the year -4, the biggest group exhibits the highest levels of assets to sales, or what is the same, the lowest turnover and the maximum value is in working capital to total assets, regarding the minimum values are in total debt to net worth, fixed assets to net worth and coverage of financial expenditures. Once again, this group let us conclude that the problems of the previous year go on. However, there is not a symmetrical group as the last year because the opposite values are distributed between the two other clusters.
3. For the year -3: the majority group show the highest levels in cash flow to total debt and allowances to assets, but the lowest in current assets to fixed asset. It may seem that the main features are different. If two years ago, the current assets to fixed assets was the highest, now is the opposite, and the same happens (but in the opposite direction: from

the lowest to the highest value) for allowances to total assets. We can interpret this change in different ways: an improvement of the situation in this group, a window-dressing of the ratios or maybe the result of deeper deterioration in the other groups. Regarding this last possible interpretation, we can see that the medium group shows the symmetric view of the majority one.

4. For the year -2: once again, a change in the portrait of the groups appears. The majority group has the highest profitability, coverage of financial expenditures and allowances to assets, but the least values in indebtedness of total assets and working capital to assets. It can be considered that the situation is in line with the previous year as the most important ratios show maximums; however, once again it is difficult to find only one explanation.
5. For the 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 image is in the median group.

So, after analysing the composition of the ratios and the values in each group for every year before the insolvency, we can conclude that the majority group shows different behaviour to what we can expect from a firm, which is going to bankruptcy. It is especially shocking that as the insolvency date approaches, the profitability and solvency ratios improve, instead of show deterioration. All in all, this leads us to think that some window-dressing or some other mechanism has been done in order to offer a financial and economic situation that is very different to reality.

Now, we can answer the hypothesis tested before:

**Hypothesis 1:** the grouping process is stable over time: the ratios are equal in every year previous the bankruptcy and the composition of the groups is the same for every year. The analysis shows that the hypothesis is not fully accomplished. It is true that the composition of

the groups, as for the majority one, is more or less the same for each year (even the number of firms increase in the years closer the insolvency), but it is also true that the ratios used in every year are different. So, we cannot say that the first hypothesis is validated in full.

**Hypothesis 2:** the relevant factors in each group are stable over time: the factors are the same for each group and the factors are repeating every year before the bankruptcy. In this case the analysis show that neither the factors are the same for each group (even the big group) nor they are repeating completely. This second hypothesis is not fulfilled.

**Hypothesis 3:** the path to insolvency through the grouping process is a way with clear signs 5 years before the event. After studying the results, we cannot discard that 5 years before the event firms show signs of financial troubles, but what it is not possible to ascertain with this analysis is if the path is a clear way. In every year before the event, some signs might lead us to wrong conclusions, as we have mentioned.

From the test of this hypothesis it is very clear that we are in front of, what Laitinen [1991] called as a group of “chronic failure firms”: the biggest group show all financial ratios were behind the average and poor already in the fifth year before failure. So, we cannot say that financial ratios were deteriorated dramatically in the first year before insolvency.

Some implications in the relationship banks-SMEs can be drawn from this analysis. The first one is that although for each year before the bankruptcy, most of SMEs have similar profiles and therefore, can be included in the same big group, some of them are placed in other groups (minority or median), whose features are different from the first one. So, following Berger and Frame [2007] the use of rules for banks in order to concede loans seems to be a good strategy as the major part of bankrupt SMEs share common characteristics, although as the authors state, “may exacerbate informational opacity problems” [*ibidem*: 19]. However, and taking into account the seriousness of current crisis, it is better to use a discretionary strategy “by adding

credit scores to information gathered from one or more of other lending technologies” [ibidem], and specially, backing on “soft” information.

## **Conclusions**

SMEs in Spain is the predominant size of the firm, also are the main contributor to the national wealth, also inside this group the predominant activity is services. The current crisis has affected these firms, and during the last term of 2007 the number of entities has dramatically increased.

In this study we have tried to explore and reach some conclusions about the structure and the main traits of failed SMEs. The research methodology is based on a wide sample of firms, which has asked the protection of insolvency laws for the period 2005-2007. A matching-process has not been applied here and only the failed firms have been studied. The ratio selection has been based on a previous study and the most relevant ratios used in literature.

The typology of SMEs is a firm with an age of 12 years, with less than 20 employees, independent from other companies, with one or two shareholders, usually with familiar relationship. The number of managers is three in average (superior to the number of shareholders); men in most of cases, and the owner also take the management of the firm. Finally, the number of banks they get in touch is two, in average. Our analysis shows that these traits are not high correlated each other, but when the correlation appears is positive, for example, as the firm is getting older, the number of shareholders increase, the familiar relationship also appears, and the number of banks the firms have financial relations with grow.

The analysis of the ratios reveals some interesting features about the structure and the path of the firms to insolvency. First of all, as the insolvency gets closer, the number of ratios with either negative average or negative asymmetry increases. The descriptive analysis let us say that

the primary problems of these firms are an unsatisfactory generation of resources (in general, profitability) jointly with a problematic self-financing situation and an undercapitalization. As the time goes by, these problems are worsened and other appears, for example, the short-term solvency.

The correlation analysis shows us that the association among variables is unstable over time, but in general, lets us see that it is feasible to find a pattern of these firms with a few ratios. Effectively, the factorial analysis reduces the number of ratios to be studied in a little group of 6-8 factors in which is concentrated all the relevant information of the firm. What is more, these techniques offers a clearer portrait of the SMEs for each year and in this way we can conclude that the problems of insolvency are well known 5 years before the event. Profitability and indebtedness are the early warming signals of deterioration, but as time passes, some other factors appear, especially interesting are short-term solvency, liquidity, and financial coverage. Therefore, it seems that the insolvency path begins long before the legal proceeding starts.

Our last analysis tries to respond if the three hypotheses are accomplished. In order to do so, we applied the cluster analysis and the results show that in each year before the bankruptcy all the firms are grouped in a scarce number of cluster, one is the most important in number and the other usually are much less numerous. Analysing the structure and the progress of each group we can say that although the vast majority of the firms converges to the majority group, they don't always exhibit the same pattern, sometimes some of the firms go to a minority group from the largest, or vice-versa, but what is clear is that in few cases a firm keeps in the same group, except for the largest.

Regarding the behaviour in this large group, one can see that as the insolvency date approaches, some of the factors, like profitability or solvency, instead of deteriorating, show an improvement. Obviously, we can question if this development is based on reality or only an artificial result.

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