A competing risks analysis of exit for Spanish manufacturing firms

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Abstract

Firms may exit the market in several ways, mainly through merger, acquisition, voluntary liquidation and bankruptcy, and each form of exit is likely to be caused by different factors (Schary, 1991). This paper explores the determinants of different exit routes. Using a sample of Spanish manufacturing firms for the period 1990-2000, we estimate a competing risks proportional hazard model to identify the factors leading firms to exit the market through (the mutually precluding events of) liquidation and acquisition. Our results show the existence of a sharp difference between the determinants of the different forms of exit in terms of firm and industry characteristics, mainly in relation to age and size.

Key words: Exit, Liquidation, Acquisition, Competing-Risks Hazard Model.

JEL Classification: L1, C41, L60

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1.- Introduction

Understanding the factors determining different forms of firms' exit has recently attracted an increased attention of researches and policy makers. Firms may indeed exit the market in several ways, mainly through merger (or acquisition), voluntary liquidation and bankruptcy, and each form of exit is likely to be caused by different factors (Schary, 1991). However, most of the existing literature has treated exit as a homogeneous event, or focused only on one form of exit (mainly, either bankruptcy or merger) and ignored others. Therefore, no much is known about the similarities or differences in the factors determining the various exit routes.

The existing empirical evidence on firms' exit taking into account the exit route is scarce. Harhoff *et al.* (1998) explore the differences between the factors leading firms to voluntary liquidation and bankruptcy using a sample on German firms, but they do not consider acquisitions or mergers. Dickerson *et al* (2003) focus on the determinants of making an acquisition as against being taken over using two large samples of UK manufacturing firms within a competing risks framework, but they do not consider other forms of exit. Headd (2003) analyses closure and failure of new firms using US census data from the CBO and BITS and focusing on the differences between successful and unsuccessful closure. Bhattacharjee *et al*. (2002) estimate a competing risks model to determine characteristics leading firms to bankruptcy and acquisition for a sample of firms in the UK. Their focus is, however, on the impact of macroeconomic factors on the probabilities of these two forms of exiting the market. They also extend this analysis in Bhattacharjee *et al*. (2003) to include a sample of US quoted firms, and compared the factors behind the failure probabilities of UK and US firms, and in particular, the role of different legal systems. Köke (2002) and Heiss and Köke (2004) examine the determinants of acquisitions and failures for a sample of large and medium-sized German corporations using a multinomial logit framework.

The aim of this paper is to explore whether there are differences in the factors driving firms to exit the market through different exit routes. We consider that firms may exit the market through the mutually exclusive events of liquidation and acquisition and investigate the factors determining the probability

of exiting the market through these two forms for Spanish manufacturing firms. To this end, we apply non-parametric survival methods and also estimate a competing risks hazard model in which the probability of each "risk" (i.e., exit route) at time *t* is conditional on the firm's history prior to *t*. Unlike discrete outcome models (probit, logit), survival methods allow to account for both whether and when an event occurs, thus controlling for the evolution of the risk over time. The data analysed are drawn from the *Encuesta sobre Estrategias Empresariales* for the period 1990-2000 which is representative of the Spanish manufacturing firms classified by industrial sectors and size categories. We build a panel of firms, identify their entry and exit dates and routes, and use the exhaustive information at the firm level provided by the data in order to explain different exit form probabilities.

The contribution of this paper to the existing literature is threefold. First, we explicitly explore the determinants of the different forms of firms' exit (liquidation and merger or acquisition) using a sample of Spanish manufacturing firms. [1] This allows us to provide a comprehensive analysis of the direction and magnitude of the factors influencing the different exit routes, an issue that has been frequently overlooked by the industrial organization literature on exit. Second, most of existing papers analysing exit also focus on the exit probabilities of new establishments or firms.[2] We consider instead a panel of existing firms, including also large and mature ones, and investigate the hazard rates by different exit routes taking into account their different age. Third, most of empirical studies on the determinants of either bankruptcy or acquisitions are based on firms' financial information, within the approach of the financial economics literature, and have been used mainly for inference purposes. By contrast, our approach lies on the industrial organization literature and our focus is to investigate the effect of factors such as size, age, economic activity, export orientation, R&D investments, legal structure, etc., on the probability of exit

[1] Empirical evidence on entry and exit in the case of Spanish manufacturing firms is scarce. Two main contributions are those by Fariñas and Moreno (2000) and Segarra and Callejón (2002). However, they do not take into account the different forms of firms' exit.

[2] Empirical evidence on survival of new firms based on the estimation of hazard rates are Disney, Haskel and Heden (2003) for the UK, Dunne, Roberts and Samuelson (1988, 1989) for the US, Mata, Portugal and Guimaraes (1995) and Mata and Portugal (2002) for Portugal, Audretsch and Mahmood (1995) for the US, and Boeri and Bellman (1995) for Germany.

through a particular route. These factors have been relatively less explored in the literature as determinants of firms' failures and acquisitions.

To anticipate the results, we find remarkable differences in the factors determining exit depending upon the exit route in terms of firm and industry characteristics. Introducing the distinction between liquidation and acquisition reveals that pooling exit routes into the same analysis is a major source of misspecification. Our results highlight a number of interesting features concerning liquidation and acquisition in Spanish manufacturing. First, the effect of both age and size on exit differs depending upon the exit route considered. The risk of liquidation decreases with size and is lower for medium-aged firms, whereas the risk of acquisition increases for the oldest firms in the sample and continuously increases with size. Other factors, such as producing final goods and undertaking R&D activities affect the risk of liquidation but have no significant effect on the risk of acquisition.

The rest of the paper is organised as follows. Section 2 reviews the main determinants of liquidation and acquisition as suggested in the related literature. Section 3 describes the methodology used, in particular the competing risks hazard model. Section 4 describes the data and section 5 presents the main results. Finally, section 6 concludes.

2.- The determinants of liquidation and acquisition.

As already noted, most of existing literature has considered firms' exit as a homogeneous event, or focused only on one form of exit (mainly, either bankruptcy or acquisition) and ignored others. Existing studies therefore have not taken into account that firms may exit the market in different forms and that these forms are likely to be determined by different factors (Schary, 1991). Most of existing studies may be placed within the financial economics literature and have used financial information at the firm level with the primary aim of successfully predicting failure or acquisition, rather than attempting to understand the causal mechanisms at work.

The factors leading firms to liquidation and bankruptcy have been extensively explored in the financial economics literature.[3] Poor performance, usually measured as profitability, (Altman, 1968, Powell, 1997, Astrebo and Winter, 2001, Kease and Mcguiness, 1990, Köke, 2002, Heiss and Köke, 2004) and financial pressure (Altman, 1968, Powell, 1997, Zingales, 1998, Köke, 2002, Heiss and Köke, 2004) make failure more likely. Also the factors determining whether a firm is likely to be acquired[4] have been investigated at length (see, e.g., Dickerson et al., 1997, 1998, and references therein). Company performance (Denis and Sarin, 1999**,** Maksimovic and Phillips, 2001), liquidity (Rege, 1984), leverage (Powell, 1997, Zingales, 1998, Köke, 2002, Heiss and Köke, 2004), the ratio of tangible to total assets (Ambrose and Megginson, 1992), dividends (Rege, 1984, Jensen, 1986, Dickerson et al., 1997, 1998) and size (Bethel et al. ,1998, Mulherin and Boone, 2000, Köke, 2002, Heiss and Köke, 2004) have been extensively investigated as determinants of takeovers.

