

## C ASSESSING THE DETERMINANTS OF FINANCIAL DISTRESS IN FRENCH, ITALIAN AND SPANISH FIRMS<sup>1</sup>

*Knowledge of the determinants of financial distress in the corporate sector can provide a useful foundation for analysing the degree of credit risk facing banks, and represents a key input for assessing risks and vulnerabilities to financial stability. This special feature examines the determinants of corporate failure in Italian, Spanish and French SMEs in order to shed light on whether the predictors of financial distress in these countries are the same or not. This is done by estimating models for each of these countries and a common model for the three. This allows an assessment of the differences in the determinants of financial distress and in the predictive ability of the two model set-ups.*

### INTRODUCTION

An important part of financial stability analysis entails assessing the degree of corporate sector credit risk facing banks. For financial stability analysis on a euro area-wide basis, it is important to ascertain whether common or country-specific factors drive corporate failures. If the factors that give rise to financial distress are the same across countries, then aggregation of individual corporate sectors into a single group is justified, whereas if country-specific factors are more important, this would call for analysing conditions in each individual corporate sector. Moreover, such issues are also relevant for the risk management practices of individual credit institutions. The Revised Framework for Capital Measurement and Capital Standards, also known as Basel II, opens up the possibility that credit institutions themselves can estimate their minimal capital requirements. According to Basel II, credit institutions can choose between one of two internal ratings-based approaches when they calculate their capital requirements.<sup>2</sup> If they choose to do so and follow one of the two internal ratings-based approaches, they need to assess the probability

of default of their obligors in order to calculate their minimal capital requirements. As many credit institutions in Europe operate on a cross-border basis, the choice between setting up individual country credit scoring models or a common credit scoring model is a highly relevant one. In order to shed light on these questions, the determinants of corporate failure in French, Italian and Spanish firms are investigated.

Financial stability analysis of non-financial firms usually involves examining conditions in SMEs as well as large companies separately. In order to assess the financial health of large companies, a number of information sources are available, such as credit ratings and market-based indicators such as EDFs. However, these sources are not available for most SMEs. Instead, the analysis of SMEs usually relies on company accounts. For this special feature, income statement and balance sheet information was collected for SMEs in France, Italy and Spain, and accounting-based credit scoring models were estimated for each country.<sup>3</sup> An accounting-based credit scoring model is a model which, on the basis of information extracted from company accounts, and perhaps also non-financial information (such as the age of the company), estimates the probability that a particular firm will default on its debt obligations, usually over a one-year horizon.

In contrast to other studies, which also compare the determinants of corporate failure across countries, this study focuses on countries that are fairly similar in some important aspects.

1 This special feature draws heavily on A. D. Rommer (2005), "A Comparative Analysis of the Determinants of Financial Distress in French, Italian and Spanish Firms", Danmarks Nationalbank Working Paper, No 26; and A. Dyrberg (2004), "Firms in Financial Distress: An Exploratory Analysis", Danmarks Nationalbank Working Paper, No 17.

2 For further details, see Basel Committee on Banking Supervision (2004), "International Convergence of Capital Measurement and Capital Standards: A Revised Framework", BIS, June.

3 In the case of other large countries, such as Germany, data have a survivorship bias, and could therefore not be meaningfully included.

The three countries all belong to continental Europe, are a part of EMU, and their legal traditions are all inspired by the French Commercial Code.<sup>4</sup> Furthermore, despite the deregulation and financial liberalisation process which took place in these countries in the 1980s and 1990s, banks remain very important sources of financing in all three.

### DATA AND METHODOLOGY

The data used for Italy, Spain and France were obtained from the Amadeus database provided by Bureau van Dijk. As opposed to most Italian, Spanish and French credit scoring models presented in the literature, which use non-public information from credit registries operated by governments (usually by bank supervisors) or from other non-public sources (such as banks), the analysis uses purely public information.

Several sample selection criteria are applied to the raw data in order to identify a homogeneous group of firms across countries. Some of the important sample selection criteria screen the data to ensure that only SMEs that are public or private limited liability companies are analysed. The definition of SMEs adopted follows the European Commission definition of an SME where a firm should have at least 10 employees and have total assets of at least 2 million euro up to a limit of 250 employees and total assets of 43 million euro. The lower-bound criterion ensures that micro-companies, which resemble households, are excluded from the sample, and furthermore, that only “truly” active companies are analysed. The upper-bound criterion ensures that the analysed group of firms is fairly homogeneous.

The dependent variable is the exit type as recorded in the Amadeus database. Firms can exit for the following reasons: 1) corporate distress, 2) voluntary liquidation, 3) mergers and acquisitions and 4) inactive (no precision). Corporate distress is defined as a condition where firms have either gone bankrupt or where active firms are in receivership. Voluntary

liquidations and mergers and acquisitions are self-explanatory. The final category, inactive (no precision), consists of firms that are known to have exited the database, but not why they did so.

As firms can exit to these various mutually exclusive states, the credit scoring model to be estimated is a competing risks model. The competing risks model estimates simultaneously the probability that a firm will exit to each of the states (financial distress, voluntary liquidation, etc.).<sup>5</sup> The estimation delivers four equations, from which the determinants of corporate distress, voluntary liquidations, mergers and acquisitions and the group inactive (no precision) are obtained. Here the focus is on the firms in financial distress, and so only these results are reported.

While ideally the estimation period would have covered a whole business cycle, information on exits is only retained in the database for three years.<sup>6</sup> The final dataset, which is used in the

4 The rules and practices governing the resolution of financial distress in 49 countries is discussed in R. La Porta, F. Lopez-De-Silanes, A. Shleifer and R. Vishny (1998), “Law and Finance”, *Journal of Political Economy*, Vol. 106, No 6, pp. 1113-1155. They explain how commercial laws come from two broad traditions. One tradition is the common law family, which is English in origin. The other tradition is civil law, which derives from Roman law. Within the civil tradition, the modern commercial laws can have French, German, and Scandinavian origin. The French Commercial Code, which Italy, Spain and France are inspired by, dates back to Napoleon in 1807. The German Commercial code was written in 1897 after Bismarck’s unification of Germany. The Scandinavian laws, by contrast, are “similar to each other but “distinct” from others” (see La Porta et al. (1998), p. 1119)).

5 The literature provides suggestions on how to estimate credit scoring models (see for example D. Lando (2004), “Credit Risk Modeling: Theory and Applications”, Princeton Series in Finance). Usually information on firms in financial distress and active firms is gathered and a credit scoring model based on this information is estimated. Here the usual framework is extended. As firms can exit for other reasons than financial distress, these other exit types are included in the estimations, and a competing-risks model is estimated. The methodology follows P. D. Allison (1982), “Discrete-time Methods for the Analysis of Event Histories”, in S. Leinhardt (ed.), *Sociological Methodology* (San Francisco: Jossey-Bass), pp. 61-98. Allison (1982) shows that a discrete-time competing risks model can be estimated as a multinomial logit model.

6 In early 2005, the database only held information for the period 2000-2002, thus restricting the empirical analysis to cover just this period.

**Table C.1 Number of firms**

(2000 - 2002)

	Spain		Italy		France		Total
Firms in financial distress	180	(0.2)	155	(0.2)	1,703	(1.6)	2,038 (0.7)
Voluntary liquidations	95	(0.1)	24	(0.0)	1,409	(1.3)	1,528 (0.5)
Mergers	917	(1.2)	439	(0.4)	63	(0.1)	1,419 (0.5)
Inactive (no precision)	50	(0.1)	65	(0.1)	1,095	(1.0)	1,210 (0.4)
Active firms	74,624	(98.4)	97,049	(99.3)	104,263	(96.1)	275,936 (97.8)
Total	75,866	(100.0)	97,732	(100.0)	108,533	(100.0)	282,131 (100.0)

Sources: Bureau van Dijk (Amadeus) and ECB calculations.