Size is expected to be negatively related to the probability of being taken over, mainly because larger size requires larger funds to be raised by the potential acquirers[5] (Bond and Meghir, 1994, Schiantarelli, 1996) or because the market for corporate control is less liquid as size increases (Shleifer and Vishny, 1992). Bethel et al. (1998), Mulherin and Boone (2000), Köke (2002) and Heiss and Köke (2004) provide empirical evidence that smaller firms are more likely to be acquired.

The influence of size on the probability of exit has also been explored in the industrial organization literature. A general result within the empirical literature on entry and post-entry performance (Dunne, Roberts y Samuelson, 1988, *Special Issue of International Journal of Industrial Organization,* 1995*)* is that small firms are found to suffer a significantly higher risk of exit than large

[3] See, among others, Dambolena and Khoury (1980), Zavgren (1985), Gentry *et al.* (1987), Houghton and Woodliff (1987), Barniv and Raveh (1989), Gilbert et al. (1990), Kease and McGuiness (1990) and Altman (1984).

[4] There is a large literature on the motives for acquisitions (Scherer and Ross, 1990). However, since we are analysing firms' exit, we only take into account factors leading firms to be taken over and not the determinants of making an acquisition (given that acquirers do not exit the market).

[5] There is empirical evidence showing that acquired firms tend to be small compared to their acquirers (Cosh et al., 1980, Schwartz, 1982, Ambrose and Megginson, 1992, Hugues, 1993, Dickerson et al., 2003).

firms, which is in line with the predictions of the selection models literature (Jovanovic, 1982; Ericson y Pakes, 1995).

In this paper we further investigate a number of factors determining liquidation and acquisition that have been relatively less explored in the literature. Firm's age has been generally recognised as one important factor determining survival prospects. As first argued by Stinchcombe (1965), new firms suffer a "liability of newness", that is, a greater risk of failure than older firms. Accordingly, the youngest firms (which are probably the smallest firms) bear a higher failure risk. Recent entrants do not know yet if they have some of the characteristics necessary to adapt themselves to the competitive environment and survive (selection models, Jovanovic, 1982). The critical factor to survive seems to be the firm's relative efficiency. In line with this, our dataset allows us to introduce other factors to proxy firms' competitiveness. In particular, we consider two factors to be related to survival: investment in R&D and export activities. Firms undertaking these activities are probably more efficient which in turn is directly related with having better survival prospects and a better market competitive position. This is also in line with the predictions of the selection models of *active learning* (Ericson and Pakes, 1995). By investing in R&D, firms improve their abilities to survive and so their probability of failure and liquidation decreases. Moreover, competition in international markets is probably tougher as compared to domestic markets so exporting firms will probably be associated with higher efficiency.

In addition, we explore whether the probability of liquidation and acquisition is related to the economic activity performed by firms. We expect firms whose main activity is the production of final goods to endure a higher risk of failure, as compared to firms producing intermediate and capital goods. Final goods producers are supposed to face higher market competition and higher degree of demand uncertainty which in turn may be associated with higher failure rates.

The effect of the legal structure of the firm on its survival prospects has also been investigated in the literature on exit (Brüdel *et al*., 1992, and Harhoff *et al*., 1998, Mata and Portugal, 2002). The theoretical expectation is that limited liability corporations are significantly more likely to exit the market through bankruptcy than firms with other legal structures. Stiglitz and Weiss

(1981) show that in firms with limited liability, entrepreneurs undertake projects with relatively higher expected returns and higher risk of failure. We therefore investigate whether limited liability corporations have a higher risk of liquidation and acquisition as compared to other legal forms.

Finally, we explore the relationship between foreign capital participation and the risk of exit. Firms may have inherent disadvantages in doing business abroad, as compared to local firms, in terms of coordinating businesses across distance or learning about the *modus operandi* of the market (Hymer, 1976). These factors may in turn decrease the survival prospects of new foreign firms. By contrast, foreign capital participation could mean access to foreign technologies which in turn could improve the efficiency of the participated firm and so raise its survival probability.

3.- Methodology.

Survival methods are appropriate to examine the determinants of firm exit, and exit taking into account the existence of different exit routes.[6] These methods take into account the evolution of the exit risk and its determinants over time since they control for the occurrence of exit and the timing of the exit decision. This contrasts to traditional cross-section techniques that focus on the unconditional average probability of occurrence of an event during the sample period (e.g. logit and probit) or the average duration (OLS). Furthermore, survival methods are appropriate in presence of right censoring,[7] when we only know that the firm has survived at least up to a determined period *t*, and easily handle time-varying covariates. The latter is a desirable feature since the ability of a firm to survive varies over time as the competitive environment changes (Mata *et al.*, 1995).

The central concept in survival analysis is the *hazard rat*e. Following Kalbfleisch and Prentice (1980), this is defined as the probability that a firm exits the market in a moment *t* conditional upon survival up to that time *t*, and conditional on a vector of covariates *X*, which may include both time varying and time-constant variables:

[6] See Kiefer (1988) for a survey on the application of these models to economic studies.
[7] The presence of left censored observations, i.e. firms that started production some time before the beginning of the sample period, is not a problem in so far the interest lies on the study of conditional probability of exit.

$$\lambda(t;x) = \lim_{dt \to 0} \frac{\Pr[t \le T < t + dt \setminus T \ge t, x]}{dt}, \qquad (1)$$

where T is a non-negative random variable (duration), which we initially assume continuous. Hence, it involves that $\lambda(t)$ is an instantaneous exit rate.

Survival methods can be extended to situations where there are different failure types. Thus, a firms' "life" may end owing to acquisition, merger, bankruptcy or voluntary liquidation. Consequently, we are also interested in examining whether the determinants of exit differ depending on the type of exit. The treatment of the different exit routes only requires that the competing risks be mutually exclusive and exhaustive (that is, two different events cannot happen at the same time for an individual). Let us suppose that firm *i* is at risk for *k* different kinds of events, i.e. it faces *k* competing risks. We make the usual assumption of *independent competing risks*, which makes the models remarkably straightforward to estimate.

Thus, each firm *i* has a (latent) corresponding duration associated with each event type $T_{1k},...,T_{ki}$ associated with it, and a corresponding hazard function $\lambda_{ki}(t)$. We just observe the shortest duration: T_i=min{$T_{i1},\ldots,T_{ki}$}. Therefore, the empirical approach when analysing one risk (for instance, risk 1 out of *K*) is to consider as censored both censored observations and transitions to the other risks (i=2,...,*k*). That is, each destination state is examined separately.