Note: Figures in parentheses are shares in the total.

estimations, covers 282,131 firm-year observations covering Italian, French and Spanish firms in the period 2000 to 2002. Table C.1 gives an overview of the number of firms in the three countries split up according to active firms and the exit type. The proportion of firms in financial distress to the overall number of firm-years is 0.2% in Spain and Italy and 1.6% in France. Despite the differences in levels, it is the assessment, that the sample is random and accordingly, that the estimations are consistent and that the effects of the explanatory variables can be meaningfully compared.<sup>7</sup>

The explanatory variables included in the estimations are divided into core variables, proxy variables and controls.<sup>8</sup> The core variables are the variables that are usually used in credit rating studies, such as the earnings ratio and the solvency ratio. The proxy variables include ownership variables and a variable which indicates the legal form of the company. Controls for the macroeconomic environment and for the various sector affiliation categories are also used. The definitions of the explanatory variables, as well as their expected effects, are presented in Box C.1.

#### THE ESTIMATED DETERMINANTS OF FINANCIAL DISTRESS IN THE COUNTRY MODELS

The individual credit scoring models are estimated. The estimations show that the determinants of financial distress differ

between the countries, although there are also some similarities (see Box C.2).

Two determinants of financial distress have similar explanatory power across countries: the earnings ratio and the solvency ratio. As theory predicts, they are significant in all countries and the coefficient is negative, indicating that the higher the ratios, the less likely a firm is to enter financial distress.

The variables, which differ between the countries in terms of whether or not they are significant or what sign they have, are leverage, size, age of the company, legal form and ownership (high concentration).

Leverage is only significant (and has a positive sign) in Spain and France. The variable is not significant for Italy.

<sup>7</sup> To benchmark the French, Spanish and Italian data, they are compared to a sample of Danish SMEs, which covers the whole population of Danish public and private limited liability companies. The sample is analysed and discussed extensively in Dyrberg (2004). In this sample of Danish firms, the proportion of firms in financial distress to all other firms is 0.8%, which is higher than the percentage in Italy and Spain and lower than in France. Compared to the dataset used by Dyrberg, the following corrections are made in order to make the Danish figures comparable to the French, Spanish and Italian figures. Only SMEs are considered, and the financial distress measure is modified to be comparable to the financial distress measure used in this special feature. The Danish dataset includes firms in financial distress in the period 1995-2001.

<sup>8</sup> A number of potential explanatory variables (not reported) were also considered, but were not found to be significant. These included the interest payment burden, other earnings ratios such as profit for the period over total assets, profit for the period over operating revenue, and cash flow over operating revenue.

## Box C.1

## THE EXPLANATORY VARIABLES (CORE VARIABLES, PROXY VARIABLES AND CONTROLS)

This Box describes the key independent variables that are considered with the aim of explaining the likelihood of financial distress among the firms examined. The variables are separated into two groups: core and proxy. Controls are also included in the estimations.

*Core variables:*

- 1) Earnings ratio: earnings before interest, taxes, depreciation and amortisation (EBITDA), relative to total assets. As higher profits ordinarily imply a lower likelihood of financial distress, the expected sign of this variable is negative in all countries.
- 2) Solvency ratio: shareholder funds relative to total assets. The solvency ratio provides information on the past ability of a firm to generate satisfactory earnings. Higher financial buffers should lower the likelihood of financial distress, and so the expected sign of this variable is negative in all countries.
- 3) Leverage: loans over total assets. As a high level of leverage implies that companies may find it difficult to repay their loans, or a higher likelihood of experiencing financial distress, this variable is expected to have a positive coefficient.

The next two hypothesised effects are the effects of firm size and age. It is important to mention that the effects of these variables are correlated (i.e. because older firms tend to be larger than younger firms), and that it can be difficult to disentangle the effects. Here the effect of one variable given the effect of the other variable is discussed.