Given that our primary goal is to examine the determinants of exit when we take into account that there exist different types of exit, a set of explanatory variables are brought into the analysis. Firstly, (non-parametric) log-rank tests of equality of hazard functions across the *r*-groups of firms, obtained for each one of the different covariates, is carried out for each risk (*k*) studied. This test is an extension of non-parametric rank tests to compare two or more distributions for censored data. Under the null hypothesis, there is no difference in the hazard rate of each of the r groups at any of the failure times and the t-statistic distributes as χ^2 with *r*-1 degrees of freedom. At any failure time, the contribution to the t-statistic is obtained as a weighted standardised sum of the difference between the actual and expected number of exits for each of the r

groups. The weight at each distinct failure time is 1. Furthermore, stratified log-rank tests of equality of hazard functions are also carried out given the sampling scheme of the ESEE. To this end, we use a size variable that splits the sample into two groups according to the threshold level of 200 employees.[8]

Secondly, the multivariate analysis of the exit decision is carried out estimating a semi-parametric proportional hazards survival model for the single risk of exit and competing risks semi-parametric hazards survival models. The competing risks considered in our analysis are liquidation and acquisition. The estimations are performed using the semi-parametric Cox Proportional Hazards Model (CPHM, henceforth) proposed by Cox (1972):

$$\lambda(t; X_i) = \lambda_0(t) \cdot \exp(X_i \beta) \qquad (2)$$

where $\lambda_0(t)$ represents the *baseline function* obtained for values covariates equal to 0 (X=0). In this specification, the effect of the independent variables is a parallel shift of the baseline function, which is estimated for all those firms that survive up to a particular period. The baseline function is left unspecified and the model is estimated by the partial likelihood principle.

We also estimate a competing risks model to analyse the differences between the determinants of the different forms of firm exit (Narendranathan and Stewart, 1991, 1993). In the competing risks model, when independence of risks is assumed estimation is simple. Narendranathan and Stewart (1991) have shown that the log-likelihood for the competing risks model is additively separable into terms where each of one is a function of the parameters of a single cause-specific hazard. Thus, in order to estimate these models we must proceed with the estimation of single risk hazards treating durations finishing for other reasons than the one of interest as censored at the point of completion. Therefore, we will also estimate the following models:

$$\begin{aligned} &\lambda_{ri}(t) = \lambda_{r0}(t) \exp\left(x_{ri}(t) \beta_r\right) \quad \text{Competing-risks model} \\ &r = \{\textit{liquidation};\ \text{acquisition}\} \end{aligned} \qquad (3)$$

Narendranathan and Stewart (1991) provide a test of whether exits to different states are behaviourally distinct (rather than simply incidental) for continuous time proportional hazards models. Hence, we carry out a test of equality of all

[8] For a description of the sampling procedure of the ESEE see footnote 8 below.

parameters except intercepts in the models for the destination-specific hazards. This is a test of the hypothesis that the cause-specific hazards are all proportional to one another (i.e. that all parameters except for intercepts are equal across the hazards). The test statistic is:

$$LR = 2\left[\ln(L_{CR}) - \ln(L_{SR}) - \sum_{r=1}^{R} n_r \cdot \ln\left(\frac{n_r}{\sum_{r=1}^{R} n_r} \right) \right] \qquad (4)$$

where $\ln(L_{CR})$ is the maximised log-likelihood from the competing risk model (the sum of those from the component models), $\ln(L_{CR})$ is the maximised log-likelihood from the single-risk model; n_r is the number of exits to state *r*, with *R* representing all the competing risks -i.e. all the destination states-. The test statistic is a Chi-squared with degrees of freedom equal to the number of restrictions (that is, the number of covariates). If we cannot reject the null hypothesis, then it is accepted that the risks are not different, indicating that the events are essentially random with respect to the covariates and baseline hazards.

4.- The data.

The data used in this paper are drawn from the *Encuesta sobre Estrategias Empresariales* (ESEE, hereafter), an annual survey of Spanish manufacturing firms since 1990. The ESEE is representative of Spanish manufacturing firms classified by industrial sectors and size categories and provides exhaustive information at the firm level.[9]

The sample used in this paper, corresponding to the period 1990-2000, is made up of a total of 18,046 observations: 12,689 observations for small firms (those with 10 to 200 employees) and 5,357 for large firms (those with more than 200 employees). This means an annual average of 1,805 firms, 70% of

[9] The sampling procedure of the ESEE is the following. Firms with less than 10 employees are excluded from the survey. Firms with 10 to 200 employees were randomly sampled by industry and size strata (according to 21 different productive activities and 4 size intervals), holding around a 4% of the population in 1990. All firms with more than 200 employees were requested to participate, obtaining a participation rate around 60% in 1990. Important efforts have been made to minimise attrition and to annually incorporate new firms with the same sampling criteria as in the base year so that the sample of firms remains representative of the Spanish manufacturing sector over time (see http://www.funep.es for further details).

them being small firms. This is an unbalanced panel of firms, as there is entry and exit of firms. We compute a firm as exiting (through liquidation or voluntarily closure and through acquisition) in period *t* when this is the last year in business (or independently active).

In table 1 we report the evolution of the sample of firms analysed, i.e., the total number of firms, the number of firms that exit the market (in which all types of exit are pooled), the number of firms exiting through liquidation and the number of firms exiting through acquisition. Liquidation or voluntary exit includes both definitive closure and actual liquidation, as well as shifts to non-manufacturing activity. Acquisition includes firms either acquired by or merged with another firm in the sample (the exiting firm being the smaller one). To deal with mergers and acquisitions we follow Klepper and Simons (2000). When two firms merge we do not compute it as two firms exiting and one "*de novo*" entering, but consider the bigger firm in the merger as a continuing firm and the smaller firm as an exiting one.[10] Finally, in the last column of table 1 we report the difference between the number of censored observations in *t*, i.e. those firms leaving the survey at *t* for reasons other than failure, minus the number of firms entering the sample in *t+1*.

[INSERT TABLE 1]

Table 2 presents information about the firms classified by size. A more detailed explanation on the variables used is described in the appendix.

[INSERT TABLE 2]

To better understand the effects of the explanatory variables used in our analysis we carry out non-parametric tests for the equality of survival (or hazards) functions across groups of firms, according to a number of explanatory

[10] We should notice that the ESEE does not provide information to distinguish when a sampled firm (being the larger firm) acquires or mergers with other firms in the sample or outside the sample from the situation where a non-sampled firm acquires a company within the sample. However, as long as the ESEE is a representative sample of the Spanish manufacturing sector, the fact of no considering entry or exit of firms in the latter case does not represent a serious limitation. Indeed, it does not affect either the number of firms in the sector or the concentration in the industry. Furthermore, the former possibility (and also other forms of firm restructuring) is controlled for using the appropriate explanatory variables.

variables.[11] Table 3 presents the results for these tests, using the Log-rank test, for three groups: first, when we do not distinguish between types of exit, second, when we consider firms exiting through liquidation (and account of other types of exit as censored data) and third, when we consider firms exiting through acquisition.[12]

When we pool all types of exit, the results for the log-rank test point out, unequivocally, to the existence of significant differences in survival between groups for each of the variables considered (except for "foreign capital participation"). We get that being a large firm, producing intermediate and capital goods, having a limited liability legal structure, exporting and undertaking innovative activities makes that a firm enjoys a better survival prospect. In addition, both younger and very old firms bear a higher risk of failure.

Now we turn to analyse the hazard function accounting for the two competing exit types (liquidation or acquisition). If we consider the risk of liquidation, we get similar results to those reported above. The results for the rank test indicate that there are significant differences in survival between groups for all the variables considered (see column 2 in table 3).[13] If we consider the risk of acquisition we get important differences with respect to the risk of liquidation. In particular, being an exporting firm, undertaking R&D activities or belonging to a determined sector does not make a significant difference in the survival of the firm. However, the legal form structure of the firm, its size, age and whether the firm is participated by foreign capital have

[11] These tests are extensions, for censored data, of non-parametric rank tests used to compare two or more distributions. Under the null hypothesis, there is no difference in the survival rate of each of the r groups at any of the failure times and the t-statistic distributes as χ^2 with r-1 degrees of freedom. At any failure time, the contribution to the t-statistic is obtained as a weighted standardised sum of the difference between the actual and expected number of exits for each of the r groups.

[12] Although we have carried out the three different tests: Log-rank test, Wilcoxon-Breslow-Gehan test and Peto-Peto-Prentice test, we only report the results for the first one as the three of them shed the same conclusions. The differences among them lie on the weights used. The Log-rank test is more appropriate when the survival functions for the different groups are proportional. The Wilcoxon-Breslow-Gehan test is more suitable when the survival functions are not proportional and the censoring patterns are similar across groups. Finally, the Peto-Peto-Prentice test is adequate when the survival function varies non-proportionally among groups. It also controls for different censoring patterns for each group.

[13] The results we get for exiting through liquidation are similar to those obtained when we do not distinguish the types of exit except that, in this case, being a firm participated by a foreign enterprise reduces the probability of surviving. We also get that the survival prospect of firms improves by age.

significant effect on the probability of being acquired. As regards to age, the older the firm the higher the probability of being acquired (see column 3 in table 3).

[INSERT TABLE 3]

Further, given that the data sampling procedure differs for large and small firms, we further analyse the probability of surviving with stratified non-parametric tests (log-rank tests). These tests provide an overall test after controlling for the effect of the variable used for the stratification and separate tests for each of the values of the variable. That is, in our case the sample will be broken down into two groups: large firms and small firms. After controlling for the effect of size, the results are similar to those obtained with non-stratified log-rank tests for the sub sample of small firms (regardless of the form of exit). However, in the sub sample of large firms, we find no significant differences in the survival patterns for most of the explanatory variables.

[INSERT TABLE 4]

Finally, in table 5 we present a univariate analysis of the effect of covariates on the hazard rate for the single and competing risks models. This information is complementary to the non-parametric tests in the sense that allows investigating the direction of the effects on the hazard function. For each model, we present two sets of results: the non-stratified results and the stratified results, which corresponds to the estimates accounting for the two size groups sampled in the data set (large firms and small firms). The estimates in table 5 clearly show that covariates have significant different effects by type of exit. This indicates that one should treat both types of events separately. Specifically, if we do not distinguish between types of exit (column 1 in table 5) we get that firms aged between 11-25 and 26-50 years have a significant better survival profile than others firms (both younger and older). But, by types of exit the results are different (see columns 2 and 3). First, age reduces the probability of liquidation and the older the firms the lower the probability of being liquidated.

Second, age increases the probability of being acquired and the older the firm the higher the probability of being acquired.

Looking at size we have that in the single risk model, the bigger the firm the better its survival profile.[14] As before, looking separately at the two types of exiting we get very different results: size indeed reduces significantly and importantly the probability of being liquidated but size increases the probability of acquisition. The sector in which the firm is producing has also effects on the risk of exit. We get those firms producing goods defined as final goods have a higher risk of exit through liquidation, while producing these goods does not affect the probability of exiting through acquisition. The legal form of the firm also influences differently the type of exit. Being a limited liability firm reduces the probability of being liquidated but increases the probability of being acquired. Being an exporter also reduces the probability that a firm stops its production by liquidation and it does not seem to have effects on acquisition. Looking at firms that undertake R&D activities, we get that these activities reduce significantly the risk of exit. But analysing the types of exit we get that R&D activities reduces the risk of liquidation but increase the risk of acquisition. Finally, foreign capital participation also plays a role among the determinants of exit. We obtain in the unviariate analysis that being a firm participated by foreign capital reduces de probability of liquidation and increases the probability of acquisition.

The above results suggest that many of the variables analysed play a significant role in the risk of exit (through liquidation or acquisition) and that most of them affect, in a different direction, to the risk of exiting in the two exit routes exit we analyse. These results should be taken as indicative of the direction of the effects of covariates on the hazard rate for each type of exit but we should undertake a regression analysis to precisely estimate the effect of each variable jointly with all the other variables. This is done in section 5.

5.- Regression results

Figure 1 displays non-parametric estimates of the hazard rates, that is, the probability that a firm exits (pooled exit, exit through liquidation and exit through

[14] We have two different variables to account for the effect of size on the risks of exit: one that accounts for two size groups (firms with less than 200 employees and firms with more 200 employees) and size in 5 different groups. We get similar results in both cases.

acquisition) in a particular period given that it has survived until the beginning of that period.[15] It shows the evolution of the exit risks over time. From 1990 until 1992, all hazard rates increased independently of the risk considered, which seems to be consistent with the business cycle. From 1993, firm pooled exit, and exit by liquidation declined continuously until the 1997 in line with the general evolution of the economy. The risk of acquisition does not exactly follow the same pattern, probably because its determinants are not necessarily so related to macroeconomic fluctuations. Furthermore, the estimate for pooled exit is very similar to that obtained for liquidation given that liquidation is, by far, the more frequent exit route. Moreover, at first glance we can anticipate that the evolution of the two competing risks of exit is rather different.

[INSERT FIGURE 1 HERE]

In table 6 we report the main results obtained from the estimation of (2) and (3). The estimated models are continuous time CPHM estimated maximising a partial likelihood function with respect to the vector of coefficients β without the need to estimate the *baseline function* (although it can be recovered non-parametrically), using the method proposed by Efron for handling "ties" (i. e. the presence of firms that exit in the same period). We use standard error robust to autocorrelation and heteroscedasticity, as we deal with multiple records per firm. Finally, we apply Efron's method for handling "ties". A unit change in a variable leads to a proportional shift, constant across time, in the conditional probability of suffering the event analysed. The effect of the covariates is reported by the *hazard ratios*. A value smaller (greater) than 1 implies a negative (positive) effect on the hazard rate.