- 4) Firm size: the logarithm of total assets. Two hypotheses can be constructed based on the effect of firm size. The first is that an optimal firm size does exist, meaning that there is a trade-off between being relatively small and being relatively large. This would indicate that the effect of firm size on the probability of experiencing financial distress is nearly U-shaped. The reasoning is that small firms have a higher probability of falling into financial distress, because they are not so resistant to the shocks they might encounter, whereas large firms have a high probability of falling into financial distress, as they might have inflexible organisations, encounter problems with monitoring managers and employees, and struggle to provide efficient intra-firm communication. The second hypothesis is that the probability of financial distress decreases along with an increase in firm size. This is in line with the theoretical literature. Various studies have shown that exit rates are a decreasing function of firm size, because larger and older firms are better at adjusting to drastic innovations.<sup>1</sup> Along the lines of the literature, it is expected that larger firms are less likely to face financial distress.
- 5) The age of the firm: according to theory, firms learn about their efficiency as they operate in the industry.<sup>2</sup> Firms know the average level of market profitability, but they do not know their own potential. After entry, firms start to learn about their own profitability potential, and either expand, contract or exit, depending on where they are in the distribution of profitability. Efficient firms grow and survive, whereas inefficient ones decline and fail. It takes time for entrant firms to acquire sufficient information about their parameters before they are able to

1 See B. Jovanovic and G. MacDonald (1994), "The Life Cycle of a Competitive Industry", *Journal of Political Economy*, Vol. 102, No 2, pp. 197-247 and S. Klepper (1996), "Entry, Exit, Growth and Innovation over the Product Life Cycle", *American Economic Review*, Vol. 86, No 3, pp. 562-83.

2 See B. Jovanovic (1982), "Selection and the Evolution of Industry", *Econometrica*, Vol. 50, No 3, pp. 649-70; and A. Pakes and R. Ericsson (1998), "Empirical Implications of Alternative Models of Firm Dynamics", *Journal of Economic Theory*, Vol. 79, No 1, pp. 1-45.

decide whether or not they want to exit or stay in the market. The theory implies that when firms are young they have not yet learned their own potential and the profitability of exit is low. This phase is then followed by a period in which the probability of exit is high, before a final phase when the probability of exit decreases again. In other words, the effect of age on exits is bell-shaped. As the firms considered in this special feature are firms that have at least ten employees and total assets of at least 2 million euro, the assumption is that they have already learned about their own potential. The hypothesis is therefore that only the last effect is applicable, namely that the older the firms are, the less likely they are to head into financial distress.

*Proxy variables:*

6) The number of registered subsidiaries is a proxy for diversification. As information is lacking on whether the subsidiaries are wholly owned or not, the effect of the variable is ex ante ambiguous.

7) The legal form is a proxy for the willingness to take on risk. It is set to 1 for private limited liability companies and at 0 for public limited liability companies. As private limited liability companies have less share capital than public limited liability companies, this variable is likely to have a positive sign, reflecting the higher risk of limited liability companies.<sup>3</sup>

8) The number of registered shareholders is a proxy for the environment the firm is operating in. It measures the number of shareholders but not the degree of ownership concentration (see below). However, it is correlated with the concentration of ownership. It is left to the estimations to show whether or not this variable has a significant effect.

9), 10) and 11) Ownership information is included in the estimations as a proxy for the firms' internal environment. The governance of a firm, and thus its financial decisions, is influenced by its ownership structure. Three variables which measure the concentration of ownership are included: ownership (small concentration), ownership (medium concentration) and ownership (high concentration). Ownership (small concentration) is equal to 1 when none of the company's shareholders has an ownership share larger than 24.9%. Ownership (medium concentration) is equal to 1 when none of the company's shareholders has more than 49.9%, but at least one or more shareholders have an ownership percentage above 24.9%; and ownership (high concentration) is equal to 1 when at least one of the shareholders owns over 49.9% of the firm's shares. In all three cases it is equal to 0 when there is no information on the shareholders. Analysis of the potential conflict between owners leads to the result that it is desirable to concentrate ownership among a few individuals.<sup>4</sup> The hypothesis is therefore that ownership (high concentration) is significant and has a negative sign. No hypotheses are set up with regard to ownership (small and medium concentration).