We have tested for specification errors using classical *link tests.* The results from these tests indicate that we cannot reject the null hypothesis that

[15] It is estimated as the hazard contribution to the cumulative hazard function between two failure times. This hazard contribution is recorded at all periods at which failure occurs t_j and is obtained as $\hat{\lambda}(t) = \frac{d_j}{n_j}$, where d_j is the number of failures at time t_j and n_j is the number at risk at t_j, before the occurrence of the event. It is done for firm exit, liquidation and acquisition.

the model is correctly specified.[16] Moreover, in order to test for the proportionality assumption, both for all variables and for each variable, we have carried out the tests proposed by Grambsch and Therneau (1994). The null hypothesis that the hazard rates are proportional cannot be rejected, in general, at a 5% significance level. Furthermore, we also reject (at a 1 % of statistical significance) the null hypothesis that the different forms of exit are behaviourally equal (Test of Proportionality of Risks proposed by Narendranathan and Stewart, 1991).

[INSERT TABLE 6 HERE]

The regression results reported in table 6 are discussed below. In order to highlight the effect of allowing for different exit routes, we present results from single hazard estimates in which both exit types are pooled, and results from competing risk specifications in which liquidations and acquisitions are treated as competing exit routes. Starting with firms' age, the entry and exit literature stresses that the youngest firms (which are probably the smallest firms) bear a higher exit risk (*liability of adolescence effect*). Recent entrants do not know yet if they have some of the necessary characteristics in order to adapt themselves to the competitive environment and survive (selection models, Jovanovic, 1982, and Ericson and Pakes, 1995). Taking as reference firms younger than 6 years of age, we find a non-linear effect of age on the exit probability. Firms between 11 and 25 years face a significant lower exit risk (22.57% inferior) than that suffered by the youngest firms.[17] In addition, firms older than 50 years face worse surviving conditions than younger firms (50% higher risk of exit). However, the effect of age on exit is hiding two different effects. When we consider the two competing routes of exiting (liquidation and acquisition) this non linear effect vanishes as we get that firms between 11-25 years old enjoy a significant lower risk of being liquidated (27% lower) and that firms older than 50 years face a significant higher risk of being acquired. The first result might be

[16] We reject the null hypothesis for the acquisition risk, maybe due to the reduce number of observations for this exit route.

[17] If we analyse the effect of age on the risk of liquidation, by breaking down the sample in two groups (small and large firms) we find that the result that firms between 11-25 years enjoy a lower probability of being liquidated is driven by the small group as we do not get any significant effect of age in the group of large firms.

interpreted in line with the selection models predictions that younger firms endure higher probabilities of bankruptcy, whereas the second result might be related to the fact that long-established brand reputation can be seen as a valuable asset attracting acquiring competitors.

Secondly, in relation to firm size we define five size categories: <21, 21-50, 51-200, 201-500 and >500 employees.[18] After controlling for other variables, we find that size is positively related to survival. In particular, our results indicate that the larger the firm the lower the risk of exit. The instantaneous probability of exit for the largest firms (51-200 and >500 employees) is around 54% lower than that for the smallest firms (those with less than 21 employees).[19] However, as in the case of the effect of age on exit, these results change when we consider the two competing exit routes. We obtain two opposite effects of size for the two risks analysed. On the one hand, the risk of liquidation decreases with size, and, on the other hand, the risk of acquisition increases with size.[20] The effect of size on the probability of liquidation is in line with the predictions of the Industrial Organization selection models literature (Jovanovic, 1982; Ericson y Pakes, 1995) and with most of the empirical evidence obtained by the literature on entry and post-entry performance (Dunne, Roberts y Samuelson, 1988, *Special Issue of International Journal of Industrial Organization, 1995*) as this literature refers to exit in the sense of failure or closure of businesses.[21]

When we consider jointly the effect of age and size on the probability of exit we have that for the group of firms aged between 11-25 years, the

[18] Following Mata *et al.* (1995), the variable size we use refers to firm current size, instead of firm's size when entering the market, as we consider that current size captures the actual status of the firm, i.e. the competition position of the enterprise, at any time period.

[19] Agarwal and Audrestch (1999) suggest that small firms in mature phases of the industry life cycle may enjoy better survival conditions. Ghemawat and Nalebuff (1995) also find a strategic advantage for small firms in declining industries. Our results are not incompatible with this since the ESEE excludes very small firms (those with less than 10 employees) and we do not control for the stage of the industry life cycle.

[20] This result should be taken with caution given the small number of acquisitions in our sample, and given that we cannot distinguish between acquisitions and mergers. Indeed, the result could be driven by the fact that large firms tend to be involved in mergers.

[21] We have also used a dummy variable for size taking value one if the firm has less than 200 employees and zero if the firm has 200 or more employees. We obtain that large firms have a 44% lower probability of exit than small firms. This result is driven, however, by the fact that large firms enjoy a significant lower probability of liquidation, whereas size does not seem to affect the risk of acquisition as we get a non significant coefficient.

probability of exit decreases with size, a result driven specifically by the analysis of the risk of liquidation.[22]

Thirdly, after controlling for other characteristics, two factors noticeably improve the survival performance of the Spanish manufacturing firms: exports and investment in R&D (either externally contracted R&D or internally undertaken R&D or both). Exporting firms endure a 31% inferior probability of exit than non-exporting firms. Relating the two competing risks, being an exporter decreases the probability of suffering both events (liquidation and acquisition) in a 26% and in a 61%, respectively.[23] The participation in R&D activities improves survival performance in a 56%. It lowers the liquidation risk (in a 25%), but it does not seem to significantly affect the risk of being acquired. Firms undertaking these activities are probably more efficient which in turn is directly related with having better survival perspectives and with a better competitive position. This is also in line with the predictions of the selection models of *active learning* (Ericson and Pakes, 1995). By investing in R&D, firms improve their abilities to survive. This result differs from the empirical findings of Audretsch (1995) and Audretsch *et al*. (2000) for the Netherlands, and Segarra and Callejón (2002) for Spain, who found the exit rate of new entrants to be greater for R&D intensive industries. The reason of this difference is that their data is at the industrial level, whereas our data refers to firm level.

Taken together, being an exporter and undertaking R&D activities jointly reduces the exit risk up to 69% (70% of exit through liquidation). Moreover, if the firm is also a large firm (more than 200 employees) this is further reduced in 86% (in a 91% if we analyse the risk of liquidation).

Fourthly, those firms whose main activity is the production of final goods endure a 34% higher risk of failure than firms producing intermediate or equipment goods.[24] This result is driven by the liquidation exit route that increases the risk of liquidation by 32%. This is probably due to the higher

[22] Firms aged 11-25 years and with 21-50, 51-200, 201-500 and more than 500 employees enjoy a 37%, 38%, 63% and 65% lower risk of exit, respectively, and 42%, 45%, 74% and 84%, lower risk of liquidation, respectively.

[23] This result is driven by the small firms group, in which exporting firms enjoy a 33% lower probability of being liquidated whereas for large firms, being an exporter does not have any significant effect. One should take into account that only 67 out of 812 large firms are liquidated (8%), whereas 376 out of 2452 small firms are liquidated (15%).

[24] This result is also driven by the result obtained from the sample of small firms when analysing the risk of being liquidated.

degree of uncertainty and competition faced by final goods producers as compared to intermediate or equipment goods producers, which in turn increases their chances to exit the market.

In relation to the legal structure of the firm, we do not find that, after controlling for other factors, limited liability corporations have a higher exit probability as compared to the rest of legal forms.[25] Finally, our results indicate that those firms with foreign capital participation bear a notorious higher risk of exit, in particular of being acquired. In principle, if the aim of the foreign investment were to improve efficiency of the participated firm, then one would expect a positive effect of foreign participation on the survival probability of the firm. By contrast, it could be argued that firms may have inherent disadvantages in doing business abroad (Hymer, 1976). Foreign firms may have to incur in increased costs (as compared to local firms) in order to learn about the *modus operandi* of the market and in order to coordinate business across distance. These factors may in turn decrease the survival prospects of new foreign firms. The scarce empirical evidence on the impact of foreign ownership on survival is mixed. Our result is consistent with Görg and Strobl (2003), who find increased probabilities of exit for Irish majority foreign-owned plants, and with Bernard and Sjöholm (2003) who obtained for a sample of Indonesian firms that after controlling for plant size and productivity, foreign-owned plants are far more likely to close down compared to domestically-owned ones. [26] By contrast, both Li and Guisinger (1991) and Mata and Portugal (2002, 2003), find that domestic entrants are much more likely to exit than foreign ones. However, both Mata and Portugal (2002) and Bernard and Sjöholm (2003) find evidence supporting the idea that the different survival rate among foreign and domestic owned firms is caused by firm and industry characteristics rather than ownership *per se.*

6.- Conclusions.

This paper has analysed empirically whether there are differences in the factors driving firms to exit the market through different exit routes. To this end, we

[25] There is, however, empirical evidence supporting the association between the legal form of firms and their survival prospects, although with mixed results (Brüdel *et al*., 1992, and Harhoff *et al*., 1998, Mata and Portugal, 2002).

[26] We have further investigated the effect on survival of alternative definitions of foreign capital participation. In particular, our results do not change when we consider that the firm foreign capital participation reaches 10 and 25 percent level.

have applied non-parametric and semi-parametric survival methods and estimated a competing risks hazard model to a sample of Spanish manufacturing firms. The data used has been drawn form the survey ESEE for the period 1990-2000, which is representative of Spanish manufacturing firms classified by industrial sectors and size categories. We have used the data to build a panel of firms to identify firm entry and exit routes. The regression analysis has been carried out using a Cox competing risks proportional hazard model (Cox, 1972).

We find important differences in the factors determining exit depending upon the exit route in terms of firm and industry characteristics. Firstly, related to firms' age, we have obtained a non-linear effect of age on the probability of exit. Both the youngest (less than ten years old) and the oldest firms (more than fifty years old) bear a significantly higher exit risk. However, the effect of age on exit is hiding two different effects. When we consider the two competing routes of exiting (liquidation and acquisition) this non linear effect vanishes as we get that firms between 11-25 years old enjoy a significant lower risk of being liquidated and that firms older than 50 years face a significant higher risk of being acquired. Secondly, after controlling for other variables, we find that size is positively related to survival. In particular, our results indicate that the larger the firm the lower the risk of exit. However, this result changes when we consider the two competing exit routes. We obtain two opposite effects of size for the two risks analysed. On the one hand, the risk of liquidation decreases with size, and, on the other hand, the risk of acquisition increases with size. Third, exporting firms endure a lower probability of exit, both through liquidation and through acquisition, than non-exporting firms, and participation in R&D activities improves survival prospects, in particular, it decreases the liquidation risk but it does not seem to significantly affect the risk of being acquired. Fourthly, those firms whose main activity is the production of final goods endure a higher risk of exit compared to firms producing intermediate or equipment goods. This result is driven by the liquidation exit route. In relation to the legal structure of the firm, we do not find that, after controlling for other factors, limited liability corporations have a higher exit probability as compared to the rest of legal forms. Finally, our

results indicate that those firms with foreign capital participation bear a notorious higher risk of exit, in particular of being acquired.

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Appendix. Variable definitions, sector classification and descriptive statistics.

Age	Firm age is measured as the difference between the current year (*t*) and the constituent year reported by the firm. This variable is classified into 5 categories: firms younger than 5 years, firms between 6 and 10 years, firms between 11 and 25 years, firms between 26 and 50 years and firms older than 50 years. In the empirical analysis, we define 5 dummy variables capturing this classification.
Size	Firm size is calculated using the number of employees. We classify firms into two groups: small firms (from 10 to 200 employees) and large firms (more than 200 employees) The variable *size* is a dummy variable taking value one when the firm is a large firm, and zero otherwise.
Sector	In the ESEE there are 18 manufacturing sectors using the CNAE-74 classification. These sectors have been grouped into three categories (see table A.2): firms that produce final goods, firms that produce intermediate goods and firms that produce equipment goods. The variable *final goods* is a dummy variable taking value one when the firm is a final goods producer, and zero otherwise.
Legal form	This variable refers to the legal structure of the firm and is defined as a dummy variable taking value one when the firm is a Limited Liability Corporation, and zero otherwise.
Exports	This is a dummy variable taking value one when the firm exports (any percentage of sales) and zero otherwise.
R&D	This is a dummy variable taking value one when the firm performs R&D activities and zero otherwise.
Foreign capital participation	This is a dummy variable taking value 1 when the firm is participated by foreign capital (any percentage).

Notes:

1. Final goods: motors and cars, meat, and preserved meat, food and tobacco, beverages, textiles and clothing, leather and shoes, wood and wood furniture and other manufacturing goods.
2. Intermediate goods: ferrous and non-ferrous metals, non metallic miner products, chemical products, metallic products, other transport material, paper, and paper and printing stuff and rubber and plastic products.
3. Equipment goods: industry and agriculture machines, office machines and electrical material and other electrical goods.