*Controls:*

Year dummies are included to control for the macroeconomic environment. The reference year is 2000.

Sector affiliation dummies are included to control for the various sectors that the firms are operating in.

3 See J. E. Stiglitz and A. Weiss (1981), "Credit Rationing in Markets with Imperfect Information", *American Economic Review*, Vol. 71, No 3, pp. 393-421.

4 See M. Bennedsen and D. Wolfenzon (2000), "The Balance of Power in Closely Held Corporations", *Journal of Financial Economics*, Vol. 58, No 1-2, pp. 113-39.

The estimations show that size and age do not affect financial distress in the Spanish case, but that they do affect financial distress in the Italian and French case. The size and the age variables are correlated, so that it can be difficult to disentangle the effects. This is what is seen from the estimations. In France and Italy both variables are significant, but with changing signs, so that if age is significant and has a positive effect in one country, then size is significant and has a negative effect in the same country, or vice versa. When the least significant variable (either age or size) is left out of the estimations for France and Italy, respectively, the remaining variable is significant and has the expected negative sign.<sup>9</sup>

The legal form dummy is only significant in the Italian case, where it has the expected positive sign. The level of share capital between public and private limited liability companies differs between the countries. It is not surprising that the effect of the private limited liability variable is only significant in the case of the Italian firms, where the difference in share capital between the private and public limited liability companies is the largest.

The estimations show that there is no effect of ownership (high concentration) for the Italian and Spanish firms. The parameter estimate is however significant for the French firms and has the expected negative sign.

The following variables were examined to establish whether they affect financial distress or not: the number of registered subsidiaries; the number of registered shareholders; the concentration of ownership (medium concentration); and the concentration of ownership (small concentration). No effects were expected. The estimations show that none of the variables was significant in any of the countries.

### DETECTION OF FINANCIAL DISTRESS

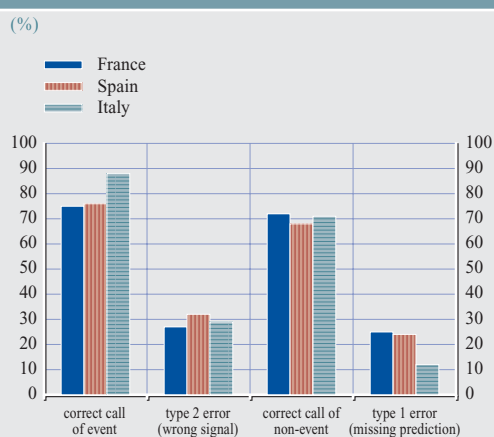
A measure of how well the models fit the data is the proportion of correct predictions in the

total. There is a trade-off between incorrectly classifying a firm that does not exit because of financial distress as a financially distressed firm, and failing to classify correctly a financially distressed firm.

In order to separate the predictions which are probabilities, it is necessary to choose a cut-off value for the probability. The naïve predictor uses a cut-off value of 0.5, which means that firms that have a predicted probability above 0.5 are classified as financially distressed, whereas firms that have a predicted probability below 0.5 are classified as active. Such a cut-off level has a rationale if 50% of the firms in the samples eventually became financially distressed. However, the samples analysed here were skewed, with only a fraction of firms in financial distress compared to all other firms, calling for the 0.5 cut-off to be modified. Instead, the cut-off level is set as the proportion of financially distressed firms to all other firms. With these cut-off levels, the models correctly classify between 75 and 88% of the financially distressed firms, and between 68 and 72% of the active firms (see Chart C.1).

<sup>9</sup> If the age variable is left out of the French estimation, the size variable is still significant and has a negative sign in the estimated credit scoring model. If size is left out of the Italian estimation, age is still significant and has a negative sign in the estimated credit scoring model.