Figure 1.- Non-parametric hazard function

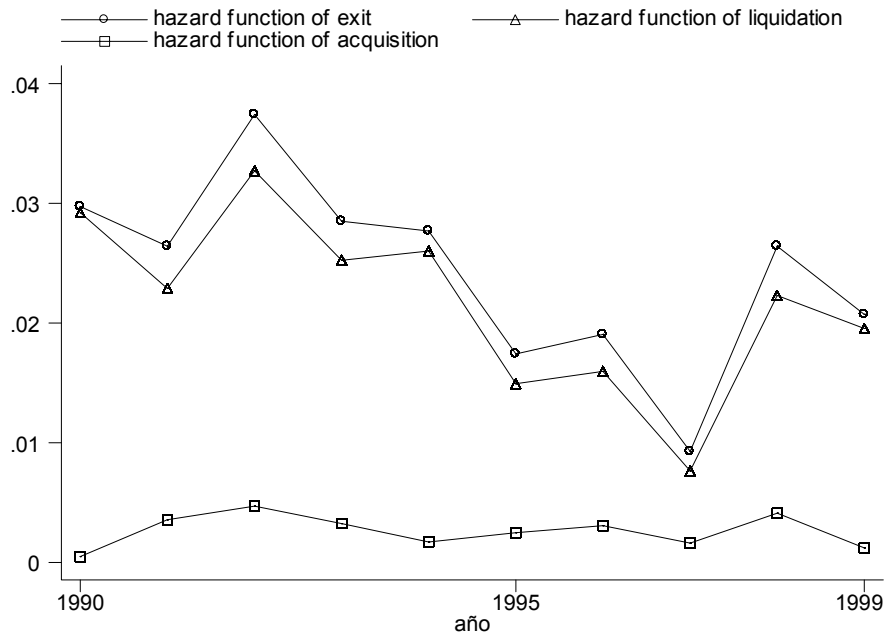

Table 1. Evolution of the sample of firms analysed.

Year	All firms	Exit	Exit through liquidation	Exit through Acquisition	"Net lost"
1990	2053	61	60	1	25
1991	1967	52	45	7	-10
1992	1925	72	63	9	-8
1993	1861	53	47	6	39
1994	1769	49	46	3	112
1995	1608	28	24	4	-48
1996	1628	31	26	5	-243
1997	1840	17	14	3	118
1998	1705	45	38	7	-30
1999	1690	35	33	2	-140
Total	18046	408	363	45	-

Notes:
1. The total sample (18046 observations) corresponds to 3035 firms.
2. "Net lost" = Number of firms censured in *t* minus the number of firms entering the sample in *t+1*.

Table 2. Evolution of firms by size.

	All firms		Exiting firms	
Year	**Small firms**	**Large firms**	**Small firms**	**Large firms**
1990	1452	601	53 (3.65%)	8 (1.33%)
1991	1289	678	45 (3.49%)	7 (1.03%)
1992	1294	631	56 (4.33%)	16 (2.54%)
1993	1298	563	42 (3.24%)	11 (1.95%)
1994	1226	543	43 (3.51%)	6 (1.10%)
1995	1112	496	25 (2.25%)	3 (0.60%)
1996	1165	463	27 (2.32%)	4 (0.86%)
1997	1366	474	13 (0.95%)	4 (0.84%)
1998	1237	468	39 (3.15%)	6 (1.28%)
1999	1250	440	33 (2.64%)	2 (0.45%)
Total	12689	5357	376 (2.96%)	67 (1.25%)

Note: “Large firms” are firms with more than 200 employees and “small firms” are those with 10 to 200 employees.

Table 3. Non-parametric tests (log-rank) for the equality of hazard functions accounting for different types of exit (by explanatory variables)

	Exit			Exit through liquidation			Exit through acquisition		
	Log-rank test		Higher surviving probability	Log-rank test		Higher surviving probability	Log-rank test		Higher surviving probability
Sector	16.53	(0.000)	Sector=0	16.64	(0.0002)	Sector=0	2.21	(0.330)	Sector=0
Legal form	19.10	(0.000)	Legal form=1	34.57	(0.000)	Legal form=1	12.87	(0.0003)	Legal form=0
Exports	56.32	(0.000)	Exports=1	71.05	(0.000)	Exports=1	2.10	(0.148)	Exports=0
Size	49.18	(0.000)	Size=1	83.80	(0.000)	Size=1	25.09	(0.000)	Size=0
R&D	79.32	(0.000)	R&D=1	99.67	(0.000)	R&D=1	2.70	(0.100)	R&D=0
Age	28.04	(0.000)	(see note 4)	40.62	(0.000)	(see note 4)	26.98	(0.000)	(see note 4)
Foreign capital participation	2.83	(0.092)	Foreign capital participation=0	18.40	(0.000)	Foreign capital participation=0	50.91	(0.000)	Foreign capital participation=1

Notes:

1. Exit through liquidation indicates that we consider that the other type of exit (acquisition) as censored cases. Similarly, exit through acquisition indicates that we consider exit through liquidation as censored cases.
2. 18,046 observations, 3035 firms, and 443 exits for the whole period.
3. P-values in parenthesis.
4. Sector: All sectors have been grouped in three groups: production of final goods, production of intermediate goods and production of equipment goods. Table A.2 in appendix reports the sectors included in each category. The survival probability reported in the table has been calculated re-classifying the above sectors into two categories: sector=1 for final goods and sector=0 for the other two.
5. Legal form. We consider two types of firms: type =1 if it is a Limited Liability Company and type =0 other legal forms.
6. Exports: Two types of firms, export=1 if the firm exports and 0 otherwise.
7. Size: We consider two types as regards to size, i.e., small firms (up to 200 workers) and large firms (more than 200 workers).
8. Age. We group firms into 5 age categories. Firms younger than 6 years, firms between 6-10 years, firms between 11-25 years, firms between 26-50 years and firms older than 50 years. Age: the survival probabilities, from lower to higher, if we do not distinguish between types of exit, are: firms between 6 and 10 years, firms younger than 5 years, firms older than 50 years, firms between 11 and 25 years, and firms between 26 and 50 years. When we analyse exit through liquidation the survival probabilities are: firms younger than 5 years, firms between 6 and 10 years, firms between 11 and 25 years, firms older than 50 years and firms between 26 and 50 years. When we analyse exit through acquisition we get that the survival probabilities decrease with age.
9. Foreign capital participation. We divide our firms into two groups depending on whether the firm is or not participated in its capital by foreign enterprises.

Table 4. Non-parametric tests (log-rank tests) for equality of the hazard functions by explanatory variables, controlling for firm size.

	Small firms			Large firms			All firms		
	Exit	**Exit through liquidation**	**Exit through acquisition**	**Exit**	**Exit through liquidation**	**Exit through acquisition**	**Exit**	**Exit through liquidation**	**Exit through acquisition**
Sector	15.88 (0.00)	13.34 (0.00)	3.67 (0.06)	0.00 (0.99)	0.05 (0.82)	0.08 (0.78)	13.52 (0.00)	12.63 (0.00)	0.92 (0.34)
Legal form	2.55 (0.11)	5.10 (0.02)	7.88 (0.00)	1.49 (0.22)	2.22 (0.14)	0.04 (0.85)	3.25 (0.07)	6.01 (0.01)	5.19 (0.02)
Exports	14.55 (0.00)	19.67 (0.00)	5.63 (0.02)	12.54 (0.00)	0.56 (0.45)	20.64 (0.00)	21.44 (0.00)	20.19 (0.00)	1.22 (0.27)
R&D	22.80 (0.00)	25.94 (0.00)	0.85 (0.36)	23.34 (0.00)	24.80 (0.00)	2.75 (0.10)	41.13 (0.00)	42.46 (0.00)	0.75 (0.39)
Age	12.34 (0.02)	15.80 (0.00)	14.62 (0.00)	9.02 (0.07)	1.04 (0.90)	14.05 (0.01)	18.43 (0.00)	16.56 (0.00)	10.77 (0.03)
Foreign capital participation	3.53 (0.06)	0.00 (0.99)	49.16 (0.00)	1.06 (0.30)	0.11 (0.73)	3.64 (0.00)	3.53 (0.06)	0.03 (0.87)	20.86 (0.00)

Notes:

1. The higher surviving probabilities for each group are the same than the ones reported in table 3, except for foreign capital participation when we consider single risk of exit for which the higher probability of exit corresponds to firms participated by foreign capital and for size when we analyse the hazard function for acquisition for which we get that the higher probability of exit corresponds to small firms.
2. See notes in table 3 for description of covariates.
3. The survival probabilities for the five groups by age, if we do not distinguish by types of exit, from lower to higher, are: firms with more than 50 years, firms from 6 to 10 years, firms with less than 6 years, firms from 26 to 50 years and firms from 11 to 25 years. When we analyse exit through liquidation the survival probabilities are: firms with more than 50 years, firms with less than 6 years, firms from 6 to 10 years, firms from 11 to 25 years and firms from 26 to 50 years. When we analyse exit through acquisition we get that the survival probabilities decrease with age.

Table 5. Univariate analysis of the effect of covariates on the hazard rate.

	Single risk model		Competing risks model			
	Exit risk		Risk of liquidation		Risk of acquisition	
	Hazard ratio	Hazard ratio (stratified results)	Hazard ratio	Hazard ratio (stratified results)	Hazard ratio	Hazard ratio (stratified results)
Age: (<5 years omitted)	-	-	-	-	-	-
6-10 years	1.009 (0.953)	1.012 (0.934)	0.974 (0.860)	0.977 (0.873)	3.981 (0.207)	4.103 (0.195)
11-25 years	0.659 (0.003)	0.703 (0.012)	0.606 (0.000)	0.658 (0.004)	5.132 (0.117)	4.493 (0.148)
26-50 years	0.527 (0.000)	0.710 (0.035)	0.437 (0.000)	0.655 (0.03)	7.934 (0.045)	4.940 (0.130)
>50 years	0.791 (0.188)	1.210 (0.303)	0.557 (0.004)	1.011 (0.960)	19.682 (0.004)	10.835 (0.022)
Size group (>200 employees)	0.407 (0.000)	-	0.235 (0.000)	-	4.083 (0.000)	-
Size: (10-20 employees omitted)	-	-	-	-	-	-
21-50 employees	0.728 (0.009)	-	0.702 (0.004)	-	3.287 (0.159)	-
51-200 employees	0.668 (0.005)	-	0.577 (0.000)	-	9.503 (0.004)	-
201-500 employees	0.348 (0.000)	-	0.223 (0.000)	-	12.603 (0.001)	-
>500 employees	0.326 (0.000)	-	0.129 (0.000)	-	19.609 (0.000)	-
Sector (Final goods=1)	1.467 (0.000)	1.416 (0.000)	1.499 (0.000)	1.426 (0.000)	1.219 (0.499)	1.324 (0.330)
Legal form	0.657 (0.000)	0.833 (0.073)	0.555 (0.000)	0.775 (0.015)	5.342 (0.001)	3.311 (0.043)
Export	0.483 (0.000)	0.608 (0.000)	0.416 (0.000)	0.602 (0.000)	1.559 (0.147)	0.666 (0.410)
R&D Activities	0.326 (0.000)	0.403 (0.000)	0.235 (0.000)	0.347 (0.000)	1.609 (0.102)	0.750 (0.430)
Foreign capital participation	0.811 (0.093)	1.295 (0.059)	0.523 (0.000)	0.974 (0.872)	6.555 (0.000)	4.628 (0.000)
Number of events	443		396		47	

Notes:

1. The total sample (18046 observations) corresponds to 3035 firms.
2. Coefficients indicate the effect on the risk rate of a standard increase in a continuous variable or a change from 0 to 1 in a dummy variable.
3. P-values are reported in brackets.

Table 6. Single and competing risks failure estimates for Spanish manufacturing firms 1990-2000 (Cox Proportional Hazards Model).

	Single risk model		Competing risks model			
	Exit risk		Risk of liquidation		Risk of acquisition	
	Hazard Ratio	P-value	Hazard Ratio	P-value	Hazard Ratio	P-value
Age: (<6 years omitted)	-	-	-	-	-	-
6-10 years	1.0608	0.687	1.0258	0.864	3.8733	0.218
11-25 years	0.7743	0.072	0.7281	0.030	4.1776	0.153
26-50 years	0.8293	0.259	0.7939	0.190	3.8125	0.171
>50 years	1.5011	0.033	1.3159	0.197	8.1743	0.032
Size: (10-20 employees omitted)						
21-50 employees	0.8125	0.090	0.7918	0.061	3.1633	0.165
51-200 employees	0.7978	0.160	0.7511	0.097	6.5528	0.028
201-500 employees	0.4766	0.001	0.3567	0.000	7.6763	0.031
>500 employees	0.4465	0.005	0.2159	0.000	10.5573	0.021
Sector (Final goods)	1.3437	0.002	1.3229	0.005	1.4486	0.224
Legal form	1.0089	0.937	0.9974	0.982	1.5401	0.477
Export	0.6932	0.003	0.7449	0.018	0.3899	0.023
R&D Activities	0.4427	0.000	0.4030	0.000	0.6588	0.189
Foreign capital participation	1.8462	0.000	1.4502	0.056	4.27	0.001
Log-likelihood	-3245.013		-2875.401		-317.1741	
Wald test (d.f.)	130.30 (13)	0.000	144.75 (13)	0.000	77.09 (10)	0.000
Number of events	443		396		47	

Notes:

1. The total sample (18046 observations) corresponds to 3035 firms.
2. Coefficients indicate the effect on the risk rate of a standard increase in a continuous variable or a change from 0 to 1 in a dummy variable.
3. To deal with “ties” (when there is more than a firm exiting within a year), estimation has been carried out using the method proposed by Efron.
4. P-values are calculated using robust standard errors. P-values correspond to two-tails tests of significance for each variable (where the null is that the multiplier is equal to 1). We also report a joint test of global significance.
5. In the competing risks model we reject the null hypothesis of risk proportionality at 1% of significance, i.e., we reject that the different forms of exit are behaviourally equal (Narendranathan and Stewart, 1991).