Chart C.1 Discriminatory power



Sources: Bureau van Dijk (Amadeus) and ECB calculations.



Had a lower cut-off level been chosen, then the models would have predicted that more firms would become financially distressed, but this would be at the cost of an increased number of so-called type 2 errors (i.e. sending the wrong signal). If the cut-off level is increased, then the frequency of type 2 errors will diminish, but at the cost of a decreased number of firms being predicted as being in financial distress (and with an increase in type 1 errors). Ultimately, the cut-off level depends on the agents' objective function, also called the loss function. It should reflect an assessment of the cost of making type 1 and type 2 errors.

#### THE COUNTRY MODELS COMPARED TO A COMMON CREDIT SCORING MODEL

The country models are compared to a common credit scoring model in order to assess the differences in the determinants of financial distress and in the predictive ability of the two set-ups (see Box C.2). The common credit scoring model is estimated on a pooled data set,

which includes the data used for all three country models.

The comparison of the core variables in the common model with the individual country models shows that the only country with results similar to the results in the common model (in terms of what predictors of financial distress are significant, their sign and their magnitude) is France. Except for leverage, which is not significant in the pooled model, but is significant in the French country model, all core variables are significant in both the French country model and the pooled model; they also have the same sign and are of similar size in the two set-ups. When the pooled model is compared to the Italian and the Spanish country models, only the earnings ratio and the solvency ratio are significant and have the same sign in both model set-ups. However, the parameter estimates are of quite different magnitude.

#### Box C.2

#### ESTIMATION RESULTS

Table C.2.1 Core variables

core variables	estimated sign			
	Italy	France	Spain	pooled model
earnings ratio	-	-	-	-
solvency ratio	-	-	-	-
leverage	insignificant	+	+	insignificant
firm size	+	-	insignificant	-
age	-	+	insignificant	+

Table C.2.2 Proxy variables

proxy variables	estimated sign			
	Italy	France	Spain	pooled model
number of subsidiaries	insignificant	insignificant	insignificant	-
legal form	+	insignificant	insignificant	-
number of shareholders	insignificant	insignificant	insignificant	-
ownership (small concentration)	insignificant	insignificant	insignificant	+
ownership (medium concentration)	insignificant	insignificant	insignificant	+
ownership (high concentration)	insignificant	-	insignificant	+

Comparison of the proxy variables in the common model with the individual country models shows that there are no similarities between the country models and the common model. All proxy variables are significant in the pooled model. Only one proxy variable was significant in the French and in the Italian case (but with different signs than in the pooled model), and none of the proxy variables was significant in the Spanish case.

The estimation of the pooled model delivers a sign on four variables which were insignificant in the individual credit scoring models, and for which no hypotheses were set up. These are the number of subsidiaries (-), the number of shareholders (-), ownership (small concentration) (+) and ownership (medium concentration) (+). The sign of two of the other significant proxy variables in the pooled model seems puzzling. The proxy variable ownership (high concentration) is significant and has a positive sign in the pooled model. Furthermore, the legal status variable is significant and has a negative sign in the pooled model.

The overall predictive ability of the common model is similar to that of the individual country models, but it hides important differences between the two model set-ups.<sup>10</sup> The common model correctly predicts 74% of the financially distressed firms, and 72% of the active firms. Further investigation shows that the common model does better for France than the French credit scoring model, but worse for Spain and Italy than the Spanish and Italian credit scoring models.

## CONCLUDING REMARKS

This study investigated the determinants of corporate failure in Italian, Spanish and French SMEs. The empirical analysis is based on a sample, which covers the period 2000-2002. The estimations show that some common factors, such as the earnings ratio and the solvency ratio, have similar predictive power across countries, but also that there are important differences in the determinants of

financial distress across the three countries. The findings have implications for at least two policy areas, namely financial stability analysis and Basel II.

<sup>10</sup> The conclusions from the comparisons depend on the chosen cut-off levels. In all models the proportion of firms in financial distress to all other firms was chosen as the cut-off level.